

Bangladesh

Address: Gazipur 1701, Bangladesh. **Phone:** (+880 681) 2176; 2168.

Director/Head: M. Nasiruddin (Research).

Number of Research Scientists: 190; **Number of Staff:** 464.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Varietal development; crop-soil-water management; pest management; rice farming systems; farm mechanization; socioeconomics and policy; technology transfer (training is a component under this programme area).

Major Scientific Results or Products: BRRI has developed more than 30 modern rice varieties suitable as well as more than 100 associated technologies.

Main Research Facilities Available: Tissue culture lab, germplasm bank and research facilities for cultural practices, plant protection, soil science and grain quality; computer, centre for data analysis; 7 regional stations; library with 12,000 books and 560 periodicals.

Future Development Plans: To nurture hybrid rice; develop saline, drought resistant and early maturing rice varieties; discover new rice cultures; strengthen technology transfer strategies; establish 3 additional regional stations.

Cooperation Arrangements with Developing Countries: BRRI has informal links with major rice growing countries through IRRI.

Other International Cooperation Arrangements: USAID, World, JICA, ODA, CIDA, Australian Government.

Bolivia

Address: Casilla 247, Santa Cruz, Bolivia. **Phone:** (+591 3) 343668 or 368590; **Fax:** (+591 3) 342996;

E-mail: ciat@mitai.nrs.net.bo.

Director/Head: Gustavo Perreyra C.

Number of Research Scientists: 133; **Number of Staff:** 306.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: CIAT undertakes the research and technology transfer activities necessary for the agricultural development of the Santa Cruz department, in tropical and temperate environmental conditions. The institutional works are concentrated in thirteen programmes as follows: Soil Management, Agroforestry, Fruit and perennial crops, Rice, Maize, Wheat, Oil crops, Cotton, Vegetables, Production Systems, Diverse crops, Animal Production and Silk cultivation. Technology Transfer is achieved through intermediary users, who undertake rural extension.

Major Scientific Results or Products: About 95% of the total area annually sowed with soybean, rice and wheat use CIAT varieties; CIAT undertakes preservation and improvement of "Criollo" cattle. Research on production systems has had great impact on some tropical areas, particularly in the Santa Cruz department.

Main Research Facilities Available: Agricultural equipment; computers; laboratories (soil, entomology, phytopathology; rhizobiology); two field stations; 10 small regional research stations; library; communication equipment (radio, telephone, fax, e-mail).

Future Development Plans: CIAT wants to strengthen its work through systems-approach based projects. Major efforts focus on improving institutional capacity in research management; training technicians and scientific staff; and research and technology transfer dealing with natural resources and small-scale and intensive agriculture.

Cooperation Arrangements with Developing Countries: ABC, LAPAR, CATIE, PROCIANDINO, PROCITROPICOS.

Other International Cooperation Arrangements: ODA, NRI, SRI, University of Edinburgh, JICA, EMBRAPA, CIAT (Colombia), IRRI, CIMMYT.

Brazil

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) — Centro de Pesquisa Agropecuária dos Cerrados (CPAC)

Address: BR-020, Km 18, Cx. Postal 08223, 73.301-970 Planaltina D.F. Brazil. **Phone:** (+55 61) 3891121, 3891171, 3893442; **Fax:** (+55 61) 3892953.

Director/Head: Jamil Macedo.

Number of Research Scientists: 101; **Number of Staff:** 517.

Scientific Fields of Interest: Agriculture; Biology; Earth Sciences; Environment; Veterinary Sciences.

Main Lines of Research and Training Activities: Evaluation of the potential and limitations of natural resources (soil, climate and vegetation) of Cerrado Region. Crop selection and adaptation with emphasis on soybean, cassava, corn, wheat, barley, beans, tropical and temperate fruits, coffee, sunflower and rubber. Soil, climate and water studies comprising soil fertility, soil management and conservation, soil survey, soil microbiology, agrometeorology, irrigation, and mechanization. Biological sciences: botany, entomology, nematology, physiology, phytopathology and virology.

Major Scientific Results or Products: Since its inception 20 years ago, CPAC has developed more than 30 economically valuable cultivars and created technologies to increase and maintain soil fertility through use of lime, fertilizers, soil management and conservation. CPAC-selected rhizobium for legumes and soybeans can be grown without N. fertilizer — a technology worth US\$500 million a year.

Main Research Facilities Available: CPAC research takes place on 3,500 hectares of land, 27,000 square metres of buildings and 3,000 metres of open canals that allow irrigation of a 200-hectare area. The building consists of glasshouses and laboratories equipped for research and experimentation in soil fertility, soil physics, mineralogy, plant physiology and pathology, animal nutrition, entomology, nematology and microbiology. CPAC also has an up-to-date library, three image-processing and personal computers (386 and 486) and a Macintosh.

Future Development Plans: Training new scientists and increasing collaborative research efforts with national and international institutions to advance applied science and technologies that meet the needs of Cerrado region growers.

Cooperation Arrangements with Developing Countries: Participation in research and training activities with CIAT, International Centre for Tropical Agriculture (Colombia), Cotia, Takenaka, Pioneer, Adubos Trevo, Monsanto and others.

Other International Cooperation Arrangements: JICA, Japan International Cooperation Agency; Cornell University, Bayreuth University, Companhia des Phosphates Gafsa, Nasa, North Carolina S. Univ. PROCITROPICS (IICA), CIRAD, ORSTON, ODA/UK, BIRD.

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) — Centro Nacional de Pesquisa de Agrobiologia (CNPAB)

Address: Caixa Postal 74505, 23851-970 Rio de Janeiro, Brazil. **Phone:** (+55 21) 6821500; **Telex:** 055-21-32723 EBPA BR; **Fax:** (+55 21) 6821230; **E-mail:** cnpab@risc.ufrj.rederio.br.

Director/Head: Maria Cristina P. Neves.

Number of Research Scientists: 29; **Number of Staff:** 84.

Scientific Fields of Interest: Agriculture; Environment.

Main Lines of Research and Training Activities: Development of sustainable agricultural technologies; recovery of eroded soil and subsoil through reforestation with legumes trees; maximization of nitrogen fixation in soybeans, beans and forage legumes through better elucidation of plant bacteria relationships; identification of diazotrophic bacteria that colonize forage grasses, rice, maize, sorghum and sugar cane and clarify mechanisms for interaction with the plant. Quantification of the contribution of nitrogen fixation to these crops; technologies for inoculation of legumes and gramineous plants with selected mixtures of diazotrophs and interaction with VA mycorrhizae; identification of VA mycorrhizae and their role in establishing legume and non-legume crops in the field.

Major Scientific Results or Products: Soybeans in Brazil, which are grown without any N fertilizer and beans, obtain most of their N from BNF. Legume trees inoculated with VA mycorrhizae and selected Rhizobium form 5 metre-high forests in marginal soils. Sugar cane cultivars CB-45-3 and SP 701143

produce high yields (up to 120t/ha) without any N fertilizer, reducing costs and increasing the energy balance for alcohol production in Brazil.

Main Research Facilities Available: Electron microscope (scanning and optical), microthons, ultracentrifuge, mass spectrometer, lyophilizers, computers, FIA. Field station with 200 hectares; library containing 2,500 books, 281 journals and database listing 21,000 articles. Five greenhouses, including one with facilities to test genetically modified microorganisms.

Future Development Plans: Application of gene probes in ecological studies involving diazotrophs; biological control of plant pests and diseases; plant breeding for organic agriculture.

Cooperation Arrangements with Developing Countries: University of Buenos Aires, Argentina; Unit of Nitrogen Fixation, Cuernavaca, Mexico; VITAE Foundation for Brazil-Argentina cooperation; Instituto de Investigacion Biológicas C. Estable, Uruguay.

Other International Cooperation Arrangements: European Economic Community; The World Bank; Inter-American Development Bank.

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) — Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia (CENARGEN)

Address: Caixa Postal 02372, SAIN Parque Rural, 70849-970, Brasília, D.F., Brazil. **Phone:** (+55 61) 272-0253; 272-4203; 273-3311; 349-1262. **Telex:** 061-1622; **Fax:** (+55 61) 2743212.

Director/Head: Marcio De Miranda Santos.

Number of Research Scientists: 118; **Number of Staff:** 182.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Environment; Veterinary Sciences.

Main Lines of Research and Training Activities: Collection, characterization, conservation and utilization of genetic resources for all germplasm material introduced in the country; animal embryology; plant genetic engineering, biological pest control. Training is provided through courses and postgraduate field work.

Major Scientific Results or Products: National network for genetic resources conservation consisting of 84 gene banks. Competence in plant molecular biology, embryology and field biological control.

Main Research Facilities Available: 20 fully equipped laboratories, 31 greenhouses, up-to-date library.

Future Development Plans: Continue research in the genetic resources and biotechnology and increase competitiveness of Brazilian products.

Cooperation Arrangements with Developing Countries: Participation in research and training activities in the following programmes: PROCITROPICOS, PROCISUR, Amazonian Cooperation Treaty, Bilateral Agreement between Brazil and Argentina.

Other International Cooperation Arrangements: Proposal submitted to GEF; agreement with US universities; agreement with Asian research institutions.

Institute of Food Technology (ITAL)

Address: Caixa Postal 139, 13073-001 Campinas S.P. Brazil. **Phone:** (+55 192) 415222; **Telex:** 19-1009; **Fax:** (+55 192) 415034.

Director/Head: Faber de Freitas Leitão.

Number of Research Scientists: 92; **Number of Staff:** 261.

Scientific Fields of Interest: Agriculture; Biochemistry/Biophysics; Engineering/Technology; Environment Packaging; Marine; Food Science and Technology.

Main Lines of Research and Training Activities: ITAL is dedicated to research and development in food technology. Its main objectives are to implement techniques for the preparation, processing, packaging, storage, distribution and utilization of food related to juices, pulps and concentrates and the canning of fruits and vegetables; industrial fermentations; storage of grains; post-harvest of fruits and vegetables; baking, beverages; edible oils; dehydrated foods; fish and marine resources; meats; dairy products; microbiology; quality control; and pesticides residues.

Major Scientific Results or Products: Brazil's food industry has made rapid progress and ITAL has played an important role in this effort. The Institute supports middle- and small-size firms across the country. ITAL's scientific findings are published twice yearly in Coletanea. English abstracts accompany each article.

Main Research Facilities Available: Laboratories on food science; chemistry, biochemistry, microbiology and pesticide residues that enable staff to conduct sensitive analysis and tests (including plasma spectrometer, atomic absorption spectrophotometer, texture analyser, gas chromatograph, amino acid analyser, multichannel fluoroptic thermometer, stereomicroscope "zoom", impedance system, electronic centrifuges, and hunterlab colorimeter; computers; microcomputers AST 3/25s. Pilot plants for milk and dairy products, meats, flours, fermentation and distillery, dehydrated food, fruit juices and soft drinks, horticulture products, canning, aseptic line, fish and marine resources, fats and edible oils. The best library on food in South America with a Sectorial Nucleus for Information on Food (NSI-AL), linked to a national information chain devoted to other areas of knowledge.

Future Development Plans: Alternatives for fish industrialization and food irradiation.

Cooperation Arrangements with Developing Countries: South and Central American countries; Caribbean countries; Suriname; Portuguese-speaking African countries (Angola, Mozambique), and others.

Other International Cooperation Arrangements: EEC, European Economic Community; IATA, Instituto de Agroquímica y Tecnología de Alimentos (Spain); CIDA, Canadian International Development Agency (Canada); ODA, Overseas Development Agency (UK); INRA, Institut National de Recherche Agronomique (France).

Instituto Agrônômico (IAC)

Address: Avenida Barão de Itapura 1481, Caixa Postal 28, CEP 13020-902 Campinas, SP, Brazil.

Phone: (+55 192) 348144; **Fax:** (+55 192) 314943; **E-mail:** tisselli@barao.iac.br.

Director/Head: Otavio Tisselli Filho.

Number of Research Scientists: 247; **Number of Staff:** 1,250.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Crop production and breeding (more than 130 different species), emphasising cotton, sugar cane, coffee, cereals (corn, rice and wheat), citrus, flowers and ornamentals, tropical and temperate fruits, legume and oil crops (beans, soybeans, peanuts and sunflowers), roots and tubers, tropical plants (rubber and palm) and horticultural plants. Soil, climate and water studies focusing on soil fertility and plant nutrition, soil conservation, soil survey, soil microbiology, agrometeorology and irrigation. Biological sciences (plants only): botany, cytology, entomology, physiology, phytopathology, and virology; mechanization and phery.

Major Scientific Results or Products: Since the late 19th century, Instituto Agrônômico has released more than 380 cultivars for state growers and studied cropping systems for nearly all Brazilian crops, most notably coffee, cotton, tropical soybeans, commercial corn hybrid, bean, cassava, and tropical wheat. Other major activities include soil survey, mapping and classification.

Main Research Facilities Available: Twenty experimental stations scattered across the state comprising about 6,000 hectares for field research, 43 (blue ribbon) glasshouses, library, laboratories for soil and plant analyses, plant chemistry, plant physiology, remote sensing, plant pathology, motors and field machinery, molecular biology.

Future Development Plans: IAC will continue to concentrate on applied science and technologies that match the needs of São Paulo state growers. Brazil's agriculture, which is highly diversified, is often driven by widespread poverty and threats of famine, and therefore shaped by policies that extend beyond agricultural concerns. For these reasons, the Institute will continue to study issues related to productivity and sustainability.

International Cooperation Arrangements: Open to any opportunity.

Instituto de Pesquisa Jardim Botânico do Rio de Janeiro

Address: Rua Jardim Botânico 1008, Rio de Janeiro 22260, Brazil.

Director/Head: Sergio de Almeida Bruni.

Number of Research Scientists: 29.

Scientific Fields of Interest: Agriculture; Biology; Environment; Marine Sciences.

Main Lines of Research and Training Activities: Taxonomy; conservation; floristic survey.

Major Scientific Results or Products: Scientific publications, Atlantic rainforest database.

Main Research Facilities Available: Computers in local area network, library, herbarium.

International Cooperation Arrangements: John D. and Catherine MacArthur Foundation.

Universidade Federal de Viçosa (UFV) — Departamento de Tecnologia de Alimentos (DTA)

Address: Av. Peter Henry Rolfs s/n, Campus Universitario, 36570-000 Viçosa, Minas Gerais, Brazil.

Phone: (+55 31) 899-2225; **Fax:** (+55 31) 899-2208; **E-mail:** dta@ufv.br.

Director/Head: Frederico S. Vieira Passos.

Number of Research Scientists: 37; **Number of Staff:** 52.

Scientific Fields of Interest: Engineering/Technology; Food Science.

Main Lines of Research and Training Activities: Food product development; meat science and technology; dairy science and technology; starch and baking science and technology; quality control; food fermentation; juices and beverages; food chemistry and microbiology; natural dyes and antioxidants; vegetable science and technology; agrobusiness; biotechnology.

Major Scientific Results or Products: Development of H2B20 culture, liquid yogurt, tropical juice technology, isolation and identification of ginger antioxidants.

Main Research Facilities Available: Meat, dairy, starch and bakery, microbiology, vegetable and fruit, computer and chemistry laboratories and pilot plants, university library.

Future Development Plans: Continue staff training programmes, develop food irradiation programme, increase computer facilities and update existing equipment and expand graduate and undergraduate exchange programmes.

Cooperation Arrangements with Developing Countries: Student and professional training programmes at DTA/UFV through courses and technical support.

Other International Cooperation Arrangements: Staff inter-exchange and training; research inter-exchange and cooperation.

Chile

Pontifical Catholic University of Chile — Department of Cell and Molecular Biology

Address: Faculty of Biological Sciences, P.O. Box 114-D, Santiago, Chile. **Phone:** (+56 2) 6862725;

Fax: (+56 2) 6862717.

Director/Head: Enrique Brandan S.

Number of Research Scientists: 14; **Number of Staff:** 11.

Scientific Fields of Interest: Cell biology; medical sciences; neurosciences; signal transduction, development and differentiation.

Main Lines of Research and Training Activities: Regulation of neurotransmitter and glutamate receptors; function and processing of the Alzheimer's amyloid precursor protein; monoclonal antibodies; biogenesis of peroxisomes; protein kinase C and ecotoxicology; fish oils and cardiovascular disease; skeletal, muscle differentiation; extracellular matrix; doctorate programme in cell and molecular biology.

Major Scientific Results or Products: Subcellular localization of acetylcholinesterase; regulation of PKC by hypolipidemic drug; settlement inducers of molluscs; regulation of excitatory amino acid receptors; treatment of cardiovascular diseases with fish oils; diagnostic methods for Alzheimer's disease; synthesis and processing of proteoglycons.

Main Research Facilities Available: Department has several well-equipped biochemical laboratories with mass spectrometers, ultracentrifuges, HPLC, computer networks and electron microscopes, including transmission and scanning electron microscopes.

Future Development Plans: The Department plans to advance its current research efforts in the fields of biomedical sciences, molecular marine sciences and environment, and neurosciences.

International Cooperation Arrangements: National Science Foundation (NSF) projects (USA), Stiftung Volkswagenwerk (Germany), International Centre for Genetic Engineering and Biotechnology (Italy), International Foundation for Science (IFS, Sweden), Cooperation Programme Italy and Chile (Italy), Howard Hughes Medical Institute (USA).

Pontifical Catholic University of Chile — Department of Ecology

Address: Faculty of Biological Sciences, Alameda 340, P.O. Box 114-D, Santiago, Chile. **Phone:** (+56 2) 2224516 ext. 2620; **Telex:** 40 395; **Fax:** (+56 2) 6862621.

Director/Head: Juan Correa.

Number of Research Scientists: 15; **Number of Staff:** 12.

Scientific Fields of Interest: Biology; Environment; Marine sciences.

Main Lines of Research and Training Activities: The Department focuses on teaching and research and offers extension courses in ecology in the following areas: botany and zoology in terrestrial and aquatic living systems. The Department oversees doctorate programme in the biological sciences with concentration in ecology. Researchers concentrate on the structure and dynamics of Chile's terrestrial and marine ecosystems. Department has developed two interrelated research programmes: community ecology and population biology. Conservation biology and environmental management are other major areas of study.

Major Scientific Results or Products: Book chapters in specialized and technical monographs; scientific papers in international journals; studies and evaluation of marine and terrestrial human/environment interactions; new technologies for algae and marine invertebrate cultivation; advances in biotechnology on selection and propagation of plants of economic importance; ecology of Chilean vertebrates.

Main Research Facilities Available: Marine Coastal Research Field Station (ECIM) at Las Cruces. Laboratory and other facilities — concentrating on plant physiology, plant and animal ecophysiology, plant and invertebrate histology, ecoenergetics and nutrient cycling analysis — cover approximately 2,000 square metres. Department also has a seawater aquarium, plant nursing facilities and phytotrons and cultivation and growing chambers. Researchers and students enjoy access to the university library system with more than 18,000 books and nearly 500 subscriptions to journals specialized in biology and medicine. There are also extensive computer facilities.

Future Development Plans: The Department encourages interdisciplinary research designed to strengthen the ties between terrestrial and marine programmes. This effort is centred on biodiversity and human/environment interactions.

Cooperation Arrangements with Developing Countries: The doctoral programme in biological sciences with concentration in ecology is widely recognized as a top-ranked programme that attracts applications from a broad geographic area.

Other International Cooperation Arrangements: Cooperative project financed by the Italian government, related to "Research and Educational Programme for the Management of Benthic Marine Resources."

China

Chinese Academy of Agricultural Sciences (CAAS) — Biotechnology Research Centre

Address: 30 Baishiqiao Road, Beijing 100081, China. **Phone:** (+86 10) 6217-4052; **Fax:** (+86 10) 6217-4142; **E-mail:** liudehu@public.bta.net.cn.

Director/Head: Huang Dafang.

Number of Research Scientists: 15; **Number of Staff:** 55.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: The Biotechnology Research Centre was founded by the Chinese Academy of Agricultural Sciences in 1986 based upon the realization that biotechnology and its applications may be key factors in the future development of agriculture. The Centre consists of three laboratories and one workshop, the work of which is closely related. The most research topics are listed as follows: Genetic engineering (insect resistance, plant virus resistance, resistance to disease caused by bacterium, resistance to disease caused by fungus, nutrition improvement of crop); Mechanism of expression and gene structure (gene cloning, promoter analysis); Molecular marker

(RAPD, RFLP); Production of monoclonal antibody (diagnosis of plant virus, study on virus strains); Tissue culture (virus-free plant materials, transformation system).

Major Scientific Results or Products: Transgenic cotton resistant to insects; transgenic potato resistant to potato virus Y (PVY); transgenic potato resistant to *Pseudomonas solanacearum*; kits (ELISA) for diagnostics of PVY, PVX and TuMV.

Main Research Facilities Available: High-speed refrigerated centrifuge; ultra-speed refrigerated centrifuge; spectrophotometer; GeneAMP PCR system; DNA sequencing system; computers; biolistic delivery system; vacuum evaporator; growth chamber; icemaker; refrigerators; oligonucleotide synthesizer; thermostatic circulators; HPLC systems; greenhouse; library.

Future Development Plans: Field testing for plant resistance to insects, plant viruses and bacteria; development of tissue cultures and gene systems in monocots; participation in the formation and training of biotechnologies; commercialization of scientific results or products; nurturing of relationships with other institutes or universities in both developing and developed countries.

Chinese Academy of Medical Sciences (CAMS) — Institute of Medicinal Plant

Address: Xi Bei Wang, Haidian District, Beijing 100094, China. **Phone:** (+86 10) 62581114; **Fax:** (+86 10) 62581114; (+86 10) 62581114.

Director/Head: Yang Shilin.

Number of Research Scientists: 72; **Number of Staff:** 241.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Chemistry; Pharmacy.

Main Lines of Research and Training Activities: The institute includes several laboratories and departments (medicinal plant cultivation, medicinal plant resources, medicinal fungus, herbarium, phytochemistry, analytical chemistry, organic chemistry, immunology I and II) as well as a botanical garden and a pilot plant.

Major Scientific Results or Products: About 90 scientific activities have been appraised, including three state-level and 30 ministerial projects. Assessments have focused on introduction and cultivation of such drugs as *Gastrodia elata*, *Panax quinquefolium* and *Ganoderma lucidum*, which were well-received by villagers living in remote areas. Nearly 500 scientific papers and many scientific monographs have been published. The institute is a WHO Collaborating Centre on TRM. Thus far, 87 students have received master or doctoral degrees and nearly 20 products have been produced in the pilot plant.

Main Research Facilities Available: HPLC, TLC, Ultraviolet, GC, GC-MS, HPLC-MS, IR, CD, NMR, MS, etc.

Future Development Plans: Hope to develop two to three new drugs each year, over the next five years, in an effort to make the institute a key player in the Chinese Academy of Medical Sciences as well as a noted international centre for the research and development of medicinal plants.

Cooperation Arrangements with Developing Countries: The institute has trained many scientists from developing countries in medicinal plant research, ranging from cultivation to preparation, and it hopes to expand this unique role in the future.

Other International Cooperation Arrangements: The institute has developed exchanges with many international scientific organizations. It has fostered cooperative ventures, for example, with Glaxo-Wellcome Company, Taisho Pharmaceutical Co. Ltd., Polish Academy of Medical Sciences, and Poznan Institute of Medicinal Plants, to advance the research and development of medicinal plants.

Chinese Academy of Sciences (CAS) — Shanghai Institute of Plant Physiology (SIPP)

Address: 300 FengLin Road, Shanghai 200032, China. **Phone:** (+86 21) 64042090; **Telex:** 33275 CASS CN; **Fax:** (+86 21) 64042385; **E-mail:** sipp@iris.sipp.ac.cn.

Director/Head: Tang Zhang-cheng.

Number of Research Scientists: 208; **Number of Staff:** 162.

Scientific Fields of Interest: Biology; Biochemistry/Biophysics; Environmental Biology; Medical Sciences; Mathematics; Agriculture.

Main Lines of Research and Training Activities: The Institute's research encompasses three interrelated disciplines — plant physiology, microbiology and molecular genetics. Specifically, Institute focuses its research on the molecular, cellular, organism and community levels and concentrates on

basic life activities of plants and microbes, including growth, metabolism, energy transduction, heredity and mutation. The Institute also studies the impacts of environmental factors. Our ultimate goal is to seek ways to control life processes, modify microbe and plant characters and behaviour, and provide the theoretical basis and techniques for advances in biological engineering.

Major Scientific Results or Products: Discovery of high-energy intermediate state in photophosphorylation, application of growth regulatory substances, protoplast culture of crops, fine structure mapping and regulation study of nitrogen fixation genes, cloning and expression of genetic determinants for K88 and K99 and their use in the prevention of acute diarrhoea in piglets, regulatory effects of nitrogenous metabolites on the biosynthesis of rifamycin and validamycin, and explorations of concentrated protein derived from soybean and micropropagation of plants by tissue culture.

Main Research Facilities Available: Centrifuges, spectrophotometers, chromatography instruments, instruments for DNA synthesis and DNA sequencing, analytical instruments for protein and amino acids, electron microscopes, computers, library and large phytotron.

Future Development Plans: Establish several national or key laboratories; undertake more projects of unquestioned national importance, place more emphasis on basic research and high technologies of critical importance.

Other International Cooperation Arrangements: The Institute cooperates with and is supported by Rockefeller Foundation, United Nations Environment Programme (UNEP), University of California, Illinois University, New York University, German Research Association (DEG) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the European Economic Community.

China, Taiwan

Asian Vegetable Research and Development Center (AVRDC)

Address: P.O. Box 42, Shanhua, Tainan 74199, Taiwan, China. **Phone:** (+886 6) 5837801; **Telex:** 73560 AVRDC; **Fax:** (+886 6) 5830009; **E-mail:** cstsou@netra.avrdc.org.tw.

Director/Head: Samson C.S. Tsou.

Number of Research Scientists: 19; **Number of Staff:** 316.

Scientific Fields of Interest: Agriculture; Biology; Biotechnology; Biochemistry/Biophysics; Environment; Socioeconomics.

Main Lines of Research and Training Activities: Research: Breeding for improved higher yielding vegetable varieties; conservation of genetic resources; crop tolerance and resistance to biotic and abiotic stresses; technical requirements and infrastructure needed for production, processing, testing and storage of vegetable seeds; crop and resource management, soil science, physiology; biotechnology; integrated pest management; socioeconomics (factors affecting adoption of technologies, including the economics of technological innovations, impact of improved varieties and cultivar practices, marketing and trade opportunities); home gardens; postharvest problems. Training: Research training for young and middle-level researchers; production training; special purpose training on research, extension or both. Research scholars for master's, doctorates, and post-doctorate fellows and visiting scientists.

Major Scientific Results or Products: Raised yield potential of six primary vegetable commodities: Chinese cabbage, mungbean, pepper, soybean, tomato and sweet potato; improved production systems for tropics that reduce weed growth and soil-borne diseases by alleviating effects of high temperature and rainfall and excessive soil moisture and improving soil fertility; one of the world's largest vegetable genebanks, world-base collection of mungbean, and global duplication collection of peppers. Trained more than 1,400 vegetable researchers and extension workers from more than 50 countries or territories.

Main Research Facilities Available: Electron microscope and small compound microscopes; near-infrared spectroscopy (NIRS); desktop PCs and minicomputer (HP3000); assortment of biotechnology, chemistry, pathology/virology equipment; 110 hectares field experiment station; library; quarantine facility; screenhouses; greenhouse complex; transgenic plants greenhouse; service building; cold-store facility; seed storage facilities.

Future Development Plans: Expand the Center's reach into Africa, Latin America and the Caribbean and West Asia and North Africa; address principal and regional vegetable commodities and crops; strengthen research capacity in biotechnology, postharvest, seed production and technology and

marketing research; broaden and strengthen links and collaboration with regional and national agricultural research systems (NARS) and international agricultural research centres (IARCs) with advanced laboratories; strengthen national capacity in vegetable research; refocus programme on home gardens; emphasize assessment of improved vegetable technologies and impact on nutrition and income of producers.

Cooperation Arrangements with Developing Countries: Existing links with national agricultural research systems (NARS); Memoranda of Understanding with SACCAR, Tanzania, Ethiopia, Bhutan; Executing agency for CONVERDS, SAVERNET, AVNET and in LAC; Plans other networks in LA, NA, and West Asia.

Other International Cooperation Arrangements: Cooperates with other universities (for example, Cornell University and University of Arizona) on biotechnology and breeding; established INTHOPE for pepper research with collaborating NARS.

Colombia

International Center for Tropical Agriculture (CIAT)

Address: Apartado Aéreo 6713, Cali, Colombia. **Phone:** (+57 2) 4450000; **Telex:** 05769 CIAT CO; **Fax:** (+57 2) 4450273.

Director/Head: Robert D. Havener.

Number of Research Scientists: 100; **Number of Staff:** 1,100.

Scientific Fields of Interest: Agriculture; Environment.

Main Lines of Research and Training Activities: The International Center for Tropical Agriculture is dedicated to the alleviation of hunger and poverty in developing countries in the tropics. It seeks to reach this goal by applying science to agriculture in ways that increase productivity while sustaining natural resource base. CIAT's four commodities are: beans, cassava and forages, worldwide and rice grown in Latin America. Programmes focus on three ecosystems: sustainable production on under-utilized grassy savannahs with highly acid soils; farming systems for erosion-prone hillside areas; and stabilization of agriculture at the edge of rain forests.

Costa Rica

Instituto Nacional de Biodiversidad (INBio)

Address: P.O. Box 33-3100, Santo Domingo, Heredia, Costa Rica. **Phone:** (+506) 236-7690; **Fax:** (+506) 236-2816; **E-mail:** rgamez@quercus.inbio.ac.cr.

Director/Head: Rodrigo Gámez L.

Number of Research Scientists: 25; **Number of Staff:** 75.

Scientific Fields of Interest: Agriculture; Biology; Chemistry; Environment; Marine; Veterinary; Medical Sciences.

Main Lines of Research and Training Activities: Biodiversity inventory, prospecting, and information management and dissemination programmes. In-service short-term training programmes, workshops and internships in biodiversity inventory, prospecting, and information management and dissemination.

Major Scientific Results or Products: Biodiversity inventory: Collection and computerized information on more than 2 million specimens; taxonomic revision and field guides. Biodiversity prospecting: Market-driven research and development, collaboration with local universities and foreign research centres and companies valued at more than US\$2 million. Information management: Development of cutting-edge technology management, analysis, presentation, distribution and integration of biodiversity information. Biodiversity dissemination: Biological literacy through natural history and taxonomic information at

schools and universities, analysis of commercial development of conserved wildlands, working with legislators, serving on policymaking commissions and symposia, training of conservation staff; publishing of field guides and other materials on biodiversity; organization of national and international meetings.

Main Research Facilities Available: Laboratory facilities and equipment for taxonomic identification, classification and monitoring systems, biodiversity management system hardware and software, specimen storage facilities, chemical extraction laboratories, 22 field biodiversity offices; biology screening laboratories.

Future Development Plans: Completion of national and taxa biodiversity inventories; further development of the biodiversity information management system, GIS modules, international networking and multimedia software to support INBio's multi-user information dissemination programme; development of 12-hectare institutional campus.

Cooperation Arrangements with Developing Countries: Collaborations with Mexico, Kenya, Philippines and Indonesia for information exchange, training and technical assistance. Regional Central American biodiversity management support programme.

Other International Cooperation Arrangements: Cooperative agreements on biodiversity and its sustainable use with universities and research centres in Costa Rica, Europe and USA. Programmed collaborations with bilateral and multilateral agencies, foundations and other entities interested in financing biodiversity programmes.

Tropical Agriculture Research and Higher Education Centre (CATIE)

Address: CATIE 7170, Turrialba, Costa Rica. **Phone:** (+506) 556-6431; **Telex:** 8005 CATIE C.R.; **Fax:** (+506) 556-1533; **E-mail:** catie@catie.ac.cr.

Director/Head: Rubén Guevara Moncada.

Number of Research Scientists: 68 PhD; 82 MSc; 76 BMs; **Number of Staff:** 480.

Scientific Fields of Interest: Agriculture; Earth Sciences; Environment.

Main Lines of Research and Training Activities: Research, postgraduate education, training and outreach in: Tropical crops and ecological agriculture area; Agroforestry systems area; Graduate studies area; Training area; Watershed management area; Conservation and management of biodiversity area; Economy for production and conservation area; Tropical forests management and silviculture area; Plant protection area.

Major Scientific Results or Products: Issue more than 400 scientific/technical publications each year; publish three renowned scientific journals; register more than 50 MSc and 10 PhD graduates per year from more than 30 countries; train more than 6500 professionals from over 30 countries.

Main Research Facilities Available: State-of-art computer facilities; 12 research laboratories, for example, in biological control, genetic engineering, and GIC; most comprehensive agricultural library in Latin America; experiment stations in several countries operated through alliances; state-of-art teleconferencing capabilities.

Future Development Plans: Strengthen doctorate programme and extend outreach programme by including more students from South America and the Caribbean.

Cooperation Arrangements with Developing Countries: Member of at least 10 networks; work with more than 200 institutions at national level in LAC.

Other International Cooperation Arrangements: Have more than 40 strategic alliances with US and European institutions and more than 20 strategic alliances with international organizations.

Universidad de Costa Rica — Centro de Investigación en Biología Celular y Molecular (CIBCM)

Address: Ciudad Universitaria "Rodrigo Facio", San José, Costa Rica. **Phone:** (+506) 2246749; **Telex:** UNICORI 2544; **Fax:** (+506) 2249367; **E-mail:** gmacaya@carlari.ucr.ac.cr.

Director/Head: Gabriel Macaya.

Number of Research Scientists: 14; **Number of Staff:** 38.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Biotechnology; Veterinary Sciences; Medical Sciences; Virology.

Main Lines of Research and Training Activities: Molecular characterization of plant viruses; diversity of insect vectors and epidemiology of viral diseases; production of virus-free plants; genetic engineering

of virus-resistant plants; diagnosis and characterization of viral diseases; molecular and biochemical characterization of plant genetic diversity; molecular and biochemical characterization and diagnosis of human inherited diseases; organization of animal genomes; search for antiviral activities in natural products; investigations into bovine immunodeficiency virus in Costa Rica.

Major Scientific Results or Products: Many publications in international research journals; diagnosis kits for plant viruses; genetic fingerprinting services; oligonucleotide primers for PCR.

Main Research Facilities Available: Basic laboratory facilities (400 square metres) for ultracentrifugation, DNA sequencing, oligonucleotide synthesis, cell and tissue culture (plant and animal), plant transformation (He gun), electroporation, PCR, electrophoresis, liquid scintillation, spectrophotometry, electron microscopy, local macrocomputer network, access to mainframes and minicomputers.

Future Development Plans: Further development of 1200 square metre laboratory completed in 1995 and greenhouse facilities built in 1996 (including greenhouse for the handling of transgenic plants). Will seek to increase capabilities for diagnostic services.

International Cooperation Arrangements: Cooperative projects with several US and European institutions. Major donors include US-AID, Rockefeller Foundation, Commission of the European Communities, International Atomic Energy Agency.

Egypt

American University in Cairo — Desert Development Center (DDC)

Address: P.O. Box 2511, 16 ibn Sakeb Street, Zamalek, Cairo, Egypt. **Phone:** (+20 2) 3397717; **Telex:** 92224 AUCAI UN; **Fax:** (+20 2) 3397715; **E-mail:** masabbah@ac.auc.eun.eg.

Director/Head: Mohamed A. Sabbah.

Number of Research Scientists: 6; **Number of Staff:** 60.

Scientific Fields of Interest: Agriculture; Biology; Energy; Engineering/Technology; Environment; Veterinary sciences; Socioeconomics.

Main Lines of Research and Training Activities: Sustainable desert farming systems; arid land restoration; desert agroforestry systems; environmental and socioeconomic impacts of development; renewable energy, including solar, wind and biogas; desert housing.

Major Scientific Results or Products: Development of desert development models that are ecologically, economically and socially sustainable; creation of integrated desert farming systems; explorations of renewable energy sources under desert conditions; socioeconomic analyses of new desert settlements.

Main Research Facilities Available: Two experimental desert stations; laboratories for analyses of soil, water, plants and tissue culture; solar- and wind-energy systems; library; computers; animal sheds; agricultural equipment; greenhouses; machine shops.

Future Development Plans: Transform training and research facilities into regional centre for desert development.

Cooperation Arrangements with Developing Countries: Training of personnel from Middle East and Africa; joint research on desert development systems and clonal propagation of stress-tolerant species; analyses of renewable energy resources under desert conditions.

Other International Cooperation Arrangements: International Development Research Centre (IDRC), Canada: research on efficient water use under desert farming; Ford Foundation, USA: desert socioeconomics; Egyptian Ministry of Agriculture/USAID: training of young farmers; Danish International Development Agency (DANIDA): renewable energy.

Desert Research Center (DRC)

Address: 1, Mathaf El Matariya, Matariya, Cairo, Egypt. **Phone:** (+20 2) 2435449; **Fax:** (+20 2) 2457858.

Director/Head: N. El Mewailhy.

Scientific Fields of Interest: Agriculture; Biochemistry/Biophysics; Energy; Chemistry; Engineering/Technology; Earth Sciences; Environment; Veterinary Sciences.

Main Lines of Research and Training Activities: Exploration and evaluation of aquifers in desert regions; well drilling and testing; monitoring of groundwater in desert and reclaimed areas; surveying and evaluation of surface water in coastal regions; management of desert and newly reclaimed soils; research on performance of species and cultivars of field crops, fodder, vegetables and fruits; protection and improvement of range forage resources; studies into increasing productivity of animals raised under desert condition; investigations into use of agricultural by-products and processing of less palatable desert plants for animal feed; analyses of desert animal fibres in small-scale industries; socioeconomic studies in marketing, agricultural cooperatives, settlements and labour; monitoring and control of desertification; creation of urban greenbelts; training of postgraduate students from Arab, African and Asian countries.

Major Scientific Results or Products: Exploration and evaluation of new aquifers; drilling and testing of 60 productive wells in newly reclaimed regions; national research projects on soils; production of leguminous and cereal plants under desert soil conditions; establishment of farm in El Arab; production of seedlings from various plants; improvements in pasture land and animal performance in northern Sinai; production of stud Barki rams in Nahda (El-Hamam); protection of eastern portion of Siwa Oasis from sand dune encroachments; review of economic, social and urban studies in the five Egyptian desert governorates. Centre issues biannual scientific periodical (Desert Institute Bulletin) and detailed scientific reports in the various fields of desert research.

Main Research Facilities Available: Satellite receiving station (NOAA); geographic information system (GIS); computer centre; library; laboratories for soil, geology, geophysics, hydrogeology, ecology, tissue culture, plants and animal production.

Future Development Plans: Quantification of groundwater potentiality; development of experimental station for desert development programme; feasibility studies for agricultural desert development; desertification studies; assessment of land reclamation projects; creation of a cartographic division; improvements in productivity of rainfed land; sand dune fixation; agricultural extension.

Cooperation Arrangements with Developing Countries: Cooperation with Arab countries in fields related to agricultural development of arid lands; exchange of experts in soil, water, plant and animal production; training courses for Afro-Asian developing countries; cooperation among DRC and Sahel-Saharan countries in Africa; information exchange among DRC and similar centres in developing countries.

Other International Cooperation Arrangements: Planned cooperation with such international donors as the United Nations Development Programme (UNDP), UN Food and Agriculture Organization (FAO), UN Educational, Scientific and Cultural Organization (UNESCO) and other organizations. Cooperation with European and North and South American countries, particularly in training programmes and scientific research activities.

Ethiopia

International Livestock Research Institute (ILRI-Ethiopia) formerly International Livestock Centre for Africa (ILCA)

Address: P.O. Box 5689, Addis Ababa, Ethiopia. **Phone:** (+251 1) 613213; **Telex:** 21207 ILCA ET; **Fax:** (+251 1) 611892; **E-mail:** ilca@cgnnet.com.

Director/Head: H.A. Fitzhugh.

Number of Research Scientists: 65; **Number of Staff:** 506.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Chemistry; Veterinary.

Main Lines of Research and Training Activities: Productivity and sustainability of mixed crop/livestock; market-oriented smallholder dairying; conservation of biodiversity; livestock and resource management policy; livestock biological efficiency and production under trypanosomiasis risk; strengthening national research capability.

Major Scientific Results or Products: ILRI-Ethiopia has contributed to increasing productivity, stability and sustainability of smallholder mixed crop/livestock systems through feed resources development in sub-Saharan Africa; development of simple animal-drawn implements for shaping land to help drain

excess water; advances toward economically and environmentally feasible livestock production in tsetse-infested areas; characterization of the production and adaptive traits of indigenous livestock to help improve food production; range monitoring; farming systems studies; aerial resource surveys; research on marketing of livestock and livestock products; improvements in animal reproduction management and health; training young African scientists in research methodology; information dissemination to scientists, policy makers and NGOs.

Main Research Facilities Available: The programmes and assets of the former International Livestock Centre for Africa (ILCA) in Ethiopia were merged with those of the International Laboratory for Research on Animal Diseases (ILRAD) in Kenya to form ILRI, a single global livestock research entity with headquarters in Kenya. The site in Addis Ababa has advanced library and laboratory facilities and a local area network linking it with sites and e-mail users in CGIAR. Research station at Debre Zeit with facilities for research on animal nutrition, forages, crops and milk processing. Less extensively equipped facilities are found in Nairobi, Mombasa, Niamey, Ibadan and Kaduna.

Future Development Plans: Activities will expand into Asia and Latin America.

Cooperation Arrangements with Developing Countries: ILRI-Ethiopia supports three national scientific networks — small ruminant, animal feed resource and cattle research. Network activities encompass all sub-Saharan African countries. ILRI has signed a memorandum of agreement with 19 African countries to facilitate collaborative research among NARS in these countries.

Other International Cooperation Arrangements: ILRI has a wide range of collaborative research with advanced institutions in donor countries.

Plant Protection Research Center (PPRC)

Address: Ambo, Western Shewa, Ethiopia. **Phone:** (+251 1) 360094.

Director/Head: Mohammed Dawd Emam.

Number of Research Scientists: 28; **Number of Staff:** 13.

Scientific Fields of Interest: Agriculture; Biology; Chemistry.

Main Lines of Research and Training Activities: Plant pathology (nematology, bacteriology, virology, mycology, pulse mycology, cereal mycology); Entomology (biological control - storage and field pests, HPR; Weed science (non-parasitic, parasitic); Biotechnology.

Major Scientific Results or Products: Center was destroyed during 1993 civil war and subsequently rebuilt. Center has identified resistant varieties of faba bean for root diseases and uncovered different races of fungi bacteria and virus for biological control.

Main Research Facilities Available: Equipment: Microscopes, centrifuges, spectrophotometers, Elisa testers, greenhouses, laboratories; four different types of computers; intermediate library; one field station.

Future Development Plans: Basic research on virology, nematology, bacteriology, mycology, entomology, weed science and biotechnology.

Cooperation Arrangements with Developing Countries: Kenya, Uganda and Madagascar in African Highland Initiative Programme.

Other International Cooperation Arrangements: Nematology research with IITA, AHI; Bacteriology research with AHI, CIP; virology research with ICARDA.

Ghana

Cocoa Research Institute of Ghana (CRIG)

Address: Private Mail Bag, International Airport, Accra, Ghana. **Phone:** (+233 81) 22221 or 23097; **Fax:** (+233 81) 3257.

Director/Head: D. Adomako.

Number of Research Scientists: 36; **Number of Staff:** 1,000.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Research on cocoa, coffee, shea and kola crops, in fields of agronomy, pest- and disease-control, crop improvement (breeding) research, postharvest and by-product utilization studies.

Major Scientific Results or Products: Isolation and characterization of Cocoa Swollen Shoot Virus (CSSV); development of early bearing and high-yielding hybrid cocoa; analyses of cocoa fermentation and flavour chemistry; cocoa by-product development and studies of other uses of cocoa.

Main Research Facilities Available: HPLC; GLC; spectrophotometer; centrifuges; autoclave; incubators; microwave oven; computers; hybridization chamber; field stations; library.

Future Development Plans: Expand cashew research in agrosilvipastoral studies; training in cocoa by-product development and agronomy.

Cooperation Arrangements with Developing Countries: Training of scientists and technicians from cocoa producing West African countries in cocoa by-product development.

Other International Cooperation Arrangements: International Atomic Energy Agency (IAEA) funded project on cocoa tissue culture and mutation breeding; joint CRIG/BBA (Germany) project on cocoa swollen shoot virus (CSSV) research; cocoa by-products research funded by Common Fund for Commodities; research on breeding for drought resistance in cocoa funded by WFP.

Council for Scientific and Industrial Research (CSIR) — Crops Research Institute of Ghana (CRI)

Address: P.O. Box 3785, Kumasi, Ghana. **Phone:** (+233 51) 60396, 60389; **Fax:** (+233 51) 60397, 60142; **E-mail:** criggdp@ncs.com.gh.

Director/Head: Owusu Bempah Hemeng.

Number of Research Scientists: 80; **Number of Staff:** 99.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Improvement of following crops and their production technologies: cereals (maize, rice); legumes (cowpea, soybean, groundnut, bambara nut); horticultural crops, fruits (pineapple, avocado, citrus), vegetables (pepper, onion, tomato); roots and tubers (cassava, yam, cocoyam, sweet potato); plantain and banana; integrated management of pests and diseases, including biological controls; prevention of postharvest losses; resource and crop management; socioeconomic studies on production technologies and impact of research. Institute offers two-week training courses in crop, soil and water management to extension- and other workers.

Major Scientific Results or Products: Institute has developed and released improved varieties of following crops and their production technologies: maize (8), cowpea (6), soybean (2), cassava (3); improved crop management practices on plantain, rice, horticultural, citrus, mangoes.

Main Research Facilities Available: Institute has seven outstations in various ecological zones of Ghana where research results are tested before recommended for adoption by farmers; three moderately equipped laboratories for work in pathology, biochemistry, physiology and biotechnology; 20 PCs for data analyses; library.

Future Development Plans: Short courses for scientists and doctorate training of staff; commercialization of research findings and consultancy to generate funds to support research activities.

Cooperation Arrangements with Developing Countries: Institute collaborates with both local universities and such international research centres as IITA, Nigeria, WARDA, Cote d'Ivoire, INIBAP, France, CIMMYT, Mexico and FHIA, Honduras.

Other International Cooperation Arrangements: CRI currently has joint research activities with Clemson University, USA, and Monsanto Chemistry Company, USA.

Council for Scientific and Industrial Research (CSIR) — Institute of Aquatic Biology (IAB)

Address: P.O. Box 38, Achimota, Ghana. **Phone:** (+233 21) 775511; **Fax:** (+233 21) 777655.

Director/Head: Charles A. Biney.

Number of Research Scientists: 27; **Number of Staff:** 125.

Scientific Fields of Interest: Agriculture; Biology; Environment; Marine.

Main Lines of Research and Training Activities: Studies on limnology, water quality, pollution and monitoring of indicators of global warming in Ghana; invertebrate biodiversity; hydrobiological monitoring

and assessment of productivity of Ghana's major rivers. Development, pilot production and field application of biological agents for control of vectors of water-associated diseases; fisheries/aquaculture studies; surveys, studies, management and control of noxious aquatic plants (weeds) in Ghanaian water bodies and catchment areas.

Major Scientific Results or Products: Aquaculture products and provision of information, services, consultancies, mainly to public organizations.

Main Research Facilities Available: Two research laboratories/offices blocks in Accra; Gear for fish stock assessment; pollution monitoring equipment; two field stations: Akosombo, with 24 ponds and fish hatchery, and Tamale, with one research laboratory/office block; one research vessel on Volta Lake.

Future Development Plans: Activities to be more commercially oriented; research to ensure increased aquaculture fish production; expansion to cover diverse environmental issues, including global warming.

Cooperation Arrangements with Developing Countries: Joint programmes, visits and information exchanges with other institutes, especially within West Africa.

Other International Cooperation Arrangements: Project sponsorship and cooperation with UN Food and Agriculture Organization (FAO), UN Environment Programme (UNEP), World Health Organization (WHO), IOC, International Atomic Energy Agency (IAEA), Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), EC, ICLARM, universities of Hamburg and Bergen.

India

Council of Scientific and Industrial Research (CSIR) — Central Food Technological Research Institute (CFTRI)

Address: Mysore 570013, India. **Phone:** (+91 821) 565760; **Telex:** 846 241 FTRI IN; **Fax:** (+91 821) 520758; **E-mail:** prakash@nicfos.ernet.in.

Director/Head: V. Prakash.

Number of Research Scientists: 400; **Number of Staff:** 450.

Scientific Fields of Interest: Food Science and Technology.

Main Lines of Research and Training Activities: Multidisciplinary institute in food and related fields. Has developed 18 major research and development areas in food science and technology, including infestation control and protectants; grain science; fruits and vegetables; proteins; animal products; plantation products and flavours; microbiology and bioengineering; biochemistry and nutrition; lipid/convenience foods; milling and baking; plant cell biotechnology; food packaging/distribution; process engineering/plant design; sensory analyses and statistical services; quality control.

Major Scientific Results or Products: Developed 275 processes in postharvest technologies covering animal and beverage products, disinfection process, equipment and machinery, products related to fruits and vegetables, cereals, microbial and fermentation, plantation and spices, protein and bakery, speciality and convenience foods. Average 250 publications each year. Train food technologists from 43 developing countries.

Main Research Facilities Available: Modern pilot plant with state-of-art equipment. Special purpose machines such as aroma recovery plant, aseptic filler, supercritical fluid extractor; different types of dehydration equipment, including freeze dryer; evaporation equipment such as plate evaporator and double effect evaporator; centrifuge separators such as desludging bowl, high-speed tubular and scroll; grinding equipment. Sophisticated instrumentation facilities, including gas chromatograph, mass spectrometer; Instron universal testing machine; Fourier transform infra-red spectrometer; DNA sequencing system; atomic absorption spectrophotometer; grain X-ray system; scanning electron microscope; analytical ultra centrifuge; stopped flow spectrophotometer; optical rotatory dispersion system.

Cooperation Arrangements with Developing Countries: CFTRI cooperates with more than 40 developing countries in Asia, Africa and Latin America.

Other International Cooperation Arrangements: International linkage with UN Food and Agriculture Organization (FAO), UN Environment Programme (UNEP), UN University (UNU), World Health Organization (WHO), UN Development Programme (UNDP), UN Economic and Social Commission for

Asia and the Pacific (ESCAP), UN International Children's Emergency Fund (UNICEF), Institute of Food Technologists (IFT), UN Conference on Trade and Development (UNCTAD).

Council of Scientific and Industrial Research (CSIR) — National Botanical Research Institute (NBRI)

Address: Post Box No. 436, Rana Pratap Marg, Lucknow 226001, India. **Phone:** (+91 522) 282879; 282881; **Telex:** 0535-315 NBG IN; **Fax:** (+91 522) 282881; **E-mail:** manager@nbri.sernetd.ernet.in.

Director/Head: P.V. Sane.

Number of Research Scientists: 114; **Number of Staff:** 437.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Chemistry; Environment.

Main Lines of Research and Training Activities: The major R&D programmes relate to plant biotechnology, floriculture, tree biology, plant wealth utilization, environmental sciences and taxonomy and ethnobotany. Major thrust area programmes are directed towards (i) basic and applied research in plant molecular biology, biochemistry and stress physiology; (ii) standardization of agrotechniques and package of practices for ornamental plants for nursery and cut-flower trade and development of new cultivars; (iii) development of production and nursery technology for wood biomass and energy plantation on sub-standard soils.

Major Scientific Results or Products: Development of 190 new cultivars of 15 well-known ornamental plants; tissue culture protocols for a number of ornamental and medicinal plants and forest trees; botanical authentication of more than 50 indigenous herbal drugs; extraction of industrial gum from 'Dhaincha', *Sesbania aculeata* seed; production of woody biomass on substandard soils sites; role of calcium and calmodulin in regulating enzymes of nitrogen metabolism in plants; stable BT transgenic tobacco plants raised; polymorphism studies in rice and sorghum; sequencing of 15 kb of populus chloroplast genome; bipartite genome of tomato leaf curl virus cloned and sequenced; developed DNA fingerprinting for *Amaranthus* as test system for biodiversity assessment. Examples of technologies transferred: improvement of betelvine cultivation; cultivation of German Chamomile *Chamomilla recutita* on substandard soils; agrotechnology for a high-yielding opium poppy variety, BR0P-1, and grain amaranth; tissue culture protocol for *Populus deltoides* clones G48 and G5.

Main Research Facilities Available: Botanical garden; herbarium; Banthra Research Station; economic botany information service; wide range of modern sophisticated equipment/instruments for conducting work in photosynthesis, biochemistry, molecular biology and plant tissue culture; several testing and evaluation facilities — e.g., for irradiation of plants and plant materials with gamma rays, plant identification, estimation and analyses of plant materials for proteins, amino acids, oils, fats, active medicinal principles, gums, mucilages; pharmacognostical analyses of herbal drug formulations; library holds more than 400 periodicals and nearly 50,000 books.

Future Development Plans: Plant molecular biology and biotechnology for developing transgenic molecular biology and biotechnology for developing transgenic plants of tobacco/cotton/pulses expressing a bacterial gene for toxicity to a variety of polyphagous insects; DNA fingerprinting with other approaches for biodiversity assessment, identification of elite plant varieties, and for establishing taxonomic relationships; development of silvicultural practices for cultivation of high biomass yielding trees as renewable source of energy on waste lands; agrotechnologies for commercial cultivation of ornamentals; environmental impact assessments.

Cooperation Arrangements with Developing Countries: NBRI provides technical training and support to scientists from Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, and Maldives in development of South Asian legume species diversity data base.

Other International Cooperation Arrangements: Commonwealth Science Council, UK; with Worldwide International Legume Database and Information Service (ILDIS), UK, establish a computerised database of South Asia legumes and later act as "on-time enquiry centre" in region for dissemination of information in electronic form; NBRI, Lucknow and UN Food and Agriculture Organization (FAO), Rome, formalized agreement whereby NBRI will serve as national centre for FAO technical papers, books and database. This FAO Information Centre will prepare database for beneficiaries. NBRI and FAO will focus on degraded land afforestation, biomass production and agro-biotechnology.

Forest Research Institute

Address: New Forest, Dehra Dun 248006, India. **Phone:** (+91 135) 755277; **Telex:** 0585-258 FRI-IN; **Fax:** (+91 135) 758 571; 756 865.

Director/Head: P. Keswani.

Number of Research Scientists: 123; **Number of Staff:** 1323.

Scientific Fields of Interest: Forestry and Ecology.

Main Lines of Research and Training Activities: (1) Research in the field of forestry, ecology and related sciences. The thrust area is ecology, regeneration, tending and management of forests, utilization of forest products including non-wood forest products, forest inventory methods, watershed management, socio-legal aspects of forestry, forestry operations, forest fires and nutrient budgeting, plant systematics, forest mycology and pathology, bio-fertilizers forest entomology, forest soils and application of biotechnology in forestry. (2) Training and education in plantation technology, wood science technology, pulp and paper technology, seed technology and management, mycorrhiza. MSc in forestry and MSc in wood science and technology.

Major Scientific Results or Products: Developed arsenic copper chromate for wood preservation; pulping techniques for tropical hardwoods and bamboos; control measures for termites, insects and pests of sal, sissoo, teak and babul; hybrids of eucalyptus capable of producing higher biomass; developed modern seed orchards of teak and semal and protocol for tissue culture of eucalyptus; developed methods for ecological rehabilitation of mined areas; extracted industrial and other chemicals from wood wastes and non-wood forest products; developed techniques for production of synthetic lignosulphonate from alkali pulping spent liquor; designed solar seasoning kiln; developed new wood preservatives and standardized treatment methods for different timber; developed composite woods and fibre boards from wood/agricultural residues; developed substitute for bark of *Machilus mcrantha* (JICAT), used as binder for making agarbattis; developed eco-friendly vegetable dyes; developed ammonia fumigation techniques to bring out markings and colour comparable to decorative walnut on plain looking woods like eucalyptus.

Main Research Facilities Available: Well equipped laboratories; library with collection of approximately 130,000 books and subscriptions for 375 journals/periodicals; six field stations; 60 personal computers and one minicomputer.

Future Development Plans: To undertake research in fields of ecodevelopment, ecological rehabilitation, tree improvement, biodiversity, biotechnology, and other aspects of forestry; conduct postgraduate, PhD and DSc programmes in various disciplines of forestry and related sciences; develop institute as centre of excellence.

Cooperation Arrangements with Developing Countries: Provide technical expertise to developing countries and develop facilities for training of trainers for universities in India and other southeast Asian countries.

Other International Cooperation Arrangements: Cooperation with UNDP, Ford Foundation, FORSPA, FAO and IDRC. World Bank assistance for strengthening of research.

Indian Agricultural Research Institute (IARI)

Address: New Delhi 110 012, India. **Phone:** (+91 11) 5754595; 5787461; **Telex:** 031-77161 IARI IN; **Fax:** (+91 11) 5766420, 5751719; **E-mail:** rbs%bic.iari.@dbt.emet.in.

Director/Head: R.B. Singh.

Number of Research Scientists: 697; **Number of Staff:** 4,517.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Conduct basic and applied research in crop improvement, crop management, crop protection and social sciences; Develop human resources at national and international levels through postgraduate teaching and training; develop and extend farm technologies for integrated rural development.

Major Scientific Results or Products: Institute has developed large number of higher yielding and disease-resistant varieties of cereals, millets, pulses, oilseeds, fruits, vegetables, fodder and fibre crops. IARI wheat varieties account for about 50 percent of wheat varieties released at the national level. Institute is credited with bringing about the green revolution in India. Agro techniques, fertility and water management practices, crop protection schedules and control of pests and diseases for above crops have been worked out to realize maximum yields. Institute has earned 26 patents.

Main Research Facilities Available: X-ray diffraction and differential thermal analyser; mass spectrometer; NMR spectrometer; gas chromatographs; amino acid analyser; Nis and auto N analysers; ultracentrifuges; refrigerated centrifuges; electron microscopes; scintillation and GM counters; atomic absorption spectrophotometer; infrared spectrometer; UV/Vis spectrophotometer; electrophoretic apparatus; gamma irradiation chamber; soil bin; feed compactive unit; seed drill testing machines; pump test rig; package testing machine; borehole camera; lysimeter; automatic weather station. IARI has modern phytotron facility, farm operation service, computer application centre and central library with 600,000 publications and 26 divisional libraries. Institute also has nine regional research stations across country.

Future Development Plans: Research projects on rice wheat farming system, development of hybrids of important crops sustainability of farming/cropping systems, biotechnology, food and agriculture policy, environmental sciences, collection and conservation of peanuts/microorganisms and integrated nutrient and pest management.

International Cooperation Arrangements: Cooperation arrangements with State University of Ghent, Belgium — through DST, New Delhi; Indo-French Protocol; TOKTEN project; with Israel in field of agriculture; between Republic of Kazakhstan and Republic of India through DARE/ICAR, New Delhi. UNDP (United Nations Development Programme); World Bank; NARP (National Agricultural Research Project); USDA (United States Development Authority); PL-480 and UK.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Address: Patancheru 502 324, Andhra Pradesh, India. **Phone:** (+91 40) 596-161; **Telex:** 422203 ICRI IN; **Fax:** (+91 40) 241-239; **E-mail:** icrisat@cgnet.com.

Director/Head: J.G. Ryan.

Number of Research Scientists: 165; **Number of Staff:** 85.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Environment.

Main Lines of Research and Training Activities: ICRISAT's mandate is: (1) To serve as a world centre for the improvement of grain yield and quality of sorghum, millets, chickpea, pigeonpea, and groundnut and act as a world repository for the genetic resources of these groups; (2) Develop improved farming systems that will help to increase and stabilize agricultural production through more effective use of natural and human resources in the seasonally dry semi-arid tropics; (3) Identify constraints to agricultural development in the semi-arid tropics and evaluate means of alleviating them through technological and institutional changes; (4) Assist in the development and transfer of technology to the farmer through cooperation with national and regional research programmes, and by sponsoring workshops and conferences, operating training programmes and assisting extension activities.

Major Scientific Results or Products: Stabilizing production of groundnut in India and pearl millet in West and Southern Africa; production of world's first pigeonpea hybrid; nearly 160 genotypes of sorghum, pearl millet, chickpea, pigeonpea, and groundnut jointly developed by ICRISAT with NARS have been released in 47 countries of the Americas, Africa and Asia.

Main Research Facilities Available: Adequate facilities to conduct strategic research at all locations of ICRISAT available.

Future Development Plans: A medium-term plan has been designed and articulated into 12 global multi-disciplinary research projects.

Cooperation Arrangements with Developing Countries: Bangladesh, Burkina Faso, China, Botswana, Ethiopia, India, Indonesia, Iran, Kenya, Lesotho, Malawi, Mali, Myanmar, Nepal, Niger, Nigeria, Pakistan, Philippines, Sri Lanka, Thailand, Zambia and Zimbabwe.

Other International Cooperation Arrangements: CIMMYT, Mexico; ICARDA, Syria; IITA, Nigeria; IFAD, USA; ILCA, Ethiopia; IRAT, INTSORMIL, USA; INRA/CIRAD/ORSTOM, France; IRRI, Philippines; IFPRI, USA; ICRAF, Kenya; IIMI, Sri Lanka; IBPGR, Italy, CARDI, Trinidad; IBSNAT, USA; IBSRAM, Thailand; AVRDC, Taiwan; CATIE: Tropical Agricultural Research and Training Center for the Semi-Arid Tropics of Central America; US Department of Agriculture, USA; Queensland Department of Primary Industries, Australia.

Swaminathan Research Foundation (MSSRF)

Address: Third Cross Street, Institutional Area, Taramani, Chennai 600 113, India. **Phone:** (+91 44) 2351229; **Fax:** (+91 44) 2351319; **E-mail:** mssrf.madras@sm8.sprintpg.sprint.com.

Director/Head: M.S. Swaminathan.

Number of Research Scientists: 130; **Number of Staff:** 35.

Scientific Fields of Interest: Agriculture; Biology; Environment; Marine Sciences.

Main Lines of Research and Training Activities: The major purpose of the Centre is to undertake research and training that promotes job-led economic growth, and is based on a pro-nature, pro-poor and pro-women orientation to technology development and dissemination. The Centre's activities are organized into 5 research programmes: Coastal Systems Research; Biodiversity and Biotechnology; Sustainable Agriculture; Reaching the Unreached; and Communication, Information, Training and Capacity Building.

Major Scientific Results or Products: International mangrove ecosystem information service database has been developed and disseminated. Resource Centre for Farmers' Rights has been established. Ecotechnology Centre has been established. Results of research activities are disseminated through books and publications.

Main Research Facilities Available: 27 computers with 22 printers; field stations; library (4,000 books; 125 periodical subscriptions); electronic library (3.5 million records). Equipment: high speed centrifuge; microcentrifuge; refrigerator with stabilizer; freezers; icemaker; regulated static water bath; agarose gel electrophoresis; PCR machine; spectrophotometer; vortex mixer; orbital shaker; UV-transilluminator; vacuum oven; shaking water bath; air-conditioners; pH meter; microwave oven; electronic balance; UV stratalink; ultracentrifuge; growth chamber; inverted microscope with photographic attachment; stereo microscope with photographic attachment; laminar flow chamber; medical preparation equipment including water purification equipment; greenhouse equipment; autoclaves.

Future Development Plans: Major opportunities for programme expansion exist within Ecotechnology Centre, Informatics Centre and Resource Centre for Farmers' Rights.

Cooperation Arrangements with Developing Countries: Cooperative relationships with Chinese Academy of Sciences and several other scientific organizations in South and South East Asia. Organized international training programmes on behalf of the International Tropical Timber Organization.

Other International Cooperation Arrangements: Agreements with the NI Vavilov Institute, Russia; International Agricultural Training Programme, United Kingdom; CAB International, United Kingdom; University of Bologna, Italy; Philippines Rice Research Institute.

National Bureau of Plant Genetic Resources (NBPGR)

Address: New Delhi 110 012, India. **Phone:** (+91 11) 573 2365/5783697; **Telex:** 3177257; **Fax:** (+9 11) 5731495; **E-mail:** nbpgr@x400.nicgw.nic.in.

Director/Head: P.L. Gautam.

Number of Research Scientists: 110; **Number of Staff:** 245.

Scientific Fields of Interest: Environment; PGR Biodiversity.

Main Lines of Research and Training Activities: Exploration and collection of crop plant germplasm including wild relatives; plant introduction and exchange; plant quarantine for germplasm under exchange; germplasm characterization and evaluation; *ex situ* germplasm conservation - gene bank modules, cryopreservation and tissue culture; molecular characterisation and DNA fingerprinting - research back up. On-job training for orientating on PGR activities; postgraduate degree programme on plant genetic resources.

Major Scientific Results or Products: Long-term *ex situ* conservation of 1.60 lakh seed samples of agri-horticultural crops, standardisation of protocols for tissue culture and cryopreservation for several plant species; development of several quarantine treatments for salvaging infected germplasm.

Main Research Facilities Available: Scanning electron microscope, ELISA reader; laboratory facilities for DNA fingerprinting, cryopreservation, tissue culture, orthodox seed conservation, phytochemical/biochemical evaluation, plant quarantine clearance and supportive research; 100 acres research farm; 10 regional stations with farms; well developed computer facilities for database.

Future Development Plans: Integration of *ex situ*, on farm and *in situ* conservation; protocols for long-term cryopreservation/tissue culture conservation; molecular characterisation of varieties, germplasm; centre of excellence for HRD and PhD degree programme.

Cooperation Arrangements with Developing Countries: Collaboration under bilateral and multilateral protocols, SAARC and G-15 countries.

Other International Cooperation Arrangements: All collaboration and cooperation under the umbrella of ICAR/DARE; Indo-USAID PGR Project; Indo-UK PGR Project.

National Dairy Research Institute (NDRI)

Address: Kamal 132 001 (Haryana), India. **Phone:** (+91 184) 252800; **Telex:** 0396 - 204 NDRI IN; **Fax:** (+91 184) 20042; **E-mail:** ndri@x400nicgw.nic.in.

Director/Head: O.S. Tomer.

Number of Research Scientists: 230; **Number of Staff:** 1,929.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Research on livestock nutrition, growth, reproduction, physiology, genetics/breeding and management for more efficient milk production; Chemistry, microbiology, quality control and technology of milk and dairy products; design and development of dairy equipment; Economics of milk production and processing under farm and field conditions, dissemination of new technologies to farm and industry; Organizing and conducting programmes at undergraduate and postgraduate levels in various branches of Dairy Science to meet manpower need; Organizing short period training programmes, demonstration of practice packages for field application and providing consultancy services to farmers and dairy industry.

Major Scientific Results or Products: Developed two strains of high yielding dairy cattle — 'Karan Swiss' and 'Karan Fries'; birth of first-ever test tube buffalo calf through in vitro maturation and fertilization techniques; enrichment of crop residues; comparative evaluation of draft efficiency in cattle and buffalo; standardization of methodology for field recording of cattle and buffalo productivity; processes and techniques standardized for large-scale manufacture of Indian and Western dairy products; developed several cheese varieties; developed special dietary and formulated dairy products; applied UF technology to manufacture of Indian dairy products; supplied microbial culture to dairy industry; developed continuous ghee and khoa making equipment.

Main Research Facilities Available: Dairy herd of cattle, buffaloes and goats; experimental dairy plan; farm operations section; computer centre; library; embryo biotechnology centre; artificial insemination laboratory; molecular biology laboratory; small animal house.

Future Development Plans: Application of embryo transfer technique for rapid genetic improvement of cattle and buffaloes; development of processes and equipment for hygienic production of indigenous dairy products.

Cooperation Arrangements with Developing Countries: Training of students from China, Vietnam, Egypt, Iran, Bangladesh, Nepal. Would like expand activity and train larger number of students from developing countries.

Other International Cooperation Arrangements: UNDP, World Bank, USAID, Netherlands, Swiss International Centre for Agriculture. Cooperative programmes to be expanded in future.

Jamaica, West Indies

University of the West Indies (UWI) — Biotechnology Center

Address: Mona, Kingston, 7, Jamaica, West Indies. **Phone:** (+854) 9275578; **Telex:** 2123 JA; **Fax:** (+854) 9271640.

Director/Head: M.H. Ahmad.

Number of Research Scientists: 15; **Number of Staff:** 5.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Environment.

Main Lines of Research and Training Activities: Agricultural and plant biotechnology: tissue culture and crop improvement, particularly for yams (*Dioscorea*), cowpeas (*Vigna unguiculata*) and beans (*Phaseolus vulgaris*); biotechnology to improve nitrogen fixation and VAM fungus to improve P uptake in legumes and non-legumes; yam biotechnology. Molecular Biology: release of genetically manipulated

microorganisms into soils; research and training in gene cloning; DNA sequencing of viruses affecting plants and animals by the use of PCR; plant molecular biology; RFLP analysis of plant genome. Environmental Biotechnology: recycling of agricultural and animal wastes for feed and fertilizer production.

Major Scientific Results or Products: In field trials, co-selected strain of VAM fungus and Rhizobia have shown 30 percent increase in cowpea yield, with results that can be applied and tested in Africa and Southeast Asia. Field trials have shown cost reduction in sweet yam production (*Dioscorea alata*) by use of miniset technology, which can be applied and tested in African and Pacific countries. DNA sequencing of Bean Golden Mosaic Virus (BGMV) and production of virus resistant bean (*Phaseolus vulgaris*).

Main Research Facilities Available: Ultra centrifuge, laminar flow chamber, cold room, deep freezer, scintillation counter, 20L and 1L fermentor, densitometer, gel electrophoresis apparatus, greenhouse, plant growth chamber, freeze dryer, GLC, PC computers, sonicator, large and small shakers, sterilizer, ice machine, fraction collector, spectrophotometer, DNA Polymerase Chain Reaction (PCR).

Future Development Plans: Centre will seek to excel in molecular biology and plant biotechnology with special emphasis on such export crops as yams and sweet potatoes. Plans to develop programmes in environmental biotechnology focusing on biodegradation and recycling of industrial and agricultural waste.

Cooperation Arrangements with Developing Countries: Nigeria: IITA; Ibadan, Benin University, Benin City. India: JNU Delhi and PAU Ludhiana, Punjab. Pakistan: University of Karachi.

Other International Cooperation Arrangements: EDF, European Economic Community (EEC), IADB and US Agency for International Development (USAID), Canada, Germany and UK, Universities of Florida, Gainesville and Ohio State, USA; University of Alberta, Canada; University of Marburg, Germany; Wye College, UK.

Kenya

International Centre for Research in Agroforestry (ICRAF)

Address: P.O. Box 30677, United Nations Avenue, Gigiri, Nairobi, Kenya. **Phone:** (+254 2) 521450;

Telex: 22048 ICRAF; **Fax:** (+254 2) 521001; **E-mail:** icraf@cgnet.com.

Director/Head: Pedro A. Sanchez.

Number of Research Scientists: 103; **Number of Staff:** 217.

Scientific Fields of Interest: Agroforestry.

Main Lines of Research and Training Activities: Natural resources policy; Domestication of agroforestry trees; Tree-crop-environment interaction; Systems improvement; Training and education; Information dissemination.

Major Scientific Results or Products: Develop agroforestry into science emphasising natural resources management; develop improved agroforestry technologies currently being tested on farmers' fields; identify hundreds of not well known, multipurpose, trees.

Main Research Facilities Available: Laboratories; information and documentation centre; germplasm unit.

Future Development Plans: To work more intensively with farmers and to foster organizations that promote adoption of improved agroforestry systems.

Cooperation Arrangements with Developing Countries: About 80 agreements with government and institutions in Africa, Southeast Asia and Latin America.

Other International Cooperation Arrangements: ICRAF coordinates CGIAR system-wide programme for alternatives to slash-and-burn agriculture and African highlands initiative; domestication of indigenous fruit trees.

Tea Research Foundation of Kenya (TRFK)

Address: P.O. Box 820, Kericho, Kenya. **Phone:** (+254 361) 20598/9; **Fax:** (+254 361) 20575.

Director/Head: Jeremiah K. Rutto.

Number of Research Scientists: 14; **Number of Staff:** 73.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Chemistry; Environment.

Main Lines of Research and Training Activities: Analyse problems related to tea and other crops and husbandry systems associated with tea throughout Kenya, focusing on issues of productivity, quality, and suitability. Main research areas include increasing tea yields and improving tea quality.

Major Scientific Results or Products: Major achievements in the areas of soil chemistry and nutritional requirements; plant propagation methods; agronomic technologies; removal of shade trees; crop husbandry, including crop spacing and plucking and pruning techniques; crop protection research concentrating on appropriate control strategies.

Main Research Facilities Available: Well equipped laboratories, which contain HPLC, gas chromatographs, atomic absorption spectrophotometers, incubators, ovens, PCR (Polymerase chain reaction for DNA work), electrophoresis for Iso-enzyme analysis, lamina flow cabinet, centrifuges, leaf-area analysis, tissue culture laboratory.

Future Development Plans: In addition to continuing research on tea cultivation designed to improve productivity and quality, tea factory research will be a major focus emphasising innovative manufacturing technologies.

International Cooperation Arrangements: British Council; University of Dundee (Scottish Crops Research Institute); Natural Resources Institute (United Kingdom).

Lebanon

American University of Beirut — Faculty of Agricultural and Food Sciences

Address: P.O. Box 11-0236, Beirut, Lebanon. **Phone:** (+961 1) 343-002; **Telex:** 20801 LE; **Fax:** (+961 1) 351-706; (+1 212) 478-1995; **E-mail:** fafs@aub.edu.lb.

Director/Head: N. Dagher.

Number of Research Scientists: 28; **Number of Staff:** 60.

Scientific Fields of Interest: Agriculture; Environment.

Main Lines of Research and Training Activities: Main lines of research are agricultural economics and development, animal science, crop production, food technology and nutrition and soils. Training activities include two undergraduate programmes: the BSc in agriculture and the Diploma of Ingénieur Agricole; and the BSc in nutrition and dietetics. The faculty also offers the MSc degree in agricultural economics, animal science, crop production, food technology, soils and mechanization, and others.

Major Scientific Results or Products: Survey of most critical animal diseases in Lebanon; selection scheme for improving reproductive efficiency and milk production of Awassi sheep; establishment of electrophoretic library for varietal identification; weed survey in Lebanon; development of planning and design strategies for coastal zone irrigation.

Main Research Facilities Available: Agricultural science laboratories; food processing pilot plant; 250-acre experimental station.

Future Development Plans: MSc degree programme in environmental sciences initiated in September 1997 with specialization in ecosystem management.

Cooperation Arrangements with Developing Countries: Many arrangements exist with developing countries.

Other International Cooperation Arrangements: Several cooperative programmes with ICARDA, IDRC, WHO and universities in region.

Malaysia

Fisheries Research Institute

Address: Department of Fisheries, Ministry of Agriculture, 11700 Gelugor, Penang, Malaysia. **Phone:** (+60 4) 872777; **Fax:** (+60 4) 876388.

Director/Head: Ong Kah Sin.

Number of Research Scientists: 84; **Number of Staff:** 432.

Scientific Fields of Interest: Environment; Marine Sciences; Fisheries including Aquaculture.

Main Lines of Research and Training Activities: research on fisheries biology; fisheries resource assessment; fishing gear development; research and development of agriculture technology; research on aquatic ecology and conservation.

Major Scientific Results or Products: Information on coastal and offshore fisheries resources; development of appropriate fishing and fish-handling techniques, including hatchery and culture technologies for molluscs, crustaceans and finfishes; information on aquatic ecology, water and fish quality and conservation.

Main Research Facilities Available: Vessels and facilities for research on fisheries resources, water quality and aquaculture; PC's software, including for remote sensing; equipment (HPLC, GC, AAS).

Future Development Plans: Building and acquisition of new research facilities; strengthening linkages with other R&D agencies; advanced training, including postgraduate training for staff.

Cooperation Arrangements with Developing Countries: Arranged through Malaysia Technical Cooperation Programme.

Other International Cooperation Arrangements: Bay of Bengal Fisheries Development Programme; network of aquaculture centres in Asia and Pacific; South East Fisheries Development Centre.

Forest Research Institute of Malaysia (FRIM)

Address: Kepong, 52109 Kuala Lumpur, Malaysia. **Phone:** (+60 3) 634-2633; **Fax:** (+60 3) 636-7753.

Director/Head: Abdul Razak Mohd. Ali.

Number of Research Scientists: 147; **Number of Staff:** 350.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Chemistry; Engineering/Technology; Environment; Medical Sciences.

Main Lines of Research and Training Activities: Tropical forestry and forest products research; Training in tropical forestry and utilization of tropical forest products.

Major Scientific Results or Products: Guidelines for silvicultural management of tropical forests and for processing and utilization of forest products; numerous patents for products/processes derived through R&D.

Main Research Facilities Available: Workshop and laboratories in all aspects of forestry and forest products research.

Future Development Plans: Closer collaboration with industry and end-users through greater promotion and dissemination of our research findings.

Cooperation Arrangements with Developing Countries: Mostly through government-to-government arrangements.

Other International Cooperation Arrangements: ITTO, Yokohama, Japan; ACIAR, Australia; JIRCAS, Japan; NIES, Japan.

Malaysian Agricultural Research and Development Institute (MARDI)

Address: P.O. Box 12301, General Post Office, 50774 Kuala Lumpur, Malaysia. **Phone:** (+60 3) 9486601; **Telex:** MA 371115; **Fax:** (+60 3) 9483664.

Director/Head: Mohamed Yusof B. Hashim.

Number of Research Scientists: 456; **Number of Staff:** 3,091.

Scientific Fields of Interest: Agriculture; biology; engineering/technology; environment; veterinary; water management; socio-economic studies; technology transfer.

Main Lines of Research and Training Activities: Research: fruit; cocoa-coconut; rice, tobacco; horticulture and livestock; agricultural engineering; biotechnology; food technology; techno-economic and social studies.

Major Scientific Results or Products: Release of new varieties/clones for rice (23 varieties), cocoa (15 clones), tropical fruits, sweet corns, tapioca, groundnuts, coffee, vegetables, orchids and livestock breeds. Productivity improvements through efficient crop and livestock management practices (cultural practices, pest and disease management, mechanization, water-management engineering). Technology on post-harvest handling, processing and product development.

Main Research Facilities Available: 32 research stations with laboratory and field facilities; mainframe computer (IBM 4381) and several hundred PCs and software; main library with 50,000 volumes; smaller libraries at major stations; laboratory equipment and farm implements.

Future Development Plans: Research thrusts: Productivity and efficiency improvements; competitive advantage improvements of agricultural products; sustainability in agricultural production; production of high quality food products; exploitation of new and emerging sciences in agricultural production; economic and social forces that influence agricultural production.

Cooperation Arrangements with Developing Countries: Arrangements with 35 organizations, including International Centre for Improvement of Maize (CIMMYT), International Centre of Tropical Agriculture (CIAT), Kesarsart University (KU) in Thailand, Man and Biosphere (MAB) in Thailand, and Council for Agriculture and Resource Research Development (PCARRD) in Philippines.

Other International Cooperation Arrangements: Australian Economic Cooperation Programme (AAECP); Australian Centre for International Agricultural Research (ACIAR); Asian Development Bank (ADB); Food and Agriculture Organization (FAO); FAO-United Nations Development Programme (UNDP); Japan International Cooperation Agency (JICA); United Nations Development Programme (UNDP); United Nations Educational, Scientific and Cultural Organization (UNESCO).

Palm Oil Research Institute of Malaysia (PORIM)

Address: P.O. Box 10620, 50720 Kuala Lumpur, Malaysia. **Phone:** (+60 3) 8259155, 8259775; **Telex:** MA 31609; **Fax:** (+60 3) 8259446; **E-mail:** pms.porim.gov.my.

Director/Head: Yusof B. Basiron.

Number of Research Scientists: 149; **Number of Staff:** 642.

Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Environment; Medical Sciences.

Main Lines of Research and Training Activities: *Research in Biology:* Crop production and management (agronomy and crop nutrition, breeding and genetics); Plant Protection (entomology, pathology, biocontrol, farm mechanization, by-products utilization); Plant science and biotech. (physiology, vegetative propagation, biotechnology). *Research in chemistry and technology:* product dev. and quality (food uses, non-food uses, analytical, nutrition); engineering and technology (milling and engineering, processing); oleochemicals (detergent and cosmetics, agro and ind. chemical, processing and engineering, quality and environment); *Training:* short training courses are run each year covering topics relevant to the industry.

Major Scientific Results or Products: Advanced planting materials, new uses of oilpalm/palm oil products (for example, vitamin E, biofuel, pulp and paper, cosmetics and toiletries, polyurethane), technologies (for example, effluent treatment), farm mechanization.

Main Research Facilities Available: NMR, GCC, pilot plants, GCMS.

Future Development Plans: To find higher value-added palm oil products.

Cooperation Arrangements with Developing Countries: Collaborative research with various organizations around the world.

Mexico

International Maize and Wheat Improvement Center (CIMMYT)

Address: Apdo. Postal 6-641, Col. Juárez, 06600 Mexico, D.F. Mexico. **Phone:** (+52 5) 7269091;

Telex: 1772023-CIMTME; **E-mail:** cimmyt@cimmyt.mx.

Director/Head: Donald L. Winkelmann.

Number of Research Scientists: 100; **Number of Staff:** 800.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Primary objective is to produce experimental maize and wheat varieties that developing country partners — whether engaged in publicly or privately supported research — can use to increase farm-level productivity while protecting environment. CIMMYT distributes varieties to more than 100 countries through its international testing and distribution networks. Collaborative research with dozens of advanced scientific institutions reinforces its efforts on behalf of the developing world's poor. In addition to producing improved varieties, its work generates new scientific knowledge and more effective research procedures. CIMMYT maintains two of the world's largest collections of maize and wheat genetic resources. It supports national agricultural research programmes through training, information services, and consulting.

Major Scientific Results or Products: Main products are improved varieties of maize and wheat developed in collaboration with scientists from around the world. Varieties are grown on millions of hectares in developing world. Some 4,000 people have been trained.

Main Research Facilities Available: Complete office, laboratory, greenhouse and field growth facilities at El Batán Headquarters. Four other experimental stations in Mexico.

Future Development Plans: CIMMYT will continue to improve genetic stocks of maize and wheat and train specialists. More attention will be given to research on natural resources management and to issues of sustainability of maize and wheat cropping systems.

Cooperation Arrangements with Developing Countries: Staff are stationed in 13 countries.

Research collaboration takes place in approximately 80 countries. In most cases, formal agreements have been signed.

Other International Cooperation Arrangements: CIMMYT is part of the Consultative Group on International Agricultural Research (CGIAR), which includes 16 other centres and receives funding from 18 technical aid agencies.

Universidad Nacional Autónoma de México (UNAM) — Centro de Investigación Sobre Fijación de Nitrógeno (CIFN)

Address: Apdo. Postal 565-A, Cuernavaca, Morelos, Mexico. **Phone:** (+52 73) 139877; **Fax:** (+52 73) 175581. **E-mail:** direccio@cifn.unam.mx.

Director/Head: Georgina Hernández Delgado.

Number of Research Scientists: 22; **Number of Staff:** 45.

Scientific Fields of Interest: Molecular Biology; Agriculture.

Main Lines of Research and Training Activities: Research: Structure, dynamics and manipulation of the genome; integration of carbon and nitrogen metabolism; evolution and ecology of symbiotic genome; evolution and ecology of chemical communication signals between bacteria and plants; genetic engineering of legumes; theoretical approaches to regulation of gene expression. Training: Bachelor's degree thesis preparation for graduate studies; graduate programme (PhD) in molecular biology.

Major Scientific Results or Products: Research at CIFN (1980-1992) has produced 120 papers in international journals that have received 1,700 citations in the literature; 80 chapters in scientific books; 6 books have been edited and 650 papers and reports have been presented at scientific meetings. Major research achievements include characterization of metabolic cycle and glutamine cycle that participates in integration of carbon and nitrogen metabolism in microorganisms; demonstration that Rhizobium genome is complex structure containing large amount of reiterated DNA sequences and subject to frequent rearrangements; and discovery of *R. tropici*, new Rhizobium species.

Main Research Facilities Available: Five laboratories each with facilities for 20 scientists; PCs, Mac and VAX computers; library; greenhouse; laboratory for plant cell tissue culture work. Major equipment:

electronic microscope; DNA sequencer; HPLC; liquid and gas chromatography; ultracentrifuges; centrifuges; liquid scintillation counters; cold rooms; dark room.

Cooperation Arrangements with Developing Countries: Academic collaboration with EMBRAPA-CNPBS in Brazil.

Other International Cooperation Arrangements: Belgian government.

Morocco

National Institute of Agronomic Research (INRA)

Address: Avenue de la Victoire, BP 415, Rabat, Morocco. **Phone:** (+212 7) 770955; **Telex:** 317 02M.

Director/Head: Abdelaziz Arifi.

Number of Research Scientists: 178; **Number of Staff:** 2,165.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Soil science; cereals; legumes; vegetable crops; sugar crops; oil plants; fruit trees; citrus fruits; fodder plants; animal products; dryland farming; saharan; farming systems.

Main Research Facilities Available: Department of Documentation: 30,000 books, 1,300 periodicals, four internal data bases filed on CD-ROM; on-line research; computer stations: HP 3000, HP 9000.

Future Development Plans: Internet network; connection of the regional centres of INRA to department of documentation; connection to the Internet.

International Cooperation Arrangements: Cooperation with France, USA and Germany.

Nigeria

International Institute of Tropical Agriculture (IITA)

Address: Oyo Road, P.M.B. 5320, Ibadan, Nigeria. **Phone:** (+234 2) 2412626; **Telex:** 31417, 31159 TROPIB NG; **Fax:** (+234 2) 874-1772276; **E-mail:** iita@cgnet.com.

Director/Head: Lukas Brader.

Number of Research Scientists: 180; **Number of Staff:** 1,500.

Scientific Fields of Interest: Agriculture; biology; biochemistry / biotechnology; chemistry; engineering/technology; environment.

Main Lines of Research and Training Activities: Crop breeding, improvement and development; soil management and land development; seed distribution and handling; post-harvest technology; tissue culture and biotechnology; biological control of crop pests; training of extension personnel in Africa.

Major Scientific Results or Products: Improved maize for Africa; improved high yielding cassava, cowpea, soybean, yam and plantain.

Main Research Facilities Available: Well-equipped library; laboratories and workshops; research fields available on 1,000 hectares of land donated by federal government; administrative and research activities computerized for data analysis and word processing. Research stations in Cotonou (Benin Republic), Mbalmayo (Cameroon), Ferkessedougou, (Côte d'Ivoire) and Namulonge (Uganda).

Cooperation Arrangements with Developing Countries: Good working relationship with all countries in sub-Saharan Africa. Memorandum of Understanding signed with almost all National Agricultural Research Systems (NARS).

Other International Cooperation Arrangements: Integrated collaborative research work with advanced laboratories in developed countries, particularly Europe and America. New emphasis on sustainable agriculture. IITA is one of the centres supported by the Consultative Group on International

Agricultural Research, which is sponsored by the World Bank, UN Development Programme, Food and Agriculture Organization (FAO) and UN Environment Programme.

Pakistan

National Agricultural Research Centre — Pakistan Agricultural Services Academy

Address: Park Road, Chakshazad, Islamabad, Pakistan. **Phone:** (+92 51) 240299.

Number of Research Scientists: 4; **Number of Staff:** 30.

Scientific Fields of Interest: agriculture; biology; biochemistry/biophysics; engineering/technology; veterinary sciences.

Main Lines of Research and Training Activities: Agricultural sector, crops, natural resources, live stock, social sciences and related aspects.

Major Scientific Results or Products: Productivity improvements and resource sustainability.

Main Research Facilities Available: Research internship facility.

Future Development Plans: Expertise in repair and maintenance of advanced bio-equipment and bio-technology.

Cooperation Arrangements with Developing Countries: Focus on degradation of biodiversity; conservation of natural resources and environment; HRD strengthening.

Nuclear Institute for Agriculture and Biology (NIAB)

Address: Jhang Road, P.O. Box 128, Jhang Road, Faisalabad, Pakistan. **Phone:** (+92 411) 654221-30; **Telex:** 43356 NIAB PK; **Fax:** (+92 411) 654213.

Director/Head: S.H. Mujtaba Naqvi.

Number of Research Scientists: 84; **Number of Staff:** 172.

Scientific Fields of Interest: agriculture; biology; biochemistry/biophysics; environment; veterinary science.

Main Lines of Research and Training Activities: Research in soil biology; soil chemistry; soil physics; mutation breeding; entomology; plant pathology; plant physiology; plant biotechnology; microbiology; animal nutrition and reproduction; post-harvest technology; pesticide residues; postgraduate research programme leading to masters and PhD degrees in collaboration with universities; two-week course on nuclear and other advanced techniques for biological research held each year, as are specialized courses on various topics.

Major Scientific Results or Products: Developed two insect resistant and high yielding cotton varieties; developed nectaryless-hirsute cotton germplasm for resistance against cotton insect pests; released 10 mutant varieties of rice (1), cotton (1), chickpea (1) and mungbean(7) as commercial varieties; developed new molecular marker that has received wide hybridization using wild and cultivated species of wheat and rice; patented antifungal antibiotic F from B subtilis AECL69; isolated penicillin G acylase producing E Coli and amino acid fermenting bacteria; developed protocols for collenessis in Kinnow, chickpea, lentil and protocol for rengeration of lentil from callus culture; identified and introduced new plants on salt affected lands designed to make economic use of saline lands and saline groundwater; identified 76 compounds from volatile components of rice; irradiated Kinnow bud wood and grafted mature plants to pick mutations for seedlessness; pursued studies on goats to acquire information about reproductive cycle; conducted research on fate and significance of pesticide residues in oilseed crop.

Main Research Facilities Available: Experimental field area; research laboratories; Cobalt-60 gamma sources (gamma cell, gamma beam and Mark IV irradiators); controlled temperature and humidity rooms; growth room; net house; incubators; soil extract collection system and EC meters; refrigerators/freezer/cold cabinets; spectrophotometers, atomic absorption, scintillation counters, gamma scanners; HPLCs with detector and printers; microscopes; fibro-graph with blender; balances; computers; Gel electrophoresis; flame photometers; macro- and semimicro-Kjeldahl digestion and distillation systems; high vacuum assembly with optical emission for 15 N analyser; gas chromatographs; centrifuges; neutron moisture probe; gamma density probe; four electrode EC probe.

Future Development Plans: Creation of better germplasm of rice, cotton, chickpea, mungbean, mash and lentil by induction of mutations through radiation by wide crosses and tissue culture; release of promising mutant lines as commercial varieties; detection of genetic variation through (RFLPs) and other biological techniques; transfer of salt tolerance from alien species to cultivated wheat through wide hybridization; genetic analysis of microbes and plants; macro- and micro-nutrient nutrition of fruit crops; development of methodology for better utilization of fertilizers; study of large number of plants collected from around the world for salt tolerance and productivity on saline soil; agro-forestry research on selected salt tolerant plants for maximizing production on saline land; establishment of well-equipped soil physics laboratory; study of effect of saline water use on soil physico-chemical and moisture properties.

Cooperation Arrangements with Developing Countries: Provided training facilities to research scholars of developing countries.

Other International Cooperation Arrangements: Research projects partly funded by International Atomic Energy Agency (IAEA); Rockefeller Foundation, USA; National Academy of Sciences Board of Science and Technology for International Development (BOSTID), USA; NIAB-Wurzburg University, Germany; University of Ghent, Belgium; Waite Agricultural Research Institute, Adelaide, Australia; Kasetsart University, Bangkok Thailand; University of Illinois, USA; ENEA, Italy; International Foundation of Science; Collaboration with CEA France; CSIRO, Australia, AIDAB, Australia.

University of Agriculture, Faisalabad (UAF)

Address: Faisalabad 38040, Pakistan. **Phone:** (+92 41) 33499; **Fax:** (+92 42) 647846; **E-mail:** shafqat%SARC-UAF%SDNPAKAD. UNDP.ORG.

Director/Head: M. Anwar-ul-Haq.

Number of Research Scientists: 495; **Number of Staff:** 2014.

Scientific Fields of Interest: Agriculture; biology; chemistry; engineering/technology; veterinary sciences; mathematics.

Main Lines of Research and Training Activities: (i) The faculty of veterinary science is composed of the departments of: veterinary anatomy, veterinary physiology and pharmacology, veterinary microbiology, veterinary parasitology, veterinary clinical medicine and surgery, veterinary pathology, and animal reproduction; (ii) The faculty of agricultural economics and rural sociology is composed of the departments of: data processing unit, agricultural economics, rural sociology, agricultural marketing, cooperation and credit, and farm management; (iii) The faculty of sciences is composed of the departments of: human environmental cell, botany, zoology and fisheries, special cell "fisheries research. farm", chemistry, physics, mathematics and statistics, social sciences and humanities, Islamic studies, agricultural meteorology; (iv) The directorate of advanced studies and research; (v) Miscellaneous: includes the general administration, library, department of public relations and publications, sports and students activities, medical and health services, hostel warden, senior tutor, placement bureau, students record branch, engineering construction, motor pool, estate management, stores department, and the directorate of students affairs. The animal reproduction section is located at the College of Veterinary Sciences in Lahore.

Major Scientific Results or Products: Produced 165 PhDs, 175 MPhils, 9312 MScs and 134 BScs; developed wheat variety LU-26, identified salt-tolerant varieties/lines of wheat; developed saline agriculture technology, new reclamation technique for salt-affected areas; developed embryo transfer technology both in indigenous cows and buffaloes; synthesized crossbreed of cows for high milk production and resistance to disease; developed Lyallpur Silver Black poultry for rural areas; developed high lysine single cell proteins.

Main Research Facilities Available: Most laboratories are well-equipped with computers (PCs) and other equipment, including spectrophotometers, flame photometers, pH meters, atomic absorption spectrophotometers, HPLC, amino acid analyser, GC. Library has collection of recent books and periodicals in various fields of research. Two experimental stations for field work.

Future Development Plans: Centre for Agricultural Biochemistry and Biotechnology (CABB); Centre for Advanced Study in Applied Genetics and Saline Agriculture Animal Health Biotechnology Research Centre; Rural Women Development Centre.

Cooperation Arrangements with Developing Countries: Training and visits to SAARC countries and Egypt.

Other International Cooperation Arrangements: World Bank Project ARP-II; Australian Centre for International Agricultural Research (ACIAR); Overseas Development Authority (ODA); Japan International Cooperation Agency (JICA); Asian Development Bank (CLCV).

Peru

International Potato Center (CIP)

Address: Apartado Postal 5969, Lima 100, Peru. **Phone:** (+51 14) 354283; **Telex:** 25672 PE; **Fax:** (+51 14) 351570.

Director/Head: Hubert Zandstra.

Number of Research Scientists: 79; **Number of Staff:** 400.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Production systems (potato and sweet potato); genetic resource conservation and utilization; integrated disease management; integrated insect and nematode management; seed production systems; post-harvest management.

Major Scientific Results or Products: Establishment of world potato and sweet potato collections; development of improved potato cultivars for developing countries; development of true potato seed; advances in integrated pest management, virus detection and diffused light storage technologies.

Main Research Facilities Available: 40-hectare research farm; laboratories in virology, entomology, nematology, physiology, pathology, nutrition quality; library, information and computer units, greenhouses, genebank (cold storage for tubers and seed, in vitro).

Future Development Plans: Centre recently agreed to conduct research on eight lesser-known Andean root and tuber crops and to survey and study the Andean ecosystem.

Philippines

International Rice Research Institute (IRRI)

Address: P.O. Box 933, Manila 1099, Philippines. **Phone:** (+63 2) 818-1926; **Telex:** (IIT) 40890 RICE PM or 40890 RICE PM; **Fax:** (+63 2) 818-2087; **E-mail:** postmaster@irri.cgnet.com.

Director/Head: George H.L. Rothschild.

Number of Research Scientists: 105; **Number of Staff:** 1,441.

Scientific Fields of Interest: Agriculture; biology; biochemistry; engineering; environment.

Main Lines of Research and Training Activities: Institute pursues wide-ranging programmes in rice cultivation and production examining issues related to irrigation, rainfed lowland and upland rice fields, floodprone rice fields.

Major Scientific Results or Products: Advancement of rice-related knowledge and production technologies that are environmentally, socially and economically sound and that benefit present and future generations of rice producers and consumers.

Main Research Facilities Available: Service building; engineering shops; genebank and biochemistry laboratory; library and documentation service building, bookstore, visitors' centre, exhibition, and conference services, IRRI Riceworld Museum; communication and publication services building; training rooms and audiovisual facilities; biofertilizer building; greenhouses and screenhouses; field stations; containment facility.

Future Development Plans: *Research:* To extend testing of higher yielding new plant types to NARS and incorporate new plant types that are resistant to major pests and diseases; link research on soil processes to farm practices that increase income and enhance productivity; increase transfer of knowledge-based technologies to farmers, particularly with respect to reduced inputs for pest management; raise productivity of rainfed rice systems through rice varieties tolerant of extreme water condition. *International Services:* To increase international rice seedbank collection of land races and wild species of rice, expand activities of International Network for Genetic Evaluation of Rice (INGER) to Mediterranean and West and Central Asia; launch non-seed-based technology evaluation network (CREMNET).

Cooperation Arrangements with Developing Countries: International Network for Genetic Evaluation of Rice (INGER); Crop and Resource Management Network (CREMNET); Integrated Pest

Management Network (IPMNET); Asian Rice Biotechnology Network (ARBN); Simulation and Systems Analysis in Rice Production (SARP) Network; Rainfed Lowland Rice Research Consortium, with participants from Bangladesh, India, Indonesia, Philippines and Thailand; Upland Rice Research Consortium, with participants from India, Indonesia, Philippines and Thailand. In addition, there are more than 150 NARS-IRRI bilateral collaborative research activities with national agricultural research systems in Bangladesh, Cambodia, China, Egypt, India, Indonesia, Iran, Korea, Laos, Madagascar, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand and Vietnam, and with regional and international centres.

Other International Cooperation Arrangements: About 30 cooperation agreements with research institutions and universities in industrialized countries, including Australia, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom and USA.

Qatar

Department of Agricultural and Water Research (DAWR)

Address: P.O. Box No. 1967, Doha, Qatar. **Phone:** (+974) 417-662; **Fax:** (+974) 410-526.

Director/Head: Abdel Rahman M.Y. Al-Mahmoud.

Number of Research Scientists: 69; **Number of Staff:** 37.

Scientific Fields of Interest: Agriculture; biology; engineering/technology; earth sciences; environment; water research.

Main Lines of Research and Training Activities: Water research, irrigation and meteorology; Field and horticultural crop research; Soil research; Agricultural economics and statistics; Geographic information system; Plant tissue culture; Agriculture extension.

Major Scientific Results or Products: Foster advancements in land and water management systems; technical reports and statistics; training courses, seminars, workshops; improved crop seeds.

Main Research Facilities Available: Three field stations; central laboratory for soil and water analyses; plant tissue culture laboratory; agricultural information system and library; agriculture and water meteorology stations.

Future Development Plans: Plans are underway to conduct research on salt plants (the Halophyte) irrigated with untreated seawater; update soil classification; conduct agricultural census.

Cooperation Arrangements with Developing Countries: Plan to strengthen our close relationship with the Gulf Cooperation Council to further improve the coordination and integration of all aspects of our agricultural and water research.

Other International Cooperation Arrangements: Arrangements with International Hydrological Programme; U.N. agreement for combating desertification; cooperation with the International Centre for Agricultural Research in Dry Areas (ICARDA).

Saudi Arabia

King Saud University — Centre for Desert Studies

Address: P.O. Box 2454, Riyadh 11451, Saudi Arabia. **Phone:** (+966 2) 4675573; **Fax:** (+966 2) 4675574.

Director/Head: Abdulmalik Al-Alsheikh.

Number of Research Scientists: 4; **Number of Staff:** 6.

Scientific Fields of Interest: Agriculture; biology; environment.

Main Lines of Research and Training Activities: Environmental studies; sand dunes; range management; afforestation; remote sensing; desertification; desert plants.

Main Research Facilities Available: Experimental research station.

Cooperation Arrangements with Developing Countries: Cooperation with other international centres and university.

Senegal

Institut Sénégalais de Recherches Agricoles (ISRA) — Centre National de Recherches Agronomiques de Bambey

Address: BP 53, Bambey, Senegal. **Phone:** (+221) 736050/51/54.

Director/Head: Dogo Seck.

Number of Research Scientists: 13; **Number of Staff:** 33.

Scientific Fields of Interest: Agriculture; chemistry; veterinary sciences.

Main Lines of Research and Training Activities: Improvement of biological material and production techniques; Improvement of processing methods and storage of agricultural produce; Improvement of agricultural and silvicultural systems and pastures; Product diversification; Improvement of animal feed.

Major Scientific Results or Products: Creation of fast-growing varieties of peanut (*Arachis hypogea*), southern pea (*Vigna unguolata*) and millet (*Penisetum americanum*) adapted to the Western African Sahel zone. Devising of agricultural production techniques for dry zones. Identification of new plant-derived substances to control pests affecting stored commodities.

Main Research Facilities Available: One selection laboratory; one phytopathology laboratory; one laboratory for applied entomology; one main station (650 hectares); one library.

Future Development Plans: Centre of excellence in research material for legumes (peanut and southern pea). Training centre for teachers and producers with regard to production techniques. Reference research centre for new plant-derived biocide substances.

Cooperation Arrangements with Developing Countries: Base Centre Arachide and CORAF, centre of excellence. Scientific cooperation with Burkina Faso, Mali, Benin in the framework of the PEDUNE project for ecologically sustainable production of the southern pea. Member of RENACO, the Southern Pea Network for Central and Western Africa.

Other International Cooperation Arrangements: Partnerships with universities in the USA in the framework of CRSP (collaborative project on bean, cowpea and peanut). Partnership with CIRAD, France.

Sri Lanka

Rubber Research Institute of Sri Lanka (RRISL)

Address: Dartonfield, Agalawatta, Sri Lanka. **Phone:** (+94 34) 47426, 47383; **E-mail:** director@rri.ac.lk.

Director/Head: L.M.K. Tillekeratne.

Number of Research Scientists: 51; **Number of Staff:** 108.

Scientific Fields of Interest: Agriculture; biology; biochemistry/bophysic; energy; materials; chemistry; engineering/technology; environment.

Main Lines of Research and Training Activities: Genetics and plant breeding; plant science, plant pathology and microbiology; soils and plant nutrition; biochemistry and physiology; agricultural economics; adaptive research, biometry; polymer chemistry; raw rubber and chemical analysis; rubber technology and development; raw rubber process development and chemical engineering.

Major Scientific Results or Products: Development of high yielding rubber clones that have received high rankings in international clone trials; development of nontoxic chemicals for use in crepe industry; introduction of rainguard to allow tapping on rainy days, which has increased rubber production by 20

percent; development of cost-effective effluent treatment system to treat rubber factory effluent; introduced sun drying for RSS without deteriorating quality.

Main Research Facilities Available: Analytical equipment (IR, UV, atomic absorption, spectrophotometer); polymer processing equipment (Brabender plasticorder); rubber product testing equipment such as rheometer, tensometer, hardness testers; computers; two field stations (Nivithigalakele and Kuruwita); technology development for products at laboratory level; library.

Future Development Plans: Update biological research, including tissue culture; increase productivity in rubber plantations through use of technology; create ultramodern laboratory for analyses and development of rubber products; introduce power factor correctors in all factories; update library; implement effluent treatment and ISO 9000 in all crepe factories.

Cooperation Arrangements with Developing Countries: Cooperation arrangement with SAARC. On-going collaboration with most rubber growing countries in Southeast Asia under the ANRPC and IRRDB.

Other International Cooperation Arrangements: International cooperation arrangements with World Bank, IAEA, FAO and CIDA.

Tea Research Institute (TRI)

Address: Talawakelle, Sri Lanka. **Phone:** (+94 52) 8385, 8386; **Fax:** (+94 52) 8311, 8229; **E-mail:** research@tri.ac.lk.

Director/Head: W.W.D. Modder.

Number of Research Scientists: 43; **Number of Staff:** 184.

Scientific Fields of Interest: Agriculture; biology; biochemistry/biophysics; energy; chemistry; environment.

Main Lines of Research and Training Activities: Crop production; crop improvement; crop protection; process technology; advisory and extension service.

Major Scientific Results or Products: Development of new planting material; integrated management of pests and diseases; integrated fertilizer application; improved harvesting systems, including development of hand shears; intercropping of tea and rubber; product improvement and diversification, including liquid tea concentrates.

Main Research Facilities Available: Scientific equipment for research (atomic absorption spectrophotometer, high pressure liquid chromatography.); library with 20,000 volumes; six extension centres.

Future Development Plans: Plans are currently underway to prioritize research, based on Composite Approach to Decision Making in Agricultural Research (CADMAR) methodology.

Cooperation Arrangements with Developing Countries: Participate in seminars and conferences with other tea producing countries.

Other International Cooperation Arrangements: Cooperative arrangement sought from Korea International Cooperation Agency (KOICA) and Japanese International Cooperation Agency (JAICA).

Syria

International Center for Agricultural Research in Dry Areas (ICARDA)

Address: P.O. Box 5466, Aleppo, Syria. **Phone:** (+963 21) 213433, 213477, 225112; **Telex:** 331206, 331208, 331263 ICARDA SY; **Fax:** (+963 21) 213490, 225105, 551860.

Director/Head: Adel El-Beltagy.

Number of Research Scientists: 68; **Number of Staff:** 478.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Research at ICARDA focuses on areas with limited winter rainfall and dry summers. Centre has global responsibilities for improvements of barley, lentil and faba bean, and regional responsibilities, in West Asia and North Africa (WANA), for improvement of wheat, chickpea, pasture and forage crops and related farming systems. *Research/training:* Germplasm

evaluation and enhancement (breeding, physiology, entomology, pathology, biotechnology); germplasm collection and conservation; resource management and conservation (soils, water, vegetation); management and improvement of pastures; livestock (small ruminant); nutrition; agronomy; agro-ecological characterization; socio-economic research associated with technology transfer, adoption and impact assessments. ICARDA hosts MSc and PhD students and runs in-house long-term residential courses, in-country training courses and individual short-term courses.

Major Scientific Results or Products: Improved varieties of barley, lentil and chickpeas (particularly cold-tolerant chickpea varieties for winter sowing); collection and preservation of germplasm, including land races and wild relatives; computerized spatial weather generator for scientific assessments of weather conditions and characterization of crop environments; mechanized harvesting of lentil and chickpea.

Cooperation Arrangements with Developing Countries: ICARDA operates four extended programmes with resident regional coordinators throughout WANA; has agreements with the governments of most countries of WANA for cooperative research; works in partnership with National Agricultural Research Systems of WANA in conducting agricultural research.

Other International Cooperation Arrangements: ICARDA, established in 1977, is one of 16 international agricultural research centres supported by CGIAR. Centre collaborates with other IARCs (for example, ICRISAT, CIMMYT, IPGRI) and universities and advanced institutions world-wide (for example, in Canada, France, Germany, Italy, Japan, Netherlands, UK, USA).

Tunisia

Centre de Biotechnologie de Sfax (CBS)

Address: B.P. 358, 3018 Sfax, Tunisia. **Phone:** (+216 4) 274110; **Fax:** (+216 4) 275970.

Director/Head: Radhouane Ellouz.

Number of Research Scientists: 23 researchers; **Number of Staff:** 15.

Scientific Fields of Interest: Agriculture; biology; engineering/technology; environment.

Main Lines of Research and Training Activities: Glucose syrup and HFS production; Glucoamylase glucose isomerase, cellulases production; Endotoxin from bacillus; Treatment of olive mill waste water; Production of transgenic potato plants resistant to potato virus Y; Therapeutic protein (p53; HBS); Industrial enzymes (amylolytic enzymes, glucose isomerase, cellulases, pectinases, lygnin peroxydase, transgenic wheat, biopesticides).

Major Scientific Results or Products: Publications in international journals.

Main Research Facilities Available: Fermentation; downstream processing (pilot plant); genetic engineering.

Future Development Plans: MA and PhD degree programmes with the École Nationale des Ingénieurs de Sfax (ENIS).

Cooperation Arrangements with Developing Countries: Planned with Morocco and Egypt.

Other International Cooperation Arrangements: International Centre for Genetic Engineering and Biotechnology (ICGEB), Trieste, Italy; France.

Institut des Régions Arides (IRA)

Address: Secretariat d'Etat à la Recherche Scientifique et la Technologie, 4119 Medenine, Tunisia.

Phone: (+216 5) 640661; **Fax:** (+216 5) 640435.

Director/Head: Houcine Khatteli.

Number of Research Scientists: 35; **Number of Staff:** 80.

Scientific Fields of Interest: Agriculture; biology; energy; earth sciences; environment; veterinary.

Main Lines of Research and Training Activities: Research and Development: Development of techniques to halt formation of sand dunes; management of water harvesting in wadis; study of behaviour of main pastoral plant species; creation of bank of arid zone species; cartography of pastoral resources covering 700,000 hectares and desertification dynamics of 750,000 hectares; study of life

cycle of two insects — *Apathe monachus* and *Ectomyelois ceratonia* — posing danger to oasis agriculture; improvement of milk and meat production of local goat strain; improvement of camel reproduction; identification and analyses of production systems in arid and desert zones. Training: Training of 144 technicians, 16 engineers and 15 technical engineers. More than 40 training sessions have been organized for some 550 students from Tunisia and various Arab, African and European countries. Promulgation and Sensitization: Implementation of information programme advising farmers, primary and secondary schools and agricultural schools; encouragement of farmers to adopt modern farming techniques; establishment of fertilization stations for breeding of local goats. Studies: Contributions to regional and national through regional studies of integrated development.

Major Scientific Results or Products: Several scientific and technical reports about arid zone agriculture and the fight against desertification; *Revue des Régions Arides* informs readers of current research results and studies concerning human/land interactions in arid areas, management of natural resources, arid soils, desertification and sustainable farming in arid areas; *Cahiers de ITRA* highlights programmes currently underway and summarizes various technical reports.

Main Research Facilities Available: Nine laboratories (water and soil, agronomy, statistics, genetics, remote sensing, pastoral resources, economics, wind erosion, livestock); 26 computers; library containing 6,000 books, 7,000 brochures and 30 subscriptions to specialized journals and reviews; four field stations in Gabès, Kabilia, Tataouine and Ben Gardane.

Future Development Plans: Courses on afforestation, desertification control, livestock. Training, workshops and seminars focusing on Institute's areas of expertise.

Cooperation Arrangements with Developing Countries: Institute conducts cooperative projects and information exchange visits with the Arab Maghreb countries, Arab countries, African and Asian countries. It also organizes training sessions for technicians.

Other International Cooperation Arrangements: Institute cooperates with Food and Agriculture Organization (FAO), UN Educational, Scientific and Cultural Organization (UNESCO), UNSO, Arab League Educational, Cultural and Scientific Organization (ALECSO), Islamic Educational, Scientific and Cultural Organization (ISESCO), Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD), International Centre for Agricultural Research in the Dry Areas (ICARDA), Third World Academy of Sciences (TWAS), ICRA, RUG (Belgium), ASDI, and laboratories in Germany.

Venezuela

Instituto Venezolano de Investigaciones Científicas (IVIC) — Centre of Ecology and Environmental Sciences (CECA)

Address: Apartado 21827, A-1020 Caracas, Venezuela. **Phone:** (+58 2) 5011467, 5011280; **Fax:** (+58 2) 5713164, 5011088.

Director/Head: Jorge E. Paolini.

Number of Research Scientists: 13; **Number of Staff:** 29.

Scientific Fields of Interest: Environment.

Main Lines of Research and Training Activities: Marine biology (mangrove and life cycles of crabs); plant ecophysiology (mineral nutrition, photosynthesis and organic matter decomposition); soil science (soil chemistry and biochemistry); limnology (water chemistry); quaternary research; plant productivity research; mycorrhizae research; nutrient cycles in natural vegetation and crops; postgraduate studies programme in ecology (MSc and PhSc).

Major Scientific Results or Products: Publications.

Main Research Facilities Available: Laboratory equipment for diverse areas in ecology research (atomic absorption spectrophotometer, ion analysers, spectrophotometer UV and visible, digestors, chambers, microscopes, infrared carbon dioxide analysers, porometer); computer facilities; two field stations; library.

Future Development Plans: Launching laboratory in animal ecology; strengthening existing laboratories through appointments of new research scientists.

Cooperation Arrangements with Developing Countries: Exchange of scientists for projects with Brazil and Colombia; contract with Venezuelan oil industry for environmental impact assessments; teaching and research activities with Venezuelan Universities (UCV, USB, UDO, UNEFM).

Other International Cooperation Arrangements: Exchange of scientists for projects with Germany and Australia; headquarters of Tropical Center of Ecology sponsored by UN Educational, Scientific and Cultural Organization (UNESCO).

Zambia

University of Zambia — School of Agricultural Sciences

Address: P.O. Box 32379, Lusaka, Zambia. **Phone:** (+260 1) 250587; **Telex:** ZA 44370; **Fax:** (+260 1) 295448; **E-mail:** deanagric@unza.zm.

Director/Head: Vernon R.N. Chinene.

Number of Research Scientists: 31; **Number of Staff:** 49.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: Testing indigenous phosphate fertilizer sources; Stockfeed development research; Nitrogen fixation studies; Goat breeding research; Shifts in agricultural production under liberalized marketing system; Reproductive performance of goats; Wheat and maize breeding; Conducting of in-service training programmes in various fields of agriculture.

Major Scientific Results or Products: Production of stockfeed formulations and wheat varieties.

Main Research Facilities Available: Laboratories for crop, soil and animal sciences; 15 hectare field station; 23 microcomputers.

Future Development Plans: Establishment of department of food science and technology.

Cooperation Arrangements with Developing Countries: Oversee regional MSc programme in crop science that admits students from SADC region.

Other International Cooperation Arrangements: Cooperation in human resource development among faculties of agriculture, forestry and veterinary medicine in SADC region; cooperation with Flemish Association of Belgian Universities to develop department of food science and technology.

Zimbabwe

Department of Research and Specialist Services (DR&SS) — Ministry of Lands, Agriculture and Water Development

Address: P.O. Box CY 594, Causeway, Harare, Zimbabwe. **Phone:** (+263 4) 704531; **Telex:** 22455 AGRIC ZW; **Fax:** (+263 4) 728317.

Director/Head: N.R. Gata (Acting Director).

Number of Research Scientists: 172; **Number of Staff:** 1,803.

Scientific Fields of Interest: Agriculture.

Main Lines of Research and Training Activities: The Department is entrusted with the furtherance of the welfare and technical progress of agriculture in Zimbabwe. It is responsible for conducting research in agricultural science and crop and livestock production and for the provision of services to the agricultural industry.

Major Scientific Results or Products: Improved varieties from 13 national breeding programmes, water harvesting techniques, intensive livestock production systems.

Main Research Facilities Available: Laboratory and field equipment, field stations, computers information services, libraries.

Future Development Plans: Department has proposed restructuring plan that, if approved by government, will enable research programmes to pursue multi-disciplinary and commercial initiatives. Strategy is designed to help research programmes obtain additional funds from private sources.

Cooperation Arrangements with Developing Countries: Linkages with neighbouring countries and international research organizations will be continued and strengthened.

Other International Cooperation Arrangements: Number of collaborative research programmes take place with international research organizations. Several projects are funded by international agencies (FAO) and agencies in other countries.

University of Zimbabwe — Crop Science Department

Address: P.O. Box M167, Mount Pleasant, Zimbabwe. **Phone:** (+263 4) 303211 ext. 1139; **Telex:** 26580 UNIVZ ZW; **Fax:** (+263 4) 333407.

Director/Head: I.K. Mariga.

Number of Research Scientists: 18; **Number of Staff:** 12.

Scientific Fields of Interest: Agriculture and environment.

Main Lines of Research and Training Activities: Agronomy: Soil fertility and intercropping, agroforestry. Breeding: Barley quality and summer wheat, groundnut improvement. Biotechnology: Tissue culture. Entomology: Storage Entomology. Virology: Maize Virus Classification. Weed Science: Reduced herbicide dosages, Weed management systems.

Major Scientific Results or Products: Publications in local, regional and international journals.

Main Research Facilities Available: 16 ha field station; computer workroom; student laboratories; glasshouses.

Future Development Plans: To develop horticulture; strengthen biotechnology (further development of existing laboratory and collaboration with department of biochemistry); launch MSc in Agronomy/Plant Breeding.

Cooperation Arrangements with Developing Countries: Staff exchanges; theses examinations; undergraduate programme external examination.

Other International Cooperation Arrangements: Collaborations with Imperial College and Wageningen Agricultural University on MSc (Crop Protection); sponsorship of MSc students by Belgian government; sponsorship of research projects by Rockefeller Foundation.