

NOTE OF UNIT: II
NATIONAL AND GLOBAL AGRICULTURAL RESEARCH SYSTEMS

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Content

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INSTRUCTION FOR THE ASSIGNMENT TO BE SUBMITTED FOR THIS UNIT

1. **1. Followings are the questions for assignment to be answered and submitted to the course teacher in the handwritten form compulsorily on or before 15th April, 2012.**
2. List of components of National Agricultural Research System
3. Write in detail on the following systems
 - The Agricultural Universities System
 - Other Agencies in research system
 - The ICAR System
4. Prepare a list of project directors working under ICAR system.
5. Prepare a list of SAUs of India with their head quarters.
6. List out National Bureaux working under ICAR system.
7. Enumerate Crop Science Institutes working under ICAR system.
8. List out Horticulture and Plantation Crops Institutes working under ICAR system.
9. List out Resource Management Institutes working under ICAR system.
10. Enumerate Technological Institutes working under ICAR system.
11. List out Animal Science Institutes working under ICAR system.
12. Enumerate Fisheries Institutes working under ICAR system.
13. List out Social Science Institutes working under ICAR system.
14. Write major avenues of international research collaboration.
15. Write short note on the Consultative Group on International Agricultural Research.
16. List out organizations working under the Consultative Group on International Agricultural Research with their area of major research and headquarter.
17. Write short note on CIMMYT.
18. Write short note on Dr. Norman Borlaug.
19. Write in detail on ICRISAT.
20. Write short note on International Rice Research Institute.

- 2. At the end of this unit, objective types of questions with correct answers in multiple choice forms have been given for the semester end examinations. Students are informed to study them carefully.**

INTRODUCTION

Agriculture continues to remain a major sector of the Indian economy. It contributes considerable per cent of GNP, provides 60 per cent of employment and continues to be the primary source of living for 70 per cent of the population. Technological progress in agriculture is, therefore, crucial for the overall economic development of the country.

- The total geographical area of India is estimated at 328.8 million hectares.
- The gross cropped area is about 180 m.ha, of which 35 m.ha are under double cropping.
- Rice is the most important crop followed by wheat, pulses, oilseeds, sorghum, and maize. Cotton and sugarcane are the principal commercial crops.
- India has one-half of the buffalo and one-sixth of the cattle population of the world.
- India ranks first in goat
- India ranks sixth in sheep population.
- It has a vast potential of fishing resources comprising 2.02 m.sq.km of Exclusive Economic Zone (EEZ),
- India has 7,517 km of coastline
- 29,000 km of rivers
- 1.7 m.ha of reservoirs,
- 0.902 m.ha of brackish water areas, and
- 0.753 m.ha of tanks and ponds

The climatic setting is highly diverse, ranging from tropics in the south to warm, temperate subtropics in the north. The extreme east receives very high rainfall while, in the extreme west, the rainfall is very low and erratic. Nearly one-third of the country receives an annual rainfall of less than 75 cm. Two-thirds of the agriculture is rainfed and is prone to vagaries of monsoonal aberrations like drought. The arid zones occupy nearly 320,000 sq. km mainly in the States of Rajasthan, Gujarat and Haryana. In addition, a cold desert of 84,000 sq. km exists in cold regions like in Ladakh.

Nearly one-sixth of the land area has serious limitations for crop production such as erosion, aridity, water logging, acidity, salinity, and alkalinity. It is estimated that nearly 80 m. ha of cultivated area require soil conservation measures. The problems of salinity and water logging have appeared within a few years of the introduction of irrigation. An estimated 7 m. ha of land are affected by salinity and alkalinity, the majority of which occur in the potentially fertile irrigated areas of the Indo-Gangetic alluvial plains.

India has an estimated 176 million hectares of surface water and 57 m. ha of ground water potential. As against an ecologically safe level of 30 per cent, only about 20 per cent of the land area is under forest cover. About 2 million people, mostly in the North- Eastern Hill Region, follow shifting cultivation involving 11 million hectares of land causing serious environmental degradation and ecological imbalance. Indiscriminate destruction of forests coupled with irrational use of soil and water resources have resulted in land degradation at an alarming rate of 1.5 m.ha every year.

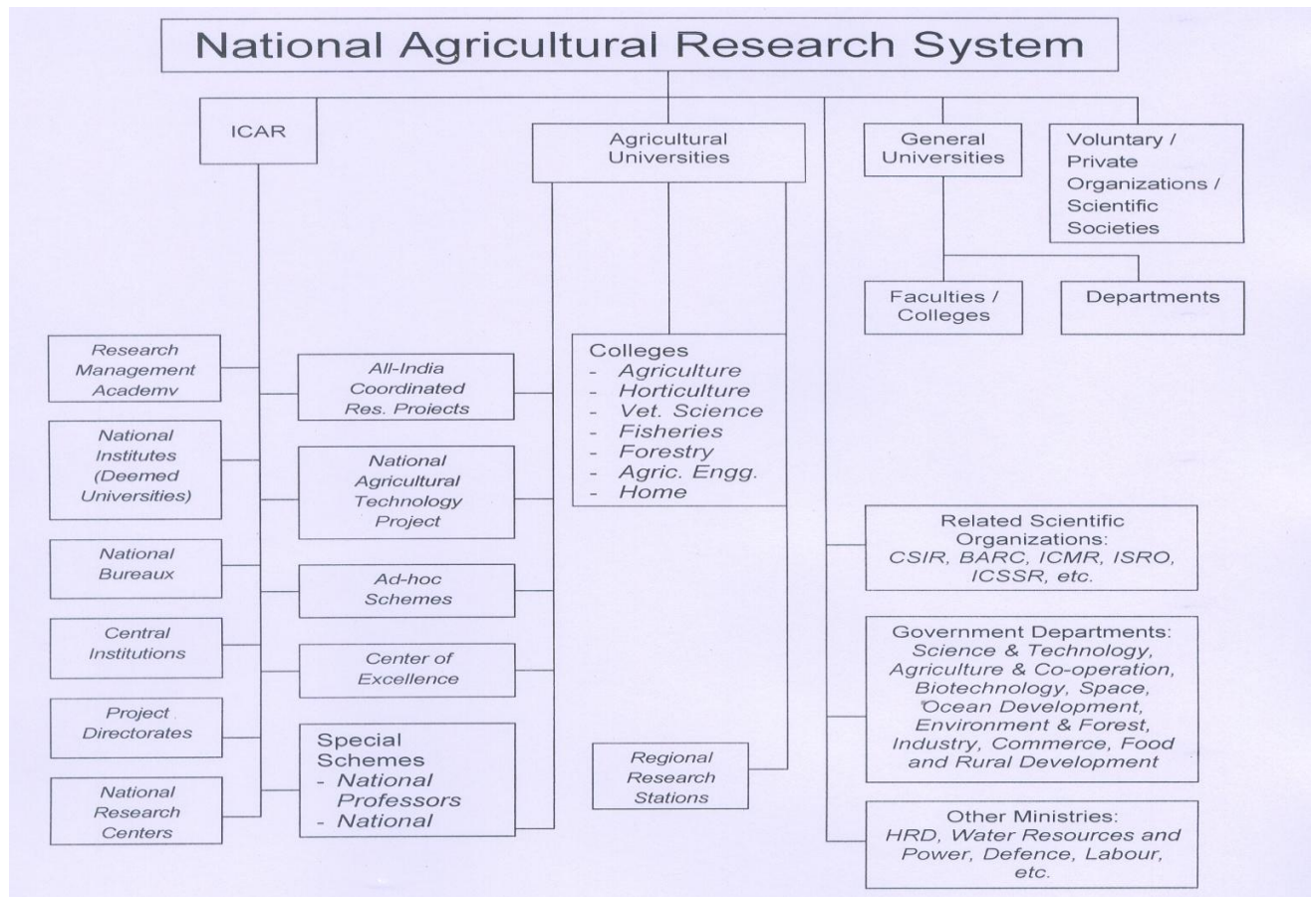
THE PRESENT AGRICULTURAL RESEARCH SYSTEMS OF INDIA

India has one of the largest agricultural research systems in the world with the largest number of scientific personnel of any developing country except China. The research system includes approximately 30,000 scientists and more than 100,000 supporting staff actively engaged in research related to agriculture. Although the total number of scientists engaged in agricultural research in India looks very impressive, it compares less favorably with many developed countries.

The present agricultural research system comprises essentially two main streams, the ICAR at the national level and the Agricultural Universities at the State level. Besides, several other agencies such as General Universities, Scientific Organizations, and various Ministries/Departments at the Centre, as also Private or Voluntary Organizations participate directly or indirectly in research activities related to agriculture.

NATIONAL AGRICULTURAL RESEARCH SYSTEM

1. THE ICAR SYSTEM
2. THE AGRICULTURAL UNIVERSITIES SYSTEM
3. OTHER AGENCIES
4. LINKAGES AMONG THE SUB-SYSTEMS
5. INTERNATIONAL CO-OPERATION



1. THE ICAR SYSTEM

The ICAR has the following major objectives: (i) to undertake, aid, promote and coordinate agricultural, animal husbandry and fisheries education, research, and its application; (ii) to act as a clearing house of research and general information relating to agricultural and veterinary matters; (iii) to maintain a research and reference library; (iv) to do other things considered necessary to attain the above objectives; and (v) to provide consultancy services in the fields of education, research and training in agriculture and allied sciences.

Among the major scientific organizations in the country, ICAR is unique in having concurrent responsibility for both research and education. As an apex body at the national level, ICAR is mainly responsible for the promotion and coordination of agricultural research in the various branches of agricultural and allied sciences in the country. In addition to its promoting and coordinating roles, ICAR is also directly involved in undertaking research at the national level, basic as well as applied, on diverse problems facing production of crops, animals, fisheries, etc., with the objective of evolving new production technologies suited to different agro-climatic conditions. Just as the University Grants Commission (UGC) plays a major role for the general education in the country, ICAR plays a similar role in the area of agricultural education. The Charter of the ICAR also includes extension education, which is carried out through a network of projects and other mechanisms.

Research Infrastructure of the ICAR

Although agriculture is a State subject, ICAR has established many Central Research Institutions over the years to meet the agricultural research needs of the country. These are essentially meant for: (i) implementing research mandates extending beyond the administrative boundaries of the States; (ii) pursuing basic research not undertaken by most Agricultural Universities; (iii) evaluating research results through multi - locational testing; and (iv) developing manpower for Agricultural Universities and other agricultural institutions.

A. Central Research Institutes: ICAR directly administers 49 research institutes in the areas of crop, animal and fishery sciences. They are:

(a) Research Management Academy: National Academy of Agricultural Research Management (NAARM) originally started as Central Staff College for Agriculture, at Hyderabad provides research management training to the agricultural scientists in the country. In addition, it organizes seminars, conferences and workshops, both national and international, based upon the scientific studies and reviews undertaken on the management problems encountered in the research system. It publishes training materials and functions as a repository of information in the field of agricultural research and education management. Besides meeting national needs as a premier management institution, the Academy has now developed an institutional capability to act as a Regional Training Centre in this part of the World

(b) National Bureaux: In order to collect, conserve and initiate such measures as would lead to long-term productivity of basic resources like plants, animals, fish, soil, and water, ICAR has established four national bureaux. They are:

1. National Bureau of Plant Genetic Resources (NBPGR) at New Delhi undertakes research and coordinates activities in germplasm collection; introduction and exchange of seeds and plant materials; and characterization, documentation, maintenance, and conservation of genetic resources for utilization in crop management.

2. National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) at Nagpur is engaged in the preparation of soil map of India; preparation of district level soil resource inventories; soil correlation and classification at national level; research in soil genesis and classification; imparting training in soil survey and mapping; soil taxonomy, land use planning, etc; and establishment of a soil data bank for use in agricultural research and extension.
3. National Bureau of Animal Genetic Resources (NBAGR) at Karnal is engaged in the collection, maintenance and conservation of animal genetic resources for utilization in livestock improvement.
4. National Bureau of Fish Genetic Resources (NBFGR) at Lucknow is engaged in the collection, conservation and efficient utilization of fish genetic resources.

(c) Crop Science Institutes: There are nine crop science institutes carrying out basic and applied research on specific crops and transferring the results thereof. They are:

1. Indian Agricultural Research Institute (IARI) at New Delhi is the premier agricultural institution engaged in basic and applied research in crops, postgraduate education and training, extension education, and transfer of technology. It has a Deemed University status, and awards postgraduate degrees in various disciplines of crop science.
2. Central Rice Research Institute (CRRI) at Cuttack is engaged in basic and applied research in all disciplines of rice culture; in the generation of information for planning adaptive research; and serves as a centre of information on all matters concerning rice production, protection and conservation.
3. Central Research Institute for Jute and Allied Fibers (CRIJAF) at Barrackpore is engaged in developing varieties of jute suitable for different jute growing areas; in developing appropriate crop management and crop protection technology including broad types of farm tools and implements for jute and allied fibers; and in the production of breeder and foundation seeds of jute.
4. Central Tobacco Research Institute (CTRI) at Rajahmundry is engaged in varietals improvement of FCV tobacco; in pest and disease management; in the improvement of curing technology; in the utilization of tobacco wastes; and in extension education.
5. Indian Grassland and Fodder Research Institute (IGFRI) at Jhansi carries out basic and applied research on grasses, grass lands and fodder crops including all aspects of forage seed production and its protection for producing high quality forage. It also attempts to develop and evaluate various crop/tree species combinations for silvipasture and agroforestry systems.
6. Sugarcane Breeding Institute (SBI) at Coimbatore is engaged in evaluating important sugarcane varieties for different agro-climatic regions in the country. It conducts research on breeding methodologies by taking advantage of its situational factor favourable for the flowering of sugarcane crop. It also imparts postgraduate training.
7. Indian Institute of Sugarcane Research (IISR) at Lucknow has the mandate to standardize the sugarcane production and protection technologies; to devise and develop prototype of machines and implements required to promote the interest of sugarcane cultivation for maximum economic benefits to the farmers; to provide advisory services; and to impart training in sugar crops and agro-techniques.
8. Central Institute of Cotton Research (CICR) at Nagpur is engaged in basic and applied research to improve cotton production; in the collection and conservation of germplasm for cotton improvement programmes; and in imparting training in advanced cotton protection technology.
9. Vivekananda Parvatiya Krishi Anusandhan Shala (VPKAS) at Almora is engaged in the development of improved high yielding and disease resistant varieties of different cereals, millets, pulses, vegetables, and fodder crops grown in hills; collection, evaluation and maintenance of germplasm resources of hill crops and identification of suitable improved cropping systems for these areas; and conduct research on soil and water management problems and transfer research results for the benefit of farmers of hill areas.

(d) Horticulture and Plantation Crops Institutes: There are six horticulture and plantation crops institutes conducting and coordinating research on the crops they deal with. They are:

1. Indian Institute of Horticultural Research (IIHR) at Bangalore has the mandate to conduct cytogenetical studies to improve horticultural crops; standardize propagation techniques; nutritional growth regulators in horticulture; physiology and biochemistry of flower and fruit development; control of weeds, viral, fungal and bacterial diseases, mites and pests; postharvest technology; design of tools and implements; and conservation of germplasm.
2. Central Institute of Horticulture for Northern Plains (CIHNP) at Lucknow is engaged in the investigation of major production problems of fruit and vegetable cultivation for the northern plains with special reference to mango.
3. Central Institute of Temperate Horticulture (CITH) at Srinagar has the mandate to carry out basic and applied research relating to temperate fruits and vegetables in the country.
4. Central Potato Research Institute (CPRI) at Shimla has the mandate to conduct and coordinate potato research in India; to serve as a centre of information on all aspects of potato research and development; and to produce breeder seed required by the country.
5. Central Tuber Crops Research Institute (CTCRI) at Trivandrum conducts and coordinates research on all tropical tuber crops other than potato, viz. cassava, sweet potato, amorphophallus, aroids, yams, arrowroot, etc.
6. Central Plantation Crops Research Institute (CPCRI) at Kasargod has the mandate to improve the genetic potential of plantation crops; conduct basic and applied research; serve as an information centre on all matters relating to these crops; and produce genetically superior planting materials.

(e) Resource Management Institutes: There are eight resource management institutes which are primarily responsible for undertaking research on soil and water conservation for optimizing production of crops under different conditions. They are:

1. Central Soil and Water Conservation Research and Training Institute (CSWCR&TI) at Dehradun has the mandate to study erosion problems, and conservation of land and water resources; evaluation of hydrological barriers and management of watersheds; identification of suitable plant materials for different land use; development of suitable technology for increasing production from arid lands; development of techniques for rainfed farming and efficient water management; imparting training to state and central officers in soil and water conservation; and monitoring of changes in environment affected by integrated water management.
2. Central Soil Salinity Research Institute (CSSRI) at Karnal has the mandate to collect information on the extent, characteristic, genesis, and classification of salt affected soils; study soil and water dynamics in irrigated agriculture; conduct detailed hydrological survey; evolve methods to check deterioration of water due to pollution, and utilization of different qualities for agricultural purposes; study salt tolerance for reclamation of salt affected land; and impart postgraduate education and training.
3. Central Arid Zone Research Institute (CAZRI) at Jodhpur has the mandate to evolve location-specific technologies for optimizing production of arid lands based on ecological principles by judicious utilization of natural resources; and to train and to conduct workshops for adopting the new technologies.
4. Central Research Institute for Dryland Agriculture (CRIDA) at Hyderabad has the mandate to carry out basic research in conservation, management and utilization of natural resources in dryland ecosystem; to study the phenomenon governing crop growth and development under dryland conditions; to develop technology for exploitation of natural resources at farm level for increasing and stabilizing crop production in dryland; and also to act as a repository of knowledge on dryland farming in the country.

5. ICAR Research Complex for North-Eastern Hill Region (ICAR-NEH) at Shillong caters to the needs of agriculture, animal husbandry, fisheries, soil and water conservation, etc., for the hill areas of the north-eastern region with a major research focus on shifting cultivation, horticultural crops, pest management, livestock improvement, arid soil management, and postharvest technology.
6. ICAR Research Complex for Goa (ICAR-GOA) at Ela is engaged in research related to horticultural and other crops, livestock improvement, fisheries, etc. in the region.
7. Central Agricultural Research Institute (CARI) for Andaman and Nicobar Islands at Port Blair conducts research on high value cash and plantation crops; develops silvipastoral system and appropriate land use pattern through cropping systems; develops effective health coverage and livestock production systems; and conducts studies on capture and culture fisheries including coastal aquaculture.
8. Indian Institute of Soil Science (IISS) at Bhopal has the mandate to study the fundamental aspects of soils, particularly those that are basic to develop agricultural expertise and generate information on various basic aspects of soil research; to collaborate with other organizations to identify gaps and provide direction for further research; and to have collaboration with similar international research institutions.

(f) Technological Institutes: The technological and engineering problems in crop production and quality of commercial crops are handled by five institutes. They are:

1. Central Institute of Agricultural Engineering (CIAE) at Bhopal has the mandate for research and development of improved farm equipment related to crop production; postharvest technology; development of energy resources and power units for agriculture; to liaise with industry for the manufacture of improved implements; and to train farmers on modern agricultural technology.
2. Central Institute for Research on Cotton Technology (CIRCT) at Bombay has the mandate to improve the production of quality cotton; and to find ways and means for better utilization of cotton and its by-products.
3. National Institute of Research on Jute and Allied Fiber Technology (NIRJAFT) at Calcutta has the objectives of improvement of fiber quality; preparation of textiles by blending jute and other fibers; basic research on fibers and products; and transfer of technology for application in agriculture and industry.
4. Indian Lac Research Institute (ILRI) at Ranchi carries out research towards effecting improvements in cultivation, modification and standardization of lac, and studies its constitution and modifications so as to intensify its production and utilization; and to impart training in improved methods of lac cultivation and its industrial use.
5. Central Institute of Postharvest Engineering and Technology (CIPET) at Ludhiana undertakes research on various aspects of postharvest technology related to agricultural produce.

(g) Animal Science Institutes: Eight animal science institutes have the mandate of breeding animals for higher productivity and suggest better management practices. They are:

1. Indian Veterinary Research Institute (IVRI) at Izatnagar, a Deemed University, has its objectives to conduct basic and applied research on all aspects of livestock health, production, and nutrition; and impart postgraduate education in veterinary sciences and animal husbandry.
2. National Dairy Research Institute (NDRI) at Karnal, a Deemed University, has the mandate to meet the manpower needs for research, teaching, and dairy development through undergraduate and postgraduate instructional programmes; study of dairy production, milk and milk processing, dairy economics and management; and conduct of transfer of technology programmes.

3. Central Sheep and Wool Research Institute (CSWRI) at Avikanagar has the mandate to improve productivity of indigenous breeds of sheep through selection or cross breeding, superior exotic breeds well adapted to the tropical conditions to improve the carpet, wool and meat production.
4. Central Institute for Research on Goats (CIRG) at Makhdoom undertakes research for developing superior strains of goats for high productivity of meat, milk and fiber; to develop package of practices for feeding, management, and disease cover; and to study various aspects of goat meat, milk and pashmina.
5. Central Avian Research Institute (CARI) at Izatnagar has the objectives to develop avian species of economic importance with their optimum productivity; to conserve, evolve and improve indigenous and exotic germplasm; to impart training at various levels; to transfer the technology developed; and to undertake studies on various aspects of management to evolve environmental and ecological factors of postharvest technology.
6. Central Institute for Research on Buffaloes (CIRB) at Hissar carries out research on all aspects of buffalo production; co-ordinates research on buffalo in the country; functions as a clearing house of information on all aspects of buffalo development; establishes a nucleus breeding herd of important buffalo breeds for genetic studies on improvement of milk, meat, and draught potential; builds up adequate germplasm of improved breeds; and organizes training programmes in buffalo management.
7. National Institute of Animal Genetics (NIAG) at Karnal provides scientific support to the NBAGR and takes up research work of very fundamental nature not ordinarily taken up at the existing ICAR Institutes and Agricultural Universities.
8. National Institute of Animal Nutrition and Physiology (NIANP) at Bangalore conducts research related to nutritional and physiological aspects of livestock and management.

(h) Fisheries Institutes: Six fisheries institutes conduct studies for assessing the production of fish, conduct training programmes and undertake research. They are:

1. Central Inland Capture Fisheries Research Institute (CICFRI) at Barrackpore has the mandate to develop systems for monitoring of fish population in rivers, fresh water reservoirs, estuaries, and to study factors influencing these population and systems for optimum exploitation; and to conduct postgraduate and specialized training and extension programmes.
2. Central Marine Fisheries Research Institute (CMFRI) at Cochin conducts research for assessing and monitoring exploitable marine fishery resources for rational exploitation and conservation; to assess the exploited and under-exploited fishery resources; to understand the fluctuation in abundance of marine fishery resources; to develop suitable mariculture technology for fin fish and shell fish in open seas; and to conduct transfer of technology and postgraduate and specialized short-term training programmes.
3. Central Institute of Fisheries Education (CIFE) at Bombay has the Deemed University status. It conducts undergraduate and postgraduate degree programmes in fishery sciences; undertakes research in basic disciplines related to fish and conducts short-term and long-term training programmes for different disciplines of fishery sciences.
4. Central Institute of Fisheries Technology, (CIFT) at Cochin conducts research for the improvement of indigenous crafts and gears, and develops suitable designs for them; develops technologies for handling, processing, preservation, product development, quality control, packaging and transportation of fish and fishery products; and conducts transfer of technology and training programmes in fishery technology.
5. Central Institute of Brackishwater Aquaculture (CIBA) at Madras conducts multidisciplinary, mission-oriented applied research to develop appropriate technologies for the aquaculture organisms in the estuaries, brackishwater and salt intrusion areas; and to provide an information base for sustained growth and accelerated development of these fisheries through training, education and research linkages.

6. Central Institute of Freshwater Aquaculture (CIFA) at Dhauli conducts research for developing low input aqua-farming to benefit small and marginal farmers and also system of industrialized aquaculture for entrepreneurs; to improve existing technologies for carps and air-breathing fish culture, and develop culture technology for cat fish, freshwater prawns and mussels; to increase freshwater fish production through genetic upgrading, increased pond productivity and evolution of cheap and balanced diet; to conduct nutritional and disease aspects of fish culture; and to conduct postgraduate education and training programmes.

(i) Social Science Institutes: Two institutes come under this category. They are:

1. Indian Agricultural Statistics Research Institute (IASRI) at New Delhi conducts research in experimental design, surveys, statistical genetics, computer and data processing; imparts postgraduate courses for training professional statisticians; and provides advisory and consultancy services to agricultural scientists in the country.
2. National Centre for Agricultural Economics and Policy Research (NCAP) at New Delhi has the objectives to undertake research related to the economic aspects of agricultural production process including the associated policy issues.

The ICAR institutes vary greatly in age, size, and scope. Some are old (IVRI) while some are new (IIAEPR); some are big (IARI) while some others are small (CIRG); some have a narrow problem area (ILRI) while others have an extremely wide mandate (NBSS&LUP). They have a network of regional stations covering diverse agro-ecological areas to serve as a testing ground for the developed technologies. They are guided and serviced, both technically and administratively, by the ICAR headquarters. For ensuring greater effectiveness, from time to time, ICAR has taken steps to decentralize the decision-making process through delegation of powers to the institutes.

The individual institutes, under the supervision of a Director, are organized into well-defined divisions. On technical matters, they are assisted by scientific bodies like the Research Advisory Committee (RAC) represented by external experts, with Director as a member, and headed by an eminent person; and the Staff Research Council (SRC) which is represented by the institute scientists and headed by the Director. They meet once in a year and is charged with the responsibility to provide broad policy guidelines, and to plan, monitor, and evaluate research projects. All institutes have Management Committees except those with Deemed University status which have Management Boards. These Committees represented by the research and developmental personnel under the chairmanship of the Director, assist the institutes on broad policy formulation and financial matters. Once in five years, the performance of each institute is evaluated through a system of Achievement Audit Committees known as Quinquennial Review Teams. These teams, through a peer group review, play an important role in projecting the institutes' programmes in accordance with national policies and priorities. Besides, the Directors' Conferences, held regularly in the headquarters under the chairmanship of the Director General, consider problems common to the institutes.

B. Project Directorates: Because of the importance and magnitude of the work involved in a single commodity like rice, wheat and poultry, or a group of commodities like oilseeds, pulses and vegetables, ICAR has upgraded some of its research infrastructure/projects with added responsibilities, and designated them as Project Directorates. Except for the size and magnitude of work involved, these are basically the same as the Coordinated Research Projects. Additionally, they do undertake some research besides playing such national service roles like maintenance and supply of germplasm, organizing off-season nursery to promote and speed up research interests, monitoring pests and diseases, forecasting and issuing clearly warning about the pests and diseases outbreak, and performing such duties as a lead centre in relation to their respective subject matter, and so on. There are now ten of them under operation. They are:

1. Directorate of Rice Research, Hyderabad;
2. Directorate of Wheat Research, Karnal;
3. Directorate of Pulses Research, Kanpur;
4. Directorate of Oilseeds Research, Hyderabad;
5. Project Directorate on Vegetables, Varanasi;
6. Directorate of Cropping Systems Research, Modipuram;
7. Project Directorate on Water Management, Patna;
8. Project Directorate on Cattle, Meerut;
9. Project Directorate on Poultry, Hyderabad;
10. Directorate of Maize Research, New Delhi.

C. National Research Centres: The National Commission on Agriculture recommended setting up of 'Centres of Fundamental Research' headed by eminent scientists in particular areas. Consequently, the ICAR conceived the idea of setting up a number of National Research Centres (NRCs). The concept of NRCs revolves around the need for concentrated attention with a mission approach by a team of scientists from different disciplines. They work under a senior leader on selected topics which have direct or indirect relevance to resolving national problems in a particular crop or commodity or a problem area of research. These centres are designed to concentrate on those crops and commodities not well served by the research institutes. Unlike the institutes, these centres do not have divisional set-up for individual disciplines nor have regional stations. They feed the national network of research with new materials, technology and information for subsequent adoption in the different production-oriented research programmes. The NRC for Groundnut was the first to be organized in 1979, and the NRC for Cashew is of the more recent ones established. There are now 31 such Centres, covering a wide range of areas like crops, horticulture, animal species, fisheries, resource management, etc. Five more approved centres are yet to be established. Some of the NRCs may grow into full-fledged institutes once their standard of work is established and if the subjects assume greater national importance.

D. Research Schemes/Projects: In addition to its institute-based research, ICAR promotes research schemes/projects in agriculture and allied areas to resolve location-specific problems. It is involved in a cooperative endeavor with other research organizations in carrying out multidisciplinary research programmes. Such promotional schemes fall under the following categories.

E. All India Coordinated Research Projects (AICRPs): These projects have been essentially conceived as an instrument to mobilize available scientific resources to find effective solutions for the national problems of agricultural production through inter-institutional interactions. The projects are developed as multidisciplinary and problem-oriented projects with major emphasis on multi-locational testing of new materials/production systems. They provide opportunities for scientists working on similar problems in different institutions to come together, discuss and exchange ideas, information, and materials for mutual benefit. They also provide them with facilities for multi-locational testing of improved technologies developed by various subsystems in different agro-climatic regions. The projects constitute an effective national grid of coordinated experiments by integrating different institutions and disciplines.

The All India Maize Improvement Project, launched by the ICAR in 1957 to improve maize production using hybrids, was the forerunner of this approach. Its remarkable success led to the extension of this approach to all the major crops and other areas like animal science, fisheries, soils, agricultural engineering, horticulture, etc. Subsequently, many such coordinated projects were initiated. Each project is generally sanctioned for a period of 5 years and is headed by a full-time Project Coordinator with a Coordinating Unit to assist him. These Units are located either in the ICAR Institutes or the Agricultural Universities depending upon the location of the project. They are responsible for all the technical, financial and administrative matters as well as for organizing regular workshops. The technical programmes of the individual projects are carried out by

many cooperating centres located in the participating institutions. Regular workshops, either annual or biennial, are organized by the individual projects in which the technical programmes are finalized. The Project Coordinator is guided and serviced on all matters by the concerned Assistant Director General in the ICAR headquarters.

There are 70 such projects currently operating at 1,291 operating centres. Of these, 904 Centres are located in Agricultural Universities; 190 in ICAR Institutes; and the rest at other institutions. Crop sciences have 34 projects operating at 627 centres; and soil science and agricultural engineering have 20 projects at 364 centres. The expenditure on these projects has increased steadily and nearly one-fourth of the ICAR's budget is now spent on these projects. The complement of staff, determined on the basis of the technical work assigned and the nature of operation, are provided by the participating institutions, but paid for by the ICAR. The expenditure is shared by the ICAR and the collaborating institutions on 75:25 bases.

A high degree of accountability, based on continuous monitoring, is a noteworthy feature of these projects. Outstanding achievements have been made through these projects, and the development of such an approach has been a source of inspiration to many developing countries.

F. National Agricultural Research Project (NARP): Agricultural Universities which have a state-wide mandate for agriculture did not have a strong base for research at the regional level and most of the funds provided were utilized for developing the University main campuses, thus neglecting the regional research needs. To overcome this, the ICAR launched in 1979, with World Bank assistance, a novel scheme known as National Agricultural Research Project (NARP) to strengthen the regional research capabilities of these Universities for conducting need-based, location-specific and production-oriented research in identified agro-climatic zones. Under this project, each State is divided into a contiguous set of agro-climatic zones on the basis of climate, soils, crops and ecology. There are 131 such zones in the country with 125 zones in 17 States and Union Territories, and 6 zones in the North Eastern Region. In each zone, a major regional research station with a multidisciplinary team of scientists is established or strengthened.

The strengthening is accomplished by providing funds for incremental scientific and supporting staff, laboratory, equipment, transport, operating costs, and other physical facilities. The Agricultural University, on its part, has to provide funds for land, cultivation and station maintenance. The project also provides for strengthening the office of the Director of Research in these Universities for coordinating the research activities undertaken by these stations more effectively. An inventory of resources and systems of cultivation are prepared for each zone to serve as a basic document known as 'Status Report' for identifying regional research needs. Farming systems research with emphasis on multidisciplinary approach to problem solving and establishment of a closer linkage between research and extension at the grassroots level with active participation of farmers are the essential components of this project. In the zonal workshops, organized at the beginning of each cropping season, research station scientists, developmental staff, and farmers' representatives review the progress and plan for the future based on actual needs. The project is guided and serviced by the NARP Directorate located in the ICAR headquarters. The progress of the project is regularly monitored by the Agricultural University and the ICAR, and is also reviewed periodically by the Special Mission of the World Bank. The ICAR's assistance is available for a period of five years after which the responsibility for continuing the project rests with the University.

The Project had the IDA support of \$ 27 million in the first phase, which was about 50 per cent of the project cost. The first phase laid major emphasis on cereals, pulses and oilseeds under rainfed conditions. In this phase, nearly 109 sub-projects were approved and it was closed in September 1985 after having used \$19.5 million of the \$ 27 million credit. The second phase on NARP, under implementation since February 1986, is intended to intensify and continue the process of decentralizing agricultural research. In addition to financing the sub-projects not completed under the first phase, this phase provides support for special

research projects in irrigated farming, animal drawn equipments horticulture including postharvest technology, commercial crops, agroforestry, and animal nutrition. The second phase is estimated to cost \$110.9 million of which the IDA credit is \$ 72.1 million. The mid-term review conducted in April 1989 has recommended an extension of the second phase for two more years until September 1994.

Strengthening of regional research on a scientific agro-climatic basis has been the most significant positive development that has taken place through the implementation of NARP in the organization of agricultural research in the country. In spite of some minor problems, the project has achieved its main objective of helping to strengthen the regional research capabilities of the Agricultural Universities and decentralize agricultural research. The project has created an awareness of developing mission-oriented, problem-specific, relevant research with multidisciplinary thrust, and thus has made considerable impact in many areas where enough attention was not paid earlier.

G. Technology mission in agriculture: In the Seventh Five Year Plan, a mission-oriented approach to technology development was emphasized to faster relevance and to provide motivation for establishing organic working linkages between different sectors, which otherwise remained compartmentalized. The Steering Group on Science and Technology, constituted by the National Planning Commission, has identified.

Several Technology Missions under different sectors. The Technology Mission on Oilseeds Research was set up in April 1986, to provide research and technology support to make the country self-reliant in edible and non-edible oils. The Mission concentrates its attention on major oilseed crops like groundnut, rapeseed, mustard, soybean, sunflower, safflower, linseed, sesamum, and Niger. It also gives priority to non-edible oilseed crops to meet the requirements of industry. The Mission envisages an integrated approach involving different developmental, scientific, input, banking, and marketing agencies. A total of 180 districts are earmarked for the purpose.

The Department of Agriculture and Cooperation in the Ministry of Agriculture and the ICAR are the principal implementing agencies. The Additional Secretary to the Government of India in the Department of Agriculture and Cooperation is the Mission Director. Four Sub-Missions share the operational responsibilities. These are: (a) Production Technology (R&D) Sub-Mission for which the Director General of ICAR is the Chairman; (b) Input Supply and Production Sub-Mission for which the Additional Secretary to the Government of India is the Chairman, and the Agricultural Commissioner is the Co-chairman; (c) Postharvest Technology and Processing Sub-Mission for which the Scientific Advisor to the Planning Commission is the Chairman; and (d) Pricing, Transport, Procurement and Marketing Sub-Mission for which the Additional Secretary to the Government of India is the Chairman.

Quarterly reviews of all the developmental activities are done to effect mid-term corrections. An expert team was set up recently to review the progress. Because of its significant achievement within a short span of four years by increasing the production of oilseeds to over 20 million tones, it is decided to continue the Mission during the Eighth Plan Period.

H. Ad hoc research schemes: ICAR generates a Cess Fund by levying a custom duty at the rate of 0.5 per cent ad valorem on 25 articles of agricultural produce exported from India. It supports a large number of short-term, result-oriented ad hoc research schemes by utilizing the Agricultural Produce Cess Fund, which roughly works out to Rs.60 million a year. The schemes aim at filling critical gaps in the scientific field and are implemented by the ICAR Institutes, Agricultural and General Universities, Private Institutions and Voluntary Organizations. There are a little over 600 such ad hoc schemes currently in operation. The topics of the schemes could be identified by the individual scientists or institutions, or selected out of the recommendations made in the ICAR Regional Committee Meetings, Vice Chancellor's Conferences, or in

similar forums. The schemes are generally sanctioned for three years. Some of them are exploratory in nature and may lead to development of larger country-wide projects.

I. Centres of advanced studies: In order to improve faculty competence and develop infrastructure for better research and training, ICAR with the support of UNDP has set up, since 1971, several Centres of Advanced Studies in selected disciplines in Agricultural Universities and ICAR Institutes. These Centres were established to encourage the pursuit of excellence through collaboration between scientists of outstanding ability with their counterparts in similar institutions abroad, and thus accelerate the attainment of international standards in specific fields of agricultural research and education. They also focus on modernizing faculty capability and physical facilities for advanced research and educational programmes so as to reduce India's dependence on foreign countries for advanced training in these fields.

These Centres have been able to modernize and consolidate their programmes on an interdisciplinary basis, augment their infrastructure facilities, and provide specialized training to their scientists. Interaction with scientific institutions abroad and advanced level training in India and abroad through fellowship programme have made it possible to build up a cadre of highly competent professional scientists. These Centres also brought about considerable interaction among scientists within the country by organizing All India Workshops, Seminars and Conferences.

So far, 28 such Advanced Centres have been established, with 17 of them located in the ICAR Institutes and the rest in the Agricultural Universities. They have made good use of the combined support of the ICAR, UNDP, UNESCO, and FAO. The Centres have become the nuclei for high quality research and training in the concerned disciplines.

J. Special schemes: ICAR launched in 1978 a special scheme known as 'Professors of Eminence and National Research Fellows' to identify individuals of outstanding merit, who could provide leadership in the development of 'Schools of Thought' in specific areas by undertaking fundamental research in agriculture and allied areas. Under this scheme, scientists work on specific projects formulated by them in the ICAR Institutes and Agricultural Universities. ICAR with the cooperation of the host institutions provide physical and infrastructure facilities liberally for operating their projects, and the incumbents operate with considerable financial and administrative autonomy. These two categories have now been combined into one known as 'ICAR Professors for Mission-Oriented Fundamental Research'. Since 1959, ICAR has also been operating the 'Emeritus Scientists' scheme to support eminent retired scientists, enabling them to continue their research in various fields of agriculture and allied sciences. The scheme provides research grants to retiring scientists of established repute in ICAR Institutes and Agricultural Universities. ICAR supports this scheme from the Agricultural Produce Cess Fund.

K. Research planning, monitoring and evaluation: ICAR is responsible for agricultural research planning at the national level. Its headquarters scrutinizes and sanctions research schemes received from its own institutes as well as from other institutions. The research schemes are first technically examined by the concerned Subject Matter Divisions in the headquarters and put up for consideration before the Scientific Panels. Once they are found technically sound, they are later examined for financial implications by the Standing Finance Committee. Finally, they are placed before the Governing Body for approval.

In the ICAR system, the broader mandate and research programmes are decided by the headquarters, and the responsibility for the formulation of all research projects rests with the institutes. The institute scientists submit annually their research proposals in a standard proforma known as Research Project File (RPF) which is discussed by the Research Councils at the divisional level in a larger institutes followed by the Staff Research Councils (SRCs) at the institute level. The SRCs are attended by the institute scientists under the chairmanship of the Director. The new proposals as well as the on-going projects are evaluated by the SRC

and approved by the Director. Some of the major criteria used to evaluate new proposals in the SRC meetings are farmers' needs, urgency of research problem, compatibility with institutes' mandate, socioeconomic benefits, ease and cost of adoption by farmers, and contribution to knowledge. The proportion of multidisciplinary projects is showing an increasing trend.

The key to the success of agricultural research efforts in the ICAR system has been the in-built mechanism of research monitoring and evaluation. At the institute level, they are carried out through the SRCs and through a comprehensive review by specially constituted Quinquennial Review Teams once in five years. In the case of coordinated research projects, they are evaluated at the workshops and through mid-term appraisal committees, which review the work from time to time. The progress of ad hoc research schemes is monitored through regular reports, which are examined by the Scientific Panels. Overall monitoring of different research schemes is undertaken by the Subject Matter Divisions at the ICAR headquarters, and the overall implementation of the plan schemes by the Plan Implementation and Monitoring Unit.

2. THE AGRICULTURAL UNIVERSITIES SYSTEM

As agriculture is a State subject, the responsibilities for research, education and extension rest with the State Governments. Prior to 1960, agricultural research in the States, essentially on local problems, was carried out by the State Departments of Agriculture supported by Agricultural Colleges. During the past 30 years, research and education have been transferred to the Agricultural Universities, and the State Departments of Agriculture organize extension services. The Universities are supported by their respective State Governments. ICAR provides financial support and assists their research and education programmes.

The University Education Commission (1949) recommended the setting up of 'Rural Universities'. This was endorsed by the two Joint Indo-American Teams in 1955 and in 1959, as well as the Ford Foundation Study Team in 1959. In 1960, the Agricultural Universities Committee under the Chairmanship of Dr. Ralph W. Cummings prepared certain guidelines for the establishment of Agricultural Universities in different States, and the ICAR gave necessary support. The first Agricultural University was established at Pant Nagar in Uttar Pradesh (Nowadays in Uttarakhand) in 1960, patterned on the Land-Grant System of the United States. The Second Education Commission (1964-66) recommended at least one Agricultural University in each State, and ICAR prepared a Model Act in 1966. All the States have now at least one Agricultural University each. Though the Model Act specifies that only one University shall be established in each State, which was later endorsed by the National Commission on Agriculture, many States have established multiple Universities to meet regional needs. There are at present 45 Agricultural Universities including the Central University in the North Eastern Region. These include two veterinary and animal science universities, one in Tamilnadu and another in West Bengal. Some Agricultural Universities, as in Maharashtra State, have affiliated colleges. This goes against the provisions of the Act. In 1978, a Review Committee appointed by the ICAR reviewed the functioning of each Agricultural University and made a number of recommendations. Recently, in 1988, the USAID evaluated the impact of Agricultural Universities and made several suggestions for improvement.

Agricultural Universities are autonomous institutions established by an Act of State Legislature. Although the administrative structure differs somewhat from State to State, the general outlines are similar. As Chancellor, the State Governor is the nominal head of the University. In some States, the Agriculture Minister acts as the Pro-Chancellor. The Vice-Chancellor is the Chief Executive of the University. In some States, more than one University has been established through a Common Act; their activities are coordinated through a State level Agricultural Research and Education Coordination Committee. Of the all Agricultural Universities in the country, some of them are mono-campus while the others are multi-campus Universities. The number of campuses in each University varies from 1 to 6.

LIST OF AGRICULTURAL UNIVERSITIES IN INDIA

1. Acharya NG Ranga Agricultural Univ., Rajendranagar, Hyderabad-500030, A.P.
2. Anand Agricultural University, Anand-388110, Gujarat
3. Assam Agricultural University, Jorhat-785013, Assam
4. Bidhan Chandra Krishi Viswavidyalaya, P.O Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal
5. Birsa Agricultural University, Kanke, Ranchi- 834006, Jharkhand
6. Central Agricultural University, Imphal -795004, Manipur
7. Chandra Shekar Azad Univ. of Agriculture & Technology, Kanpur- 208002, U.P
8. Chaudhary Charan Singh Haryana Agricultural University, Hissar-125004, Haryana
9. Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur, Kangra- 176062, Himachal Pradesh
10. Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri-415712, Maharashtra
11. Dr Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola-444104, Maharashtra
12. Dr Yashwant Singh Parmar Univ. of Horticulture & Forestry, Solan, Nauni – 173230, Himachal Pradesh
13. Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Udham Singh Nagar- 263145, Uttarakhand
14. Guru Angad Dev University of Veterinary and Animal Sciences, Ludhiana-141004, Punjab
15. Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur-492006, Chhattisgarh
16. Jawaharlal Nehru Krishi Vishwavidyalaya, Krishi Nagar, Jabalpur- 482004, M.P.
17. Junagadh Agriculture University, Moti Baug, Agril. Campus, Junagadh-362001, Gujarat.
18. Karnataka Veterinary Animal and Fisheries Science University, P.B. No. 6, Nandinagar, Bidar- 585401, Karnataka
19. Kerala Agricultural University, P.O Vellanikkara, Thrissur-680656, Kerala
20. Maharana Pratap Univ. of Agriculture & Technology, Udaipur-313001, Rajasthan
21. Maharashtra Animal Science & Fishery University, Nagpur, Maharashtra
22. Mahatma Phule Krishi Vidyapeeth, Rahuri-413722, Maharashtra
23. Marathwada Agricultural University, Parbhani -431402, Maharashtra
24. Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad- 224229, Uttar Pradesh
25. Navsari Agricultural University, Vijalpore, Navsari-396450, Gujarat
26. Orissa Univ. of Agriculture & Technology, Siripur, Bhubaneswar-751003, Orissa
27. Punjab Agricultural University, Ludhiana -141004, Punjab
28. Rajasthan Agricultural University, Bikaner -334006, Rajasthan
29. Rajendra Agricultural University, Pusa, Samastipur-848125, Bihar
30. Sardar Vallabh Bhai Patel University of Agriculture & Technology, Modipuram, Meerut-250110, Uttar Pradesh
31. Sardarkrushinagar-Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada, Banaskantha-385506, Gujarat
32. Sher-E-Kashmir Univ. of Agricultural Sciences & Technology, Railway Road, Jammu- 180012 (J&K).
33. Sher-E-Kashmir Univ. of Agricultural Sciences & Technology, Shalimar, Srinagar- 191121, (J&K).
34. Sri Venkateswara Veterinary University, Tirupati, Chittoor- 517502, A.P.

35. Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu
36. Tamil Nadu Veterinary & Animal Sciences University, Madhavaram Milk Colony, Chennai- 600051, Tamil Nadu
37. University of Agricultural Sciences, Dharwad, Karnataka
38. University of Agricultural Sciences, Bangalore- 560065, Karnataka.
39. UP Pandit Deen Dayal Upadhaya Pashu Chikitsa Vigyan Vishwa Vidhyalaya Evam Go Anusandhan Sansthan, Mathura- 281001, Uttar Pradesh
40. Uttar Banga Krishi Vishwavidyalaya, P.O. Pundibari, Distt. Cooch Behar-736165, West Bengal
41. West Bengal University of Animal & Fishery Sciences, 68 KB Sarani, Kolkata-700037, West Bengal
42. University of Horticultural Sciences, Venkataramnagudem, West Godavari, A.P.
43. Rajmata VRS Agricultural University, Gwalior-474002, Madhya Pradesh.
44. University of Horticultural Sciences, Navanagar, Bagalkot-587101, Karnataka
45. University of Agricultural Sciences, Raichur-584102, Karnataka

DEEMED-TO-BE UNIVERSITIES

1. Indian Agricultural Research Institute, Pusa-110012, New Delhi
2. Indian Veterinary Research Institute, Izatnagar, Bareilly-243122, Uttar Pradesh
3. National Dairy Research Institute, Karnal-132001, Haryana
4. Central Institute of Fisheries Education, Mumbai-400061, Maharashtra
5. Allahabad Agricultural Institute, Allahabad-211007, Uttar Pradesh

CENTRAL UNIVERSITIES WITH AGRICULTURE FACULTY

1. Banaras Hindu University, Varanasi, U.P.
2. Aligarh Muslim University, Aligarh, U.P.
3. Vishwa Bharti, Shantiniketan, West Bengal
4. Nagaland University, Medzipherma, Nagaland

Research infrastructure: Basically, the research infrastructure consists of an experiment station at the main campus and a number of research stations and substations located in different parts of the State. There are numbers of research stations belonging SAUs, working on location-specific problems. Generally, the research programmes are headed by the Directors of Research, who are assisted by the Associate Directors of Research located at the regional research stations within the State. Some Agricultural Universities have established Advanced Centres by combining related subjects in areas such as plant protection, genetics and plant breeding, agricultural engineering, agricultural economics, water technology, etc. In order to undertake need-based and location-specific research, networks of Zonal Research Centres have been established since 1979 with assistance from the World Bank under NARP. These Centres numbering about 131 in the country, each located in a distinct agro-climatic zone, is a part of the Agricultural Universities System.

Research planning, monitoring and evaluation: Agricultural Universities have State-wide responsibility for research in agriculture. In those States where, more than one University is there, the research responsibilities are shared on the regional basis. To ensure relevant research planning, their efficient implementation and proper evaluation, each Agricultural University has a Research Council or a Research Advisory Committee as an apex body for policy formulation and coordination of research activities. This body, chaired by the Vice-Chancellor comprises Director of Research, Director of Extension Education, Deans of constituent colleges, representatives of State Departments and farmers. It reviews periodically the overall status of research activities in the University, and determines their priorities and

future direction. Research is organized under; (i) University research; (ii) Postgraduate student research; and (iii) Coordinated research programmes.

The Director of Research, who is the overall in-charge of research, prepares an annual plan indicating the main thrusts of research within the broad directions given by the Research Advisory Committee. The Directorate of Research is responsible for research review and evaluation, and timely publication of research results and reports. By and large, the individual scientists formulate research projects which are then scrutinized by the concerned Department Head, examined at the Faculty/Departmental level and finally approved by the University Research Advisory Committee. Thereafter, the Director of Research and Department Heads provide funds and facilities to the scientists. In respect of research done by teachers and postgraduate students, the Director of Research acts in coordination with the Deans/Principals of the respective colleges.

Special mechanisms exist for the planning, monitoring, and evaluation of ICAR supported programmes in the Agricultural Universities. In the case of Coordinated Projects, the University scientists work in close co-operation with others from the ICAR Institutes and other Universities through the mechanism of All India Workshops conducted periodically. Ad hoc research schemes formulated by the University scientists are first scrutinized by the Scientific Panels and approved by the ICAR. These schemes are continuously monitored and evaluated by the ICAR in collaboration with the University. In the case of NARP, the programmes formulated at Zonal Research and Extension Advisory Committee meetings are constantly monitored and reviewed by the University concerned, the ICAR, and the World Bank Missions.

In most Agricultural Universities, the Research Evaluation Committees attended by the scientists and extension subject matter specialists provide the much needed in-house review mechanism within the Universities to examine the findings and data support emerging from various research projects. Only when the results are substantiated from trials, both on the experimental farms and farmers' fields, recommendations are made for large-scale implementation.

3. OTHER AGENCIES

A. General Universities: Many General Universities with well-developed faculties in agriculture, or strong departments engaged in areas such as genetics, plant physiology, mycology, entomology, biochemistry, economics, chemistry, marine biology, home science, etc. have made distinctive contributions to agricultural research in the country. Besides, the Central Universities like the Banaras Hindu University, Shanti Niketan, etc. have Institutes/Schools of Agricultural Sciences which are engaged in research in agriculture and allied areas, some of which are supported by the ICAR.

B. Scientific Organizations: Many other scientific organizations either directly undertake research, or sponsor and support programmes related to agriculture. The Council of Scientific and Industrial Research (CSIR), through its network of National Laboratories, provides research support in areas like processing of agricultural products, recycling of agricultural wastes, development of various agro-chemicals, etc. The Indian Council of Medical Research's (ICMR) research on the nutritional qualities of various agricultural produce including toxicity and occupational health of agricultural workers have greatly helped the ICAR in planning its research programmes. Some of the areas in which the Bhabha Atomic Research Centre (BARC) is actively engaged are the development of newer varieties of crops and preservation of agricultural produce. The Indian Space Research Organization (ISRO) is helping the research system to assess India's soil and water resources.

Technological institutions like IIT, Kharagpur, are active in the fields of agricultural engineering, soil and water management, and agronomy. The Department of Science and Technology (DST) promotes research

on genetic engineering, post harvest technology, and areas of basic sciences supportive to agriculture. The Department of Non-Conventional Energy Sources works on the utilization of solar and wind energies and biogas for agricultural purposes. The Department of Meteorology is actively engaged in research on crop-weather forecasting. The Department of Ocean Development is involved in assessing the fishery resources in the country and promotes research in the area of fisheries.

In addition, institutions like the National Dairy Development Board (NDDB) under the Agriculture Ministry; various Commodity Boards like Silk, Coffee, Rubber, Tea, and Cardamom Boards under the Commerce Ministry; and the Forest Research Institute and Wasteland Development Board under the Ministry of Forestry and Environment help in strengthening the agricultural research system in the country.

C. Private Sector: Involvement of private sector in agricultural research is of recent origin. In mid 1960s, several private companies started programmes mainly to develop hybrid maize, sorghum and bajra. Research on vegetables started in late 1960s. Private sector research is confined mainly to breeding crop hybrids, certain plantation crops, agro-chemicals, poultry, and agricultural machinery.

Private sector research in seed industry has grown very rapidly. Several private companies are now engaged in the production of hybrid seeds of a variety of crops like cotton, sorghum, bajra, maize, vegetables, redgram, rice, etc., and a small seed export industry has also emerged. There are at least ten private companies undertaking plant breeding research, and several others are involved in plant protection research. Besides their own research stations, these companies conduct experiments on farmers' fields. They test the bio-efficiency of insecticides and herbicides that are new to India as well as synthesize new compounds. Private research in poultry sector is of recent origin. Although Government introduced exotic birds in commercial poultry industry, they were popularized by the private sector and many companies are now actively engaged in it. Many other large industrial concerns are engaged in research on shrimps and shrimp feed.

Some private companies undertake major research and development programmes for the improvement of tractors and irrigation pumps. Research on tractors seems to be primarily aimed at improving quality, fuel efficiency and engine durability. Some companies are now moving into agricultural implements. Research in pump industry is aimed at increasing the efficiency of pumps through improved design and better materials. Some companies are even experimenting with non-conventional sources of power. Historically, private companies in the processing and plantation sector have been a very important source of new agricultural technology. Some of the prominent ones include Indian Sugar Mills Association, Southern Planters Association, Textile Mills Association, Silk Industry, etc. Some large firms are involved in research on animal nutrition, plant growth regulators, biotechnology like tissue culture in cardamom, sugarcane, coconut and tea, biofertilizers, etc. Research in the area of tree farming including in vitro culture and tree breeding is also receiving attention of private firms.

Some of the well-established institutions such as Allahabad Agricultural Institute, Bharatiya Agro-Industries Foundation, Wool Research Association, United Planters Association of South India undertake short-term, mission-oriented research projects supported by the ICAR for multi-locational testing of varieties and agro-techniques.

In order to promote scientific research and the participation of industry in it, the Government through the Income Tax Act of 1961 has offered certain tax concessions relating to the expenditure on scientific research. The involvement of private agencies in agricultural research is gaining momentum with greater sophistication in technological development and the prospects of high returns on investment in agriculture.

4. LINKAGES AMONG THE SUB-SYSTEMS

Strong working relationships and complementarity in research efforts amongst the components of the research system is necessary in order to optimize resources and check avoidable duplication. The ICAR, as the coordinating agency at the national level, has established close working relationships with the Agricultural Universities and other agencies involved directly or indirectly in agricultural research through formal arrangements and informal exchanges.

At the policy making level, the Vice-Chancellors of Agricultural Universities are represented in the Governing Body, and in the Norms and Accreditation Committee of the ICAR. The senior level research managers of the ICAR, in turn, are represented in the Management Boards of these Universities. The Regional Committees of the ICAR provide an important forum for the scientists from these two agencies to come together and look at the regional research needs. Through Interdisciplinary Scientific Panels of the ICAR, the experts from the Agricultural Universities play a critical role in selecting research programmes at the national level as well as at the regional level. More importantly, various research schemes of the ICAR like the AICRPs, NARP, and ad hoc research schemes provide opportunities for the two subsystems to work jointly on problems of national as well as regional relevance.

As far as the General Universities are concerned, they participate in research activities under different types of research schemes and projects financed by different agencies. Through the AICRPs and ad hoc research schemes, these Universities have established linkages with the ICAR and Agricultural Universities subsystems. Joint programmes in specific areas like plant physiology, biological nitrogen fixation, etc. have been taken up by the ICAR with scientists working in these Universities. ICAR has also established close linkages with various scientific organizations like CSIR, ICMR, ISRO, BARC, etc. through Joint Panels. Problems of mutual interest have brought the ICAR closer to various Departments and Ministries at the Centre to find solutions through collaborative research efforts.

5. INTERNATIONAL CO-OPERATION

International cooperation has played a significant role in developing and strengthening the research system in India. Many developed countries like USA, UK, USSR, Canada, Australia, Japan, several European countries; Charitable Institutions, etc.; Rockefeller and Ford Foundations; various International Agencies like FAO, UNDP, UNESCO, World Bank, etc.; and the International Agricultural Research Centres under the Consultative Group on International Agricultural Research (CGIAR) System have contributed extensively to the cause of agricultural research in India. Spectacular achievements in increasing the food production have raised the country's image considerably, and the bilateral arrangements have changed from the erstwhile donor-donee status to relationship of equal partnership in research. The reciprocity and mutuality of interests with the less developed and as well as the technologically advanced countries are the essence of international co-operation.

The Government has authorized ICAR, assisted by the DARE, to enter into bilateral cooperative agreements with several countries and agencies. The mode of collaboration normally follows the pattern of: (a) exchange of germplasm of plant and animal origin; (b) exchange of scientific and

technical information; (c) visits of scientists and experts; (d) training of scientists; and (e) infrastructure development.

Some of the major avenues of international collaboration are:

- (i) Bilateral co-operation at the Government level;
- (ii) Bilateral co-operation between ICAR and counterpart foreign institutes;
- (iii) Interaction with Agricultural Research Centres under the CGIAR System;
- (iv) Foreign-aided projects funded by USDA (erstwhile PL-480 projects), Ford Foundation, IDRC, UNDP, World Bank, and USAID;
- (v) Science and Technology Initiative signed by the late Prime Minister Indira Gandhi and the US President Ronald Reagan;
- (vi) Participation in the regional projects under ESCAP and SAARC programmes; and
- (vii) Consultancy and training in the field of agricultural research in developing countries.

International collaboration has provided a mechanism to draw upon the global stock of knowledge, scientific talent and material, and for institution building to address many of the research needs in the country. The agricultural research system in India has reached a stage in its development where it could take a more active role in joint research with foreign scientists as equal partners as well as in training scientists from other countries.

GLOBAL AGRICULTURAL RESEARCH SYSTEM

It is system that supports and funds to carry out research to develop agriculture and its related aspects to reduce hunger and poverty in the world. *The Consultative Group on International Agricultural Research (CGIAR)* is a part of Global Agricultural Research System

CGIAR (The Consultative Group on International Agricultural Research)

The Consultative Group on International Agricultural Research (CGIAR) was established in 1971.

The Consultative Group on International Agricultural Research (CGIAR) is an association of public and private members that support and fund a number of International Agricultural Research Centres (IARCs) that carry out research to reduce hunger and poverty.

The Consultative Group on International Agricultural Research (CGIAR) is a global partnership that unites organizations engaged in research for sustainable development with the funders of this work.

The funders include developing and industrialized country governments, foundations, and international and regional organizations. The work they support is carried out by 15 members of the Consortium of International Agricultural Research Centers, in close collaboration with hundreds of partner organizations, including national and regional research institutes, civil society organizations, academia, and the private sectors.

The Vision:

To reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership and leadership.

The Objectives:

- Food for People: Create and accelerate sustainable increases in the productivity and production of healthy food by and for the poor.
- Environment for People: Conserve, enhance and sustainable use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors.
- Policies for People: Promote policy and institutional change that will stimulate agricultural growth and equity to benefit the poor, especially rural women and other disadvantaged groups.

A long-standing strategic partnership

The Consultative Group on International Agricultural Research (CGIAR), established in 1971, is a strategic partnership of diverse donors that support 15 international Centers, working in collaboration with many hundreds of government and civil society organizations as well as private businesses around the world. CGIAR donors include both developing and industrialized countries, international and regional organizations and private foundations.

Guided by a vision of reduced poverty and hunger, improved human health and nutrition, and greater ecosystem resilience, brought about through high-quality international agricultural research, partnership and leadership, the CGIAR applies cutting-edge science to foster sustainable agricultural growth that benefits the poor. The new crop varieties, knowledge and other products resulting from the CGIAR's collaborative research are made widely available to individuals and organizations working for sustainable agricultural development throughout the world.

Eleven of the CGIAR Centers maintain international gene banks. These preserve and make readily available a wide array of plant genetic resources, which form the basis of global food security.

In addition, the CGIAR implements several innovative Challenge Programs, which are designed to address global or regional issues of vital importance. Implemented through broad-based research partnerships, these programs apply knowledge, technology and other resources to solve problems such as micronutrient deficiencies, which afflict more than three billion people worldwide; water scarcity, which already affects a third of the world's population; and climate change, which poses a dire threat to rural livelihoods across the developing world.

A New CGIAR

In December 2009 the CGIAR adopted a new institutional model designed to improve its delivery of research results in a rapidly changing external environment. The reforms should give rise to a

more results-oriented research agenda, to clearer accountability across the CGIAR and to streamlined governance and programs.

The new model consists of a balanced partnership between donors and researchers. A new CGIAR Fund will improve the quality and quantity of funding by harmonizing donor contributions, while a new Consortium will unite the Centers under a legal entity that provides the Fund with a single entry point for contracting Centers and other partners to conduct research.

Shifting to a more programmatic approach, the CGIAR Centers will operate within a Strategy and Results Framework, aimed at strengthening collaboration for greater efficiency and development impact. A portfolio of “Mega Programs” will be developed, providing CGIAR scientists and partners with new means to deliver international public goods that address major global issues in development.

An Independent Science and Partnership Council (ISPC) will provide the CGIAR with critical advice and expertise.

The new CGIAR will foster stronger and more dynamic partnerships, which generate high-quality research outputs while strengthening national research institutions. Stakeholders, including donors, partners and beneficiaries, will provide input into the design of the Strategy and Mega Programs. The Global Conference on Agricultural Research for Development (GCARD) represents a key opportunity for engaging end users, including farmers, forest and fishing communities, and National Agricultural Research Systems (NARS), in the development of new research programs.

Benefits for the poor and the planet

International agricultural research has a strong record of delivering results that help confront the central development and environmental challenges of our time. The science developed by CGIAR-supported Centers and their partners has delivered significant gains in terms of reduced hunger and improved incomes for smallholder farmers across much of the developing world. The objectives of CGIAR research are much broader than improving agricultural productivity alone, encompassing a range of initiatives related to water, biodiversity, forests, fisheries and land conservation. It has advanced sustainable management and conservation practices, thereby protecting millions of hectares of forest and grasslands, safeguarding biodiversity, and preventing land degradation.

Among the outcomes of that research are the following:

- Biological control of the cassava mealybug and green mite, both devastating pests of a root crop that is vital for food security, succeeds in sub-Saharan Africa. The economic benefits of this work alone, estimated at more than \$4 billion, are sufficient to cover all costs of CGIAR research conducted so far for Africa.
- New rices for Africa (NERICAs) combine the high yields of Asian strains with African strains’ resistance to local pests and diseases. Currently sown on 200,000 hectares in upland areas, NERICAs help reduce national rice import bills and generate higher incomes in rural communities.

- More than 50 varieties of recently developed drought-tolerant maize varieties now grow on 1 million hectares across Eastern and Southern Africa.
- A flood-tolerant version of a rice variety grows on 6 million hectares in Bangladesh. The new variety enables farmers to obtain yields two to three times higher than those from non-tolerant versions following prolonged submergence, a situation that will become more common with climate change.
- Resource-conserving “zero-till” technology has been widely adopted in the vital rice-wheat systems of South Asia. Employed by close to half a million farmers on more than 3.2 million hectares, this technology has generated benefits estimated at \$147 million through higher crop yields, lower production costs, and water and energy savings.
- An agroforestry system called “fertilizer tree fallows” renews soil fertility in Southern Africa using on-farm resources. More than 66,000 farmers have adopted this technology in Zambia, where it has strengthened food security and reduced environmental damage, and the system is spreading in four neighboring countries.
- Information and tools are used by conservationists to monitor some 37 million hectares of forest, supporting better management of this diminishing resource and contributing to more sustainable livelihoods for forest dwellers.
- A new method of detecting aflatoxin — a deadly poison that infects crops, making them unfit for local consumption or export — benefits farmers throughout sub-Saharan Africa. This technology, together with a novel biological control method that has proved able to reduce aflatoxin by nearly 100%, helps to curb this major threat to human health, especially children’s health, and to save millions of dollars in lost sales of food for export.
- A simple methodology for integrating agriculture with aquaculture bolsters income and food supplies in areas of Southern Africa where the agricultural labor force has been devastated by HIV/AIDS. Under large-scale testing in Malawi, the method doubled the income of 1,200 households and dramatically increased fish consumption.
- A new approach predicts the likely impact of climate change on major crops’ wild relatives, which are key sources of genes needed to enhance climate resilience, as well as provides valuable findings on the likely consequences of biofuel development in China and India for increasingly scarce water supplies.
- Increasing smallholder dairy production in Kenya improves childhood nutrition while generating jobs. This award-winning project with smallholder dairies has contributed up to 80% of the milk products sold in the country and strengthened local capacity to market milk products.

The CGIAR Genebanks

CGIAR scientists play major roles in collecting, characterizing and conserving plant genetic resources. Eleven Centers together maintain over 650,000 samples of crop, forage and agroforestry genetic resources in the public domain.

INTERNATIONAL AGRICULTURAL RESEARCH CENTRES (15 centers supported by the Consultative Group on International Agricultural Research (CGIAR))

- 1. CIAT (INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE)**
- 2. CIFOR (CENTER FOR INTERNATIONAL FORESTRY RESEARCH)**

3. CIMMYT (INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER "CIMMYT" derives from the Spanish version of our name: Centro Internacional de Mejoramiento de Maíz y Trigo)
4. CIP (INTERNATIONAL POTATO CENTER) it is known by its Spanish acronym, CIP means CENTRO INTERNACIONAL DE LA PAPA)
5. ICARDA (INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS)
6. ICRISAT (INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS)
7. IFPRI (INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE)
8. IITA (INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE)
9. ILRI (INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE)
10. BIOVERSITY INTERNATIONAL
11. IRRI (INTERNATIONAL RICE RESEARCH INSTITUTE)
12. IWMI (INTERNATIONAL WATER MANAGEMENT INSTITUTE)
13. WORLD AGROFORESTRY CENTRE
14. WFC (WORLD FISH CENTER)
15. AFRICA RICE CENTER (AfricaRice)

1. CIAT - INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE www.ciat.cgiar.org
Centro Internacional de Agricultura Tropical

Headquarters: A.A. 6713, Cali, Colombia

CIAT is an agricultural research institution. They focus on scientific solutions to hunger in the tropics. They believe that eco-efficient agriculture—developing sustainable methods of food production—are the best way to eradicate hunger and improve livelihoods in the region.

CIAT is also about partnerships. By working together with likeminded organizations they ensure that they have a far-reaching and long-lasting impact. CIAT cooperates with many national and international institutions in developing and industrialized countries. Their relationships with them not only function on a one-to-one basis but also take the form of networks and consortia.

CIAT is a leading not-for-profit organization and has been helping smallholders grow more food and earn more money for 40 years. Established in 1970, as one of the four original research centers in the Consultative Group of International Agricultural Research (CGIAR), CIAT now works in more than 50 countries worldwide.

CIAT's headquarters, at the 500-hectare Agronatura Science Park near Cali, in southwest Colombia, employs some of the best scientists in the world. Their experts in regional offices in Africa and Asia enable them to reach poor farmers swiftly and effectively.

2. CIFOR - CENTER FOR INTERNATIONAL FORESTRY RESEARCH www.cifor.cgiar.org

Headquarters: P.O. Box. 6596, JKPWB, Jakarta, Indonesia

The Center for International Forestry Research is a nonprofit, global facility dedicated to advancing human wellbeing, environmental conservation and equity. Center conducts research that enables more informed and equitable decision making about the use and management of forests in less-developed countries.

Center's research and expert analysis help policy makers and practitioners shape effective policy, improve the management of tropical forests and address the needs and perspectives of people who depend on forests for their livelihoods. The multidisciplinary approach of center considers the underlying drivers of deforestation and degradation which often lie outside the forestry sector: forces such as agriculture, infrastructure development, trade and investment policies and law enforcement.

Focused on major global issues

1. How do we manage forests in ways that enable us to mitigate and adapt to climate change?
2. How can the people who depend on smallholder and community forestry improve their livelihoods?
3. How do we manage the trade-offs between conservation and development?
4. How do we manage the impacts of globalised trade and investment?
5. How can tropical production forests be managed sustainability?

CIFOR's purpose: CIFOR advances human well-being, environmental conservation and equity by conducting research to inform policies and practices that affect forests in developing countries.

CIFOR's values: The following values and associated behaviours will guide those who work at CIFOR:

Commitment to impact: Center's research is driven by a commitment to eradicating poverty and protecting the environment.

Professionalism:

- Center adheres to the highest scientific and ethical standards and is transparent in its methods and honesty in results.
- Center demonstrates accountability to its colleagues and partners.
- Center respects organisational policies and procedures and implements them consistently in a fair and transparent manner.
- Center honors individual contributions and dedication to the highest standards of achievement.

Innovation and critical thinking:

- CIFOR encourages innovative, creative and risk-taking solutions through credible and responsible scientific inquiry.
- CIFOR works with enthusiasm and maintain eagerness to learn and to think critically.

Respect and collaboration:

- CIFOR acknowledges and respects diversity in terms of race, gender, culture, religion and different needs regarding work/family balance.
- CIFOR promotes equity, empowerment, independence of thought and open participation.
- CIFOR treats colleagues and partners with trust, respect, fairness, integrity and sharing of credit.

CIFOR's aspirations: Three topic-specific aspirations, to be progressively attained over the life of the strategy, are as follows:

- CIFOR is aspired to become a leading source of information and analysis on the relationships among forests, poverty and the environment, and how management and governance arrangements affect livelihood and conservation outcomes.
- CIFOR is aspired to become a leading source of information and analysis on how to harness forests for climate-change mitigation and adaptation.
- CIFOR is aspired to become a leading source of information and analysis on the impacts of globalised trade and investment on forests and forest-dependent communities.
- In addition, CIFOR has a fourth aspiration, related to CIFOR's commitment to examining the equity dimensions of forest-related policies and practices, and CIFOR's unique 'voice':
- CIFOR's research will become known for analyzing and communicating issues in ways that are reliably inclusive of the perspectives of less powerful stakeholders such as women, forest-dependent communities, and developing countries.

In order to achieve these aspirations, CIFOR will need to combine high quality research with investment in strategic outreach, including keeping abreast of and offering connections to the work of other organisations working in these areas.

CIFOR's vision: CIFOR's vision is of a world in which forests remain high on the world's political agenda and people recognise the real value of forests for maintaining livelihoods and ecosystems services. In CIFOR's vision, decision-making that affects forests is based on solid science and principles of good governance, and reflects the perspectives of developing countries and forest-dependent people.

3. CIMMYT - INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER <http://www.cimmyt.org/> (The abbreviation "CIMMYT" derives from the Spanish version of our name: Centro Internacional de Mejoramiento de Maíz y Trigo)

Headquarters: Apdo. Postal 6-641, 06600, Mexico, D.F., Mexico

CIMMYT is a non-profit research and training center headquartered in Mexico

Mission: To sustainably increase the productivity of maize and wheat systems to ensure global food security and reduce poverty

Vision and strategic goal: CIMMYT works with and brings together public research and extension organizations, private companies, advanced research institutes, NGOs, and farmer associations in countries worldwide, working pragmatically and apolitically to fight hunger and poverty. The Center applies the best science to develop and freely share:

- High-yielding, stress tolerant maize and wheat varieties.
- Large, unique collections of maize and wheat genetic resources.
- Productivity-enhancing, resource-conserving farming practices.
- Training and information relating to the above.

Through these activities and outputs, CIMMYT works to foster global and local food security, helping farmers meet rapidly rising demand from expanding populations and affluence, while addressing the emerging challenges of global climate change and resource degradation and scarcities.

CIMMYT achieves the above with about 105 specialized research staff and 500 support staff from about 40 countries, on a yearly budget of some USD 50 million. The Center is funded by international and regional development agencies, national governments, private foundations, and the private sector. It is a member of the Consultative Group on International Agricultural Research (CGIAR).

Origins: CIMMYT grew out of a pilot program in Mexico in 1943, sponsored by the Government of Mexico and the Rockefeller Foundation. The project developed into an innovative, sustained collaboration with Mexican and international researchers. It established international networks to test experimental varieties. Under the leadership of late wheat scientist Dr. Norman E. Borlaug, the team developed shorter wheat varieties that put more energy into grain production, responded better to fertilizer than older varieties, grew well at different latitudes, and were resistant to the devastating wheat disease known as stem rust. By the late 1950s, Mexico was self-sufficient in wheat production. Mexico's success inspired project researchers to become fierce and effective advocates for the Mexican innovation model in other countries.

Around 1965, South Asian cereal production was in dire straights. Population was outstripping wheat and rice production, and more than 10 million tons of grains were regularly being imported to make up for the deficits. Hunger was widespread, and government leaders in Pakistan (which then included East Pakistan, now Bangladesh) and India were desperate to improve national cereal production. The following year, CIMMYT was established as an international center with its headquarters in Mexico. In 1967 India imported 18,000 tons of seed of the improved Mexican wheat varieties, and Pakistan soon began to use them. During 1967-71, the two countries doubled their wheat production.

The successes of the new crop varieties, along with improved management practices like the use of fertilizer, sparked the widespread adoption of improved varieties and farming techniques in the developing world—a phenomenon that came to be called the "Green Revolution." The social and economic benefits of this movement were recognized worldwide when the Nobel Peace Prize was awarded to Norman Borlaug in 1970. The following year, a small cadre of development organizations, national sponsors, and private foundations organized the Consultative Group on

International Agricultural Research (CGIAR) to spread the impact of research to more crops and nations. CIMMYT was one of the first international research centres to be supported through the CGIAR.

Why do maize and wheat matter?

- Seventy percent of the world's poorest people live in the countryside. Many depend on farming, especially of maize and wheat, for food and income.
- According to FAO, maize and wheat account for about 40% of the world's food and 25% of calories consumed in developing countries.
- Millions of people—including poor people in urban areas—get more than half of their daily calories from maize and wheat alone.
- Maize and wheat occupy almost 200 million hectares in developing countries. We must grow these crops in environmentally responsible ways, or the results could be devastating.
- To meet the need for food, developing countries will need 368 million additional tons of maize and wheat by 2020 (today, they need about 700 million tons).

The impact of CIMMYT's work

- Wheat varieties bred at CIMMYT and its predecessor organization prevented famine and hunger in South Asia and elsewhere in the world. The benefits of this Green Revolution were recognized through the 1970 Nobel Peace Prize.
- More nutritious maize varieties developed by CIMMYT won recognition through the 2000 World Food Prize.
- Recent estimates indicate that wheat varieties developed by CIMMYT and its partners are planted on more than 64 million hectares in developing countries, representing more than 75% of the area planted to modern wheat varieties in those countries.
- Maize varieties developed by CIMMYT and its partners are planted on nearly half of the area sown to improved varieties in non-temperate areas of the developing world.
- As reported in Science (v. 300: 758-62), in the absence of CGIAR Centres such as CIMMYT, with their many partners in the developing world, crop yields in developing countries would have been 19.5-23.5% lower; prices for food crops would have been 35-66% higher; imports would be 27-30% higher; calorie intake would have been 13.3-14.4% lower; and 32-42 million more children would have been malnourished. The area planted to crops would be 4% higher for wheat and 2% for maize.
- Lower food prices extend the benefits of agricultural research to poor consumers in urban areas and landless people in rural areas (and even to the industrialized world).
- If the developing world attempted to meet its food requirements in 1995 without the improved varieties of food crops developed since the Green Revolution, an additional 426 million hectares of cropped area would be needed (a five-fold increase over cropped area in 1965).
- This land savings helped to preserve forested and environmentally fragile lands and to reduce greenhouse gas emissions by 35%. A higher concentration of greenhouse gases might have caused climate change to begin sooner.

CIMMYT and Dr. Norman Borlaug



Norman Ernest Borlaug (March 25, 1914 – September 12, 2009) was an American agronomist, humanitarian, and Nobel laureate who has been called "the father of the Green Revolution". Dr. Borlaug was one of only six people to have won the Nobel Peace Prize, the Presidential Medal of Freedom and the Congressional Gold Medal. He was also a recipient of the Padma Vibhushan, India's second highest civilian honour.

Dr. Norman Borlaug dedicated almost six decades to the ending of world hunger and to the acceleration of agricultural productivity in the developing world. He talked to more peasant farmers and visited more wheat fields than any living person. Dr. Borlaug was awarded the Nobel Peace Prize in 1970 for his lifetime of work to help feed the hungry world.

Born in Iowa, Dr. Borlaug studied plant pathology at the University of Minnesota and was awarded his doctorate in 1941. Between 1944 and 1960, Dr. Borlaug served as the Rockefeller Foundation scientist in charge of wheat improvement under the Cooperative Mexican Agricultural Program. He later acted as a consultant to Mexico's Ministry of Agriculture, and was assigned to the Inter-American Food Crop Program as an associate director of the Rockefeller Foundation.

With the establishment of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico in 1963, Dr. Borlaug assumed leadership of the Wheat Program, a position he held until his official retirement in 1979. He remained a resident part-time consultant until his death. He has spent most of his working life in Mexico, where he undertook the painstaking research to develop new types of high-yielding, disease-resistant wheat varieties. These new wheat varieties and accompanying improvements in crop management practices revolutionized wheat production in Mexico since the mid-1950s.

By the mid-1960s, Dr. Borlaug was taking the technical components of the Mexican wheat technology to Asia, sparking the so-called "Green Revolution" in wheat production in India and Pakistan. Between 1964 and 2001, wheat production in India rose from 12 to 75 million tons, while wheat production in Pakistan increased from 4.5 to 22 million tons. The Green Revolution in food production made possible by Dr. Borlaug's work has touched the lives of farmers in other parts of Asia, as well as in Latin America and even many developed countries.

Since 1983, Dr. Borlaug has been a Distinguished Professor of International Agriculture at Texas A & M University. In 1988, he became President of the Sasakawa Africa Association and a Senior Consultant to Global 2000. From 1990-92, he was a member of the U.S. President's Council of Advisors for Science and Technology.

He also served on many advisory boards, including the international juries of the annual World Food Prize, sponsored by the John T. Ruan Foundation, and the annual Africa Prize for Leadership for the Sustainable End of Hunger, sponsored by the Hunger Project. He has been honoured by governments, universities, scientific societies, and farmers' associations in more than 30 countries.

Norman Borlaug Quotes

1. "I grew up on the land, on a small farm in NE Iowa. Life was not always easy. I experienced the economic depressions of the 1930s, and from the experience, I felt that families on the land needed help from scientists, and I dedicated my life to science, and especially to food production."
2. "It was during the depths of the depression. Many unemployed hungry people, asking for a hand out, for a nickel. I'd never seen this in the rural communities where I grew up. This was a horrifying experience for me. That was part of me. I saw it!"
3. "I personally cannot live comfortably in the midst of abject hunger and poverty and human misery, if I have the possibilities of—even in a modest way, with the help of my many scientific colleges—of doing something about improving the lives of these many young children."
4. "There was this huge harvest, mountains of grain by the railroad sidings waiting to be shipped, unthreshed grain on the threshing floors, and finally it was so bad, they had to close the schools and store the grain. And you could feel this enthusiasm—you would stop at farmer's field days and at experiment stations, at the agriculture universities, you could feel it everywhere."
5. "In a policy makers' office, you say brutally, frankly, look, things are seething down there, if you want government stability, the games you played by in the past won't serve. You're going to have trouble. You say that thing at the wrong time you'll be invited to leave the country."
6. "I like to play the game hard. To me the most important game of all is the game of life, to try to elevate the standard of living of whom you're trying to help. I think it requires ones best effort."
7. "Food is the moral right of all who are born into this world."
8. "...the first essential component of social justice is adequate food for all mankind."
9. "Civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply."
10. "For, behind the scenes, halfway around the world in Mexico, were two decades of aggressive research on wheat that not only enabled Mexico to become self-sufficient with respect to wheat production but also paved the way to rapid increase in its production in other countries."
11. "I am but one member of a vast team made up of many organizations, officials, thousands of scientists, and millions of farmers - mostly small and humble - who for many years have been fighting a quiet, oftentimes losing war on the food production front."
12. "Man can and must prevent the tragedy of famine in the future instead of merely trying with pious regret to salvage the human wreckage of the famine, as he has so often done in the past."
13. "The destiny of world civilization depends upon providing a decent standard of living for all mankind."
14. "The forgotten world is made up primarily of the developing nations, where most of the people, comprising more than fifty percent of the total world population, live in poverty, with hunger as a constant companion and fear of famine a continual menace."
15. "There are no miracles in agricultural production."

16. "Therefore I feel that the aforementioned guiding principle must be modified to read: If you desire peace, cultivate justice, but at the same time cultivate the fields to produce more bread; otherwise there will be no peace.

4. CIP - INTERNATIONAL POTATO CENTER (It is known by its Spanish acronym, **(CIP means CENTRO INTERNACIONAL DE LA PAPA)** <http://www.cipotato.org/>

Headquarters: P.O. Box 1558, Lima, Peru

The International Potato Center (known by its Spanish acronym, CIP) seeks to reduce poverty and achieve food security on a sustained basis in developing countries through scientific research and related activities on potato, sweet potato, other root and tuber crops, and on the improved management of natural resources in the Andes and other mountain areas.

CIP headquarters are in La Molina, outside of Lima, Peru's capital, in an irrigated coastal valley. CIP also has experimental stations in Huancayo in the high Andes and in San Ramón on the eastern, rainforest-covered slopes, taking advantage of Peru's varied geography and climate. The Center has another high Andes experiment station in Quito, Ecuador, and a worldwide network of regional offices and collaborators.

CIP has recruited an international team of scientists from 25 countries, supported by nationally recruited staff. In its first year of operation, CIP was funded by five donors. Today, the Center's budget is underwritten by more than 40 donors.

CIP is a member of the Alliance of the 15 centers of the Consultative Group on International Agricultural Research (CGIAR) and so receives its principal funding from the 58 governments, private foundations and international and regional organizations that constitute the CGIAR.

Mission of CIP

The International Potato Center (CIP) seeks to reduce poverty and achieve food security on a sustained basis in developing countries through scientific research and related activities on potato, sweet potato, and other root and tuber crops and on the improved management of natural resources in the Andes and other mountain areas.

CIP is part of the global agricultural research network known as the Consultative Group on International Agricultural Research (CGIAR).

CIP contributes to the CGIAR in a limited research area defined by commodities (potato, sweet potato, and Andean root and tuber crops) and ecoregions, in CIP's case the Andes. CIP, in close association with national research systems, selects priority activities within these major work areas. These priorities are continually refined against changes in the way crops are grown, as well as changes in science and in national programs.

Increasingly, CIP employs its expertise in convening global research initiatives that involve a range of institutions that can contribute to the Center's objectives. As opportunities arise, research is conducted in partner and client institutions around the world.

CIP statement on Partnership with the Private Sector

CIP works with hundreds of partners and constantly seeks new partnerships to seek complementary skills and opportunities, access the most advanced technologies, and broaden the reach and impact of research-for-development activities. This document outlines the principles, benefits, and safeguards that guide CIP's partnerships with the private sector. It provides a definition of private partners and offers clear guidelines for working with them to staff, donors, existing and potential partners, and other interested parties.

5. ICARDA- INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS <http://www.icarda.cgiar.org/Facelift.htm>

Headquarters: P.O. Box. 5466, Aleppo, Syria

History: In 1972, the CGIAR commissioned a team of experts to study the potential threats of food shortages and loss of natural resources in the dry areas. The team recommended that an internationally supported, research center be set up to serve developing countries with large dry areas. The proposed center would focus on sub-tropical (temperate) zones. ICARDA's founding charter was signed in 1975, with three United Nations agencies (the Food and Agriculture Organization, the UN Development Program and the World Bank) as co-sponsors, and Canada's International Development Research Centre as the executing agency. The government of Syria provided a 948-hectare site the following year, and operations began in 1977.

ICARDA's headquarters, Tel Hadya, on the outskirts of the historic city of Aleppo, is an ideal site, for many reasons. Biophysical conditions – topography, soils, rainfall – are typical of the world's non-tropical dry areas, ICARDA primary mandate area. It also lies in the heart of the Fertile Crescent, where agriculture began 10,000 years ago, and where many of the world's most important crops originated or were first domesticated. Plant genetic diversity in the region is almost unique – and this diversity allows scientists to uncover new genes that control vital traits such as drought tolerance, disease resistance or grain quality

Vision is to improve livelihoods of the resource-poor in the dry areas.

Mission: To contribute to the improvement of livelihoods of the resource-poor in dry areas by enhancing food security and alleviating poverty through research and partnerships to achieve sustainable increases in agricultural productivity and income, while ensuring the efficient and more equitable use and conservation of natural resources.

Mandate: ICARDA has a global mandate for the improvement of barley, lentil and faba bean and serves the non-tropical dry areas for the improvement of on-farm water-use efficiency, rangeland

and small-ruminant production. In the Central and West Asia and North Africa (CWANA) region, ICARDA contributes to the improvement of bread and durum wheat, Kabuli chickpea, pasture and forage legumes and associated farming systems. It also works on improved land management, diversification of production systems, and value-added crop and livestock products. Social, economic and policy research is an integral component of ICARDA's research to better target poverty and to enhance the uptake and maximize impact of the research outputs.

6. ICRISAT - INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS <http://www.icrisat.org/>

Headquarters: Pattancheru 502 324, Andhra Pradesh, India

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. ICRISAT is headquartered in Hyderabad, Andhra Pradesh, India, with two regional hubs and four country offices in sub-Saharan Africa. It belongs to the Consortium of Centers supported by the Consultative Group on International Agricultural Research (CGIAR). Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, and 644 million of these are the poorest of the poor. ICRISAT and its partners help empower these poor people to overcome poverty, hunger and a degraded environment through better agriculture.

The semi-arid regions (dry tropics) covering 55 countries of sub-Saharan Africa and Asia and inhabited by more than 800 million people, are the poorest places on earth. These regions are most vulnerable to climate change with very little rainfall, degraded soils and poor social infrastructure. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is the only research Center in the world serving the semi-arid tropics, together with its partners.

ICRISAT is supported by the Consultative Group on International Agricultural Research (CGIAR). ICRISAT conducts research on five highly nutritious, drought-tolerant crops - chickpea, pigeonpea, pearl millet, sorghum and groundnut.

Vision and mission: ICRISAT's vision is the improved well-being of the poor people of the dry tropics. Towards this, ICRISAT seeks to reduce poverty, increase agricultural productivity, enhance food and nutritional security and protect the environment of the dry tropics. ICRISAT's research is guided by science with a human face and propelled by strategic partnerships. By putting a human face to science, ICRISAT dedicates its work to the poorest of the poor.

Global research themes:

Agro-ecosystem development focuses on improving rural livelihoods, attaining food security and sustainable natural resource management. Crop improvement and management develops better crop varieties, environment-friendly and cost-effective pest management practices, efficient seed systems, and diversified uses of dryland crops. Harnessing biotechnology for the poor complements crop improvement by applying the new science of genomics, genetic engineering and bioinformatics.

Institutions, Markets, Policy and Impacts helps formulate pro-poor policies and guides investments towards improved food security, livelihood resilience, poverty reduction and sustainable environment of the dry tropics.

Locations: ICRISAT's headquarters is located in Patancheru, near Hyderabad, Andhra Pradesh in south central India. We also have six locations in sub-Saharan Africa. Our presence in this continent is anchored by two regional hubs in Nairobi, Kenya and Niamey, Niger, complemented by four country offices.

Management: ICRISAT is headed by a Director General and assisted by a Deputy Director General - Research and other members of the Management Group composed of the Directors of Finance, Human Resources and Operations, Resource Planning and Marketing, Communication and the African regional hubs.

ICRISAT is decentralized and its two regional hubs in sub-Saharan Africa are headed by Directors who are supported by Assistant Directors and Country Representatives. A diverse and experienced Governing Board provides strategic guidance, sets policies and oversees ICRISAT's management.

New horizons of research: Over the years, ICRISAT has been transformed into a global center of scientific excellence dedicated to serve poor communities of the semi-arid tropics. As ICRISAT pursues new horizons of excellence, it conducts research on strategic areas like climate change, bioenergy, agricultural diversification and linking farmers with markets.

7. IFPRI - INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE <http://www.ifpri.org/>

Headquarters: 2033 K Street, Washington, DC., USA

IFPRI is an international agricultural research center founded in the early 1970s to improve the understanding of national agricultural and food policies to promote the adoption of innovations in agricultural technology. Additionally, IFPRI was meant to shed more light on the role of agricultural and rural development in the broader development pathway of a country. According to its website, IFPRI "seeks sustainable solutions for ending hunger and poverty."

IFPRI is part of a network of international research institutes funded in part by the Consultative Group on International Agricultural Research (CGIAR), which in turn is funded by governments, private businesses and foundations, and the World Bank.

The International Food Policy Research Institute (IFPRI) seeks sustainable solutions for ending hunger and poverty. IFPRI is one of 15 centers supported by the Consultative Group on International Agricultural Research (CGIAR), an alliance of 64 governments, private foundations, and international and regional organizations.

Mission: To Provide Policy Solutions That Reduce Poverty and End Hunger and Malnutrition

This mission flows from the CGIAR mission: "To achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, livestock, forestry, fisheries, policy, and natural resources management."

Two key premises underlie IFPRI's mission:

1. Sound and appropriate local, national, and international public policies are essential to achieving sustainable food security and nutritional improvement.
2. Research and the dissemination of its results are critical inputs into the process of raising the quality of food policy debate and formulating sound and appropriate policies.

IFPRI's mission focuses on:

- Identifying and analyzing alternative international, national, and local policies in support of improved food security and nutrition, emphasizing low-income countries and poor people and the sound management of the natural resource base that supports agriculture;
- Contributing to capacity strengthening of people and institutions in developing countries that conduct research on food, agriculture, and nutrition policies; and
- Actively engaging in policy communications, making research results available to all those in a position to apply or use them, and carrying out dialogues with those users to link research and policy action.

IFPRI places priority on activities that benefit the greatest number of poor people in greatest need in the developing world. In carrying out its activities, IFPRI seeks to focus on vulnerable groups, as influenced by class, religion, ethnicity, agro ecological location, and gender.

IFPRI is committed to providing global food policy knowledge as an international public good; that is, it provides knowledge relevant to decision makers both inside and outside the countries in which it undertakes research. New knowledge on how to improve the food security of low-income people in developing countries is expected to result in large social benefits, but in most instances the private sector is unlikely to carry out research to generate such knowledge. IFPRI views both public organizations and the private sector in food systems as objects of study and as partners.

Given the large body of national and international food policy research, IFPRI's added-value derives from its own cutting-edge research linked with academic excellence in other institutions, such as other CGIAR centers, universities, and other research institutes in the South and the North, and from its application of this knowledge to national and international food policy problems.

Scope: IFPRI carries out food policy research and disseminates it through hundreds of publications, bulletins, conferences, and other initiatives. IFPRI was organized as a District of Columbia non-profit, non-stock corporation on March 5, 1975 and its first research bulletin was produced in February 1976. IFPRI has offices in several developing countries, including China, Ethiopia, and India, and has research staff working in many more countries around the world.

Research Areas: IFPRI's institutional strategy rests on three pillars: research, capacity strengthening, and policy communication.

Research topics have included low crop and animal productivity, and environmental degradation, water management, fragile lands, property rights, collective action, sustainable intensification of agricultural production, the impact of climate change on poor farmers, the problems and opportunities of biotechnology, food security, micronutrient malnutrition, microfinance programs, urban food security, gender and development, and resource allocation within households.

IFPRI also analyzes agricultural market reforms, trade policy, World Trade Organization negotiations in the context of agriculture, institutional effectiveness, crop and income diversification, post harvest activity, and agro industry.

The institute is involved in measuring the Millennium Development Goals project and supports governments in the formulation and implementation of development strategies.

Further work includes research on agricultural innovation systems and the role of capacity strengthening in agricultural development.

Organizational structure

IFPRI is made up of the Office of the Director General, a Communications Division and the Finance and Administration Division, and **5 research divisions**:

- Development Strategy and Governance
- Environment and Production Technology
- Poverty, Health, and Nutrition
- Knowledge, Capacity, and Innovation
- Markets, Trade, and Institutions

8. IITA - INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE <http://www.iita.org/>

Headquarters: Oyo Road, PMB 5320, Ibadan, Nigeria

International Institute of Tropical Agriculture (IITA) is Africa's leading research partner in finding solutions for hunger, malnutrition, and poverty. IITA's award-winning research for development (R4D) addresses the development needs of sub-Saharan Africa. IITA works with partners to enhance crop quality and productivity reduce producer and consumer risks and generate wealth from agriculture. IITA is nonprofit organization founded in 1967, governed by a Board of Trustees, and supported by several countries. IITA works on cowpea, soybean, banana/plantain, yam, cassava, and maize.

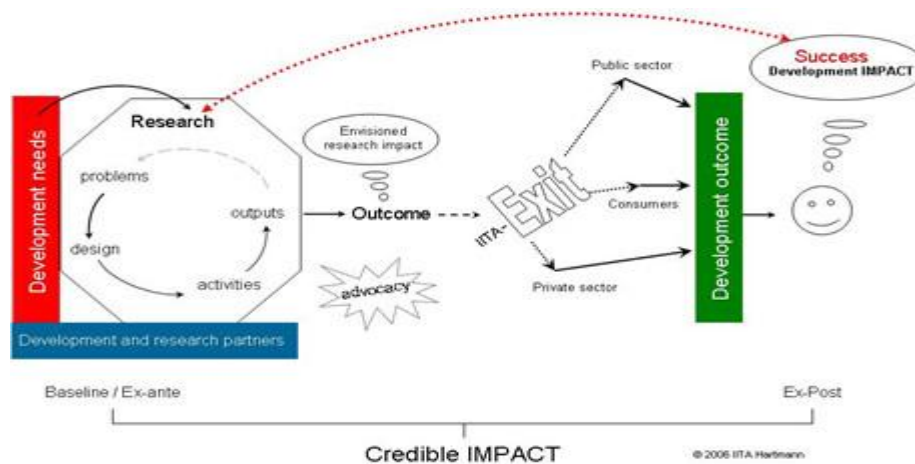
Research-for-development platform: IITA's mission is to enhance food security and improve livelihoods in Africa through research for development (R4D). IITA uses the R4D model in setting a research course that addresses major development problems in Africa rather than simply contributing to scientific knowledge. It has proven to be an effective mechanism for agricultural

research development. We and our partners have delivered about 70% of the international research impact in sun-Saharan Africa in the last three decades.

The R4D model is unique in that

1. It focuses on long-term development needs to guide our research design and choice of partners
2. It incorporates two critical elements absent in traditional models: a mid-process initial research outcome and an explicit EXIT strategy for IITA.

R4D model



- **Development needs:** Identifies societal, producer, and consumer needs that require addressing. Guarantees research relevance.
- **Research:** Specifies research problems that can be addressed by IITA with advanced research institutes and national partners. The design demands envisioning the potential impact.
- **Research impact:** Defines scalable research outcomes and any advocacy activities required. A successful outcome entices partners to adoption.
- **Exit:** Once the outcome is embraced by national/regional partners, IITA exits implementation and changes role to monitoring the research outcomes in the subsequent stages of development outputs and outcomes.
- **Success/Development impact:** Ex-post evaluations are carried out and compared to baseline information to measure the impact on the ultimate beneficiaries.
- **Further work:** Development impact creates new challenges which are referred back to development needs.

Innovative partnerships: In response to specific development needs, IITA works with research and development partners (research, development and extension actors, farmer organizations, NGOs, the private sector, and governments) to deliver research outputs that are achieving an initial outcome. IITA then uses this research outcome to excite and attract more partners who will ultimately take charge of the upscaling and outscaling of the technologies by broadening participation and increasing the chances of success and ultimate development impact.

In particular, IITA is committed to forging closer links with ARIs, NARES, and the private sector that are eager to contribute to high-quality R4D, commercialization, and market development activities in technical assistance (TA).

What IITA offers? : IITA provides solutions to problems in tropical agriculture. The agricultural sector employs two-thirds of the population of sub-Saharan Africa (SSA), hence, it plays a key role in the continent's economic development.

In collaboration with partners, we aim to develop an African agricultural sector that uses technologies that result in greater local production, wealth creation, and the reduction of risk.

We continue to work with partners to enhance crop quality and productivity and thus create a positive impact on the lives of poor people in sub-Saharan Africa. In addition, the Institute develops technologies for Africans who possess the expertise, initiative, and resources to go beyond food security to produce enough to realize a financial profit. If African agriculture is to serve as the engine of economic development, IITA understands that it also must produce research to model how industries and enterprises succeed.

IITA offers capacity building to national program partners to aid the improvement of research practices and general knowledge. We also provide the research community with both technology and seed varieties to supply the foundation to achieve research goals. IITA's knowledge base offers a wide range of documentation and materials to aid research.

9. ILRI - INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE <http://www.ilri.org/>

Headquarters: P.O. Box. 30709, Nairobi, Kenya

The International Livestock Research Institute (ILRI) works at the crossroads of livestock and poverty, bringing high-quality science and capacity-building to bear on poverty reduction and sustainable development. ILRI works in Africa, South and Southeast Asia, and China.

ILRI is a non-profit-making and non-governmental organization with headquarters in Nairobi, Kenya, and a second principal campus in Addis Ababa, Ethiopia. We employ over 700 staff from about 40 countries. About 80 staffs are recruited through international competitions and represent some 30 disciplines. Around 600 staff members are nationally recruited, largely from Kenya and Ethiopia.

ILRI envisions a world made better for poor people in developing countries by improving agricultural systems in which livestock are important.

ILRI's mission is to work at the crossroads of livestock and poverty, bringing high-quality science and capacity-building to bear on poverty reduction and sustainable development for poor livestock keepers and their communities.

ILRI works in partnerships and alliances with other organizations, national and international, in livestock research, training and information. ILRI works in all tropical developing regions of Africa and Asia.

ILRI is a member of the Consortium of CGIAR centers that conducts food and environmental research to help alleviate poverty and increase food security while protecting the natural resource base.

ILRI works on: ILRI's research is directed to address seven global livestock challenges. :

- Vaccine and diagnostic technologies for orphan animal diseases
- Animal genetic resources
- Climate change- adaptation and mitigation
- Emerging diseases
- SPS and market access within border market opportunities for the poor
- Sustainable intensification in smallholder crop-livestock systems
- Vulnerability of marginal systems and people

Capacity building at ILRI: ILRI's capacity building initiatives are based on five principles:

- Broad participation and a client-driven agenda;
- Building on local capabilities;
- On-going learning and adaptation;
- Long term commitment and partnerships; and,
- Integration of activities to address complex problems.

ILRI is not a university nor a training college and therefore guards against providing courses which could be offered by other institutions. The strength and advantage that ILRI presents for learning is its strong research base. Training at ILRI stresses practical work (both in the field and laboratory), team/group work, experiential learning, and personal development. ILRI offers individual and group training courses. Both are aimed at largely building the capacity of individuals. Some of the group training may be in an organizational context but this is not very systematic. However, there are also some recent capacity building activities within projects that are meant to enhance ILRI's ability to strengthen both institutional as well as individual capacities.

10. BIOVERSITY INTERNATIONAL <http://www.biodiversityinternational.org/>

Headquarters: are in Maccarese, Italy, just outside Rome

Biodiversity International is the world's leading organization dedicated to agricultural biodiversity research to improve people's lives through:

- Better nutrition, especially in developing countries
- Sustainable farming practices, to secure our future food supplies
- Conservation and use, to ensure that everyone can grow the food they need

Funding for Bioversity comes from statutory donors and foundations, which support us directly and through their contributions to the Consultative Group on International Agricultural Research. Bioversity is also supported by a registered charity in the United Kingdom, and in the United States by a Foundation that has 501(c)(3) status.

Bioversity's headquarters are in Maccarese, Italy, just outside Rome, where we work closely with UN Agencies such as FAO, IFAD and WFP. However, the vast majority of our staff works from 20 offices that cover the regions of the world. In addition, we are pleased to host some system-wide activities on behalf of the CGIAR.

How IBPGR became IPGRI became Bioversity: Bioversity was originally established as the International Board for Plant Genetic Resources (IBPGR) in 1974.

IBPGR was launched in response to growing awareness of genetic erosion and the rapid loss of crop biodiversity. Its original mission was to coordinate an international plant genetic resources programme. This included emergency collecting missions as well as building and expanding national, regional and international gene banks. The Food and Agriculture Organization of the United Nations (FAO) acted as the IBPGR secretariat.

In October 1991, IBPGR became the International Plant Genetic Resources Institute (IPGRI) and in January 1994 IPGRI began independent operation as one of the centers of the Consultative Group on International Agricultural Research (CGIAR). At the request of the CGIAR, in 1994 IPGRI took over the governance and administration of the International Network for the Improvement of Banana and Plantain (INIBAP).

The organization's focus has changed over time. From the emergency conservation of crop genetic resources in gene banks, it moved into research to conserve crop biodiversity through the sustainable use of genetic resources.

Harnessing genetic diversity to reach development goals and the conservation and use of forest genetic resources also became key areas of work.

In 2006, IPGRI and INIBAP became a single organization and subsequently changed their operating name to Bioversity International. The new name reflects an expanded vision of its role in the area of biodiversity research for development.

11. IRRI - INTERNATIONAL RICE RESEARCH INSTITUTE <http://irri.org/>

Headquarters: DAPO Box 7777, Metro Manila 1301 Philippines

The International Rice Research Institute (IRRI) is an autonomous, nonprofit, agricultural research and training organization. Its main goal is to find sustainable ways to improve the well being of present and future generations of poor rice farmers and consumers while at the same time protecting the natural environment.

IRRI was established in 1959 with support from the Ford and Rockefeller Foundation and the Philippine Government. It is Asia's largest non-profit agricultural research center.

Most of IRRI's research is done in cooperation with the national agricultural research and development institutions, farming communities, and other organizations of the world's rice producing nations.

Its research activities began in 1962 and are now estimated to have touched the lives of almost half the world's population. The IRRI played a major role in sparking the Green Revolution on the field of rice when it developed its first new variety of Rice grassy stunt virus resistant rice in the 1960s. The Institute has a collection of 100,000 rice cultivars.

The Institute's research headquarters includes laboratories and training facilities on a 252 - hectare experimental farm on the lower campus of the University of Philippines in Los Banos Laguna, about 60 kilometers south of the Philippine capital, Manila. In addition to rice research, IRRI is also very active in local communities providing educational scholarships; organizing income-generating training activities and arranging other community projects that will help improve living conditions in the poor communities that neighbor the Institute.

IRRI was established to help poor rice farmers in developing countries grow more rice on less land using less water, less labor, and fewer chemical inputs. By helping to greatly boost production and ease the use of farm chemicals during its first 40 years, IRRI clearly showed the importance of rice and agricultural research in helping poor nations develop. The Institute's importance has been further reinforced by the private sector's traditional lack of interest in rice research.

12. IWMI - INTERNATIONAL WATER MANAGEMENT INSTITUTE <http://www.iwmi.cgiar.org/>

Headquarters: Colombo, Sri Lanka

IWMI is one of 15 International research centers supported by the network of 60 governments, private foundations and international and regional organizations collectively known as the Consultative Group on International Agricultural Research (CGIAR). It is a non-profit organization with a staff of 350 and offices in over 10 countries across Asia and Africa and Headquarters in Colombo, Sri Lanka.

IWMI's Mission is to improve the management of land and water resources for food, livelihoods and the environment.

IWMI's Vision, reflected in the Strategic Plan is water for a food-secure world.

IWMI targets water and land management challenges faced by poor communities in the developing world/or in developing countries and through this contributes towards the achievement of the UN Millennium Development Goals of reducing poverty, hunger and maintaining a sustainable environment. These are also the goals of the CGIR.

Research is the core activity of IWMI. The research agenda is organized around four priority Themes including Water Availability and Access; Productive Water Use; Water Quality, Health and Environment and Water and Society. Cross cutting activities in all themes include, assessment of land and water productivity and their relationship to poverty, identification of interventions that improve productivity as well as access to and sustainability of natural resources, assessment of the impacts of interventions on productivity, livelihoods, health and environmental sustainability.

IWMI works through collaborative research with many partners in the North and South and targets policy makers, development agencies, individual farmers and private sector organizations.

13. WORLD AGROFORESTRY CENTRE <http://www.worldagroforestrycentre.org/>

Headquarters: United Nations Avenue, Gigiri, PO Box 30677, Nairobi, 00100, Kenya

The World Agroforestry Centre is part of the alliance of the Consultative Group on International Agricultural Research (CGIAR) centres dedicated to generating and applying the best available knowledge to stimulate agricultural growth, raise farmers' incomes, and protect the environment.

The Centre's vision is a rural transformation in the developing world as smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability.

The Centre's mission is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes, and use its research to advance policies and practices that benefit the poor and the environment.

The World Agroforestry Centre is guided by the broad development challenges pursued by the CGIAR. These include poverty alleviation that entails enhanced food security and health, improved productivity with lower environmental and social costs, and resilience in the face of climate change and other external shocks.

Headquartered in Nairobi, Kenya, the centre operates five regional offices located in India, Indonesia, Kenya, Malawi and Mali and conduct research in eighteen other countries around the developing world.

World Agroforestry Centre receives funding from over 50 different investors; including governments, private foundations, international organizations and regional development banks. World Agroforestry Centre's work is conducted with partners from a range of scientific and development

Policies and Guidelines: The World Agroforestry Centre's policies effectively raise the awareness of staff with regards to certain issues, explain and provide a systematic approach to complex and emerging issues; apply a coherent, institutional wide approach; take appropriate action through best practices; provide a mechanism to hold the Centre and staff accountable for certain activities; and provide a shield against legal action. At present, we have the following policies in place.

Research Ethics: The pursuit of our mission requires carrying out research that involves people and the environment, and this has consequences both directly through the research activity and indirectly through the results. We therefore have ethical considerations to take into account when planning and implementing research. This policy sets out the principles and standards the World Agroforestry Centre has adopted to guide our work.

Intellectual property: The pursuit of our mission requires generating data and knowledge products of many types, including: books, papers and briefs, databases, maps, models, software and data archives. All of these are essentially international public goods. They also represent intellectual property (IP) that has to be managed and disseminated if they are to lead to changes in the lives of the rural poor. This document sets out the guiding principles we have adopted.

Invasive alien species: This policy is intended to guide World Agroforestry Centre researchers on invasive species to prevent, avoid and mitigate the negative effects to biodiversity and human enterprise of their introduction, both intentional and unintentional.

Genetic resources: World Agroforestry Centre researchers are working with germplasm from a wide range of tree species, the majority of which are indigenous. In addition, the Centre also maintains a significant collection of germplasm materials, which is managed through its Genetic Resources Unit. Because the germplasm work is carried out largely with farmers and partner organizations, this document outlines the principles and protocols that will guide our researchers.

About agroforestry: Trees play a crucial role in almost all terrestrial ecosystems and provide a range of products and services to rural and urban people. As natural vegetation is cleared for agriculture and other types of development, the benefits that trees provide are best sustained by integrating trees into agriculturally productive landscapes - a practice known as agroforestry.

Farmers have practiced agroforestry for years. Agroforestry focuses on the wide range of working trees grown on farms and in rural landscapes. Among these are fertilizer trees for land regeneration, soil health and food security; fruit trees for nutrition; fodder trees that improve smallholder livestock production; timber and fuel wood trees for shelter and energy; medicinal trees to combat disease; and trees that produce gums, resins or latex products. Many of these trees are multipurpose, providing a range of benefits.

Agroforestry provides many livelihood and environmental benefits, including:

- Enriching the asset base of poor households with farm-grown trees.
- Enhancing soil fertility and livestock productivity on farms.
- Linking poor households to markets for high-value fruits, oils, cash crops and medicines.
- Balancing improved productivity with the sustainable management of natural resources.
- Maintaining or enhancing the supply of environmental services in agricultural landscapes for water, soil health, carbon sequestration and biodiversity.

The World Agroforestry Centre's role: The world population has now surpassed 6.5 billion. Demand for food increases as populations grow. Meanwhile, over one billion people continue to endure lives of extreme poverty. Agroforestry is uniquely suited to address the need to grow more food and biomass for fuel while sustainably managing agricultural landscapes for the critical ecosystem services they provide. It can serve as a means of curbing greenhouse gas emissions by slowing forest conversion to farmland and sequestering more carbon in trees on farms.

With over three decades of work with smallholder farmers in Africa, Asia and Latin America, and strategic alliances with advanced laboratories, national research institutions, universities and non-governmental organizations, the World Agroforestry Centre is uniquely positioned to address global challenges.

To improve the livelihoods of poor smallholders and improve the sustainability and productivity of agricultural landscapes, we are:

- Broadening the range and diversity of trees that can be integrated into farming systems, especially as many produce higher income per unit of area than annual crops, require less labour and are more resilient to drought.
- Maximizing the productivity of agroforestry systems through improved tree germplasm, integrated soil fertility and the enhanced supply of high-quality tree fodder resources.
- Improving the income of poor households by facilitating their access to markets. This is also important in stabilizing land-use change in some areas, as well as increasing farmers' investment in agroforestry trees and systems.
- Working in agricultural landscapes that experience the greatest environmental stress to balance improved productivity with the sustainable management of natural resources. For example, stabilizing forest margins in Southeast Asia by converting slash-and-burn systems, and rehabilitating degraded agricultural land throughout Africa.
- Managing trees in agricultural landscapes to ensure the health of river and groundwater systems.
- Examining reward systems or other types of institutional and policy innovations (such as for carbon or water) to sustain biodiversity at the interface between smallholder agricultural landscapes and conservation areas.

14. WORLD FISH CENTER <http://www.worldfishcenter.org/wfcms/HQ/Default.aspx>

Headquarters: Penang, Malaysia.

World fish center began in 1977 as the International Center for Living Aquatic Resources Management (ICLARM) based in the Philippines. In 2000 they shortened center's name to The WorldFish Center and established new headquarters in Penang, Malaysia.

Mission: Mission is to reduce poverty and hunger by improving fisheries and aquaculture. We began in 1977 as the International Center for Living Aquatic Resources Management (ICLARM) based in the Philippines. In 2000 we shortened our name to The WorldFish Center and established our new headquarters in Penang, Malaysia.

Work: WorldFish exists to help eradicate hunger and poverty by harnessing the benefits of fisheries and aquaculture.

We carry out research-for-development with our partners to make small scale fisheries more resilient and productive, and to support the adoption of sustainable aquaculture that specifically benefits the poor.

Our key competencies are in Policy Economics and Social Sciences, Natural Resource Management, and Aquaculture and Genetic Improvement. This inter-linked set of disciplines work together to provide a wide range of research and analysis, some of which are summarized below.

Policy, Economics, and Social Sciences

- Connecting the fisheries and aquaculture sector to poverty reduction initiatives at local to global scales
- Social and economic analysis of the aquaculture and fisheries sectors
- Policy and institutional analysis for the improved governance of aquatic resources
- Assessing the potential impacts of climate change on fisheries, and adaptive measures that can be taken
- Human health consequences of fisheries, reducing risks, and fisheries options that benefit health-impaired populations (HIV/AIDS and malaria)
- Working with communities to manage fisheries

Natural Resources Management

- Integrated assessment and management of small-scale fisheries
- Design and management of global information systems on aquatic resources (FishBase, ReefBase)
- Post-disaster livelihood recovery in fisheries-dependent regions
- Assessment of impacts of built structures on aquatic resources in river basins
- Analysis of external drivers such as climate change on livelihoods of fishery-dependent households

Aquaculture and Genetic Improvement

- Methods for breeding improved fish strains for aquaculture
- Aquaculture technologies for the poor, including women and the landless
- Integrating aquaculture with terrestrial small-scale agriculture
- Strategies and options for aquaculture production and national action plans
- Connecting small-scale producers to markets
- Technologies that improve water productivity while protecting environmental flows

15. AFRICA RICE CENTER (AfricaRice) <http://www.warda.cgiar.org/>

Headquarters: AfricaRice temporary headquarters is based in Cotonou, Benin

The Africa Rice Center (AfricaRice) is a leading pan-African research organization with a mission to contribute to poverty alleviation and food security in Africa through research, development and partnership activities. It is one of the 15 international agricultural research Centers supported by the Consultative Group on International Agricultural Research (CGIAR). It is also an autonomous intergovernmental research association of African member countries.

The Center was created in 1971 by 11 African countries. Today its membership comprises 24 countries, covering West, Central, East and North African regions, namely Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Gabon, the Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Madagascar, Mali, Mauritania, Niger, Nigeria, Republic of Congo, Senegal, Sierra Leone, Togo and Uganda.

Recognizing the strategic importance of rice for Africa and the effective geographic expansion of the Center – which was constituted as the West Africa Rice Development Association (WARDA) in 1971 – its Council of Ministers took a historic decision in September 2009 to officially change its name to “Africa Rice Center (AfricaRice)” and to no longer refer to it as WARDA.

Its mission is to contribute to poverty alleviation and food security in Africa, through research, development and partnership activities aimed at increasing the productivity and profitability of the rice sector in ways that ensure the sustainability of the farming environment.

The modus operandi of the Center is partnership at all levels. Its research and development activities are conducted in collaboration with various stakeholders—primarily the National Agricultural Research Systems (NARS), academic institutions, advanced research institutions, farmers' organizations, non-governmental organizations, and donors—for the benefit of African farmers, mostly small-scale producers, as well as the millions of African families for whom rice means food.

The Center hosts the African Rice Initiative (ARI), the Regional rice Research and Development Network for West and Central Africa (ROCARIZ), and the Inland Valley Consortium (IVC).

AfricaRice temporary headquarters is based in Cotonou, Benin; research staffs are also based in Senegal, Nigeria, Tanzania and Côte d'Ivoire.

OTHER INTERNATIONAL CENTERS

Earlier we discussed 15 international centers which are attached with **Consultative Group on International Agricultural Research (CGIAR)**. Following (serial No 16 to 36) are some more international centers which are not directly attached with CGIAR but working in different fields.

16. ICLARM - INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

www.iclarm.org

Headquarters: 11960, Bayan Lepas, P.O. Box. 500, GPO 10670, Penang, Malaysia

Focus: To improve the production and management of **aquatic resources**, for sustainable benefits to present and future generations of low-income producers and consumers in developing countries, through international multidisciplinary research in partnership with national agricultural research systems. The declining state and threatened sustainability of **fisheries** due to over fishing exacerbated with poverty and pollution, and the potential for increase in aquaculture production, call for research which includes understanding of the dynamics of **coastal** and **coral reef** resource systems and of integrated agriculture-aquaculture systems, investigating alternative management schemes in these systems, and improving the productivity of key species.

17. AVRDC - ASIAN VEGETABLE RESEARCH AND DEVELOPMENT CENTRE

www.netra.avrdc.org.tw/docs/intro.html

Headquarters: P.O. Box. 42, Shanhua, Tainan 741, Taiwan

Focus: To enhance the nutritional well being and raise the incomes of poor people in the rural and urban areas of developing countries through improved methods of vegetable production, marketing and distribution, which take into account the need to preserve the quality of the environment.

Training / Fellowships: Training in vegetable research and development, and IPM

18. CATIE - CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEANZA

(Centre for Research and Learning in Tropical Agronomy) www.catie.ac.cr

Headquarters: P.O. Box. 7170, Turrialba, Costa Rica

Focus: To promote and stimulate research and technical cooperation in **animal, plant and forest production**, with the objective of providing alternatives for satisfying the needs of the American tropics, especially the countries of the **Central American isthmus** and the **Caribbean**.

Training / Fellowships: Training is a part of the commitment of CATIE to the development of agriculture and renewable natural resources of the member countries and orientates its action towards the requirement of national and regional institutions. Collaborative M.Sc and Ph.D. programmes are offered with the U.S., U.K. and German Universities.

19. IBSRAM - INTERNATIONAL BOARD FOR SOIL RESEARCH AND MANAGEMENT

www.ibsram.org

Headquarters: P.O. Box. 9-109, Bangkok, Thailand

Focus: To assist and speed applications of soil science in the interest of increasing sustainable food production in developing countries.

20. **ICIPE - INTERNATIONAL CENTRE OF INSECT PHYSIOLOGY AND ECOLOGY**

www.icipe.org

Headquarters: Nairobi, Kenya

Focus: The mandate of ICIPE is to (i) research in integrated control methodologies for **crop and livestock insect pests** and for **insect vectors** of tropical diseases and (ii) strengthen the technological capacities of the developing countries in insect science and its application through training and collaborative work.

21. **IFDC - INTERNATIONAL FERTILIZER DEVELOPMENT CENTRE** www.ifdc.org

Headquarters: P.O. Box. 2040, Muscle Shoals, Alabama, 35662 USA

Focus: To help the developing countries solve their food-deficit problems by focusing on the development of fertilizers and fertilizer practices to meet the special needs of their tropical and subtropical climates and soils.

Training / Fellowships: Training on knowledge of Fertilizer industry in developing the skill of managers and professionals

22. **CARDI - CARIBBEAN AGRICULTURAL RESEARCHES AND DEVELOPMENT INSTITUTE**

www.cardi.org

Headquarters: University Campus, St. Augustine, Trinidad, and West Indies

Focus: To accelerate sustainable agricultural development through strategic management of those processes that generate, transfer, adapt and commercialize appropriate technology, which will improve the social and economic well being of Caribbean peoples.

23. **TSBFP - TROPICAL SOIL BIOLOGY AND FERTILITY PROGRAM**

Headquarters: Nairobi, Kenya

Focus: To contribute to human welfare and the conservation of the environment in the tropics by developing improved practices for sustaining tropical soil fertility through the management of biological processes and organic resources, in combination with judicious use of inorganic inputs.

24. **ICIMD - INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT**

www.icimod.org

Headquarters: 4/80, Jawalakhel, G.P.O. Box. 3226, Kathmandu, Nepal

Focus: To help promote development of an economic and environmentally sound mountain ecosystem and to improve the living standards of mountain populations. It works mainly at the

interface between research and development and acts as a facilitator for generating new mountain specific knowledge of relevance to mountain development.

25. CABI - CAB INTERNATIONAL www.cabi.org

Headquarters: Newsworthy Way, Wallingford, Oxon 8DE, UK

Focus: To collect, analyze and disseminate information on agriculture, forestry, the management of natural resources and related science including human nutrition and health.

26. ACIAR - AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURAL RESEARCH

www.aciar.gov.au

Headquarters: Traeger Court, Fern hill Park, Bruce ACT 2617, Australia

Focus: ACIAR directs it to mobilize Australia's research capacity to help solve agricultural research problems of developing countries. Thus the Centre allocates about three-quarters of its research and development budget to promoting bilateral development-related research collaboration between Australia and individual developing countries. The remaining quarter provides Australia's contribution to the institutes of the international agricultural research system.

Training / Fellowship: ACIAR awards 10 fellowships each year to developing country scientist involved in ACIAR Projects to undertake Master or Ph.D. training at Australian Universities.

27. CLIMA- THE COOPERATIVE RESEARCH CENTRE FOR LEGUMES IN MEDITERRANEAN AGRICULTURE www.general.uwa.edu.au/u/climaweb/

Headquarters: The University of Western Australia, Ned lands, Perth, WA 6907

Focus: It focuses on legumes for sustainable agriculture in the Mediterranean climate of southern Australia. Research and training cover a wide range of disciplines, genetic engineering of legumes and bacteria to assessment of farmer attitudes about risk and a new species.

28. ILRI - INTERNATIONAL INSTITUTE FOR LAND RECLAMATION AND IMPROVEMENT

www.ilri.nl

Headquarters: Wageningen, Netherlands

Focus: To undertake applied research on the sustainable development of irrigated agriculture. To hold annual, post-graduate training courses on irrigation, drainage and related subjects. To provide technical support and specialists advisory services to irrigation and drainage projects abroad.

29. WB - THE WORLD BANK www.worldbank.org

Headquarters: 1818 h Street, NW, Washington DC.

Focus: To fight poverty with passion and professionalism lasting results and to help people help themselves and their environment by providing resources, sharing knowledge, building capacity and forging partnership in the public and private sector.

30. CIDA - CANADIAN INTERNATIONAL DEVELOPMENT AGENCY www.cida.gc.ca

Headquarters: 200 Promenade du Portage, Hull, Quebec, KIA 0G4, Canada

Focus: It supports sustainable development activities in order to reduce poverty and to contribute to a more secure, equitable and prosperous world.

31. JIRCAS - JAPAN INTERNATIONAL RESEARCH CENTRE FOR AGRICULTURAL SCIENCES
www.jircas.affrc.go.jp

Headquarters: Tsukuba, Japan

Focus: To promote the advancement of agriculture, forestry, and fisheries in developing regions of the world through integrated collaborative research programmes. The new research strategy is to develop production and utilization systems in sustainable agriculture, forestry and fisheries in harmony with the environment by conducting research on such topics. To rehabilitate, maintain and improve the utilization of natural resources, with emphasis placed on tropical forest and coastal eco-systems.

32. CIRDAP - CENTRE ON INTEGRATED RURAL DEVELOPMENT FOR ASIA AND THE PACIFIC www.cirdap.org.sg

Headquarters: Dhaka, Bangladesh

Focus: To assist national action, to promote regional cooperation, to act as a servicing institution for its member countries for promotion of integrated rural development through research, action research, pilot project, training and information dissemination. Amelioration of rural poverty in the Asia-Pacific region has been the prime concern of CIRDAP. The programme priority of CIRDAP is set under 4 areas of concern; agrarian development, institutional / infrastructure development, resource development including human resources and employment.

33. ODI - THE OVERSEAS DEVELOPMENT INSTITUTE odi@odi.org.uk

Headquarters: 111, Westminster Bridge Road, London SE2 7 JD, UK.

Focus: Our mission is to inspire and inform policy and practice which lead to the reduction of poverty, the alleviation of suffering and the achievement of sustainable livelihoods in developing countries. We do this by locking together high-quality applied research, practical policy advice, and

policy-focused dissemination and debate. We work with partners in the public and private sectors, in both developing and developed countries.

Training / Fellowships: The ODI Fellowship Scheme places up to twenty young economists a year on attachment to the governments of developing countries. There are currently 40 Fellows working in 17 countries in Africa, the Caribbean and the Pacific.

34. IIED - INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT

www.iied.org

Headquarters: 3 Endsleigh Street, London WC1H ODD, UK.

Focus: IIED aims to provide expertise and leadership in researching and achieving sustainable development at local, national, regional and global levels. In alliance with others we seek to help shape a future that ends global poverty and delivers and sustains efficient and equitable management of the world's natural resources

35. IDRC - INTERNATIONAL DEVELOPMENT RESEARCH CENTRE www.idrc.org

Headquarters: Canada

Focus: To help communities in the developing world find solutions to social, economic and environmental problems through research.

36. FAO- FOOD AND AGRICULTURE ORGANIZATION www.fao.org

Headquarters : Viale delle Terme di Caracalla, 00100, Rome Italy

Focus: To raise levels of nutrition and pursuit of food security and standard of living, to improve agricultural productivity and to better the condition of rural population.

Site for **International fellowship for scientific mobility:**

<http://beasis.wascholarships.com/search/scholarship%20and%20fellowship%20for%20scientific%20mobility%20in%20india>

Short Questions with answer

1	The total geographical area of India is	A
	A. 328.8 m ha. B. 228.8 m ha. C. 428.8 m ha. D. 528.8 m ha.	
2	The gross cropped area of India is about	A
	A. 180 m ha. B. 280 m ha. C. 380 m ha. D. 80 m ha	
3.	The cropped area of India under double crop is	A
	A. 35 m ha. B. 45 m ha. C. 55 m ha. D. 65 m ha	
4.	India's position in world in possession of buffalo population	A
	A. One-half of the buffalo B. Two-thirds of the buffalo C. Three-fourth the buffalo	
5.	India's position in world in possession of goat population is	A
	A. 1 st Rank B. 2 nd Rank C. 3 rd Rank D. 4 th Rank	

6.	Coastline length of India in Kms. A. 5,517 kms. B. 9,517 km C. 9,517 km D. 7,517 km	D
7.	Approximate Total length of rivers in India A. 22,000 kms B. 21,000 kms C. 29,000 kms D. 39,000 kms	C
8.	India's rank sheep population A. 2 nd B. 6 th C. 5 th D. 8 th	B
9.	Which part of India has very high rainfall? A. Extreme east B. Extreme west C. Extreme south D. Extreme north	A
10.	Which part of India has very low rainfall? A. Extreme east B. Extreme west C. Extreme south D. Extreme north	B
11.	Annual rainfall of Nearly one-third of India A. Bellow 55 cm B. Bellow 45 cm C. Bellow 75 cm D. Bellow 65 cm	C
12.	India's occupancy of arid zones A. 520,000 sq. km B. 6320,000 sq. km C. 7320,000 sq. km D. 320,000 sq. km	D
13.	States of India under occupancy of arid zones A. Rajasthan. B. Gujarat C. Haryana D. All given in A,B &C.	D
14.	How much area of total land of India has serious limitations for crop production A. One-third B. One-sixth C. One-fourth D. One-fifth	B
15.	It is area under Cold desert in sq. km in India A. 84,000 B. 44,000 C. 384,000 D. 64,000	A
16.	Estimated area in million hectors of surface water in India A.176 B. 276 C. 376 D. 476	A
17.	Estimated area in million hectors of ground water in India A. 57 B. 67 C.77 D.87	A
18.	As against an ecologically safe level of 30 per cent, how many per cent of the land area is under forest coverage in India? A. 5 B. 10 C. 15 D.20	D
19.	Before independence ICAR was known as A. Independent Council of Agricultural Research B. Imperial Council of Agricultural Research C. Initial Council of Agricultural Research D. Indian Council of Agricultural Research	B
20.	Before independence ICAR is known as A. Independent Council of Agricultural Research B. Imperial Council of Agricultural Research C. Initial Council of Agricultural Research D. Indian Council of Agricultural Research	D
21.	It is year of establishment of ICAR A. 1948 B. 1950 C. 1942 D. 1952	A
22.	The first SAU of India was established in this year 1960 at Pantnagar A.1964 B. 1948 C.1963 D.1960	D
22.	The first SAU of India was established at this place. A. Pantnagar B. Ludhiyana C. Jabalpur D. Hisar	A
23.	Indian agricultural research systems have around these many of scientists A. 30,000 B. 60,000 C. 80,000 D. 100000	A

24.	NAARM was originally started as A. Central Staff College for Agriculture B. Central recruitment for Agriculture C. Research Station D. Extension Center	A
25.	NAARM stand for A. National Academic Agricultural Research Management B. National Academy of Agricultural Research Management C. National Agricultural Academic Research Management D. National Academy of Agricultural Recruitment Management	B
26.	It undertakes research and coordinates activities in germplasm collection; introduction and exchange of seeds and plant materials; and characterization, documentation, maintenance, and conservation of genetic resources for utilization in crop management A. National Bureau of Plant Genetic Resources, New Delhi B. National Plant Genetic Resources Bureau, New Delhi C. National Bureau of Crop Genetic Resources, New Delhi D. National Bureau of Genetic Resources, New Delhi	A
27.	National Bureau of Soil Survey & Land Use Planning is situated here. A. Nagpur B. New Delhi C. Udaipur D. Varanasi	A
28.	National Bureau of Animal Genetic Resources is situated here. A. Nagpur B. New Delhi C. Karnal D. Chennai	C
29.	National Bureau of Fish Genetic Resources is situated here. (NBFGR) at is engaged in the collection, conservation and efficient utilization of fish genetic resources A. Vishakhapatnam B. Veraval C. Chennai D. Calcutta	
30.	Who many crop science institutes are there in India for carrying out basic and applied research on specific crops and transferring the results thereof? A. 12 B. 9 C. 18 D. 15	B
31.	It is city of headquarter of Indian Agricultural Research Institute (IARI) A. New Delhi B. Pusa C. Calcutta D. Chennai	A
32.	Central Rice Research Institute (CRRI) of India is situated here A. Coimbatore B. Vyara C. Cuttack D. Navagam	C
33.	Central Research Institute for Jute and Allied Fibers is situated here. A. New Delhi B. Nagpur C. Cuttack D. Barrackpore	D
34.	Central Tobacco Research Institute (CTRI) is situated here. A. Anand B. Vijapur C. Rajahmundry D. None of these	C
35.	Indian Grassland and Fodder Research Institute (IGFRI) is situated here A. Delhi B. Anand C. Jhansi D. Karnal	C
36.	Sugarcane Breeding Institute (SBI) is situated here A. Navsari B. Coimbatore C. Lucknow D. Nagpur	B
37.	Indian Institute of Sugarcane Research (IISR) is situated here A. Navsari B. Coimbatore C. Lucknow D. Nagpur	C
38.	Central Institute of Cotton Research (CICR) is situated here A. Surat B. Coimbatore C. Lucknow D. Nagpur	D
39.	Vivekananda Parvatiya Krishi Anusandhan Shala (VPKAS) is situated here A. Almora B. Saputara C. kodaikanal D. Uti	A

40.	How many horticulture and plantation crops institutes are there in India for conducting and coordinating research on the crops they deal with? A. 12 B. 9 C. 8 D. 6	D
41.	Indian Institute of Horticultural Research (IIHR) is situated here. A. Bangalore B. Coimbatore C. Lucknow D. Nagpur	A
42.	Central Institute of Horticulture for Northern Plains (CIHNP) is situated here. A. Bangalore B. Coimbatore C. Lucknow D. Nagpur	C
43.	Central Institute of Temperate Horticulture (CITH) is situated here. A. Srinagar B. Coimbatore C. Lucknow D. Nagpur	A
44.	Central Potato Research Institute (CPRI) is situated here. A. Srinagar B. Simla C. Lucknow D. Disa	B
45.	Central Tuber Crops Research Institute (CTCRI) is situated here. A. Srinagar B. Simla C. Lucknow D. Trivandrum	D
46.	Central Plantation Crops Research Institute (CPCRI) is situated here. A. Srinagar B. Simla C. Kasargod D. Trivandrum	C
47.	How many resource management institutes are there in India that are primarily responsible for undertaking research on soil and water conservation for optimizing production of crops under different conditions? A. 12 B. 9 C. 8 D. 6	C
48.	Central Soil and Water Conservation Research and Training Institute (CSWCR&TI) is situated here. A. Dehradun B. Lucknow C. Trivandrum D. Anand	A
49.	Central Soil Salinity Research Institute (CSSRI) is situated here. A. Dehradun B. Karnal C. Trivandrum D. Anand	B
50.	Central Arid Zone Research Institute (CAZRI) is situated here. A. Dehradun B. Karnal C. Trivandrum D. Jodhpur	D
51.	Central Research Institute for Dryland Agriculture (CRIDA) is situated here. A. Dehradun B. Karnal C. Hyderabad D. Jodhpur	C
52.	ICAR Research Complex for North-Eastern Hill Region (ICAR-NEH) is situated here. A. Ela B. Shilling C. Hyderabad D. Jodhpur	B
53.	Central Agricultural Research Institute (CARI) for Andaman and Nicobar Islands is situated here. A. Ela B. Port Blair C. Mayabundar D. Rangat	B
54.	Indian Institute of Soil Science (IISS) is situated here. A. Dehradun B. Karnal C. Trivandrum D. Bhopal	D
55.	ICAR Research Complex for Goa (ICAR-GOA) is situated here. A. Ela B. Port Blair C. Mayabundar D. Rangat	A
56.	Central Institute of Agricultural Engineering (CIAE) is situated here. A. Dehradun B. Karnal C. Trivandrum D. Bhopal	D
57.	Central Institute for Research on Cotton Technology (CIRCT) is situated here. A. Bombay B. Surat C. Bhopal D. Navsari	A
58.	National Institute of Research on Jute and Allied Fiber Technology (NIRJAFT) is situated here. A. Dehradun B. Calcutta C. Trivandrum D. Bhopal	B

59	Indian Lac Research Institute (ILRI) is situated here. A. Ranchi B. Calcutta C. Trivandrum D. Bhopal	A
60	Central Institute of Postharvest Engineering and Technology (CIPET) is situated here. A. Ranchi B. Calcutta C. Ludhiana D. Bhopal	C
61	Indian Veterinary Research Institute (IVRI) is situated here. A. Izatnagar B. Calcutta C. Ludhiana D. Bhopal	A
62	National Dairy Research Institute (NDRI) is situated here. A. Izatnagar B. Calcutta C. Ludhiana D. Karnal	D
63	Central Sheep and Wool Research Institute (CSWRI) is situated here. A. Izatnagar B. Avikanagar C. Ludhiana D. Karnal	B
64	Central Avian Research Institute (CARI) is situated here. A. Izatnagar B. Avikanagar C. Ludhiana D. Karnal	A
65	Central Institute for Research on Buffaloes (CIRB) is situated here. A. Izatnagar B. Avikanagar C. Hisar D. Karnal	C
66	National Institute of Animal Genetics (NIAG) is situated here. A. Izatnagar B. Avikanagar C. Hisar D. Karnal	D
67	National Institute of Animal Nutrition and Physiology (NIANP) is situated here. A. Izatnagar B. Bangalore C. Hisar D. Karnal	B
68	Central Institute for Research on Goats (CIRG) is situated here. A. Izatnagar B. Makhdoom C. Hisar D. Karnal	B
69	Central Inland Capture Fisheries Research Institute (CICFRI) is situated here. A. Barrackpore B. Cochin C. Bombay D. Chennai	A
70	Central Marine Fisheries Research Institute (CMFRI) is situated here. A. Barrackpore B. Cochin C. Bombay D. Chennai	B
71	Central Institute of Fisheries Education (CIFE) is situated here. A. Barrackpore B. Cochin C. Bombay D. Chennai s	C
72	Central Institute of Fisheries Technology, (CIFT) is situated here. A. Barrackpore B. Cochin C. Bombay D. Chennai	B
73	Central Institute of Brackishwater Aquaculture (CIBA) is situated here. A. Barrackpore B. Cochin C. Bombay D. Madras	D
74	Central Institute of Freshwater Aquaculture (CIFA) is situated here. A. Barrackpore B. Cochin C. Bombay D. Dhauli	D
75	Indian Agricultural Statistics Research Institute (IASRI) is situated here. A. New Delhi B. Kanpur C. Mumbai D. Cochin	A
76	National Centre for Agricultural Economics and Policy Research (NCAP) is situated here. A. New Delhi B. Kanpur C. Mumbai D. Cochin	A
77	National Research Centres for Groundnut is situated here. A. New Delhi B. Kanpur C. Hyderabad D. Junagadh	D
78	The first SAU was established in India in 1960 based on this pattern. A. Land-Grant System of the United States B. Land-Grant System of the United Kingdom C. Land-Grant System of the Canada D. Land-Grant System of the Australia	A

79.	How many SAUs are there in Gujarat? A. 3 B. 4 C. 5 D. 2	B
80.	AICRP means A. All India Coordinated Research Project B. All India Cooperative Research Project C. All India Corporation Research Programme D. All India Coordinated Research Priority	A
81.	NARP means A. National Agronomy Research Project B. National Agricultural Regional Programme C. Natural Agricultural Research Project D. National Agricultural Research Project	D
82.	Which of the following is deemed to be university? A. Indian Agricultural Research Institute, Pusa-110012, New Delhi B. Indian Veterinary Research Institute, Izatnagar, Bareilly-243122, UP. C. National Dairy Research Institute, Karnal-132001, Haryana D. All above	D
83.	Which of the following is deemed to be university? A. Central Institute of Fisheries Education, Mumbai-400061, Maharashtra B. Allahabad Agricultural Institute, Allahabad-211007, Uttar Pradesh C. Indian Agricultural Research Institute, Pusa-110012, New Delhi D. All above	D
84.	Which of the following is central university with agriculture faculty? 5. Banaras Hindu University, Varanasi, U.P. 6. Aligarh Muslim University, Aligarh, U.P. 7. Vishwa Bharti, Shantiniketan, West Bengal 8. All above	D
85.	Which of the following is central university with agriculture faculty? A. Aligarh Muslim University, Aligarh, U.P. B. Vishwa Bharti, Shantiniketan, West Bengal C. Nagaland University, Medzipherma, Nagaland D. All above	D
86.	CGIAR means A. The Consultative Group on International Agricultural Research B. The Cooperative Group on International Agricultural Research C. The Consultative Guidance on International Agricultural Research D. The Consultative Group on Indian Agricultural Research	A
87.	CGIAR is a part of this system A. Global Agricultural Research System B. National Agricultural Research System C. Global Agricultural Extension System D. Global Agricultural Education System	A

88.	Major objective of CGIAR includes	D
	A. Food for People B. Environment for People C. Policies for People D. All above	
89.	How many centers together maintain major role in maintaining Genebanks under CGIAR?	D
	A. 10 B. 15 C.20 D.11	
90.	How many CGIAR supported international agricultural research centers are working worldwide?	B
	A. 10 B. 15 C.20 D.11	
91.	CIAT is	A
	A. International Center for Tropical Agriculture B. Center of International level for Tropical Agriculture C. Center of International Agricultural Technology D. Interdisciplinary Center for Tropical Agriculture	
92.	CIFOR is	B
	A. Center for International Forestry Output Research B. Center for International Forestry Research C. Center for Indian Forestry Research D. Center for Initiatives of Forestry Output Research	
93.	CIMMYT is	C
	A. International Maize and Wheat Improvement Center B. Centro Internacional de Mejoramiento de Maíz y Trigo C. A and B D. None of above	
94.	CIP is	D
	A. International Potato Center B. Centro Internacional De La Papa C. Center for Potato Initiatives D. A and B	
95.	ICARDA is	A
	A. International Center for Agricultural Research in the Dry Areas B. Intermediate Center for Agricultural Research in the Dry Areas C. International Center for Agronomical Research in the Dryland Areas D. International Center for Agricultural Research in the Drought Areas	
96.	ICRISAT is	A
	A. International Crops Research Institute for the Semi-Arid Tropics B. International Cotton Research Institute for the Semi-Arid Tropics C. International Corporation of Regional Institutes for the Semi-Arid Tropics D. International Crops Refinement Institute for the Semi-Arid Tropics	
97.	IFPRI is	B
	A. Indian Food Policy Research Institute B. International Food Policy Research Institute C. International Forestry Policy Research Institute D. International Financial Policy Refinement Institute	

98.	IITA is	D
	A. Indian Institute of Tropical Agriculture B. International Investment for Tropical Agriculture C. International Institute for Training of Agrochemicals D. International Institute of Tropical Agriculture	
99.	ILRI	C
	A. Initiatives of Livestock Research Institute B. International Lion Research Institute C. International Livestock Research Institute D. Indian Livestock Research Institute	
100.	IRRI is	A
	A. International Rice Research Institute B. Indian Regional Research Institute C. International Royal-tiger Research Institute D. International Research for Rice Institute	
101.	IWMI	B
	A. Innovative Water Management Institute B. International Water Management Institute C. Indian Water Management Institute D. International Wildlife Management Institute	
102.	WFC is	A
	A. World Fish Center B. Wild Fish Center C. World-class Fish Center D. World Finance Center	
103	Headquarter of International Maize and Wheat Improvement Center is here	A
	A. Mexico B. Jakarta C. Malaysia D. Heyderabad	
104	The crops account for about 40% of the world's food and 25% of calories consumed in developing countries are	A
	A. Wheat & Maize B. Paddy and Barley C. Chickpeas & Pigeonpea	
105	How many million tons of additional Maize and Wheat will be needed in 2020 to meet the need for food in developing countries?	A
	A. 368 B. 568 C. 768 D. 868	
106	He is known as father of green revolution	D
	A. Nariman Ernest Borlaug B. Norman Ernest Borlo C. Narman Earner Borlaug D. Norman Ernest Borlaug	
107	It is year of birth of Dr. Norman Ernest Borlaug.	B
	A. 1924 B. 1914 C. 1934 D.1904	
108	Dr. Norman Ernest Borlaug passed away in this year.	D
	A. 2008 B. 2007 C. 2005 D.2009	
109	Dr. Norman Ernest Borlaug was recipient of	D
	A. Nobel Peace Prize B. The Presidential Medal of Freedom C. The Congressional Gold Medal D. Above all	
110	Dr. Norman Ernest Borlaug was recipient of	A
	A. Padma Vibhushan B. Padma Shree C. Bharat Ratna D. None of above	

111	Dr. Norman Borlaug was awarded the Nobel Peace Prize in this year A. 1975 B. 1980 C.1999 D. 1970	D
112	Headquarter of CIAT is here. A. Colombia B. Indonesia C. Mexico D. Peru	A
113	Headquarter of CIFOR is here. A. Colombia B. Indonesia C. Mexico D. Peru	B
114	Headquarter of CIMMYT is here. A. Colombia B. Indonesia C. Mexico D. Peru	C
115	Headquarter of CPI is here. A. Colombia B. Indonesia C. Mexico D. Peru	D
116	Headquarter of ICARDA is here. A. Syria B. India C. USA D. Nigeria	A
117	Headquarter of ICRISAT is here. A. Syria B. India C. USA D. Nigeria	B
118	Headquarter of IFPRI is here. A. Syria B. India C. USA D. Nigeria	C
119	Headquarter of IITA is here. A. Syria B. India C. USA D. Nigeria	D
120	Headquarter of ILRI is here. A. Kenya B. Italy C. Philippines D. Sri Lanka	A
121	Headquarter of Bioversity International is here. A. Kenya B. Italy C. Philippines D. Sri Lanka	B
122	Headquarter of IRRI is here. A. Kenya B. Italy C. Philippines D. Sri Lanka	C
123	Headquarter of IWMI is here. A. Kenya B. Italy C. Philippines D. Sri Lanka	D
124	Headquarter of World Agroforestry Centre is here. A. Kenya B. Malaysia C. Benin D. Sri Lanka	A
125	Headquarter of World Fish Center is here. A. Kenya B. Malaysia C. Benin D. Sri Lanka	B
126	Headquarter of Africa Rice Center is here. A. Kenya B. Malaysia C. Benin D. Sri Lanka	C
127	Africa Rice Center is also known as A. Rice Africa B. African Rice C. AfricaRice D. None of above	C
128	Asian Vegetable Research and Development Centre's headquarter is here A. India B. China C. Taiwan D. Sri Lanka	C
129	International Centre of Insect Physiology and Ecology's headquarter is here. A. Kenya B. UK C. USA D. India	A
130	Caribbean Agricultural Researches and Development Institute's headquarter is here. A. Kenya B. UK C. USA D. West Indies	D
131	This international center promotes development of an economic and environmentally sound mountain ecosystem A. ICIMD B. IMD C. ICMD D. None of these	A

132	Headquarter of CAB International is here.	A
	A. UK B. USA C. Australia D. Canada	
133	Headquarter of The World Bank is here.	D
	A. London B. Toronto C. Beijing D. Washington DC	
134	Headquarter of FAO is here	C
	A. London B. Toronto C. Italy D. Washington DC	
135	FAO is	C
	A. Flood & Agriculture Organization B. Forest & Agriculture Organization	
	C. Food & Agriculture Organization D. Fertilizer & Agriculture Organization	