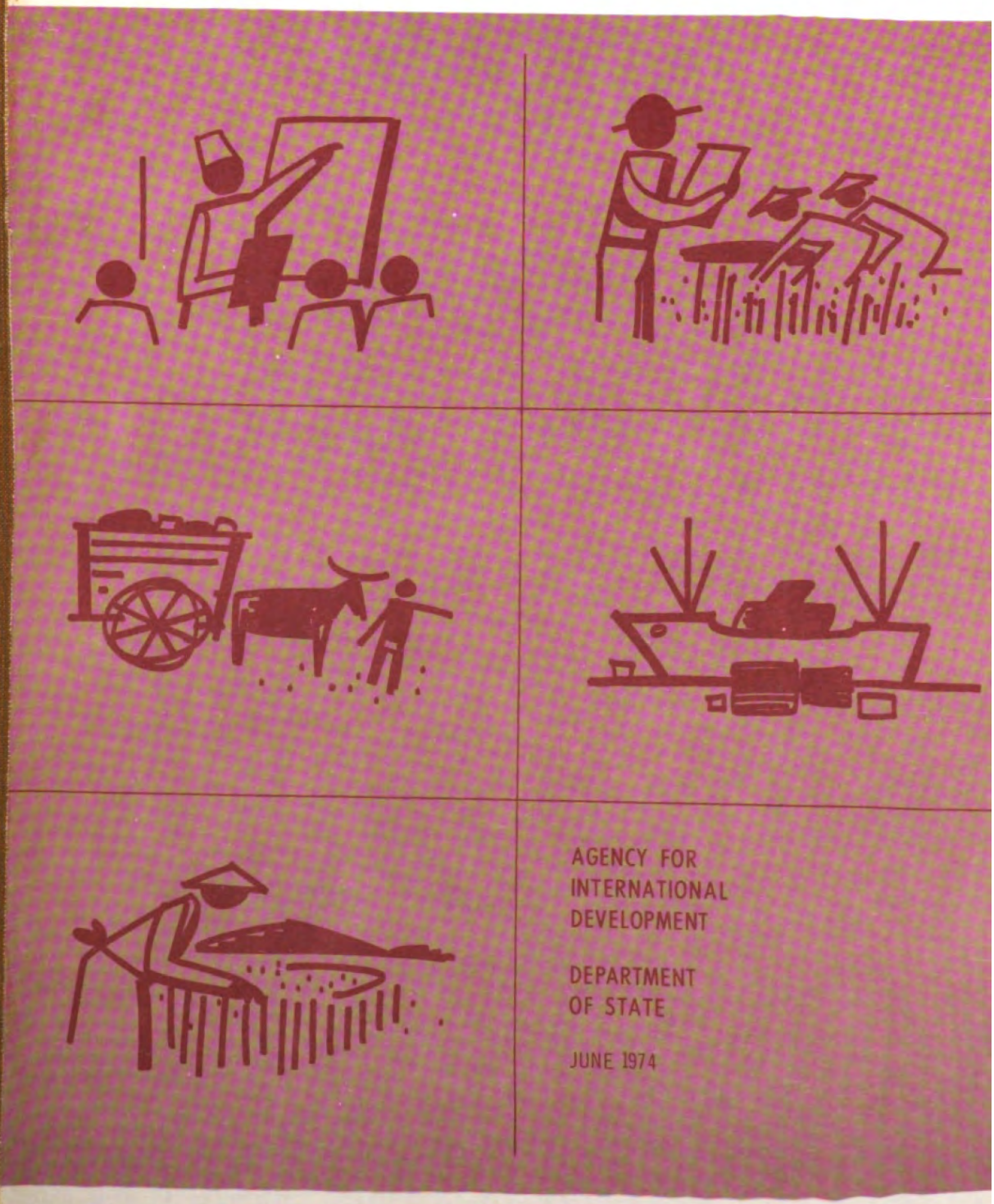
Summary of Ongoing Research an Technical Assistance Projects in Agricultu



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SUMMARY OF ONGOING RESEARCH AND TECHNICAL ASSISTANCE PROJECTS

IN

AGRICULTURE

Sponsored by the
Office of Agriculture
Bureau for Technical Assistance
(TA/AGR)

DEPARTMENT OF STATE

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D.C. 20523

FOREWORD

In recent years the Agency for International Development, Department of State (AID), has expanded its agricultural research and technical assistance program. This expansion recognized agriculture's key role in economic development, as well as the need for a multidisciplinary, coordinated attack on the deep-rooted agricultural problems afflicting the developing nations.

Responsibility for centrally-funded agricultural projects is located in the Office of Agriculture, Technical Assistance Bureau (TA/AGR). These projects may be either in the research or technical assistance areas, and they deal with production, processing, and marketing of field crops and livestock; water; soils; seeds; fertilizers; pesticides; land use; machinery; economics; and agricultural policy. They are summarized in this booklet, grouped by key problem areas. The report also lists 211(d) institutional grants designed to strengthen the capability of U.S. educational and research institutions in dealing with critical social and economic problems in the developing countries, as well as their needs in the biological and physical sciences.

Recognition is given to the former and present members of this Office who participated in the development, evaluation, monitoring and operation of the projects. Acknowledgement is given also to AID Regional Bureaus, other agencies, and the scientific community for their valuable contributions.

Omer J. Kelley, Director
Office of Agriculture
Bureau for Technical Assistance
Agency for International Development

GLOSSARY OF ORGANIZATIONS AND TERMS

ADC	Agricultural Development Council, Inc. 630 Fifth Avenue New York, New York 10020
AID	Agency for International Development Department of State, Washington, D. C. 20523
ALAD	Arid Lands Agricultural Development Program P. O. Box ~~42, Shanhua~~ 2379 ~~Tainan, 741, Taiwan~~ Beirut, Lebanon
ARS	Agricultural Research Service, U.S. Department of Agriculture, Washington, D. C. 20250
AVRDC	Dr. Robert F. Chandler The Asian Vegetable Research & Development Center P. O. Box 42, Shanhua Tainan, 741, Taiwan
BSFW/USDI	Bureau of Sport Fisheries and Wildlife, U.S. Department of Interior, Washington, D. C. 20240
CARIS	Computerized Agricultural Research Information Service (a pilot project with F.A.O. Rome)
CIAT	Dr. U. J. Grant Centro Internacional de Agricultura Tropical (International Center of Tropical Agriculture) Apartado Aereo 67-13 Cali, Colombia
CIMMYT	Mr. Haldore Hanson Centro Internacional de Mejoramiento de Maiz y Trigo (International Maize and Wheat Improvement Center) Apartado 6-641, Londres 40 Mexico 6 D.F., Mexico

CIP	Centro Internacional de la Papa (International Potato Center) La Molina Apartado 5969 Lima, Peru
EAAFRO	East African Agriculture and Forestry Research Organization P. O. Box 30148 Nairobi, Kenya
ERS	Economic Research Service, USDA, Washington, D.C. 20250
ES	Extension Service, USDA, Washington, D.C. 20250
FAO	Food and Agriculture Organization of the United Nations Rome, Italy
FORD	Dr. Lowell Hardin The Ford Foundation 320 E. 43rd Street New York, New York 10017
IACP	Inter-Asian Corn Program The Rockefeller Foundation G.P.O. Box 2453 Bangkok, Thailand
IBRD	International Bank for Reconstruction and Development, Washington, D.C. 20433
ICRISAT	Dr. Ralph Cummings International Crops Research Institute for the Semi-Arid Tropics 1-11-256 Begumpet Hyderabad 500016, A.P. India
ICTA	Instituto de Ciencias y Technologia Agricola Galerias Espana 5° Piso 7a Av. 11-59, Zona 9 Guatemala City, Guatemala

IDRC	Mr. Joseph Hulse International Development Research Center P. O. Box 8500 Ottawa, Canada
IITA	Dr. John Nickel International Institute of Tropical Agriculture Oyo Road P.M.B. 5320 Ibadan, Nigeria
ILCA	International Livestock Center for Africa Addis Ababa, Ethiopia
ILRAD	International Laboratory for Research on Animal Diseases Nairobi, Kenya
INIA	Instituto Nacional de Investigaciones Agropecuarias Apartado 7069 Guayaquil, Ecuador
IRRI	Dr. Nyle C. Brady International Rice Research Institute P. O. Box 583 Manila, Philippines
LDC(s)	Less Developed Country(s)
NAS/NRC	National Academy of Sciences/National Research Council Washington, D. C. 20418
PASA	Participating Agency Service Agreement
PCCMCA	Program Cooperativa Centroamericano para el Mejoramiento de Cultivos Alimenticios Instituto Interamericano de Ciencias Agricolas - Zona Norte Apartado 1688 - Sucursal 1 San Salvador, El Salvador

RAC	Research Advisory Committee (external to AID)
RIGC	Research and Institutional Grants Committee (internal AID)
Rockefeller	Dr. John Pino The Rockefeller Foundation 111 West 50th Street New York, New York 10020
TDY	Temporary Duty
TVA	Tennessee Valley Authority Muscle Shoals, Alabama 35660
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization Vienna, Austria
USAID	U.S. Agency for International Development Missions (A.I.D. posts overseas)
USDA	United States Department of Agriculture Washington, D. C. 20250

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INTRODUCTION

KEY PROBLEM AREAS

The Agency for International Development (AID) places high priority on agricultural assistance programs in developing countries. AID involvement through the Office of Agriculture, Technical Assistance Bureau (TA/AGR), includes financial support to international assistance agencies; central funding for agricultural research projects that have wide application; and technical assistance projects in developing countries, as requested.

To maximize its contribution to the developing nations, AID's Technical Assistance Bureau has identified several key problem areas. These are not only areas where AID has the experience and competence to make significant contributions, but also areas given priority by the developing countries. They include:

1. National agricultural research system. Through financial support, AID is helping establish a worldwide network of international agricultural research institutes.

2. Food crop production, including high protein crops and improvement of protein content and quality in other staple foods.

3. Management of tropical land, soil, and water resources to support more effective agricultural production and to conserve and develop these resources.

4. Livestock production to promote more effective utilization of land resources unsuited to cropping. Livestock production also augments supplies of meat, milk, and eggs to help provide the high-quality proteins which are seriously deficient in human diets in tropical and subtropical countries.

5. Economic analysis institution building to assist individual nations in effectively analyzing their economic status and selecting alternative programs that foster agriculture development.

6. Development of markets for agricultural products by improving marketing structures and procedures.

ROLE OF THE OFFICE OF AGRICULTURE IN RESEARCH AND TECHNICAL ASSISTANCE

The following sections discuss Fiscal Year 1974 projects which are centrally funded by TA/AGR. These projects relate to problems important to several developing nations. TA/AGR, in cooperation with the AID Regional Bureaus, undertakes basic research and provides technical assistance on these problems to support programs in individual countries or regions.

Each project is assigned to a highly competent research institution which operates both overseas and in the United States, with the continuing counsel and guidance of TA/AGR. Yearly progress and other substantive reports are made by the contractor and transmitted to USAID Missions in countries where the information may be useful. It is clearly recognized that additional applied research may be needed in each country to adapt the new information to local conditions, and that country education and assistance programs will be needed to put new research findings into actual use.

The TA/AGR research and technical assistance objectives are: to identify biological, physical, economic, and social constraints impeding agricultural development; to develop programs for applying known technologies to LDC (less developed country) problems; and to formulate research competence and adopt research findings. These objectives serve recognized needs of increasing food production and productivity, improving the dietary quality of foods, and improving farm income distribution and rural employment opportunities.

TA/AGR is developing research competence in the LDCs by training local people in the agricultural sciences. It is also helping to develop worldwide research networks to focus on key problems in the areas of high-protein crops, livestock, water management, agricultural economics, and tropical soil management.

TA/AGR contracts with land-grant colleges and universities as well as scientific organizations and foundations for work, both in the United States and overseas on key development problems. In addition, agreements are developed with other government agencies under Participating Agency Service Agreements (PASAs).

TA/AGR also identifies requirements and formulates programs under the 211(d) grant legislation to develop competency and build effective and lasting links between U.S. and LDC institutions.

SUPPORT TO INTERNATIONAL AGRICULTURAL RESEARCH INSTITUTES

AID/W Coodinator

Guy B. Baird

The United States, represented by AID, is a member of the Consultative Group on International Agricultural Research. The CGIAR, with 29 members, provides financial support for eight international agricultural institutes or centers. 1/ AID currently provides about 25 percent of the operating and new capital costs of these CGIAR-supported activities. The Technical Assistance Bureau handles the AID support for CIAT, CIMMYT, CIP, ICRISAT, and IRRI, and the Africa Bureau has responsibility for IITA.

Each international center has been established in response to a recognized need for high-priority agricultural technology which would be applicable on an international scale. The centers provide the competent scientific talent and operational flexibility required to expedite solutions to major agricultural production problems in the LDCs. They have international Boards of Directors and international staffs. Their major activities are research, outreach, 2/ and training. Each center serves as the nucleus of an international research network concerned with a particular crop(s) or problem area(s). Above all, the centers work toward strengthening national agricultural research systems of the developing countries.

When appropriate, centers cooperate in research efforts through relay links, i.e., arrangements whereby one center undertakes research in support of another center's program. For example, IRRI in the Philippines has a relay research link with CIAT in Colombia for work on rice production problems in Latin America.

1/ Six centers are presently in operation: CIMMYT (International Center for Corn and Wheat Improvement); CIP (International Potato Center); IRRI (International Rice Research Institute); CIAT (International Center of Tropical Agriculture); IITA (International Institute of Tropical Agriculture); and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). Two others were just recently approved: ILRAD (International Laboratory for Research on Animal Diseases) and ILCA (International Livestock Center for Africa).

2/ Outreach is the interaction of international centers with agricultural research and production programs in the LDCs. It includes joint research, training, advisory services, and information and material exchanges.

PROJECT TITLE: CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo, or the International Maize and Wheat Improvement Center)

CONTRACTOR: CIMMYT, Londres 40, Mexico 6, D. F.

CONTRACT COORDINATOR: Dr. Haldore Hanson, Director General

PROJECT DURATION: Started 1/16/69; Termination Date Indefinite

PURPOSE AND PROGRAM: CIMMYT was established in its present form in 1969 to assist developing countries increase corn and wheat production. Multidisciplinary teams of scientists are developing widely-adapted, high-yielding germ plasm of basic food crops which can be channeled into international trials and national crop improvement programs. They are also improving the nutritive quality of the grain, emphasizing higher protein with a better amino acid profile. On a more limited scale, research covers triticales (a cross between wheat and rye), barley, and cold-tolerant sorghum. Outreach programs and training--integral parts of CIMMYT's activities--establish working links with developing countries.

ACCOMPLISHMENTS AND UTILIZATION: CIMMYT is the focal point of effective world-wide research networks for corn and wheat. Its high-yielding, semi-dwarf wheats have fueled the Green Revolution in food-short countries such as India and Pakistan. Accomplishments in corn have produced shorter-statured, higher-yielding populations with greatly improved nutritional qualities. These are expected to be particularly useful in the tropical countries. Triticales with yield potentials comparable to the best wheats bid to make an impact in the more favorable environments. An international barley program is improving nutritional quality of the grain. Resident CIMMYT scientists are conducting outreach programs in several countries and, in 1973, 82 scientists from 35 countries were trained at CIMMYT.

ROLE OF AID: Through TA/AGR, AID provides about 25 percent of the Center's operating and capital budget. Other TA/AGR centrally-funded U.S. university research projects complement CIMMYT work on corn and wheat. AID's Regional Bureaus and country Missions support CIMMYT's outreach and workshops, seminars, and other training programs.

PROJECT TITLE: IRRI (International Rice Research Institute)

CONTRACTOR: IRRI, P. O. Box 583, Manila, Philippines

CONTRACT COORDINATOR: Dr. Nyle C. Brady, Director

PROJECT DURATION: Started 1968; Termination Date Indefinite

PURPOSE AND PROGRAM: IRRI's objectives have been to increase rice production especially in Asia, and to improve rice quality. Its multidisciplinary research approach is designed to produce new high-yielding varieties along with the package of management practices required to obtain potential yields. Increasing attention has been directed toward developing new varieties which are resistant to insect pests, diseases, and unfavorable soil and water conditions. This research effort is coupled with a vigorous outreach and training program. During its first 10 years, IRRI focused on irrigated rice. Plans for the next 10 years include expanding the research program to include multiple cropping systems and problems of rainfed lowland and upland rice.

ACCOMPLISHMENTS AND UTILIZATION: Early successes produced stiff-strawed, high-yielding varieties suitable for the tropics (e.g., IR5, IR8, IR22, and IR24); some of these doubled and tripled traditional rice yields, spurring the Green Revolution in Southeast Asia. Genetic sources of resistance to important virus and bacterial diseases and insects have been identified and incorporated into the newer selections and varieties. In addition to these IRRI varieties, 23 IRRI lines are being sold through commercial companies in 15 nations. In 1973, IRRI provided about 70 man-years of training to rice scientists from around the world. IRRI also has outreach projects which assist national rice research and development programs in Sri Lanka, Egypt, Indonesia, Philippines, Bangladesh, Vietnam, and India.

ROLE OF AID: Through TA/AGR, AID provides about 25 percent of IRRI's operating and new capital budget. The TA/AGR centrally-funded research project on machinery and equipment for the small farmer, based at IRRI, complements the core research program. AID's Regional Bureaus and country Missions further support IRRI's outreach and training programs.

PROJECT TITLE: CIAT (Centro Internacional de Agricultura Tropical, or the International Center for Tropical Agriculture)

CONTRACTOR: CIAT, Apartado Aereo 67-13 (air mail) Cali, Colombia

CONTRACT COORDINATOR: Dr. Ulysses J. Grant, Director General

PROJECT DURATION: Started 1969; Termination Date Indefinite

PURPOSE AND PROGRAM: CIAT is helping identify and solve agricultural production problems in three major Latin American lowland regions: areas with extremely infertile, highly acid soils (e.g., Eastern Plains of Colombia and Campo Cerrado of Brazil); areas in the coastal plains made up of gently rolling plains and alluvial river valleys (e.g., Magdalena Valley in Northern Colombia); and low mountain valleys (e.g., the Cauca Valley in Colombia). Work centers around six program areas: beef-swine, cassava, beans, rice, maize, and agricultural systems. CIAT has major international responsibility for beef, cassava, and beans; relatively modest maize and rice programs to support CIMMYT and IRRI research efforts; and a modest swine feeding and management program as part of its work on agricultural systems.

ACCOMPLISHMENTS AND UTILIZATION: CIAT has assembled about 160 genotypes of a promising tropical legume, Stylosanthes guyanemsis, to increase forages for beef production, particularly in areas with highly acid soils. Work on animal diseases involves advanced field testing of immunizing procedures against hemoparasites in cooperation with the Texas A&M/AID projects. Control of these diseases would greatly reduce beef production losses in large areas of Latin America. CIAT has developed swine feeding regimes based on waste bananas, cassava, rice bran and polishings, sugar or molasses, and high-lysine, high-protein opaque-2 maize. The opaque-2 program appears particularly promising for small swine producers since CIAT trials have shown that the maize is an adequate sole source of both energy and protein for most of the swine life cycle. CIAT has trained some 200 persons for 24 countries. At least another thousand officials, mostly policy, research, and education leaders, have participated in conferences, symposia, and workshops. In 1973, CIAT established a new outreach program in Guatemala.

ROLE OF AID: Through TA/AGR, AID currently provides about 25 percent of the Center's operating and new capital budget. Several TA/AGR centrally-funded U.S. university research projects (described elsewhere in this publication) complement CIAT's research program.

PROJECT TITLE: IITA (International Institute of Tropical Agriculture)

CONTRACTOR: IITA, Oyo Road, P.M.B. 5320, Ibadan, Nigeria

CONTRACT COORDINATOR: Dr. Herbert R. Albrecht, Director

PROJECT DURATION: Started 1968; Termination Date Indefinite

PURPOSE AND PROGRAM; IITA was established to improve the quantity and quality of food in the lowland humid tropics, particularly in Africa. IITA now has four main research programs: 1) farming systems--an integrated and in-depth examination of the physical, biological, economic, and engineering problems of agriculture; 2) cereal improvement--primarily rice and maize research closely linked with IRRI and CIMMYT programs; 3) grain legume improvement--international responsibility for cowpeas and limited work on lima beans, pigeon peas, and soybeans; and 4) root and tuber improvement--international responsibility for yams and sweet potatoes and a strong cassava program.

ACCOMPLISHMENTS AND UTILIZATION: In efforts to develop mulching and minimum tillage techniques, high soil temperature has been identified as an important deterrent to crop seedling growth. Breakthroughs in the development of high-lysine maize for tropical areas of Africa have produced varieties with hard endosperm, giving them the storage and processing properties of the traditional varieties. Cowpea varieties resistant to insects and diseases have been obtained through testing some 4,000 cowpea introductions. Several sweet potato clones have been produced which have a yield potential of more than 30 tons per hectare in 4 months (the world average is only 10 tons). This source for increased calories is particularly valuable in the higher rainfall areas where production of alternative food crops is limited. Outreach programs are expanding rapidly, with Zaire, Liberia, Sierra Leone, Nigeria, Tanzania, and Ghana participating. IITA has provided research training for more than 50 technicians and production training for 28 extension leaders.

ROLE OF AID: Through the Africa Bureau, AID currently provides about 25 percent of the Center's operating and capital budget. A number of TA/AGR centrally-funded U.S. university research projects (described elsewhere in this bulletin) complement the IITA work. These include Purdue's work on high-lysine maize, as well as tropical soils projects at Cornell, Prairie View, and North Carolina Universities. AID's Africa Bureau and country Missions further support IITA's outreach and training programs.

PROJECT TITLE: CIP (Centro Internacional de la Papa, or International Potato Center)

CONTRACTOR: CIP, Apartado 5969, Lima, Peru

CONTRACT COORDINATOR: Dr. Richard L. Sawyer, Director

PROJECT DURATION: Started 1972; Termination Date Indefinite

PURPOSE AND PROGRAM: CIP is designed to improve potato production in developing countries. The work is carried on in the cold, highland areas as well as the lowland tropical areas. Major projects are: 1) developing a potato germ plasm bank which will include the full range of genetic variability that exists with tuber-bearing Solanum; 2) developing resistance to major disease problems, including late blight, golden nematode, brown rot, and several major viruses; 3) developing resistance to cold; and 4) increasing the protein content of the potato.

ACCOMPLISHMENTS AND UTILIZATION: Most facilities have been completed at the La Molina (Lima) headquarters, and facilities at Huancayo - the higher elevation station - should be operational in early 1974. Staffing has progressed rapidly and should be completed in 1974. This will include approximately 20 principal staff members and 50 supporting staff members. In 1972, as a guide to long-range planning, an international symposium was held on "Key Problems and Potentials for Greater Use of the Potato in the Developing World." Over 100 scientists from six continents participated. Workshops have been held, or are scheduled, to assist in long-range planning for each major CIP project. The germ plasm bank has over 4,000 entries, and an intensive program is in progress to identify resistance to major diseases. Through CIP-based research and ties with other potato improvement programs (such as those at Wisconsin, North Carolina, and Minnesota), CIP is rapidly becoming a world information center on potato improvement and utilization. Potato scientists from Chile, Colombia, Peru, Costa Rica, Ethiopia, Uganda, and Poland have participated in training programs.

ROLE OF AID: Through TA/AGR, AID currently provides about 25 percent of the CIP operating and capital budget. Under an AID grant, the establishment of CIP was planned. Through AID's Regional Bureaus and country Missions, further support is provided for outreach and training.

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

CONTRACTOR: ICRISAT, 1-11-256 Begumpet, Hyderabad, India

CONTRACT COORDINATOR: Dr. Ralph W. Cummings, Director

PROJECT DURATION: Started 1972; Termination Date Indefinite

PURPOSE AND PROGRAM: ICRISAT has three main objectives: 1) to serve as a world center for the genetic improvement of sorghum, pearl millet, pigeon peas, and chickpeas; 2) to develop farming systems which will help increase and stabilize agricultural production by optimizing the use of natural and human resources in the seasonally dry, semi-arid tropics; and 3) to assist national and regional research programs. Programs are developed along two lines: crop improvement research and farming systems research. Crop research will have interdisciplinary teams for cereals (sorghums and millets) and food legumes (pigeon peas and chickpeas). The farming systems group will place major emphasis on soil management and efficient water utilization.

ACCOMPLISHMENTS AND UTILIZATION: Field research was initiated in mid-1972, and ICRISAT had 15 senior international staff members by January, 1974. Considerable progress has been made in assembling germ plasm collections, and the materials are being screened in breeding programs. Six agricultural engineers spent a month at ICRISAT in mid-1973 for training in farm layout and land development. Discussions have been initiated with a number of institutions outside India to develop an effective outreach program.

ROLE OF AID: Through TA/AGR, AID provides about 25 percent of ICRISAT's operating and capital budget. Other TA/AGR centrally funded U.S. university research projects (described elsewhere in this bulletin) complement the work of ICRISAT. These include projects with Purdue University, University of Nebraska, Texas A&M University, and the University of Puerto Rico. AID's Regional Bureaus and country Missions support ICRISAT's outreach efforts.

RECENTLY APPROVED RESEARCH INSTITUTES

ILRAD (International Laboratory for Research on Animal Disease)

This Center, to be located in Kenya, will concentrate initially on two of the most serious livestock diseases in Africa - Trypanosomiasis (transmitted by the tsetse fly) and East Coast Fever. A highly specialized international research team will direct its efforts toward control of these diseases through immunological techniques. Work of ILRAD will be linked with research in other locations in Africa and elsewhere. Through the Africa Bureau, AID is expected to provide up to 25 percent of the operating and capital budget requirements of ILRAD. The TA/AGR centrally funded research projects with Texas A&M University (hemoprotozoal parasites of livestock) and with the USDA (sterile male tsetse fly techniques for control of Trypanosomiasis) will be closely linked with the Laboratory.

ILCA (International Livestock Center for Africa)

Much of the information collected in African research centers has never been published. ILCA will retrieve, store, and classify this information so that it will be readily available to meet specific development and research purposes. Cooperating with existing national, regional, and international organizations operating in similar fields, the center will conduct research programs on important livestock production and marketing systems in Africa. Work will include disease control, marketing, dry season nutrition, forages and grasses, improvement of reproductive performance, and parasite control. Through the Africa Bureau, AID expects to provide up to 25 percent of the operating and capital budget requirements of ILCA. TA/AGR centrally funded livestock research projects will be linked with the Center.

FOOD CROP PRODUCTION

RESEARCH PROJECTS

AID/W Coordinator

Samuel C. Litzenberger

PROJECT TITLE: Inheritance and Improvement of Protein Quality and Content in Sorghum bicolor

CONTRACTOR: Purdue University, Lafayette, Indiana 47907

CONTRACT COORDINATOR: Dr. John D. Axtell, Professor, Department of Agronomy

PROJECT DURATION: Started 6/30/66; Termination Date 6/20/75

PURPOSE: This project is intended to produce more nutritious sorghum varieties for the LDCs. Because of the extensive use of sorghum as a human food as well as a feed grain over extensive areas of the tropics, especially in Africa, improving its protein quantity and amino acid balance is extremely important. Sorghum and millet are important diet components for some 300 million people.

DESCRIPTION OF ACTIVITY: The world sorghum collection is being screened for genetically controlled factors which could improve protein content and quality; these factors are then bred into promising varieties for the tropics. The higher yielding and more promising selections are grown in nurseries at Purdue, Texas A&M, Nebraska, and Puerto Rico. They are further evaluated by cooperating plant breeders at selected worldwide locations. Biological as well as in vitro and chemical evaluations are being made.

ACCOMPLISHMENTS AND UTILIZATION: A high-lysine sorghum gene was isolated in 1973 which could triple the protein quality of normal sorghum strains. It is a dominant gene which should be easy to breed into other strains, leading to improved sorghum varieties for human food in 3 to 5 years. The gene was found in two Ethiopian strains after screening about 9,000 lines for total protein, lysine and other amino acids, daylength response, yield performance, and consumer acceptability. Superior materials, including the high-lysine gene just discovered, are being used in crosses at Purdue and other locations. Inbred and hybrid derivatives from these crosses have been selected and assessed for yield, protein, and amino acid composition. One variety displaying improved protein quality has been selected in Colombia and named "ICS-Marupaanste." Nutritional quality is being evaluated in small animal feeding trials. The effect of tannins on availability of protein has been determined; tannin-containing sorghums, although resistant to bird damage, are much less useful as food than those containing little or no tannins. The implications of this and means for confronting the problem are being studied.

FUTURE PLANS: Indexing, selection, breeding, and testing will continue until superior varieties have been produced which incorporate high protein, desirable amino acid balance, and improved nutrition. Purdue University technical personnel will help local breeders incorporate these superior lines into breeding programs, as well as conduct special workshops and training programs for LDC cooperators.

PROJECT TITLE: Inheritance and Improvement of Protein Quality and Content in Maize

CONTRACTOR: Purdue University, Lafayette, Indiana 47907

CONTRACT COORDINATOR: Dr. L. F. Bauman, Professor of Agronomy

PROJECT DURATION: Started 6/30/70; Termination Date 6/30/75

PURPOSE: Ordinary maize, when used alone for human food or livestock feed, is low in protein and deficient in lysine. Because of these deficiencies, the diets of people heavily dependent on maize as a staple food fall short of acceptable standards of good nutrition. Genetic research with the Opaque-2 and Floury-2 genes indicates that protein content and quality are genetically controlled and can be greatly improved by incorporating these genes into conventional varieties. The purpose of this project is to isolate genes which will further improve protein quality and content in maize and also to increase grain yield, keeping quality and market acceptability. The substitution of such new varieties for those currently grown in the LDCs will help improve diets of people in those countries.

DESCRIPTION OF ACTIVITY: This project is designed to develop open-pollinated and, to a lesser extent, hybrids of maize with improved protein quality and content. Maize breeding work is being conducted at Purdue in conjunction with work at CIMMYT, the University of Vicosa in Brazil, CIAT in Colombia, U.S. Department of Agriculture, and other research centers conducting maize research. The work in plant breeding is linked to a systematic evaluation program for protein quality and content, and to adaptability trials performed under various climate and soil conditions. A central biochemical laboratory at Purdue conducts basic research on improved analytical procedures for protein determinations. Linked to the chemical analysis and breeding program, research is carried out to determine the relationship of air temperature and net radiant heat, to assist in predicting adaptation of improved varieties to local situations all over the world.

ACCOMPLISHMENTS AND UTILIZATION: In preliminary trials, a double mutant maize combining the high-protein Opaque-2 gene with the Sugary-2 gene has resulted in 75 percent more protein than standard Opaque-2, with increased nutritional efficiency. The sugary gene also makes Opaque-2 starch crystalline at maturity, giving it field and storage qualities like ordinary flint and dent types; these are now being incorporated into otherwise agronomically acceptable varieties. Feeding trials have shown that yellow crystallines are essentially equal to standard Opaque-2. High-lysine (Opaque-2) maize is already well established in commercial production in Brazil, and similar progress is being made in other countries as well.

FUTURE PLANS: The project will continue to concentrate on its major objective of locating additional genes which would boost protein quantity and quality without reducing yields. It is expected that full accomplishment of the objectives will require at least 5 years.

PROJECT TITLE: Improvement of the Nutritional Quality of Wheat through Increased Protein Content and Improved Amino Acid Balance

CONTRACTOR: University of Nebraska, Lincoln, Nebraska 68503

CONTRACT COORDINATOR: Professor Virgil Johnson, Geneticist
Professor Paul J. Mattern, Biochemist,
Department of Agronomy

PROJECT DURATION: Started 6/29/66; Termination Date Indefinite

PURPOSE: Wheat, a major food worldwide, provides ample calories but is relatively low in protein and certain essential amino acids. Increasing the protein content and quality of wheat offers a cheap, practical, acceptable way to improve the nutritive quality of diets in wheat-growing areas, particularly when the genetic process is combined with the selection of cultivars with higher grain yield.

DESCRIPTION OF ACTIVITY: Protein levels and amino acid composition of crops are genetically transmissible characteristics. The University of Nebraska has identified Atlas 66 as well as several other genetic sources of high-protein germ plasm. It is continuing to evaluate the world wheat collection for additional high-protein sources. These are crossed with high-yielding varieties to produce superior varieties with higher total protein and improved quality.

ACCOMPLISHMENTS AND UTILIZATION: Wheat protein has been increased as much as 25 percent by breeding. The main genetic source for this improvement was Atlas 66, a superior U.S. variety found by screening for protein content and quality more than 16,000 bread and related wheats in the USDA world collection and the entire Durum wheat collection. At least two genes condition protein level in Atlas 66, one linked with a gene for leaf rust resistance as well. Twenty-six lines of high protein germ plasm obtained from crosses with Atlas 66 have been released through the project and seed samples sent to 18 cooperating LDCs to test their suitability for commercial distribution. The International Winter Wheat Performance Nurseries were evaluated at 38 sites in 24 countries in 1970; at 44 sites in 27 countries in 1971; at 44 sites in 33 countries in 1972; and 55 sites in 35 countries in 1973. Varieties with superior performance and wide adaptability will be crossed with others of superior protein content and quality. Because of their performance in these nurseries, the varieties "Besostaia" and "Bolal" are now widely planted in Turkey and neigh-

boring countries; the variety "Belinda" is widely planted in South Africa. The Nebraska project works closely with CIMMYT and supplies that organization with breeding material. A rapid in vitro screening test for leaf proteases is being perfected which permits speedy identification of high protein cultivars. This technique can also be used to screen herbicides.

FUTURE PLANS: Superior high-protein, high-lysine varieties developed and tested under this project will be made available to wheat breeders in the LDCs. University of Nebraska technical personnel will help local breeders incorporate these improved materials into their breeding programs; a Basic Ordering Agreement is being developed with AID to facilitate this.

PROJECT TITLE: Development of Improved Varieties of Soybeans, Their Utilization as Food, and Supporting Cultural Practices for Production in the Tropics

CONTRACTOR: University of Illinois, Urbana, Illinois 61801

CONTRACT COORDINATOR: Dr. W. N. Thompson, Director, International Soybean Program

PROJECT DURATION: Started 4/1/73; Termination Date 3/31/76

PURPOSE: The project is directed to the reduction of the worldwide protein gap by developing improved soybean varieties for tropical and subtropical conditions and promoting their direct use as human food.

DESCRIPTION OF ACTIVITY: The contractor screens and breeds high-yielding food soybean varieties with broad adaptation to tropical and subtropical conditions; develops supporting cultural practices required to achieve and maintain high yields under these conditions; provides technical assistance, research linkages, and backstopping to LDC institutions conducting cooperative adaptive research in soybean improvement; provides formal and practical training in soybean and culture; and demonstrates processes for using soybeans directly as human food at the home and village level. A Basic Ordering Agreement has been signed with the University of Illinois enabling any USAID Mission to obtain the services of Illinois experts in any facet of a soybean development program.

ACCOMPLISHMENTS AND UTILIZATION: This project builds on experiences gained in a previous technical assistance contract which demonstrated that selected high-yielding U.S. commercial soybean varieties could produce equally high yields under tropical and subtropical conditions. The earlier project also identified some critical cultural practices required to achieve and maintain yields. In the project, 60 planting trials using 20 varieties have been established in more than 30 countries. Data from these trials will form the basis for a breeding and adaptation program being established in Puerto Rico. Varieties resistant to nematodes and stem borers have also been identified and are being crossed with higher yielding varieties.

FUTURE PLANS: The project will: 1) intensify uniform varietal testing, cultural practice, planting, and breeding activities, particularly at the University of Puerto Rico and LDC research centers; 2) demonstrate the University of Illinois method for processing soybeans as human food; 3) develop a package program for improved soybean production in LDCs; and 4) provide graduate level and practical training in soybean culture.

PROJECT TITLE: Improvement of Tropical Production of Beans and Cowpeas Through Disease and Insect Control

CONTRACTOR: University of Puerto Rico, Mayaguez Campus, Mayaguez, Puerto Rico 00708

CONTRACT COORDINATOR: Dr. J. H. Lopez Rosa, Department of Phytopathology

PROJECT DURATION: Started May 1973; Termination Date March 1978

PURPOSE: Grain legumes are important food crops throughout the tropics, but production is low because of serious insect and disease problems. This project is to study the insect and disease problems affecting food legumes in the tropics and to develop control measures, with special emphasis on developing resistant varieties. The tropical climate of Puerto Rico is especially favorable for this work, and Puerto Rico has the more important insects and disease which occur throughout the tropics.

DESCRIPTION OF ACTIVITY: Studies being conducted in Puerto Rico and throughout the tropics are identifying and characterizing the diseases, insect pests, and nematode problems of beans and cowpeas, the principal food legumes of the tropics. They are also searching for disease-resistant germ plasm. Collaboration has been established with international institutes (CIAT, IITA, IICA, and the Programa Cooperativa Centroamericano para el Mejoramiento de Cultivos Alimenticios) as well as Ministries of Agriculture and universities in LDCs.

ACCOMPLISHMENTS AND UTILIZATION: As a result of work already in progress at the University of Puerto Rico, techniques for detecting and identifying five Whitefly-transmitted bean viruses, using 18 "classical" bean varieties as differentials, have been perfected. Other diseases, nematodes, and insects are being evaluated and resistance noted, preparatory to testing in uniform field trials.

FUTURE PLANS: The study of diseases and insect pests will continue, with emphasis on developing control measures through the use of resistant varieties, improved management practices, and conventional chemicals. New varieties will be tested in Puerto Rico and abroad through uniform field trials carried out in cooperation with international institutes and national research organizations in collaborating countries. The varieties will be evaluated for protein content, quality, and nutritional value as well as disease and insect resistance, yield, and other agronomic qualities. Plans also include training for LDC technicians, seminars in Puerto Rico and abroad, and the publication of appropriate reports, journal articles, and bulletins.

PROJECT TITLE: Development of Multiple Disease Resistant High-Yielding Sorghum Cultivars and Supporting Cultural Practices for the Tropics

CONTRACTOR: University of Nebraska, Lincoln, Nebraska 68503
Texas A&M University, College Station, Texas 77843
University of Puerto Rico, Mayaguez, Puerto Rico 00928

CONTRACT COORDINATOR: Dr. J. D. Eastin (Nebraska)
Dr. R. A. Frederiksen (Texas)
Dr. Antonio Sotomayor Rios (Puerto Rico)

PROJECT DURATION: Started FY 1974; Termination Date FY 1979

PURPOSE: This project represents an effort to use existing U.S. research capabilities to improve the yield and quality of sorghum grown in the tropics. Worldwide, about a quarter of the cropland used for cereals is seeded to sorghum and millet; in Africa, this increases to 60 percent. Because these crops are staple foods for some 300 million people, nutrition levels could be greatly improved if yields were increased to give more carbohydrates, and strains were developed which had higher protein content, better amino acid balance, and improved digestibility. This project aims to develop high-yielding, nutritious, disease-resistant cultivars adapted to the tropics, as well as improved practices for their cultivation.

DESCRIPTION OF ACTIVITY: Extensive early screening will be conducted at the University of Puerto Rico, in cooperation with USDA. Breeding will be done at Nebraska, Texas, and Purdue where ongoing programs are combining selected germ plasm from the tropics with high-yielding varieties to produce strains with high yield, disease and insect resistance, and nutritional quality. Texas is concentrating on resistance to diseases and insects. Purdue is developing improved cultivars and populations with germ plasm for increased protein and better amino acid balance. Rockefeller Foundation assists in financing a major plant physiology activity at the University of Nebraska. ICRISAT is the international center for sorghum research and, as such, fully participates in planning and implementing annual and long-range work plans. Linkages are being established with other international institutes also (CIMMYT, IITA, IRRI, AND CIAT) as well as with regional crop improvement programs and Ministries of Agriculture and universities in the LDCs. These organizations will be involved in evaluation programs. Workshops, seminars, and on-the-job training will be included in the project together with academic training for LDC scientists.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but the organizations involved are testing high-yielding, nutritionally superior, disease-resistant germ plasm. Test results will be disseminated through Ministries of Agriculture of the cooperating countries and the international institutes.

FUTURE PLANS: Funds have been reserved for these activities and will be activated as soon as all papers are processed.

PROJECT TITLE: Laboratory Procedures for Rapid Identification and Determination of Specificity of Chemicals for Phytotoxicity Properties in Crop Plants, Grasses, and Broadleaf and Aquatic Weeds

CONTRACTOR: University of Nebraska, Lincoln, Nebraska 68503

CONTRACT COORDINATOR: Dr. Lowell Klepper,
Department of Agronomy

PROJECT DURATION: Started 5/14/73; Termination Date 5/13/74

PURPOSE: This project is refining a recently discovered laboratory procedure for rapid, efficient identification of herbicidal chemicals and the determination of their effectiveness and specificity. Weed control is a serious limiting factor to agricultural production in the tropics. This technique could speed the development and introduction of safer and more effective materials for controlling specific weeds.

DESCRIPTION OF ACTIVITY: The research consists of: 1) developing efficient and rapid tests to measure herbicide penetration in leaf, stem, and root tissues of various plant species; 2) investigating the interaction of surfactants and herbicides when surfactants are used to increase herbicide penetration into selected weed species; 3) determining plant response to herbicidal action as related to plant age, nutritional status, and inherent ability to reduce nitrate; and 4) identifying specific enzymatic processes responsible for the metabolic conversion of certain herbicides into photosynthetic inhibitors.

ACCOMPLISHMENTS AND UTILIZATION: A rapid <u>in vitro</u> test for determining herbicidal activity and specificity of surfactants has been refined and is now available for commercial use. Several firms are already adapting it to their needs. A leaflet explaining the test, which uses minimum equipment, was recently distributed to some 20 developing countries to help researchers adapt the test to their programs.

FUTURE PLANS: Herbicides developed as a result of this investigation will be evaluated in the field in cooperation with regional research institutes, national Ministries of Agriculture, and the USAID/Oregon State University Contract for LDC weed control.

PROJECT TITLE: Evaluation of the Potential for Improvement of Mungbean as a Major Food Grain Legume

CONTRACTOR: University of Missouri, Columbia, Missouri 65201

CONTRACT COORDINATOR: Dr. J. M. Poehlman, Department of Agronomy

PROJECT DURATION: Started May 1973; Termination Date May 1975

PURPOSE: This project compares mungbean (Vigna radiata (L.) Wilczek) with other food grain legumes as a potential crop for developing nations in the tropics.

DESCRIPTION OF ACTIVITY: A concerted research effort has never been given to the mungbean because it has been grown mostly as a catch crop after rice, for home consumption. Yields are usually low because of the use of unimproved varieties and poor cultural practices; information on the genetics, diseases, and culture of the crop is scanty. The diversity of germ plasm has been largely unexplored. It is known, however, to be a high protein crop with wide climatic adaptation. This project will accumulate and screen mungbean germ plasm for desirable characteristics. International institutes cooperating in the project include the Asian Vegetable Research and Development Center in Taiwan and IRRI in the Philippines. IRRI considers the mungbean a major possibility in the rice rotation. Linkages are also being established with other international institutes, as well as Ministries of Agriculture and universities in cooperating countries. This research project proposes: 1) to examine the genetic potential within the species and to identify characteristics of the plant which are important for its genetic improvement; 2) to develop a mungbean screening nursery in cooperation with interested research workers in other countries and at selected international research institutes in order to discover the climatic adaptation of selected strains; and 3) to research breeding problems to help evaluate the potential for improving the mungbean crop.

ACCOMPLISHMENTS AND UTILIZATION: The University of Missouri has tested more than 400 mungbean strains for high yield, disease resistance, and other desirable agronomic characteristics, selecting 26 for distribution to collaborators in seven overseas locations to obtain information on photoperiod response and other factors.

FUTURE PLANS: About 900 additional strains are to be evaluated. Appropriate reports, journal articles, and bulletins will be published and workshops and seminars are planned.

PROJECT TITLE: Improvement of the Nutritional Quality and Productivity of Barley for Semi-Arid Regions

CONTRACTOR: Montana State University, Bozeman, Montana 59715

CONTRACT COORDINATOR: Dr. L. P. Carter, Associate Dean of Agriculture

PROJECT DURATION: Started January, 1974; Termination Date Indefinite

PURPOSE: This project is designed to develop barleys of superior protein content and quality, high yield, and improved agronomic characteristics for semi-arid regions within the tropical latitudes, where conditions are unfavorable for cultivating other grain crops. Barley has a wide ecological range; it is grown from the equatorial latitudes to north of the Arctic Circle, and from below sea level to the highest mountain ranges. Because of its adaptability to cooler and drier regions, barley improvement and development can assure the production of food and feed of superior nutritional quality in marginal areas where the cultivation of other cereals is not feasible.

DESCRIPTION OF ACTIVITY: Important LDC barley producing areas will be surveyed to determine the major genetically controlled factors limiting production and to collect germ plasm for eventual use in the improvement program. The maximum recombination method 1/ will be used to develop improved barley populations with early maturity; photoperiod insensitivity; resistance to insects, diseases, drought, drying winds, and extremes of temperature; high yield with broad adaptation; high protein and improved amino acid balance; and consumer acceptance.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but the University of Montana already has considerable research experience with barley and a highly competent team working on the crop. The University has germ plasm of high-protein and high-lysine content of its own development which is available for use in this project. Also, the variety "Hiproly," selected by Swedish workers, has 14-20 percent protein and contains 20-30 percent more lysine per unit of protein than average barley.

FUTURE PLANS: Close collaboration will be established with CIMMYT and other international organizations as well as with developing country agricultural programs. It is expected that CIMMYT will assume leadership in uniform evaluation of new varieties in the LDCs, as well as training of research and production personnel. Also, any outreach activities with barley will be through CIMMYT. Workshops, seminars, and training programs will be developed at Montana State and cooperating locations.

1/ Maximum recombination refers to using male sterile plants in the breeding plot so all pollination is from outside sources. This produces great variety in the crosses made rather than uniform pollination.

SOIL AND WATER MANAGEMENT RESEARCH PROJECTS

AID/W Coordinator

Donald Plucknett

PROJECT TITLE: Water Management Research in Arid and Sub-Humid Lands of the LDCs, Latin America

CONTRACTOR: Utah State University, Logan, Utah 84321

CONTRACT COORDINATOR: Byron C. Palmer, Project Director
Management Research Programs

PROJECT DURATION: Started 6/28/68; Termination Date 3/31/76

PURPOSE: This project for water management research in Latin America is a companion to a Colorado State University project for similar research in the Near East and South Asia. It is to improve on-farm water management practices, integrating these with other essential management and cultural practices necessary for effective agricultural development.

DESCRIPTION OF ACTIVITY: USU is adapting known techniques to the on-farm water management problems of arid and sub-humid agricultural lands in Latin America. Research is: 1) determining the most efficient means of supplementing soil moisture with limited amounts of irrigation water; 2) developing data which can be used for on-farm design and construction of inexpensive conveyance, delivery, water application, and drainage systems; and 3) developing management systems to minimize salinity hazards. Problems of farmers with small holdings and limited employment opportunities are examined. Special effort is made to cooperate with local institutions on research projects.

ACCOMPLISHMENTS AND UTILIZATION: Research plots in Brazil, Chile, Colombia, and El Salvador are relating crop yields to interaction of water with fertilizers, crop varieties, plant spacing, and land preparation. Increases from 40 to 100 percent over traditional yields are being achieved. Procedures for estimating irrigation requirements have been improved, and methods for increasing water infiltration rates and underground drainage in tight soils have been developed. Computerized hydrologic model simulation methods predict the effect of alternative land uses on the underlying ground water table, and the economics of alternative levels of water use technologies have been determined. Legal constraints on agricultural water use have been cataloged for five countries.

FUTURE PLANS: Assistance to USAID Missions and cooperating developing countries with their water management research needs will continue. Close backstopping support of field research will be maintained by on-campus USU water management staff.

PROJECT TITLE: Water Management Research in Arid and Sub-Humid Lands of the LDCs, Near East and South Asia

CONTRACTOR: Colorado State University, Fort Collins, Colorado 80521

CONTRACT COORDINATOR: Dr. W. D. Kemper, Project Director

PROJECT DURATION: Started 6/28/68; Termination Date 3/31/76

PURPOSE: This project for water management research in the Near East and South Asia is a companion to the Utah State University Latin America water management project, but the emphasis is on Pakistan and Vietnam. It is to improve on-farm water management practices. These practices will be integrated with other essential management and cultural procedures basic to producing more food in order to provide adequate nutrition for the growing populations of developing countries.

DESCRIPTION OF ACTIVITY: CSU is developing new technology and adapting known technologies to on-farm water management problems in developing countries. Research is: 1) determining the most efficient means of supplementing soil moisture with limited amounts of irrigation water; 2) developing data which can be used for on-farm design and construction of inexpensive conveyance, delivery, water application, and drainage systems; and 3) developing management systems to minimize salinity hazards. The focus is on problems of farmers with small holdings and limited employment opportunities, and cooperation with local institutions on research projects is emphasized.

ACCOMPLISHMENTS AND UTILIZATION: Land leveling has been initiated in a major portion of four watercourses in Pakistan to measure and demonstrate the improved water utilization obtained from properly leveled land. About 150 miles of canals and ditches are being lined with cement, brick, pipelines, and natural clay and their grades and alignments improved to study the effects of these practices on watercourse efficiency. Skimming wells for recovery of sweet water from thin layers overlying saline groundwater are being developed and field tested. Two land leveling training films were produced in both English and Urdu.

FUTURE PLANS: USAID/Pakistan and the Government of Pakistan are planning a major program based on CSU water management research. Benefits of the technology adaptations will be assessed further, with emphasis on those technologies which show special promise for small farmers.

PROJECT TITLE: Agronomic-Economic Research on Tropical Soils

CONTRACTOR: North Carolina State University, Raleigh 27607

CONTRACT COORDINATOR: Dr. C. B. McCants, Head
Soil Science Department

PROJECT DURATION: Started 6/30/70; Termination Date 6/30/75

PURPOSE: This research is: 1) to develop an economically sound system for making fertilizer recommendations in tropical regions, using fertilizer response data and soil analyses; and 2) to obtain the necessary soil chemistry, soil fertility, and economic data needed for such a system.

DESCRIPTION OF ACTIVITY: The contractor has an active field research program in Brazil, Peru, and Central America. Work in Brazil deals with aluminum, phosphate, and lime interactions in the soil and also with the possible limiting role of zinc in plant nutrition. Data from the regional soil testing project and previous experiments are being analyzed to devise profitable recommendations for farmers. In Yurimaguas, Peru, methods of land clearing, subsequent crop sequences, and associated fertility maintenance practices are being tested. In Central America, multiple cropping is being studied with emphasis on identifying factors which limit its use. More productive farming schemes are being developed for the poorer highland soils. Economists are assembling, screening, and analyzing results of past fertility trials as well as assisting with new research design.

ACCOMPLISHMENTS AND UTILIZATION: Through improved soil management, Peruvian potato experiments have shown net returns to farmers as high as $195 per hectare, nearly double the traditional return. Liming in Brazil at the rate of 2 tons per hectare produced maximum corn yields of 7.8 tons per hectare compared to traditional yields of 1 to 2 tons per hectare. Zinc and sulfur deficiencies have been identified in the Guatemalan altiplano. These could become major limiting factors for crop production under certain conditions; for example, zinc is particularly important for coffee, citrus, and corn production. In Costa Rica, multiple cropping experiments show promise of major increases in yield per hectare of land. "A Review of Soil Research in Tropical Latin America," published with a Spanish translation, evaluates a decade of research. From this base, new field and laboratory work has been initiated to provide a better understanding of soil chemistry and management as well as the practical economics of more intensive use of tropical soils. All this work has been conducted in cooperation with the regional soil testing project. It has helped explain anomalous data while providing a basis for more precise and profitable recommendations.

FUTURE PLANS: Micronutrient studies, multiple cropping plots, and pasture/forage combination plots in Central America will be continued until clear-cut trends develop. In Peru, further refinement of land clearing and development techniques will be tried in conjunction with various systems to maintain productivity through soil management, fertilizer and lime treatments, crop rotation, and pest control. In Brasilia, phosphate-lime-aluminum interactions will be studied further. Residual effects of zinc supplements will be determined and more precise recommendations developed. Various input costs and product prices will be used to determine the economic impact of alternative practices.

PROJECT TITLE: Soil Fertility in the Humid Tropics

CONTRACTOR: Cornell University, Ithaca, New York 14850

CONTRACT COORDINATOR: Dr. Matthew Drosdoff, Professor
Tropical Soils

PROJECT DURATION: Started 6/30/69; Termination Date 6/29/77

PURPOSE: This project is to develop improved, economically sound, and reliable food crop production systems for the deep, well-drained, acid soils of the humid tropics. Under present management methods, these soils are not cultivated or are only marginally productive.

DESCRIPTION OF ACTIVITY: These studies of acid tropical soils cover nitrogen economy; phosphorus utilization, fixation, and methods of application; aluminum toxicity; and the interactions of phosphates and aluminum with lime. Techniques include field observations and classification of soils, plants, and climates according to the ways they interact. Laboratory, greenhouse, and field trials are used to gain an understanding of fundamental factors in controlling crop production in the humid tropics.

ACCOMPLISHMENTS AND UTILIZATION: Project plots using improved fertilizer and soil management practices produced 100-bushel-per-acre corn for the first time in Puerto Rico. By introducing a new variety, this yield jumped to 180 bushels per acre, with average production 130-140 bushels per acre. The plots also showed that broadcasting phosphate applications (rather than banding) and very heavy applications (exceeding 1,000 pounds of P_2O_5 per acre) are needed for maximum yield. Localized placement, the normal practice in temperate regions, was not successful. At Brasilia liberal applications of nitrogen, phosphorus, and lime failed to produce a good corn crop unless zinc was applied, and only 3 pounds of zinc per acre was required for near maximum yield. Even in the rainy season, moisture stress reduced yields drastically. When aluminum toxicity restricted root development, plants suffered sooner and loss in yield was greater.

FUTURE PLANS: Current research will continue, with moisture studies an integral part. Puerto Rican work will be reduced and Brazilian work increased. New field efforts are planned in Ghana, and are being considered in Colombia and the Dominican Republic.

PROJECT TITLE: Improved Fertilizers for Developing Countries

CONTRACTOR: Tennessee Valley Authority, Muscle Shoals, Alabama 35660

CONTRACT COORDINATOR: Dr. Donald L. McCune, Director, International Staff

PROJECT DURATION: Started 3/1/73; Termination Date 6/30/76

PURPOSE: TVA is to identify fertilizers which offer significant advantages to LDC farmers, indicating the areas where these fertilizers may be applicable, appropriate technology for their production and handling, and methods for controlling their quality and assuring expected performance.

DESCRIPTION OF ACTIVITY: This project continues work started under a previous project, "Tailoring Fertilizer for Rice." It seeks to determine the potential demand for sulfur-coated urea and ground phosphate rock (identified as promising fertilizers in the earlier work). Possible substitutes for these and more conventional fertilizers are also being studied as a secondary project goal. Means of supplying micronutrients to assure timely and uniform distribution to plants are sought, and new or little-used materials are being screened for usefulness in developing countries because of special properties or low cost.

ACCOMPLISHMENTS AND UTILIZATION: It appears that phosphate rock may allow successful fertilization of highly acid soils; soluble phosphates are prohibitively expensive on these soils because of their rapid reversion. Zinc-coated nitrogen fertilizer, now under test, looks hopeful for zinc-deficit areas such as those identified in Brazil by North Carolina and Cornell teams. Arrangements have been made to test current fertilizers on a broad range of crops in Asia, Latin America, and Africa, and the nucleus of a project advisory committee has been formed. Further refinements in production technology have reduced the cost and increased the reliability of sulfur-coated urea. Substantial interest has been created in this product, but the current fertilizer shortage gives industry little incentive to launch new products designed to stimulate demand and open new markets.

FUTURE PLANS: A major program will be launched to test products in the field. Success in this program depends on the cooperation of many institutions throughout the world, since the project staff is too limited to conduct all the required field work. Linkages established with international institutes, universities, and Ministries of Agriculture virtually assure this cooperation. It is expected that several manufacturers will undertake production of sulfur-coated urea; means are being sought to mesh engineering design, operations management, and process control to assure a quality product.

PROJECT TITLE: Crop Production and Land Potential of Benchmark Asian and African Soils

CONTRACTOR: University of Hawaii, Honolulu 96822

CONTRACT COORDINATOR: Dr. L. Swindale, Department of Agronomy

PROJECT DURATION: Started FY 1974; Termination Date FY 1979

PURPOSE: This project seeks to correlate soil types with use of agrotechnology, crop yields, and land capabilities under various levels of crop management. It is essentially a test of whether the appraisal and development of LDC land resources can be speeded through the transfer of technologies from one area to another by relating them to soil types.

DESCRIPTION OF ACTIVITY: The contractor will concentrate on tropical soils in Asia and Africa while a parallel University of Puerto Rico project will concentrate on Latin American soils. Crop production and soil management experiments will be conducted on carefully selected benchmark soils belonging to related soil families (as defined by the U.S. soil taxonomic classification system). Agrotechnology has already been transferred at this family classification level in the temperate zones and within Hawaii. Soils used in the project will be red upland soils; these are inadequately used in most tropical countries, but have proven to be highly productive in Hawaii.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but local personnel have begun a training program on how to develop systematic information using the U.S. Soil Taxonomy.

FUTURE PLANS: Local personnel will be trained and detailed project plans developed. Before actual crop management research is started in the field, leaders of all current AID projects on tropical soils will meet to discuss and review the plans to help assure that the methodology will generate sound and efficient generalization of results.

PROJECT TITLE: Crop Production and Land Potential of Benchmark Latin American Soils

CONTRACTOR: University of Puerto Rico, Mayaguez 00708

CONTRACT COORDINATOR: Dr. F. H. Beinroth, Department of Agronomy

PROJECT DURATION: Started FY 1974; Termination Date FY 1979

PURPOSE: This project seeks to correlate soil types with use of agrotechnology, crop yields, and land capabilities under various levels of crop management. It is essentially a test of whether the appraisal and development of LDC land resources can be speeded through the transfer of technologies from one area to another by relating them to soil types.

DESCRIPTION OF ACTIVITY: The contractor will concentrate on tropical soils in Latin America, with the parallel University of Hawaii project concentrating on Asian and African soils. Crop production and soil management experiments will be conducted on carefully selected benchmark soils belonging to related soil families (as defined by the U.S. soil taxonomic classification system). Agrotechnology has already been transferred at this family classification level in the temperate zones and within Puerto Rico. Soils used in the project will be red upland soils; these are inadequately used in most tropical countries, but have proven to be highly productive in Puerto Rico.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but local personnel have begun a training program on how to develop systematic information using the U.S. Soil Taxonomy.

FUTURE PLANS: Local personnel will be trained and detailed project plans developed. Before actual crop management research is started in the field, leaders of all current AID projects on tropical soils will meet to discuss and review the plans to help assure that the methodology will generate sound and efficient generalization of results.

AGRICULTURAL INPUTS

RESEARCH PROJECTS

AID/W Coordinator

James Urano

PROJECT TITLE: Agricultural Equipment Development Research for Tropical Rice Cultivation

CONTRACTOR: International Rice Research Institute, Los Banos, Laguna, The Philippines

CONTRACT COORDINATOR: Dr. Amir U. Khan, Agricultural Engineer

PROJECT DURATION: Started 6/28/65; Termination Date 1/28/75

PURPOSE: This project is intended to increase farm production and intensify cropping through mechanization, at a cost that small farmers can afford. Animal and human power on rice farms in the Far East and other regions is generally inadequate at certain times of the year for continuous and/or multiple cropping. The ultimate objective of this project is maximum utilization of rural human, land, and water resources by 1) developing an internal manufacturing and marketing capability for small agricultural equipment, and 2) providing suitable agricultural equipment to small farmers in the tropics through commercial channels.

DESCRIPTION OF ACTIVITY: IRRI is conducting applied research on the major paddy mechanization problems and assisting in development of new or improved rice machinery. It is designing and developing commercially feasible machines within the manufacturing capability of the developing countries. Also, it is assessing the economic need and practical potential of such machinery.

ACCOMPLISHMENTS AND UTILIZATION: The project has devised 27 machines to assist paddy growers. A power weeder was put into production by a Japanese manufacturer who has sold over 10,000 units. Two Philippine companies are producing a table-type power thresher which is light enough to be carried along the narrow levees between fields. It is particularly adapted to use by farmers with limited acreage. The Philippine Government saluted its value with a Presidential Citation. Over 300 rice seeders have also been produced and sold. The latest design to be accepted by commercial manufacturers is a 6-8 horsepower paddy tractor. This unit will outwork a team of carabao and it costs less than half as much as a tractor of comparable horsepower imported from Japan. It is simple to maintain and repair. Parts can be bought locally. One company is producing about 50 units per month and another over 250. At last report there was a backlog of over 500 orders and an estimated immediate demand for over 5,000. More of these tractors were sold in the first 6 months of production than had been imported in the previous 2 1/2 years. Other units which show great promise but have not been produced commercially are: a low-lift, foot-powered water pump; a grain cleaner; a power take-off thresher; and a grain dryer with several heating units, including one fired with paddy hulls and rice straw.

FUTURE PLANS: IRRI will continue to develop various sizes and types of power equipment, although the outreach program to other countries will be emphasized and less time devoted to designing new machines. Field tests will be conducted to establish operating efficiency and obtain data for economic comparisons on cropping, harvesting, and management of power equipment. Assistance to manufacturers and distributors will be increased.

PROJECT TITLE: Weed Control in Less Developed Countries

CONTRACTOR: Oregon State University, Corvallis 97331

CONTRACT COORDINATOR: Dr. Stanley F. Miller, Director, International Plant Protection Center

PROJECT DURATION: Started 1966; Termination Date 1977

PURPOSE: This project aims to improve weed control research in the less developed countries, with the ultimate goal of reducing agricultural production losses caused by weeds. As new weed control technologies are developed, they are to be evaluated in terms of such multiple goals as improved labor utilization, more equitable income distribution, and economic efficiency.

DESCRIPTION OF ACTIVITY: The contractor identifies weed problems by species, extent, distribution, control methods, and economic importance, and works with institutions in designated countries to improve research facilities, conduct research, and improve training capabilities. Activities can be summarized as follows:

1. Identify the weed problems in the LDCs.
2. Test known and new methods of weed control for effectiveness under local, tropical conditions.
3. Train local agronomists in weed research and demonstration techniques.
4. Determine economic feasibility of weed control methods.
5. Develop weed research capabilities of local institutions.
6. Provide technical information to developing countries and USAID Missions.
7. Evaluate new problems and changes occurring in weed control technology.
8. Assist host countries in applying new weed control methods.

ACCOMPLISHMENTS AND UTILIZATION: Colombia and Ecuador are now virtually self-sufficient in weed control research and several other Latin American countries have active programs. The OSU agronomist working in Ecuador and Colombia trained more than 20 weed scientists and helped organize a Colombian Weed Science Society. Project personnel have held many 1- and 2-day seminars in LDCs, in addition to providing extensive technical backstopping. Research has identified alternative and integrated cultural, biological, and chemical weed control methods, with emphasis on solving problems related to the more important food crops.

FUTURE PLANS: Present programs will continue, but with increased emphasis on the socio-economic consequences of alternative weed control methods. Two weed research specialists assigned to a new project site in Northeast Brazil will be assisted by an economist who will develop socio-economic data related to the methodology and impact of weed control research in developing countries. Activities in Central America will also work toward minimizing use of chemical weed killers.

LIVESTOCK PRODUCTION RESEARCH PROJECTS

AID/W Coordinator

Michael N. Galli

PROJECT TITLE: Research on Hemoprotozoal Diseases of Food-Producing Livestock

CONTRACTOR: Texas A&M, College Station, Texas 77843

CONTRACT COORDINATOR: Dr. Fred Maurer, Associate Dean, Veterinary Faculty, Texas A&M

PROJECT DURATION: Started 6/30/68; Termination Date 6/30/78

PURPOSE: This research, centered in Colombia, is to develop immunizations or other controls for the reduction of hemoprotozoal livestock disease losses in tropical countries. These diseases, a major reason for low animal productivity in LDCs, are caused by blood parasites transmitted by biting insects or ticks. Red blood cell destruction leads to severe anemia; secondary effects cause high mortality and morbidity rates, with consequent loss of animal protein supplies for human nutrition.

DESCRIPTION OF ACTIVITY: The contractor is: 1) developing methods for controlling hemoprotozoal diseases by immunization and other preventive procedures; 2) determining ecological factors which contribute to the perpetuation of vectors and hemoprotozoal organisms in nature; 3) studying the interaction of certain hemoprotozoal organisms in relation to pathogenecity and immunity; 4) studying species' resistance to specific hemoprotozoal organisms; and 5) training host country specialists in methodology and in organization of problem-oriented research.

ACCOMPLISHMENTS AND UTILIZATION: Tests in zones with high hemoprotozoal diseases showed that, at 6 months, vaccinated calves had gained an average of 102 pounds on pasture while control calves had only a 6-pound gain. This reflected a 50 percent death loss in the control group. At 10 months, the premunized calves had gained 255 pounds compared to 75 pounds for the controls. Vaccination is inexpensive and provides a control method for small farmers who cannot afford spraying equipment or dipping vats to control tick vectors of these diseases. Research is now centered at the CIAT laboratories in Palmira, Colombia, with the field program also on CIAT land. Private cooperators are helping expand the immunization program. Additional data on tick ecology have been accumulated and they will be related to future field control experiments. The training program, involving Texas A&M graduate students along with Colombian graduate and undergraduate students, has been accelerated. Project specialists assisted Peru, Ecuador, Guatemala, and Panama in FY 73, and the service is being extended to other countries on request.

FUTURE PLANS: The project will continue exchanging data with researchers in East Africa and Australia. Research emphasis will be shifted toward immuno-chemistry and advances in tissue culture techniques. Workshops and seminars on the principles of controlling hemoprotozoal diseases and on effective methods of field immunization have been scheduled for several Central and South American countries. African and Asian researchers have been invited to attend.

PROJECT TITLE: Research on the Sterility Method of Tsetse Fly Control

CONTRACTOR: Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C. 20250

CONTRACT COORDINATOR: Dr. David Dame, Florida - Antilles Area
Insect Attractants and Biological Research Laboratory
P. O. Box 14565, Gainesville, Florida 32604

PROJECT DURATION: Started 6/14/63; Termination Date 6/30/77

PURPOSE: Because the tsetse fly transmits diseases to man and animals, infestations now hamper use of over 4 million square miles of highly productive agricultural land in Africa. This project, now in Phase II, is to validate the Phase I finding that tsetse fly can be eliminated, or at least effectively controlled, through male sterilization. Phase II extends laboratory research on cage rearing and sterilization, and expands the limited initial field test to a full-scale trial. Sterilized males will be released on about 200-300 square miles of infested land to determine if such releases will permanently eradicate the natural fly population, and to compare the cost with other methods of fly clearance.

DESCRIPTION OF ACTIVITY: Initially, Phase II establishes the fly colony needed for the release of sterile males in suitable numbers. An area near Tanga, Tanzania, has been selected for fly rearing and field testing. Periodic fly counts in the control area determine the sequential releases required; the area will be monitored for 6 months after the final release.

ACCOMPLISHMENTS AND UTILIZATION: Cage rearing of flies under laboratory conditions was achieved in Phase I. New techniques have increased pupae survival, and a new membrane feeding technique to supply blood meal promises to reduce operational costs. Within 2 years, the Tanzania station should be able to produce enough sterile male flies for field trials on some 300 square miles. Laboratories in Bristol, England; Lisbon, Portugal; Maisson-Alfort, France; and Siebersdorf, Austria, have now established successful rearing colonies also. Consultant services have been established with Dr. Jordon's Laboratory in Bristol, England, and the International Atomic Energy Agency in Vienna.

FUTURE PLANS: Ties with the new International Laboratory for Research on Animal Diseases in Kenya will be established. More emphasis will be placed on research in membrane feeding techniques. Cage rearing will be accelerated toward a goal of doubling the fly colony annually through FY 1977.

PROJECT TITLE: Control of Vertebrate Pests--Rats, Vampire Bats, Noxious Birds

CONTRACTOR: Bureau of Sport Fisheries and Wildlife, U.S. Department of Interior

CONTRACT COORDINATOR: Dr. Nelson Kverno, Wildlife Biologist
Denver Wildlife Research Center
Denver, Colorado 80225

PROJECT DURATION: Started 4/5/67; Termination Date 6/30/77

PURPOSE: Rodents, vampire bats, and noxious birds take a heavy toll on LDC food supplies. This project is designed to develop pest control methods that are safe, effective, economical, and adaptable to LDC social and economic conditions.

DESCRIPTION OF ACTIVITY: The project includes regional research at: 1) Laguna, Philippines--concentration on rats; 2) Palo Alto, Mexico--work on bats; and 3) Cali, Colombia--emphasis on birds. A Denver back-up base provides technical support and correlates data from the field. Staff also respond to AID Regional Bureau and Mission requests on a TDY (temporary duty) basis.

ACCOMPLISHMENTS AND UTILIZATION: A recent breakthrough in the vampire bat research is greatly reducing losses in cattle production without endangering desirable bat species and the environment. Bats cause substantial animal losses annually by transmitting rabies. They also cause damage estimated at a quarter billion dollars through blood loss and secondary infections. Under the project, five vampire bat control workshops have been conducted, training 245 technicians from six Latin American countries. The first laboratory bat colony was established to augment the training programs. Rearing colonies have been established in Mexico and artificial feeding systems substituted for host animal blood. Denver has made considerable progress in refined bat sensory equipment for field use. A team studying bird damage losses in African crops has assisted noxious bird control programs in some 20 countries. Most of the work is in collaboration with FAO. Of particular interest is the quelea bird, noted as the most numerous and destructive bird in the world. It seriously damages millet, sorghum, rice, and wheat in 25 African nations. The rat control project in the Philippines found that 90 percent of the 1,693 paddies sampled had tillers (stems) cut by rats. The average tiller loss was 2.5 percent, but 5.4 percent of the sample had over 10 percent of the tillers cut and some paddies went as high as 40 percent loss. To improve field extermination programs, the project developed new techniques for determining rodent populations and their seasonal changes; optimum baiting periods for maximum rat kills and most effective types of bait and baiting techniques. Rat control workshops, proven an effective training device in the Philippines, have been extended to other Asian countries.

FUTURE PLANS: Additional international workshops are being developed. New bird control programs for Africa and South America are being planned. A large-scale bat control program is in operation in Nicaragua. Others are planned for Bolivia and Brazil in 1974, and assistance to other Latin American nations will be provided upon request. The bat control program will be broadened to include protection of swine and horses.

PROJECT TITLE: Research on Mineral Adequacies, Deficiencies, and Toxicities for Grazing Ruminants in Latin America

CONTRACTOR: University of Florida, Gainesville 32601

CONTRACT COORDINATOR: Dr. Lee R. McDowell, Department of Animal Science

PROJECT DURATION: Started July 1974; Termination Date June 1977

PURPOSE: This project is to determine mineral deficiencies, adequacies, and toxicities in selected areas of Latin America where grazing livestock predominate; to evaluate the biological response and economic benefit of mineral supplementation for grazing animals; and to publish and distribute information designed to stimulate widespread use of appropriate mineral supplementation.

DESCRIPTION OF ACTIVITY: Working primarily in Brazil, Colombia, Ecuador, and Costa Rica, the contractor will obtain livestock tissue and forage samples from selected farms. Livers will be analyzed for trace mineral content. Calcium, phosphorous, and magnesium concentrations and their interactions will be evaluated from blood serum analyses. Forage samples will be analyzed for these and other minerals as well as inorganic sulfate. When warranted, bone tests and hemoglobin determinations will be performed. Mineral supplements will then be given to test animals for 1 year and their performance compared with that of a control group. Project personnel will work closely with CIAT in Colombia, and as information becomes available, it will be disseminated through Latin American and U.S. journals, special publications, and possibly workshops.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but the contractor already is operating related projects in three of the countries. The research also complements a 211 (d) grant for strengthening the University's capacity in ruminant livestock development. Other AID projects interlock with this work, including a Utah State Latin American feed composition project; agronomic-economic research on tropical soils by North Carolina State; a Cornell project on soil fertility in the humid tropics; and a North Carolina State soil fertility evaluation.

FUTURE PLANS: This is to be a four-phase project. Phase I will be concerned with reconnaissance and recruitment. Phase II covers experimentation. Phase III will bring about distribution and application of results. Phase IV involves extension.

AGRICULTURAL ECONOMICS AND SECTOR PLANNING RESEARCH PROJECTS

AID/W Coordinator

Lehman Fletcher

PROJECT TITLE: Analysis of Capital Formation and Technological Innovation at the Farm Level in LDCs

CONTRACTOR: Ohio State University, Columbus, Ohio 43210

CONTRACT COORDINATOR: Dr. David Boyne, Department of Agricultural Economics

PROJECT DURATION: Started 6/30/69; Termination Date 10/30/74

PURPOSE: This project investigates and describes capital formation at the farm and rural community level, including forces which influence the process. Using these data, the project is to design a system to evaluate policy alternatives for stimulating capital formation.

DESCRIPTION OF ACTIVITY: The project is conducting comprehensive analyses of agriculture to determine: 1) levels and types of capital formation; 2) the circumstances under which each type occurs; and 3) policies which encourage desirable amounts and forms. Analyses cover capital formation and use at the farm level and how technology, incentives, and policies (or the lack thereof) affect these. The project will identify factors which accelerate capital formation and, in turn, increase farm income and economic development.

ACCOMPLISHMENTS AND UTILIZATION: Over 1,700 in-depth farm interviews have been completed in a 19-county, 5-State area of Brazil, together with infrastructural analyses of capital and institutional development within selected municipalities. A sector model for the wheat region of South Brazil, built on the farm-level studies, is now operational. Early research results have been published in both English and Portuguese as journal articles and special papers. These studies are relating productivity and scale; making regional and farm type comparisons; determining use of mechanization, fertilizers, and labor; and analyzing how production, investment, and consumption interrelate. This is helping Brazilian and U. S. professionals better understand how agricultural policy decisions can stimulate capital formation and technological change, and policies are beginning to reflect this. Brazilian economists have enhanced their capacity to do complex economic analysis.

FUTURE PLANS: As the work in Brazil reaches completion, the processes of intersectoral capital transfers are being reviewed and analyzed. Brazilian officials will be encouraged and aided in utilization of the results.

PROJECT TITLE: The Impact of New Technology on Rural Employment and Income

CONTRACTOR: Cornell University, Ithaca, New York 14850

CONTRACT COORDINATOR: Dr. John W. Mellor, Professor
Agricultural Economics

PROJECT DURATION: Started 6/30/70; Termination Date Indefinite

PURPOSE: This project is to discover how rural income and employment are affected by new high-yielding varieties, increased fertilizer applications, and other technology associated with the Green Revolution. This information will help decisionmakers establish a basis for policies which will strengthen forces of growth, expand employment, and broaden income distribution.

DESCRIPTION OF ACTIVITY: The project will: 1) analyze relationships among new agricultural technologies, employment growth, increased income and improved income distribution; 2) study the impact, at the farm level, of agricultural growth on income distribution; and 3) develop a theoretical model for analyzing these relationships and their effects.

ACCOMPLISHMENTS AND UTILIZATION: A mathematical analytical model, using labor, food, and capital, showed complex interrelationships among technological change and employment growth and income distribution. A second model was then developed to simulate these interactions over time. New technology substantially increases rural income, although its effects vary according to the nature of the technology and the environment in which it is applied. Some 30-35 percent of the increased income usually goes for fruit, milk, vegetables, and nonfood grains. This increases employment opportunities since these are labor intensive. Still, even without mechanization, only 5-15 percent of the increased income from agricultural technology goes to low-income laborers through increased employment. And public programs are required as employment opportunities increase to deal with credit needs, production and marketing problems, and the climate of risk and uncertainty as the small-scale industries expand to more commercial-type operations and compete with larger-scale industries. There are interactions among increased incomes, the ability to pay for education, and the demand for educated people. Rural public works programs can alleviate employment problems and help distribute the increased income from technology, but not to the extent created by the problems resulting from the technology and its associated cropping pattern and demand changes. Besides, past rural public works programs have been located in areas with the least technological change, the study found. In these areas, agriculture is stagnant, so it does not provide a basis for increased production or long-term employment. Through these and other project results, Asian professionals better understand the second-generation problems resulting from high-yielding varieties and related Green Revolution technology. Asians trained in research procedures are moving into positions where their policies and programs influence the complex and interrelated growth, employment, and income distribution goals.

FUTURE PLANS: The simulation model will be perfected, and separate reports prepared on labor utilization in agriculture; relationships between technology and farm enterprise patterns; credit impact on farm employment; results of rural public works on rural employment; and effects of uncertainty on farm resource allocations. A new project is in preparation to extend the research to areas of production function analysis, rural labor supply schedules, and inter-sectoral simulation models.

PROJECT TITLE: Adapting and Testing of Agricultural Simulation Model to Sector Analysis

CONTRACTOR: Michigan State University
East Lansing, Michigan 48823

CONTRACT COORDINATOR: Dr. George E. Rossmiller, Department of Agricultural Economics

PROJECT DURATION: Started FY 1971; Termination Date Indefinite

PURPOSE: This project applies all or significant parts of an agricultural simulation model, developed in earlier phases of this project, to the analysis of agricultural development policy options in Nigeria and Korea. This practical application will determine whether the model can be used more effectively in defining programs, policies, and project options. If the model proves useful, the project is to develop the basis for applying it to USAID Mission and host country decisionmaking processes.

DESCRIPTION OF ACTIVITY: The project will develop, for selected development inputs, indicators of expected outputs, rates of return, manpower, income, and other results. It will analyze trade-offs that appear to exist among these inputs and the factors affected. These indicators and interpretations provide decisionmakers with a better, more comprehensive understanding of policy options than present, more intuitive procedures. Nigerian and Korean colleagues will be trained in the use and application of the model. A library is being developed which makes the model and its components available to external aid agencies as well as the host countries.

ACCOMPLISHMENTS AND UTILIZATION: In Nigeria, a series of livestock and crop options have been analyzed to help formulate that country's agricultural development plan. The joint Korean/MSU team has analyzed four broad policy alternatives and five specific investment options. The team has also developed grain management and livestock programs. Koreans have begun training programs at home and abroad.

FUTURE PLANS: Adaptive research is planned to improve model components, validate estimating processes, and work on critical data gathering. MSU staff will train personnel and interact with decisionmakers on policy, project, and program options. Project staff will help national institutions adopt the model approach.

PROJECT TITLE: Rural Employment in Tropical Africa: A Network Approach

CONTRACTOR: Michigan State University, East Lansing, Michigan 48823

CONTRACT COORDINATOR: Dr. Carl Eicher, Professor of Agricultural Economics

PROJECT DURATION: Started 6/16/72; Termination Date 3/31/75

PURPOSE: Unemployment in Africa, accelerated by the population explosion, is expected to increase even more during the latter half of the 1970's. Urban centers cannot employ significant numbers of the increasing labor force. Development plans of most West and Central African nations do not address the unemployment issue. Consequently, this project is to develop and refine a conceptual framework for analyzing rural employment and food production issues in tropical Africa.

DESCRIPTION OF ACTIVITY: This project is linking selected West and Central African countries into a research network concerned with critical employment/population/food issues. It will include support for Ph.D. candidate field research and fellowships. Research will determine how macro-economic policies affect labor absorption in agriculture; it will develop expertise in evaluating alternative labor-absorbing production and marketing systems and assessing alternative public policies to generate employment opportunities.

ACCOMPLISHMENTS AND UTILIZATION: Ethiopian, Nigerian, Sierra Leonian, and U.S. colleagues have agreed on concepts and methods for establishing the research network; personnel have been appointed; data collection has begun; training needs and specialists involved have been identified; and a library has been built.

FUTURE PLANS: Continue efforts to develop the methodology for the research network, conduct workshops and seminars, refine concepts, and conduct comparative analyses of rural employment problems in tropical Africa which will contribute to overall policy guidelines and methods. Develop a 1974-79 micro-level model for the Ada District in Ethiopia in cooperation with Haile Selassie 1 University to develop the capacity for micro-level research in rural areas.

PROJECT TITLE: Agricultural Diversification and Trade

CONTRACTOR: U.S. Department of Agriculture, Washington, D.C. 20250

CONTRACT COORDINATOR: Dr. Jay Atkinson, Economic Research Service

PROJECT DURATION: Started 5/28/71; Termination Date 3/31/75

PURPOSE: This project is to help LDCs develop data and analyses on realistic agricultural production and marketing alternatives; to enhance the research capacity of LDC agricultural and planning institutions; and to strengthen the mechanisms for continuous analysis and reevaluation of opportunities and alternatives as production and marketing conditions change. This supports LDC interest in agricultural diversification. Since high-yielding varieties have increased wheat and rice yields, LDCs are seeking a wider variety of agricultural production for domestic markets and expanded exports to earn foreign exchange.

DESCRIPTION OF ACTIVITY: Data on costs, supply responses, domestic demand, export opportunities, and transfer costs will be accumulated, analyzed, and organized to help decisionmakers understand the nature and consequences of policy options. ERS work will be in the Philippines; a similar North Carolina State University project is concentrating on Latin America.

ACCOMPLISHMENTS AND UTILIZATION: A seven-volume annotated bibliography with over 9,000 titles has been completed to help decisionmakers locate relevant materials; a survey of Green Revolution progress has been made emphasizing the relationships between fertilizer and rice yields; and agricultural economic papers have been prepared on such subjects as optimum farm size and the Philippine fertilizer industry. Significant progress has been made in developing frameworks and data inputs for linear programming models to be used for continual updating and reevaluation of alternatives. These include not only commodity models but models on agricultural policy, demand-price, and integrated agricultural production, among others.

FUTURE PLANS: Plans call for increased involvement of national institutions, personnel, and resources to accelerate data collection, processing, and analysis. This project will also conduct research workshops; strengthen linear programming capabilities; and develop linkages among decisionmaking groups.

PROJECT TITLE: Agricultural Diversification and Trade

CONTRACTOR: North Carolina State University, Raleigh 27607

CONTRACT COORDINATOR: Dr. R.L. Simmons, Department of Economics

PROJECT DURATION: Started 5/28/71; Termination Date 3/31/75

PURPOSE: This project, a companion to the U.S. Department of Agriculture Economic Research Service Philippine diversification project, is to find alternative uses for Latin American land resources devoted to food production to: 1) create higher income for farmers as they use their land more intensively; 2) produce farm commodities which better meet local tastes, demands, and needs; and 3) produce more products for international markets to earn additional foreign exchange income.

DESCRIPTION OF ACTIVITY: This project is examining possibilities for exporting Mexican and Central American vegetables to the U.S. East Coast fresh winter market. Collaborating with economists in Guatemala, El Salvador, Mexico, and Honduras, the project is identifying production and marketing costs and bottlenecks, export costs, and local and U.S. demand. Supply, demand, and cost information will be adjusted to take into account new technology; changes in market structure; institutional changes; and modifications in government policy, including capital investments to increase scale and eliminate problems.

ACCOMPLISHMENTS AND UTILIZATION: Time series data were used to predict the demand for winter green peppers in 41 U.S. and 5 Canadian markets. Another model was developed to predict the response of Florida growers to specific changes in such factors as prices and labor rates. A study was completed on production costs for cucumbers, green peppers, and cantaloupes in three irrigated regions in Guatemala. A linear programming model incorporating risk aversion restrictions was used to analyze competition between the export vegetables and the safer but lower income traditional crops for domestic use.

FUTURE PLANS: Data gathered in earlier stages of the project will be used to develop a competitive spatial equilibrium model. Alternative sizes and types of marketing plants will be evaluated for Central America and costs determined. Research will develop supply response data for each production area; the level and likely changes in market demand in the United States and each participating country; the import demand in the United States and its limitations caused by import policies or practices; and transfer costs, their impact on prices, and how they could be reduced by investments or institutional changes. A model will simulate trade flows and relative prices among regions according to alternative production, market, and trade strategies. Workshops and international seminars will continue to disseminate information gained in the research.

TECHNICAL ASSISTANCE PROJECTS

PROJECT TITLE: Pest Management and Related Environmental Protection

CONTRACTOR: University of California, Berkeley, California 94720

CONTRACT COORDINATOR: Ray F. Smith, Head
Department of Entomology

PROJECT DURATION: Started 7/1/71; Termination Date 6/30/76

PURPOSE: This project appraises major pest and disease problems and their economic effects on LDC crop production. It identifies critical problems, sets priorities, and determines the nature and scope of research, training, and technical assistance needed to solve the problems.

DESCRIPTION OF ACTIVITY: Now in Phase II, the project is providing research and technical assistance in the evaluation, procurement, and use of pesticides. Particular emphasis is on environmental concerns and development of regulatory and pesticide residue monitoring capability. It is also developing country and international integrated pest management skills.

ACCOMPLISHMENTS AND UTILIZATION: Seven multidisciplinary teams have determined major crop protection problems around the world, and several countries and USAID Missions have begun programs to solve these. A basic crop protection library has been designed and Pest Management Advisory Group formed to advise AID on pesticide procurement and directives. Safeguards and regulatory procedures have been developed for importation, manufacture, formulation, distribution, and use of pesticides in LDCs. Materials published include a three-volume "Pesticide Manual," a "Directory of Plant Pathologists," and numerous reports on pest problems in West and Central Africa; Central America; South America; and Mediterranean, Near East, and Southeast Asian countries. Over 80 scientists attended a seminar in El Salvador on "Management of Pesticides and Protection of the Environment."

FUTURE PLANS: The project will: 1) train and retrain crop protection and pest management specialists; 2) educate farmers on crop protection techniques; 3) build in-country institutions to deal with pest management; 4) develop crop protection systems; and 5) continue backstopping activities. It will assist LDCs with pesticide residue problems, improve information exchanges with international institutions, and arrange multidisciplinary cooperation to establish an agro-medical approach to the pesticide and pest control problem. Pest management seminars are planned for Indonesia, Colombia, the Philippines, and Pakistan.

PROJECT TITLE: Fertilizers, Technical Assistance (Management, Marketing, Surveys, Training, and Engineering)

CONTRACTOR: National Fertilizer Development Center, TVA, Muscle Shoals, Alabama 35660

CONTRACT COORDINATOR: Dr. Donald L. McCune, Director
International Fertilizer Development Staff

PROJECT DURATION: Started 11/16/65; Termination Date Indefinite

PURPOSE: This project identifies, assesses, and helps to remove deficiencies in LDC fertilizer programs, solving problems of inefficient fertilizer factories, resource development, process engineering, market research, product distribution, and field use. It also serves as the nerve center for basic data on world fertilizer production and use, as well as a center for demand studies.

DESCRIPTION OF ACTIVITY: Because ample supplies of fertilizer are necessary to meet food production goals, more LDC requests for technical assistance are being answered this year than ever before. TVA is providing technical assistance to LDCs to increase fertilizer production, and provide data for decisionmaking and training. A study of fertilizer marketing in 30 countries is providing information for a marketing manual and for regional seminars on infrastructure and policy matters in LDCs.

ACCOMPLISHMENTS AND UTILIZATION: Project publications include 33 country studies and 100 technical or regional reports. There have been 66 technical teams in 38 countries working on more than 105 projects. TVA has shown that bulk handling of urea is practical, with considerable savings in cost and labor. More than 300 foreign fertilizer specialists have been trained. TVA has completed in-depth fertilizer marketing studies in five Central American countries.

FUTURE PLANS: Plans are underway for a high-level fertilizer marketing and use seminar in Latin America in October, 1974. Later a similar seminar will be held in Southeast Asia. Data collection and engineering studies will be continued. Emphasis in 1974/75 will be given to the growing number of requests for technical help in fertilizer manufacturing because of shortages of urea, triple superphosphate, and ammonium phosphate.

PROJECT TITLE: Seed Program and Industry Development

CONTRACTOR: Mississippi State University, State College, Mississippi 39762

CONTRACT COORDINATOR: Dr. James C. Delouche, Professor of Agronomy

PROJECT DURATION: Started 3/18/57; Termination Date Indefinite

PURPOSE: Poor seed seriously limits LDC agricultural production. Most LDCs cannot supply sufficient good quality, improved seed, even though high-yielding varieties may have been developed. This project, then, is to increase the capability of the LDCs to supply improved seed to their farmers.

DESCRIPTION OF ACTIVITY: MSU responds to USAID and host government requests for technical assistance in planning, organizing, and implementing seed improvement programs in such areas as: 1) seed multiplication, processing, drying, storage, certification, and distribution; 2) planning, designing, and constructing facilities; and 3) establishing and operating seed testing programs. Engineers, agronomists, seed processing specialists, geneticists, seed technologists, and plant management and operation specialists for technical assistance and training programs are provided by MSU.

ACCOMPLISHMENTS AND UTILIZATION: Seed processing, handling, and testing facilities have been installed and are operating in 16 countries, and plans have been developed for such facilities in 7 other countries. More than 300 seed program administrators, technologists, and specialists from 33 countries have been trained in their own countries and/or at MSU, and some 450 others have had 2- and 3-day programs with MSU staff. Research on seed drying facilities and methods has been adapted to LDC conditions. The project has generated some 175 reports, 150 bulletins for LDC distribution, and 51 M.S. or Ph.D. dissertations.

FUTURE PLANS: Technical assistance activities will be continued and expanded to meet the rapidly increasing demand for MSU assistance. Training schools and seminars, private sector seed industry development, and seed program and policy planning will be emphasized.

PROJECT TITLE: Plant and Seed Materials for Development of Potential Crops in LDCs

CONTRACTOR: U.S. Department of Agriculture, Agricultural Research Service, Beltsville, Maryland 20705

CONTRACT COORDINATOR: Dr. Howard L. Hyland, Plant Introduction, New Crops Research Branch

PROJECT DURATION: Started 6/22/55; Termination Date Indefinite

PURPOSE: Agricultural productivity in most developing countries is directly related to the characteristics of the indigenous crops being grown; typically, these are low-yielding. Advances in plant breeding have demonstrated that crop yields and nutritional quality can be greatly enhanced, provided there is a wide germ plasm base with which to work. This project provides this germ plasm service to scientists engaged in LDC crop improvement programs.

DESCRIPTION OF ACTIVITY: USDA's Agricultural Research Service (ARS) provides USAID Missions with technical advisory services and experimental quantities of improved seed and vegetative stocks. This broadens the germ plasm base available for plant introduction, collection, screening, and maintenance of varieties.

ACCOMPLISHMENTS AND UTILIZATION: More than 1,000 lots of seeds or planting stocks are distributed annually to developing countries through this project. A germ plasm collection of more than 600 yam varieties was recently established at the Federal Experiment Station, Mayaguez, Puerto Rico. Individual introductions from the world sorghum collection are evaluated regularly and working collections maintained at the Mayaguez Station. The Purdue, Nebraska, and Texas programs are using selected germ plasms to incorporate high-protein and disease and insect resistance into high-yielding varieties.

FUTURE PLANS: The contractor will continue present activities, responding to USAID Mission requests for plant and seed material as well as requests from regional plant introduction centers and LDC institutions.

PROJECT TITLE: Technical Assistance in Food Grain Drying, Storage, Handling, and Transportation

CONTRACTOR: Kansas State University, Manhattan, Kansas 66502

CONTRACT COORDINATOR: Dr. William J. Hoover, Grain Sciences Institute

PROJECT DURATION: Started 6/30/67; Termination Date 6/30/76

PURPOSE: Estimates of LDC food grain losses from the field to the consumer are as high as 50 percent of total production; in some cases, this exceeds food deficits. This project is to reduce losses of food grains and food grain quality during post-harvest handling, drying, and storage.

DESCRIPTION OF ACTIVITY: The contract is: 1) helping diagnose and solve food grain drying, storage, conditioning, handling, and transportation problems in cooperating countries; 2) conducting training courses, seminars, and conferences on these subjects for USAID and LDC personnel; 3) responding to technical inquiries; and 4) conducting adaptive research on grain preservation on small farms and in remote areas.

ACCOMPLISHMENTS AND UTILIZATION: KSU has assisted storage and marketing activities in Ghana, Dominican Republic, Honduras, Guyana, Jordan, Korea, Morocco, Guatemala, El Salvador, Panama, Ecuador, Bolivia, Brazil, Colombia, Indonesia, and West Africa. Major projects included helping implement grain storage and marketing programs in Honduras, West Pakistan, and West Africa (Entente Fund Program), as well as designing grain handling facilities and evaluating construction practices in Indonesia, Honduras, Senegal, Guatemala, and Nepal. The contractor has trained 143 participants from 22 countries in short courses and workshops at the University and overseas. In addition, KSU has conducted seminars for 150 operations and management personnel.

FUTURE PLANS: KSU will continue responding to LDC requests for help in grain handling, preservation, and marketing. A seminar is planned for Southeast Asia in January, 1975. A short course will be held on the KSU campus, June 17 to August 10, 1974. Adaptive research will be directed toward storage on small, average farms as well as farm-to-first-collection-point problems.

PROJECT TITLE: International Agricultural Economics Seminars

CONTRACTOR: Agricultural Development Council, Inc., 630 Fifth Avenue, New York City, New York 10020

CONTRACT COORDINATOR: Dr. Abraham M. Weisblat, Director, Research and Training Network

PROJECT DURATION: Started 6/30/70; Termination Date 6/30/75

PURPOSE: This project is to provide a means for U.S. and foreign professionals to identify pressing agricultural development problems, pool knowledge, gain understanding, and develop joint efforts to analyze and determine how policy alternatives affect resource use.

DESCRIPTION OF ACTIVITY: Seminars, workshops, and conferences focus on problem identification and information exchange, with concentration on sector planning, rural employment, income distribution, water resource development, markets and trade, and allocation of resources to accelerate technological changes. The project increases U.S. and foreign scientists' awareness of critical agricultural development challenges, and achieves substantial agreement of suitable ways to analyze these problems. An important element is curriculum development, in both U.S. and LDC educational institutions, on such agricultural policy issues as production incentives, land use, administration of agricultural programs, and the interrelationships of population, employment, and economic development.

ACCOMPLISHMENTS AND UTILIZATION: Some 475 U.S. and LDC social scientists have attended seminars, workshops, and conferences on methodological approaches to development. New course content and course modifications have been developed.

FUTURE PLANS: The contractor will continue overseas seminars, with greater involvement of LDC participants and more intensive treatment of the problem areas identified by TA/AGR for concentrated research and technical assistance programs. This work will further the development of curricula and course content at educational centers.

PROJECT TITLE: Improved Nutrition Information to Assist Increasing Livestock Production

CONTRACTOR: Utah State University, Logan 84321

CONTRACT COORDINATOR: Dr. L.E. Harris, Department of Animal Science

PROJECT DURATION: Started FY 1974; Termination Date FY 1977

PURPOSE: By establishing an international, computerized center, the project is to make feed composition information more readily available to LDC livestock producers. With such information, farmers can prepare more balanced feeding rations, thereby using scarce resources more efficiently and increasing production.

DESCRIPTION OF ACTIVITY: Working closely with the Food and Agriculture Organization of the United Nations and using a standardized "International Source Form" devised by an ad hoc FAO committee, the contractor will collect information on the nutrient composition of various livestock feeds such as forages, legumes, cereals, and crop residues. USU will guide laboratories and individuals in data reporting and then collate or otherwise process and enter the information into the computer. Throughout the work, USU will respond to requests for feed composition information, and also conduct seminars and workshops. When sufficient data are available, USU will publish an "Atlas of Nutritional Data on Feeds."

ACCOMPLISHMENTS AND UTILIZATION: The project is just getting underway, but the contractor has already gained considerable expertise in similar U.S. and Canadian endeavors and, more recently, work as a consultant and cooperator on a University of Florida AID contract compiling information from Latin America. USU was also a primary participant on ad hoc FAO committees regarding development of an "International Network of Feed Information Centers."

FUTURE PLANS: Immediate plans include establishing the project and beginning data collection.

PROJECT TITLE: Agricultural Credit Follow-up to the 1973 AID Spring Review

CONTRACTOR: Ohio State University, Columbus 43210

CONTRACT COORDINATOR: Dr. David Boyne, Department of Agricultural Economics

PROJECT DURATION: Started June 1974; Termination Date November 1975

PURPOSE: This project is to develop an information service to help LDCs resolve credit issues identified in the 1973 AID Spring Review. The Review demonstrated that policymakers, credit specialists, and researchers in small farmer credit programs are often isolated from information. They have few opportunities for interchanging credit ideas.

DESCRIPTION OF ACTIVITY: OSU, working closely with AID, will plan, schedule, and conduct three regional workshops; publish a bi-monthly newsletter for distribution to appropriate LDC officials and international development institutions; answer requests for published credit materials; identify potential LDC credit research topics; and provide small research grants to qualified LDC researchers. Upon AID request, the contractor will also identify and locate credit consultants for AID programs.

ACCOMPLISHMENTS AND UTILIZATION: The project is in its initial stage and there is as yet no information on these aspects.

FUTURE PLANS: Plans call for a model newsletter to be prepared within the first month; the agenda for the first workshop to be developed within 3 months; and research projects to be proposed within 6 months.

PROJECT TITLE: Technical Inquiries, Information, and Reports

CONTRACTOR: Economic Research Service and Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250

CONTRACT COORDINATOR: Oliver Bauman (ERS) and Don Carter (ES)

PROJECT DURATION: Started 7/74; Termination Date Indefinite

PURPOSE: This project provides a variety of agricultural information and related services to support AID activities.

DESCRIPTION OF ACTIVITY: USDA develops and edits technical manuscripts covering AID-sponsored and AID-related research and technical assistance; writes and distributes newsletters and press releases on materials relevant to AID development programs; provides technical information support services to AID direct hire, contract, and PASA personnel on overseas assignments; maintains a reference center and cooperates with AID's memory bank; and consults with international visitors and others regarding ways to strengthen services and programs in developing countries.

ACCOMPLISHMENTS AND UTILIZATION: This is a new project, but it continues work heretofore funded from other sources. In the first quarter, over 400 requests for technical information were answered; 144 publications were mailed to AID Missions and PASA personnel; airgrams dispatched outlining services available to the USAIDs; and three PASA team reports and two newsletters were published and several other manuscripts were written and editorial processes begun.

FUTURE PLANS: Continue and modify services as shifting program emphasis dictates.

Assistance by TA/AGR Staff Specialists

TA/AGR has some 25 competent agricultural specialists available to provide technical assistance to LDCs upon request from USAID Missions and Regional Bureaus. These specialists have extended experience in LDCs and have professional competence in such subjects as land use, soil management and fertilizers, water conservation and management, crop production, crop protection, livestock production, animal health, agricultural sector analysis, agricultural policies and planning, marketing, and agribusiness. This staff also maintains liaison with the international agricultural research institutes discussed earlier in this report as well as the United Nations agencies with agricultural programs in LDCs.

Travel costs for staff members responding to Mission technical assistance requests are arranged by mutual agreement between TA/AGR and the respective Regional Bureaus.

Assistance by Special Consultants

TA/AGR also maintains a roster of technical consultants, all highly qualified specialists in particular aspects of LDC agricultural operations. USAID Missions can tap this expertise through respective AID Regional Bureaus. Costs for consultant services are funded by mutual agreement among the USAID Mission, the Regional Bureau, and TA/AGR.

Assistance from Universities with 211(d) Experience

Universities with agricultural competence developed through 211(d) grants (see next section) may also be utilized in meeting field requests for technical assistance. This is arranged by the Office of Agriculture to the extent that "Basic Ordering Agreements," funded by the Technical Assistance Bureau, have been established so individual "Task Orders" can be used to send specialists to the field on particular assignments.

211(d) GRANTS TO U.S. UNIVERSITIES AND COLLEGES

Section 211 (d) of the Foreign Assistance Act of 1966 authorized grants to U.S. educational and research institutions for the purpose of building competence and expertise in selected areas related to international grants currently in effect.

- Ruminant Livestock Development Consortium. The Agricultural Livestock Division, TA/AGR, has a consortium of universities working on ruminant livestock development programs in the tropics. Using 211 (d) grants, this group of universities is improving its capacity to design livestock development and improvement programs through a multi-disciplinary approach. Many staff members have had foreign experience and nearly all are available for consultation. Consortium members and their specific disciplines are:

  a. Purdue University - Production and marketing systems.

  b. Texas A&M University - Livestock breeding and disease control.

  c. Tuskegee Institute - Design and organization of systems to integrate and disseminate technological information.

  d. University of Florida - Forage production and ruminant nutrition.

- Council of U.S. Universities for Soil and Water Development in Arid and Subhumid Areas (CUSUSWASH). Universities cooperating in this council, together with their major research interests, are:

  a. University of Arizona--Watershed management.

  b. Colorado State University--Water delivery and removal systems.

  c. Utah State University--On-farm water resource management.

- University of Wisconsin--Land tenure and related institutional development in LDCs.

- Consortium for Staff Support in Agricultural Economics. This university consortium mobilizes U.S. professionals in support of LDC agricultural economics programs. Consortium members are:

  a. Iowa State University

  b. Cornell University

  c. Michigan State University

  d. University of Minnesota

  e. Southern University

  f. Virginia State College

● Tropical Soils Consortium. Schools developing technical knowledge on tropical soils under this consortium, together with their main research interests, are:

a. Prairie View A&M College--Soil fertility problems under savanna-prairie ecology.

b. Cornell University--Soil cultural systems.

c. North Carolina State University--Soil fertility and soil properties.

d. University of Hawaii--Soil biology and mineralogy.

e. University of Puerto Rico--Soil conservation and protection.

f. University of Rhode Island--International center for marine fisheries resource development.

g. Auburn University--International center for fresh water (aquaculture) fisheries resource development.

● Consortium for Rural/Agricultural Development in Asia. The six universities in this consortium and their main research interests are:

a. University of Illinois--Crop diseases.

b. Kansas State University--Grain storage, handling, and utilization.

c. University of Missouri--Crop breeding.

d. Ohio State University--Soil fertility and plant-water relationships.

e. Pennsylvania State University--Seed production and technolgoy.

f. University of Tennessee--Agricultural economics and rural sociology.

● Tropical Soybean Improvement. The universities involved and their research responsibilities include:

a. University of Illinois--Plant breeding.

b. University of Puerto Rico--Disease and insect resistance and cultural practices.

- Proposed Grant Projects.

a. Consortium on dryland moisture conservation.

(Two universities to be selected.)

b. Consortium on management of natural forage (rangeland) resources.

(Two universities to be selected.)