

65241 c.1
Ing.

Centro
Internacional de
Agricultura
Tropical



Agricultural and economic
development in the lowland tropics

65241 c.1

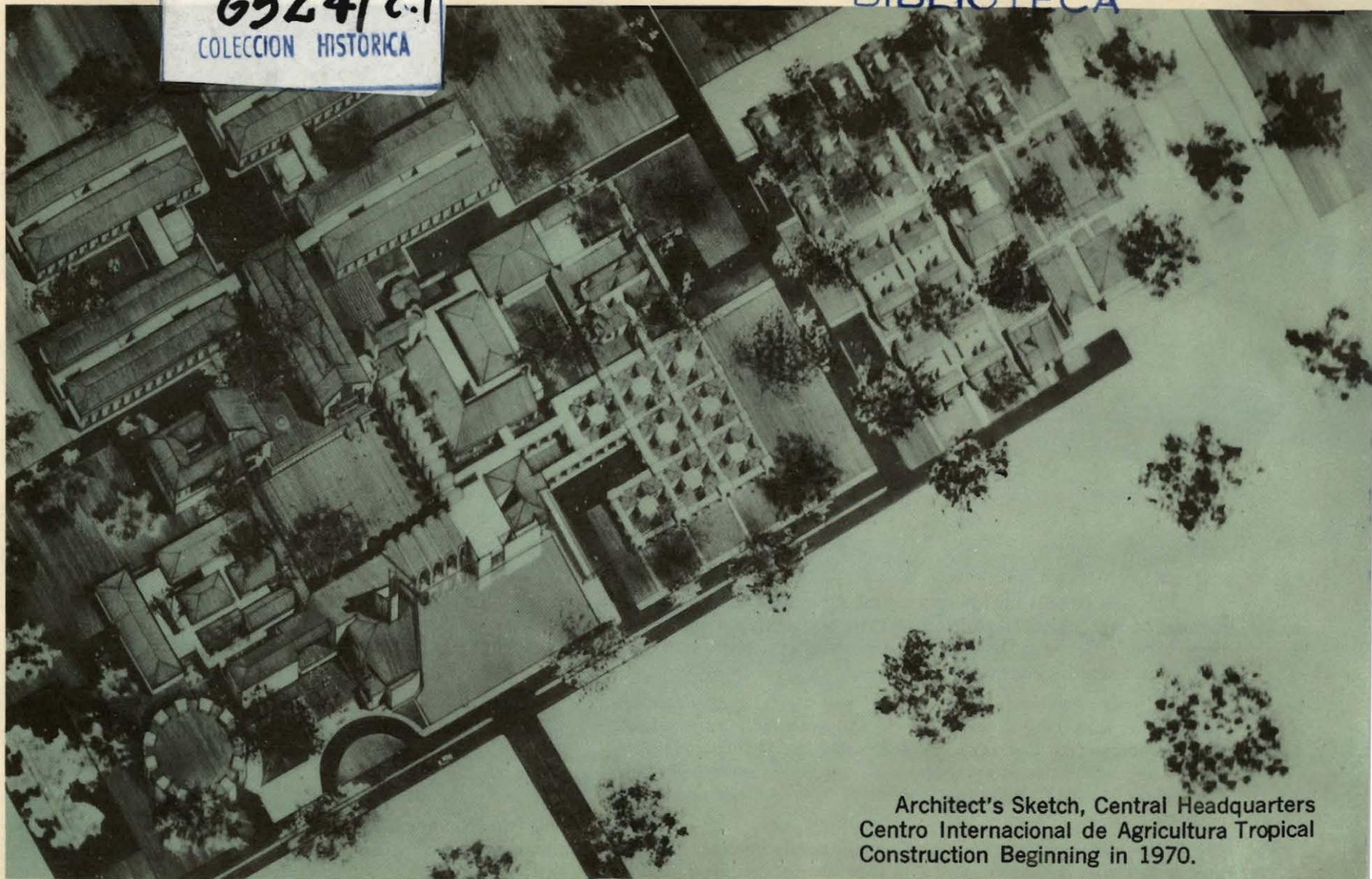
CIAT

5670
6524/c.1

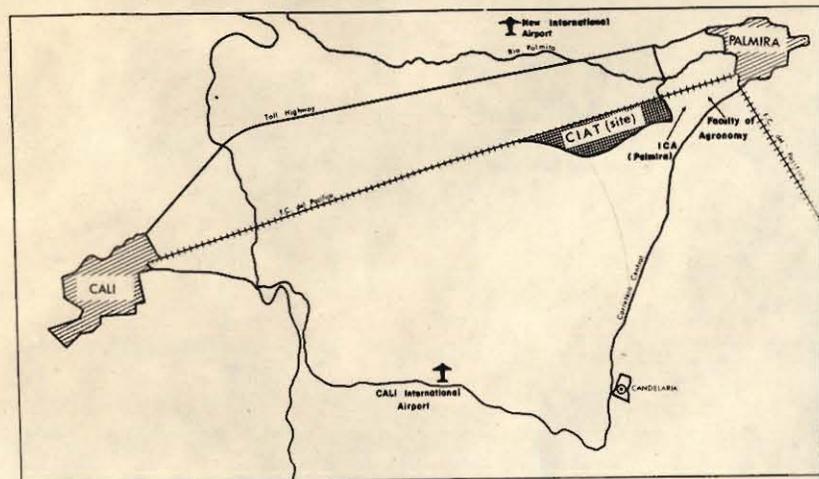
COLECCION HISTORICA

49118
CIAT

BIBLIOTECA



Architect's Sketch, Central Headquarters
Centro Internacional de Agricultura Tropical
Construction Beginning in 1970.



The International Center for Tropical Agriculture (Centro Internacional de Agricultura Tropical) (CIAT) is organized as a non-profit corporation in Colombia. It is under the direction of a Board of Trustees and an Executive Committee of the Board.

The principal financial sponsors at present are the Ford Foundation, the W. K. Kellogg Foundation, and the Rockefeller Foundation. The Government of Colombia, by purchasing the headquarters site and making it available at a nominal rent, contributes substantially to the support of CIAT. Additional sources of future support are anticipated.

Within Colombia, the Instituto Colombiano Agropecuario (ICA) greatly facilitates the activities of CIAT by sharing its research and

training facilities, participating in cooperative projects, and providing personnel for consultation and work in specific projects. Other close cooperators in Colombia include the National University and the University of the Valley. Additional cooperating partners in Colombia and other countries are invited.

While central headquarters are being constructed on the 500-hectare site near Palmira, Colombia, the CIAT staff is housed with cooperating institutions and in leased facilities in Cali.

With the philosophies and objectives outlined, the CIAT programs and activities described herein are being initiated as rapidly as staff and facilities permit.



Global problems associated with economic development and feeding growing populations demand new, imaginative solutions. The world needs better ways to organize resources to find answers to these problems and to translate them into action. Governments, public and private institutions, and individuals seek help to undertake productive action programs of research, education, and development.

CIAT has been created to work with existing agencies to pioneer new agricultural research and educational approaches in the lowland tropics. CIAT is the Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture), an institution designed to engage decisively—in both the technological and socio-economic aspects—with the closely related issues of economic development, food production, and adequate diets.

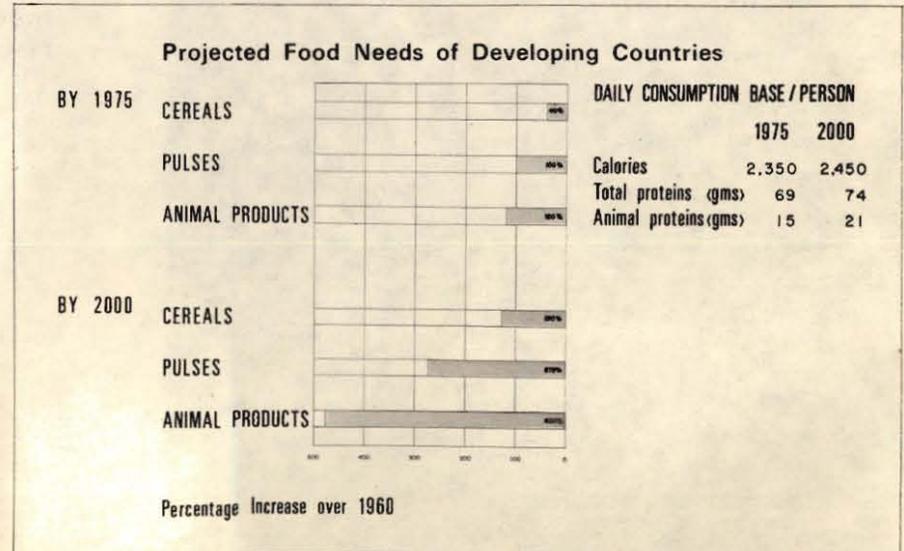
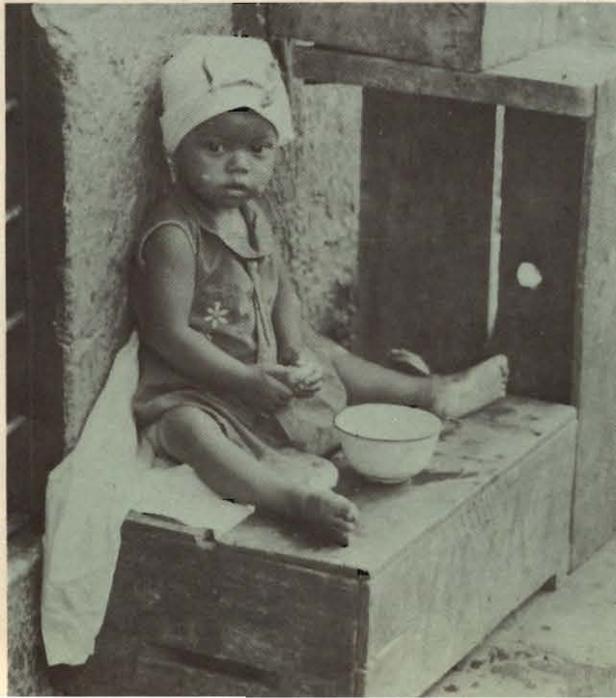
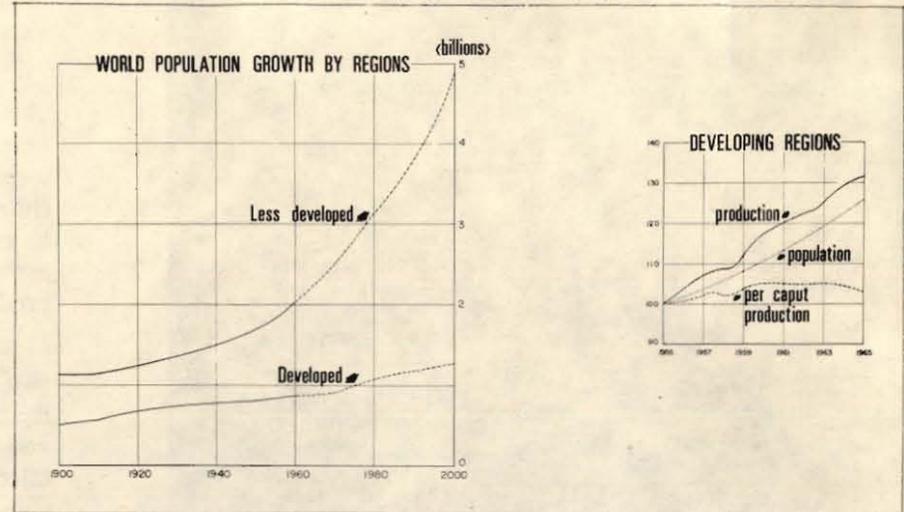
CIAT seeks to identify and solve specific animal and crop production and utilization problems. Its organization provides ways to organize men and resources so that many entities can help develop, support, and extend the research and educational activities. As an autonomous, international, non-profit entity, CIAT, when fully established, will provide data for national development programs, will operate an international conference center for national leaders, and will provide a wide range of training opportunities.

Many people . . . limited food . . . inadequate markets . . . conditions typical of the developing world.

Food production lags population growth

Food production in the developing countries lags population growth. Per capita production is decreasing in many areas despite efforts to bring additional land into production and to increase yields. The situation now demands far greater production increases and much faster rates than any experienced to date.

Short term projections vividly illustrate the tremendous increases in cereals, pulses, and animal products required to supply the rather modest daily food needs (calories and proteins) of the anticipated population. For instance, meeting food needs in the year 2000 will require increases of production, over 1960, of animal products 485 percent, of pulses 275 percent, and of cereals 130 percent. **The premium will be on protein production.**



Problems and Potentials

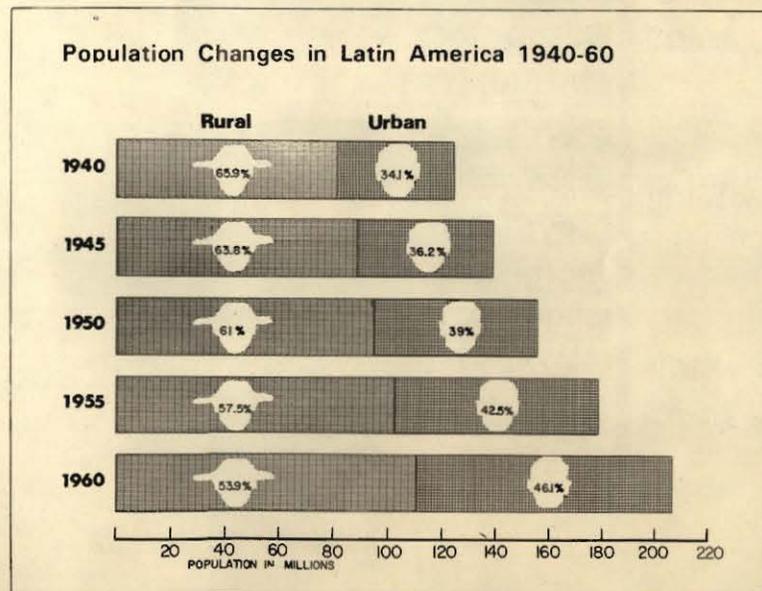
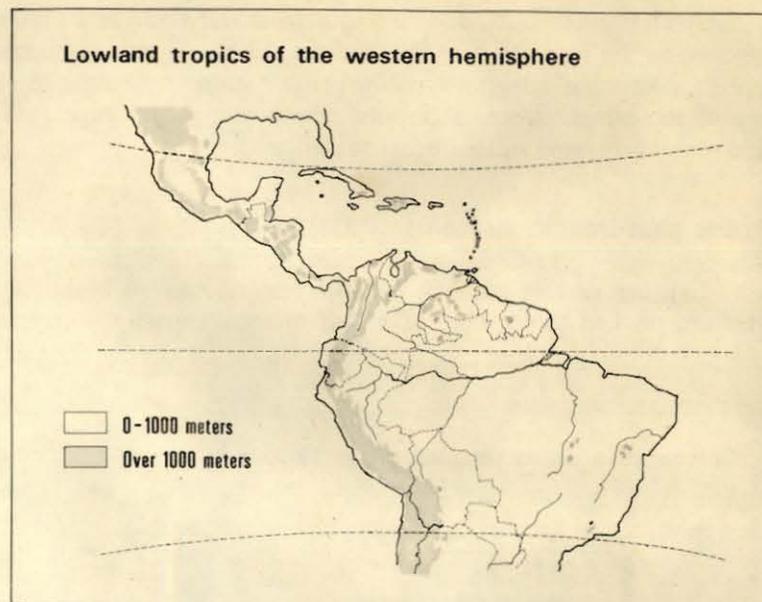
CIAT initially concentrates on specific agricultural problems of tropical Latin America from sea level to 1,000 meters. The food-population problems of Latin America are compounded by the limited amount of naturally fertile land suitable for cultivated crops, rapid movement of rural people to the cities, and the sparse population and lack of development in the tropical lowlands. Increased economic growth depends on increasing agricultural productivity at a rate of at least 5 percent a year.

Factors contributing to the great agricultural potential of the lowland tropics include solar energy (1.6 to 1.9 times greater than that of the humid temperate areas), uniformly high temperatures, ample rainfall in most areas, and a more uniform day length. Where moisture is available the year around, varieties which are insensitive to day length can be grown continuously under adequate systems of multiple cropping.

While crop and animal product yields in Latin America are low, preliminary research indicates crop yields can be significantly increased with improved management, new varieties, fertilizers, and agricultural chemicals for weed and insect control. Livestock production can be increased through improved feeding, breeding and animal health practices.

Crop research efforts of CIAT focus on the development of varieties with high yield and quality potential which are not sensitive to day length and on the control of insects, diseases and weeds, the use of improved soil management and fertilization procedures, and proper use of machinery, structures and methods for cultivation, harvesting, drying, processing, storing, and marketing.

Livestock research concentrates on the development of year-round pastures and forages, beef production systems, adequate life-cycle nutrition, utilization of by-product and indigenous feedstuffs, increasing the calf crop, beef cattle crossbreeding programs, and prevention and control of disease and parasites.



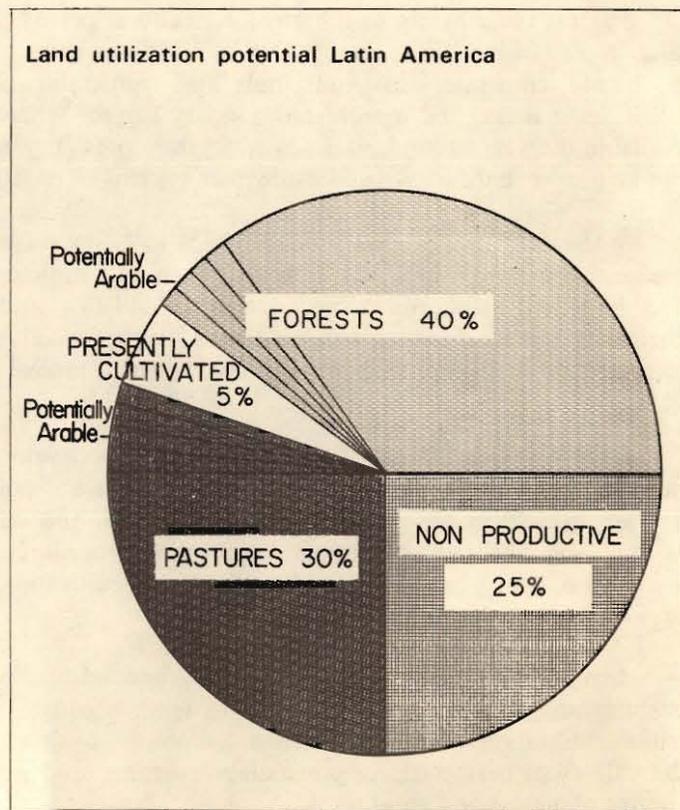
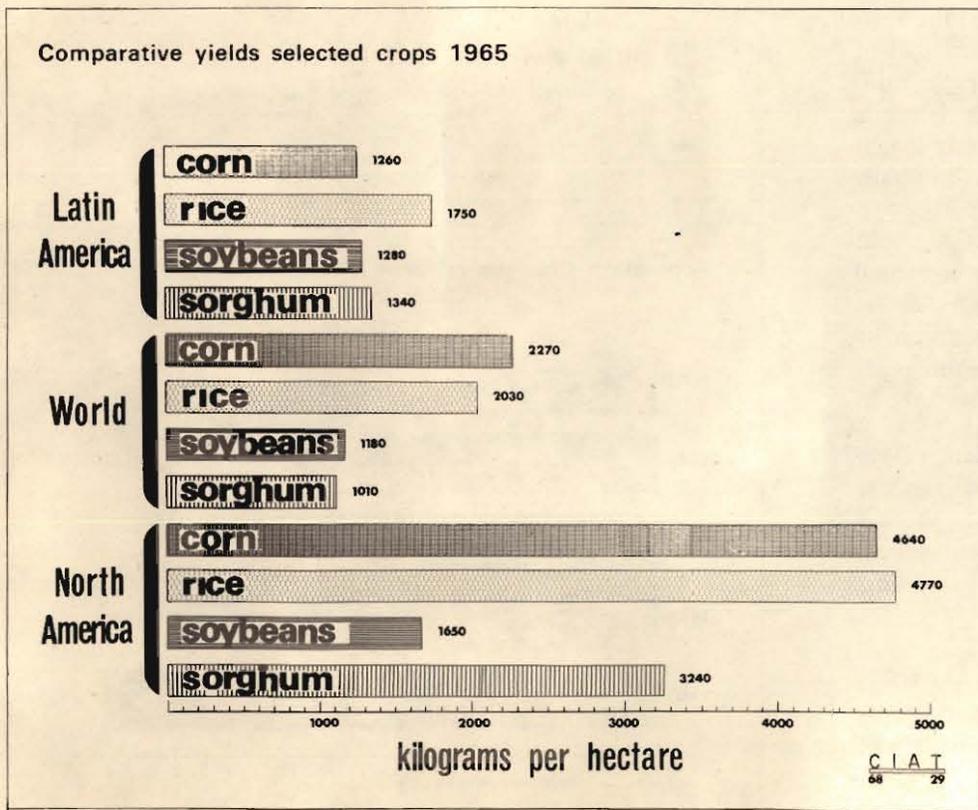
CIAT programs are designed to help develop and test production systems on the farm, to help increase the supply of trained manpower, and to encourage integrated public-private support systems to supply credit, incentives, technical inputs, transportation, storage, markets, and sound economic and technical guidance.

From pastures to proteins

Existing pasture lands in the low tropical regions of Latin America are stocked to no more than half of their capacity. For example,

the Colombian and Venezuelan Llanos, now almost idle, could support as many cattle as are currently found in both countries. In Brazil, the Campo Cerrado area of approximately two hundred millions hectares currently supports no more than ten million head of cattle—a fraction of its potential.

Apart from the role of ruminant animals in converting low quality forages to meat and milk for humans, domestic animals will continue to be important in the conversion into food for humans of many higher quality feedstuffs, not destined for human consumption, such as reject bananas, cassava, and sugar cane products.



Mission and philosophy of CIAT

The mission of CIAT is to accelerate agricultural and economic development and to increase agricultural production and productivity of the tropics so as to improve the diets and welfare of the people of the world. CIAT works in concert with governments, educational and research institutions, and private enterprise.

CIAT also is concerned with economic development leading to improved buying power so that urban residents may purchase and thus benefit from the increased food supplies.

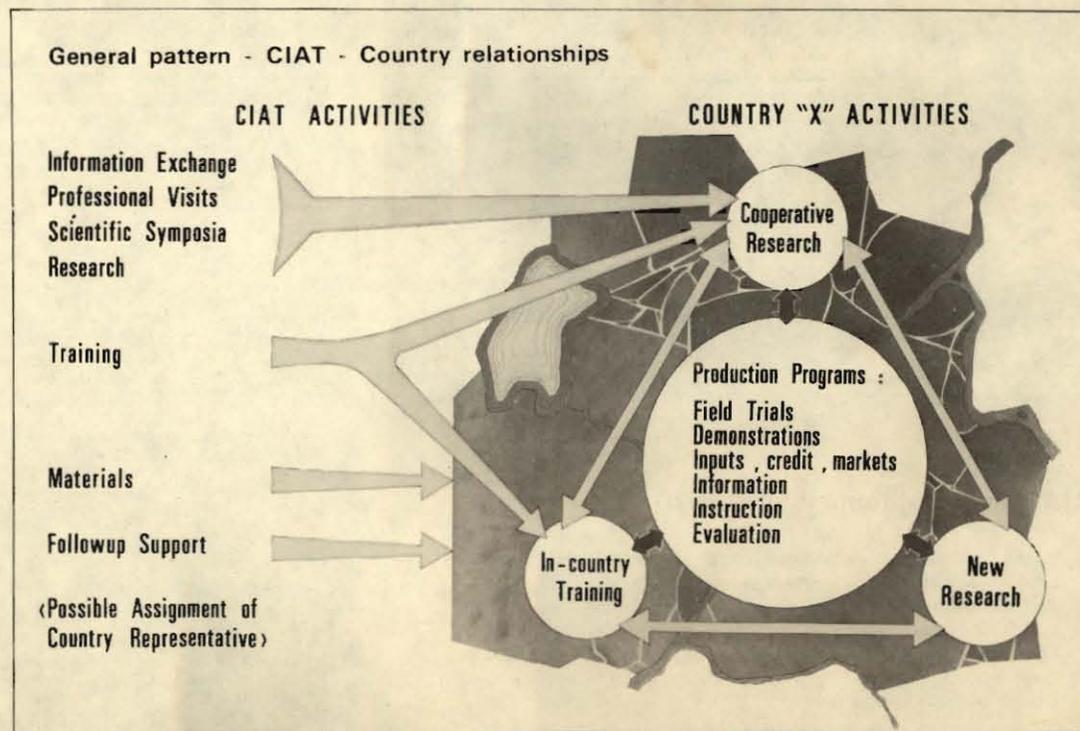
CIAT has specific goals and seeks maximum results in optimum periods of time. Its operations are characterized by multi-disciplinary approaches, concentrated thrusts, cooperative efforts with public and private entities, and parallel efforts to demonstrate and multiply results.

CIAT's basic operational philosophy is:

- To develop and demonstrate a pace-setting level of program excellence;
- To collaborate and cooperate with national institutions throughout the lowland tropics on research, educational, and extension programs, and to assist in the strengthening of these institutions.
- To be catalytic in the economic and agricultural development of the tropics; and
- To maintain mutually complementary programs and relationships with other international and regional organizations, particularly the International Rice Research Institute (IRRI), the International Maize and Wheat

Improvement Center (CIMMYT), the International Institute of Tropical Agriculture (IITA), and the Instituto Interamericano de Ciencias Agrícolas (IICA).

- To establish and maintain cooperative linkages with agricultural research and training institutions in the developed countries.



How CIAT relates itself generally to national agricultural development programs and to institutions within each country.

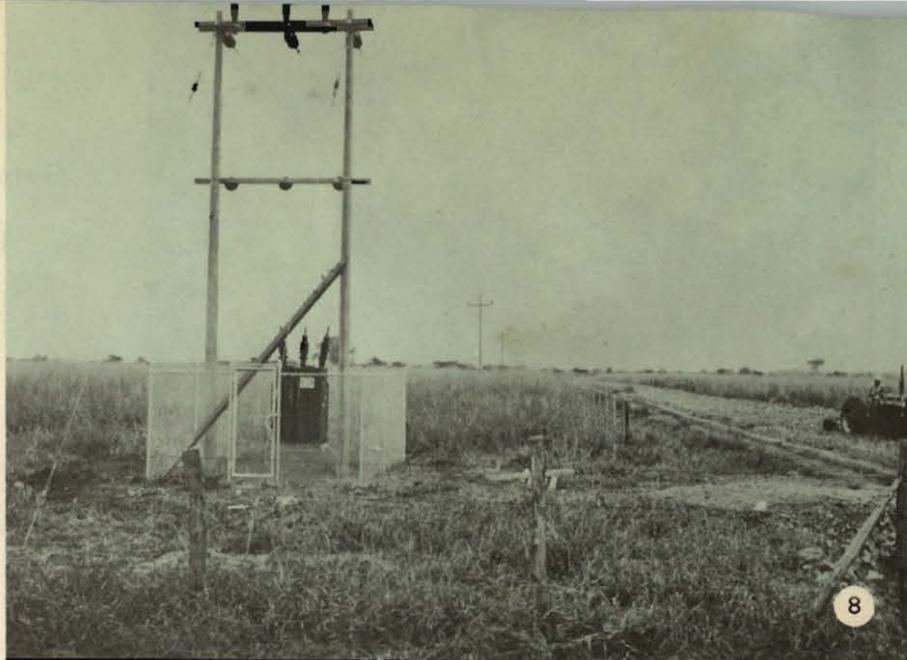


CIAT in development: 1969-70

- (1) Board Chairman Francisco de Sola and Architect Jaime Ponce de León inspect a model of the headquarters site.
- (2) Representatives of the sponsoring foundations review the construction plans: Russell Mawby, W. K. Kellogg Foundation; Lowell Hardin, Ford Foundation, and Lewis M. Roberts, Rockefeller Foundation.
- (3) Director U. J. Grant and Soils Scientist James Spain take soil samples on the 500-hectare farm.
- (4) Surveyors begin work on farm development.
- (5) Bulldozers build roads and clear land.



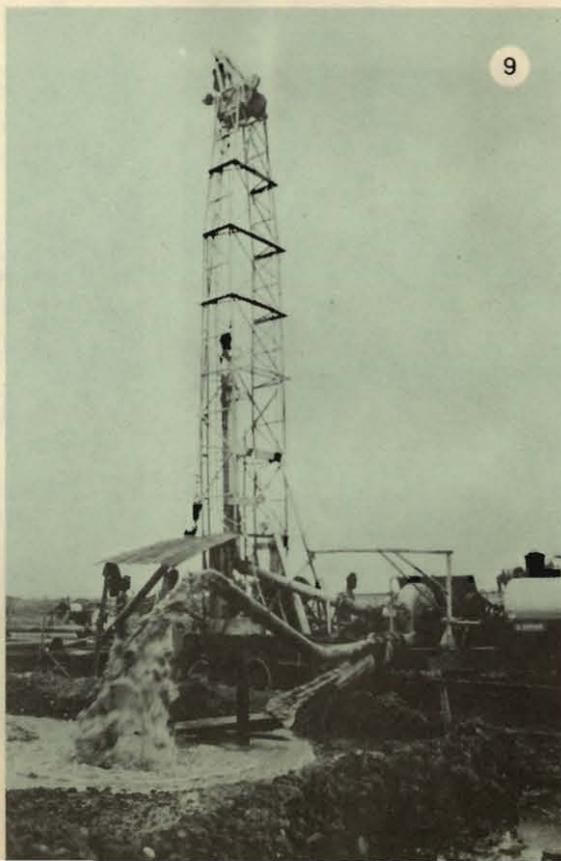
6



8



7



9

- (6) A fence, canal and road form the 15-kilometer boundary of the farm.
- (7) Gravel from a deposit on the farm is used to surface roads.
- (8) Electricity reaches the building site.
- (9) Drilling of the first of five wells nears completion.



General activities

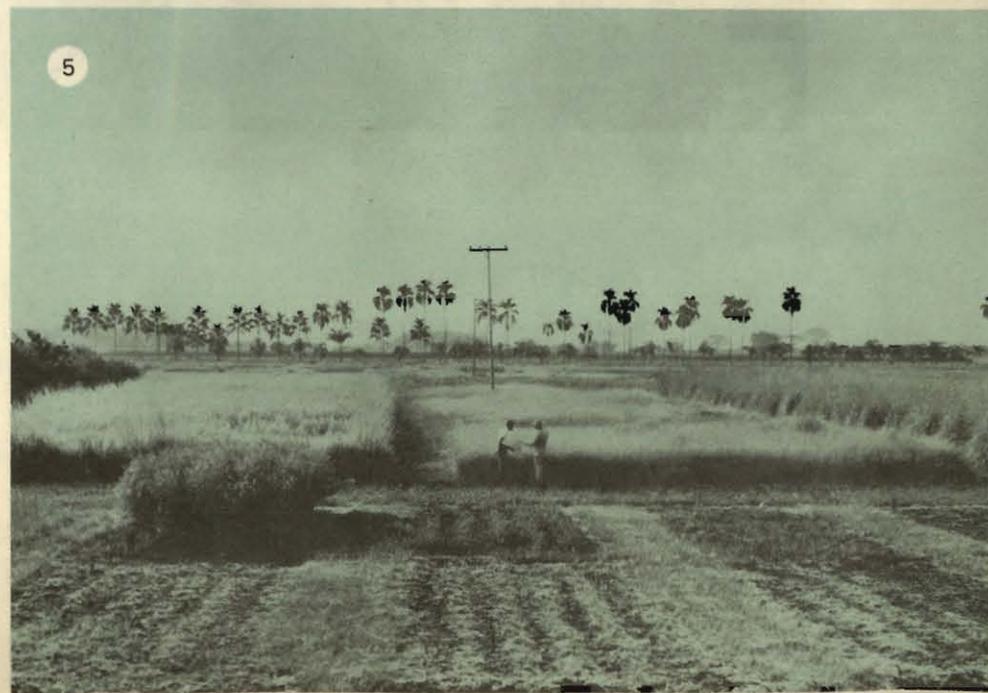
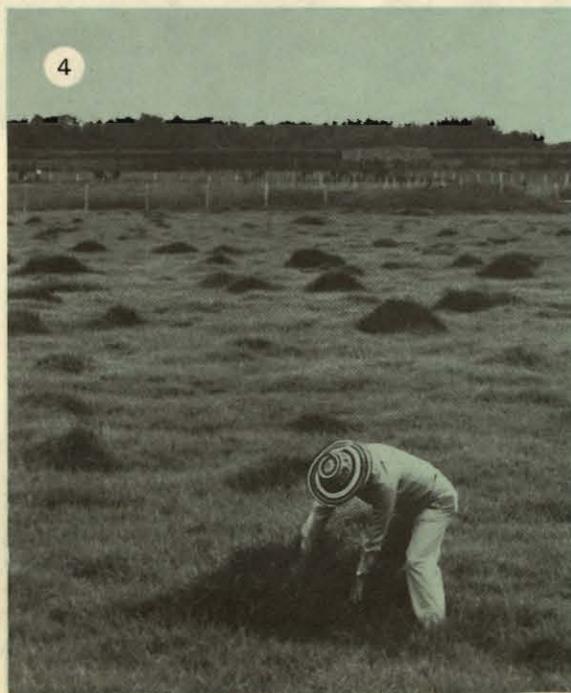
CIAT concentrates its programs on the agricultural problems of the tropical lowland areas below 1,000 meters elevation and engages in a range of activities, as follows:

1. Develops and demonstrates production systems for given crops and animal species in specific environments.
2. Develops information and practices for use in bringing into economical production designated lowland areas not presently developed or fully utilized.
3. Develops and demonstrates effective techniques and strategies for the rapid spread and adoption of improved varieties and agricultural practices.
4. Helps national institutions to develop staffs, programs, and facilities so that these may handle more effectively present and future research and educational tasks.



5. Provides an information center to process and exchange data and references relevant to the agricultural and economic development of the lowland tropics.
6. Provides facilities and staff to collect, preserve, supply, and exchange plant and animal germ plasm.
7. Provides opportunities for the further training and development of professionals and non-professionals in agriculture at CIAT and elsewhere.

The range of environmental conditions in the lowland tropics of Latin America necessitates research and training at many locations. Research and educational organizations already exist in most of these areas, and CIAT seeks to develop close working relationships with interested institutions where facilities permit.



CIAT conducts research on its own farm and in cooperation with national agencies in Colombia and elsewhere.

(1) y (2). Plant breeders and agronomists seek more productive corn varieties, particularly strains containing increased amounts of lysine and tryptophan, essential to the supply and utilization of proteins in corn.

(3). Agriculturists inspect the expanding collection of more than 1200 varieties of yuca.

(4) y (5). Pastures and forage experiments of ICA at Palmira, and (6) Range cattle in the Eastern Plains (Los Llanos) of Colombia.



Animal sciences and animal health

Beef

Prospects for beef are excellent in the tropics. Pastures are abundant in many areas. Existing stocks, particularly Brahman (Zebu) and several local breeds, resist tropical environmental stresses and efficiently convert forage to beef. Vaccines of variable quality and various pharmaceuticals are generally available.

Pastures and forages are not used efficiently. Extensive grassland areas are stocked only to a fraction of capacity. Mineral and protein deficiencies in animals are widespread, and food intake is

often inadequate. Existing stocks have not been selected for production.

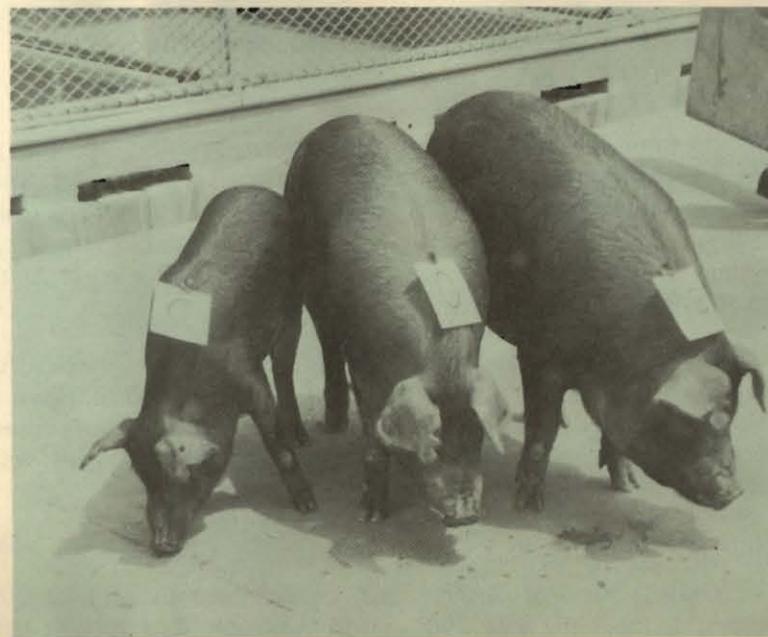
Disease and parasitism contribute to retarded growth, poor productive performance, and high mortality. Existing technology has been poorly applied, and many gaps still exist in characterizing certain aspects of disease and parasitism, their control and treatment. Reproductive performance is low in most areas, with calving percentages ranging between 40 and 50 percent.

Beef production in the tropical areas under consideration probably could be doubled or perhaps tripled in the next decade through the application of improved management systems to the existing grasslands and cattle population. Production could be eventually increased by perhaps as much as 10-fold through optimal utilization of available pasture lands, adequate nutrition, selection and cross-breeding, and control of diseases and parasites.

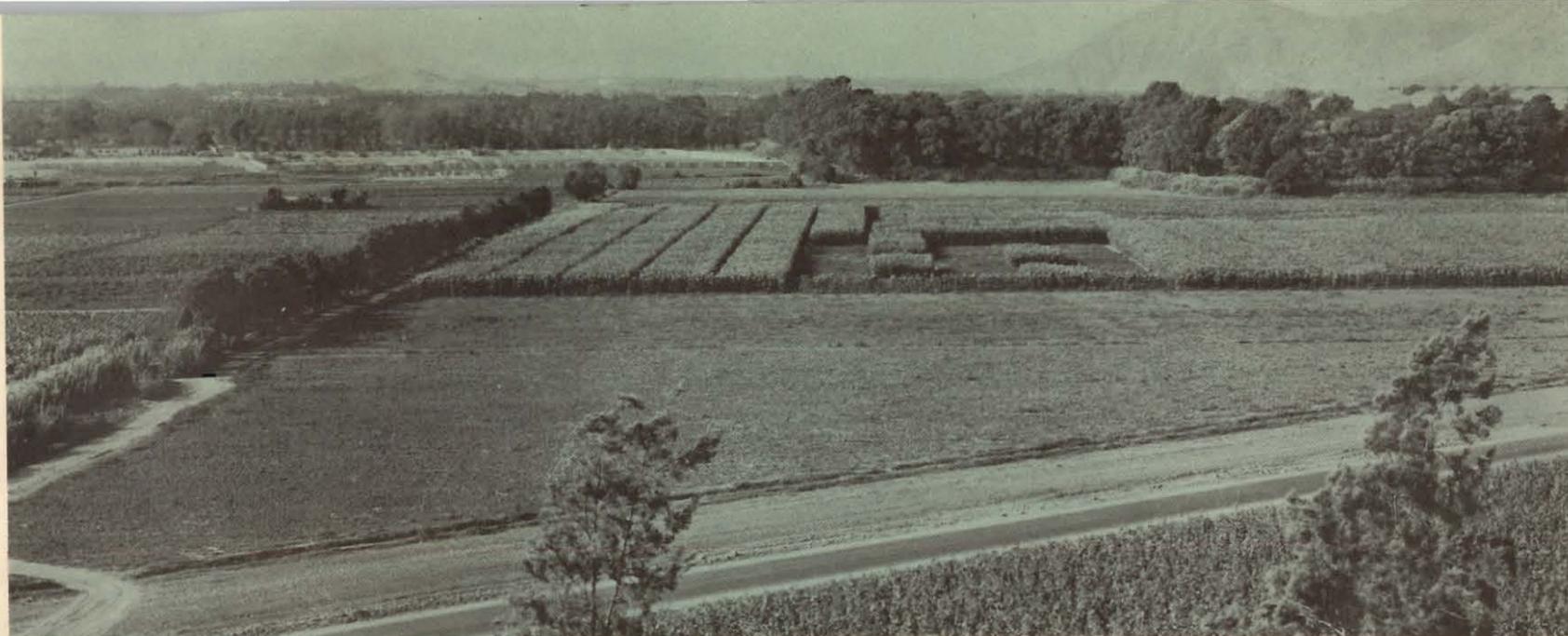
Swine

The wide range of adaptability of improved breeds of swine, the ease with which their environment can be modified, and the high rate of production and reproduction of the species offer great potential for easily increasing and improving pork production in the tropics. There are many excellent feed resources available, including cassava, reject bananas, sugar cane by-products and other energy protein feeds. Advances are being made in the identification and control of swine parasites and diseases.

Although environmental conditions favor efficient swine production, management systems are poor, malnutrition and undernutrition are widespread, unimproved breeding animals are used, and disease and parasite control measures are ignored. Many changes can be accomplished by applying existing technology, while research seeks the elimination of weak links in the production systems.



- (1) Breeds, such as the Zebu, cross well with many native strains to produce cattle capable of efficiently converting forage into beef.
- (2) The importance of protein in the diet of pigs is dramatized in this trial of litter mates. The pig at left ate only common corn, the one in the middle only opaque-2 (the high lysine corn), while the one at right had common corn supplemented with proteins.



Plant sciences and agronomic systems

Forages

Beef production in the tropics requires priority attention to forage production and utilization. Improved pasture and forage management and production systems are prime goals. At least 30 percent of the land area of Latin America is in pasture, and only a small portion of these pasture lands is likely to be shifted soon to cultivated crops in the near future.

Forage research emphasizes introduction of new species for the region, yield factors, weed control, fertilization, forage legumes, nitrogen-fixing bacteria, persistence of legumes under various forms of management, seed production and harvest, and nutritional evaluation of forage.

Plant Proteins

Grain legume production must be increased by at least 100 percent to meet the year 2000 needs. Available data suggest that

soybeans and cowpeas are more utilizable, higher yielding and perhaps more adapted than other available grain legume species. Concentrated work, starting with a world collection, is underway to identify breeding material of those species more suitable for the tropics than varieties now grown. Other pulses may be studied. Disease and insect problems on legumes are extremely severe in the lowland tropics, particularly in areas of high rainfall, and will receive appropriate attention.

Plant Starches

Yuca (also called cassava and manioc) provides a high percentage of the starch people eat in the tropics. Available data indicate that yuca now yields much more starch per unit area per unit time than does corn. Other data indicate that yuca is as good as corn for energy feed for swine and poultry if it is properly dried and supplemented with minerals. Although yuca grows around the world

and millions of tons are produced annually, research has been sparse and has lacked continuity.

Plant Protection

Plant growth in the lowland tropics is greatly accelerated when moisture is adequate because of high year-around temperatures. In such an environment, however, diseases develop and insects multiply at rates approaching their biological limits, and weeds grow unbelievably fast.

A crop production program implies identification and use of genetic disease and insect resistance as well as methods for the control of insects and weeds.

Corn

Corn is the principal food of millions of people in the tropics, and dramatic possibilities now exist for enriching the diets of these persons through introduction of the opaque-2 (high lysine) gene into local corn varieties. Most present varieties of corn cannot be moved widely over latitude and altitude ranges, therefore a continuing and strong improvement program is needed to develop materials for use around the world at the same latitude. In addition, CIAT collaborates with CIMMYT to develop corn varieties which are not sensitive to variations in photoperiod, heat and drouth stress, and light quality-consequently they will be more geographically mobile.

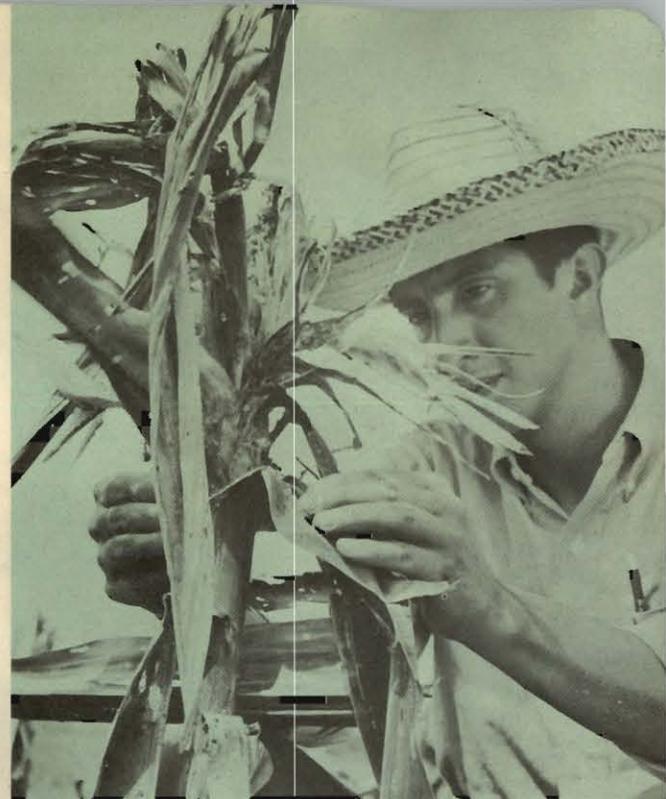
Rice

Encouraged by the success of IRRI in producing high-yielding rice varieties for the tropical lowlands of Southeast Asia, the countries of the Western Hemisphere seek to increase rice yields, to improve the rice quality, and to expand rice acreages. CIAT's rice program builds on the new IRRI varieties and adapts and makes these available; at the same time, it encourages local breeding and development programs by providing germ plasm, training, and technical assistance.

Agronomic Systems

Significant research results frequently are never effectively integrated into production systems. While farmers may quickly adopt

Insects, birds, and diseases challenge research workers in the tropics.



Research on yuca (cassava) concentrates on seeking varieties with increased protein content and more easier harvested mechanically.





Efficient, economical means of controlling weeds in cultivated crops, such as corn, are a must in the tropics.

some new practices, such as use of adequate fertilizer, they may fail to control insects or may neglect to manage properly irrigation and thus fail to profit from investments in fertilizer. Other factors of concern to CIAT include the relationship between crop and animal production on the same farm, logical rotation systems in row crop areas, how to maximize economic return from a given area in a calendar year by means of multiple cropping, and the economic use of farm labor, power and machinery.

Soils

Most traditional agriculture of the lowland tropics is based on soils of recent alluvial origin and those found in areas of low rainfall. These present few unique problems, and adaptive research, based on knowledge gained in temperate regions, is feasible. Attention is being focused on soil management, including seedbed preparation and systems of minimum tillage.

In contrast to the alluvial soils, the highly weathered, acid soils of the geologically old plains and plateaus of the humid lowland tropics present entirely new problems which require original research in determining basic soil properties and processes. This knowledge is required to formulate production systems.

These soils are important because of their extent (approximately 50 percent of the total land area in the tropics) and potential productivity if properly limed and fertilized. Their topography favors efficient mechanized production. The major research problems are related to extreme soil acidity and attendant difficulties of aluminum toxicity, calcium and magnesium deficiencies and phosphorus fixation. Most soils are deficient in nitrogen, phosphorus, and potassium and frequently are marginal or deficient with respect to sulphur, magnesium, and calcium, and the micronutrients zinc, boron, copper, and molybdenum.

Soil microbiology is an important component of CIAT's research and training program because of the potential importance of legumes for grain and forage and the limited information available about symbiotic and non-symbiotic nitrogen fixation and other microbiological processes in tropical soils.

Training and communication program

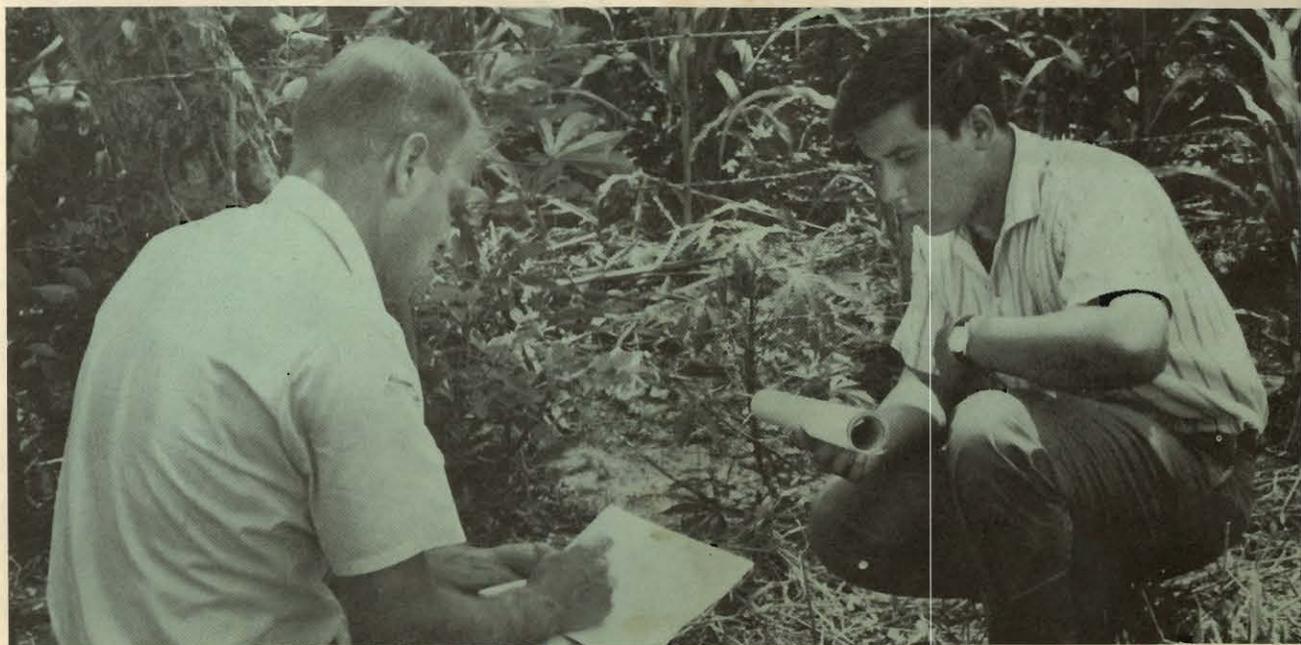
CIAT's integrated program of training and communication is designed to help mobilize, qualify, and energize the personnel and organizations in the socio-economic environment necessary for the realization of national productivity goals in the lowland tropics. This involves linking the technical production systems involved to the larger system of human, organizational, and material resources. Training and communication are necessary to influence the actions of persons and organizations upon whom the farmer must depend for support and guidance. (See chart page 18).

The activities include four elements: An international educational conference and training facility; research and demonstration projects on farms; training of professionals, sub-professionals, and technicians; and information processing and dissemination.

Specific objectives of the training and communication program include the following:

- To develop strategies and techniques for the rapid spread and adoption of improved materials and practices.

- To provide specialized instruction and experience in specific research fields for young scientists, and to provide opportunities for such persons to engage in supervised research on problems of significance to their countries.



Through post graduate intern programs, CIAT provides young agriculturists with opportunities to apply their knowledge and to gain practical experience as they work with senior scientists on research and development tasks.

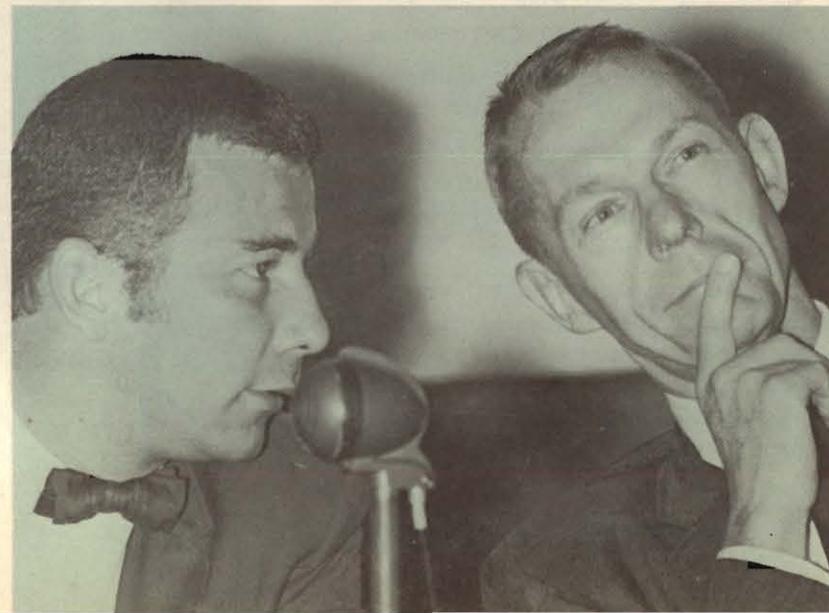
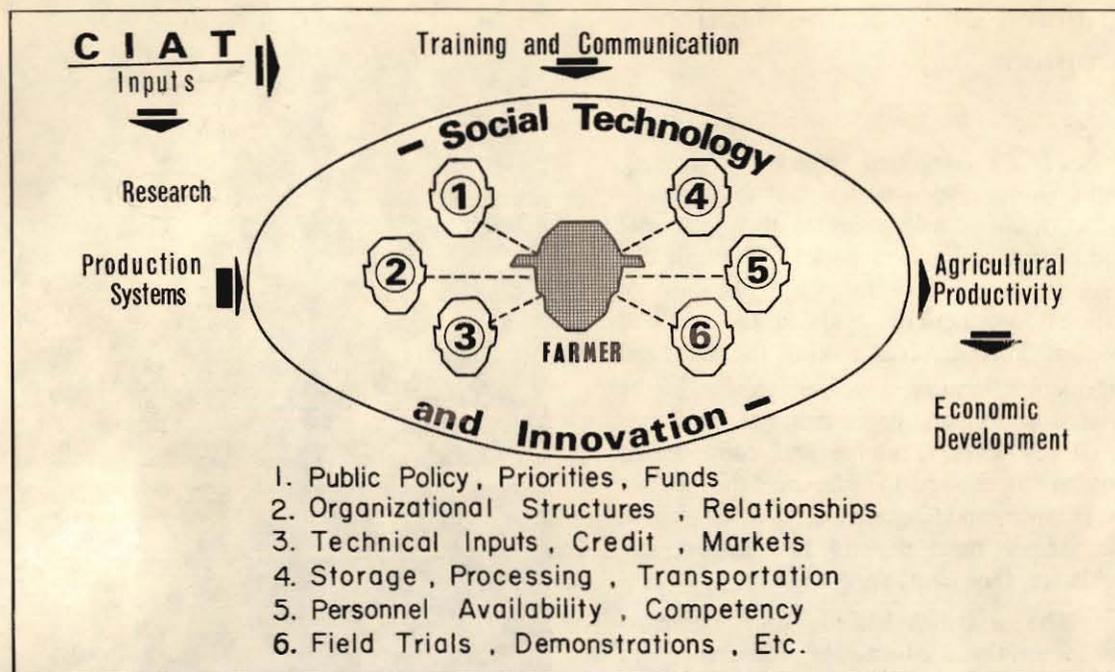
- To develop and demonstrate more productive approaches for pre-and inservice preparation of professionals and sub-professionals in agriculture, including the training of production and extension specialists.

- To assist other institutions in establishing and conducting educational and training programs appropriate to the needs and institutional capabilities.

- To help national leaders and policy-makers identify the agricultural potentials of their countries and the ways by which these can be realized.

- To provide information and instructional materials for use in reference libraries and training programs of other institutions.

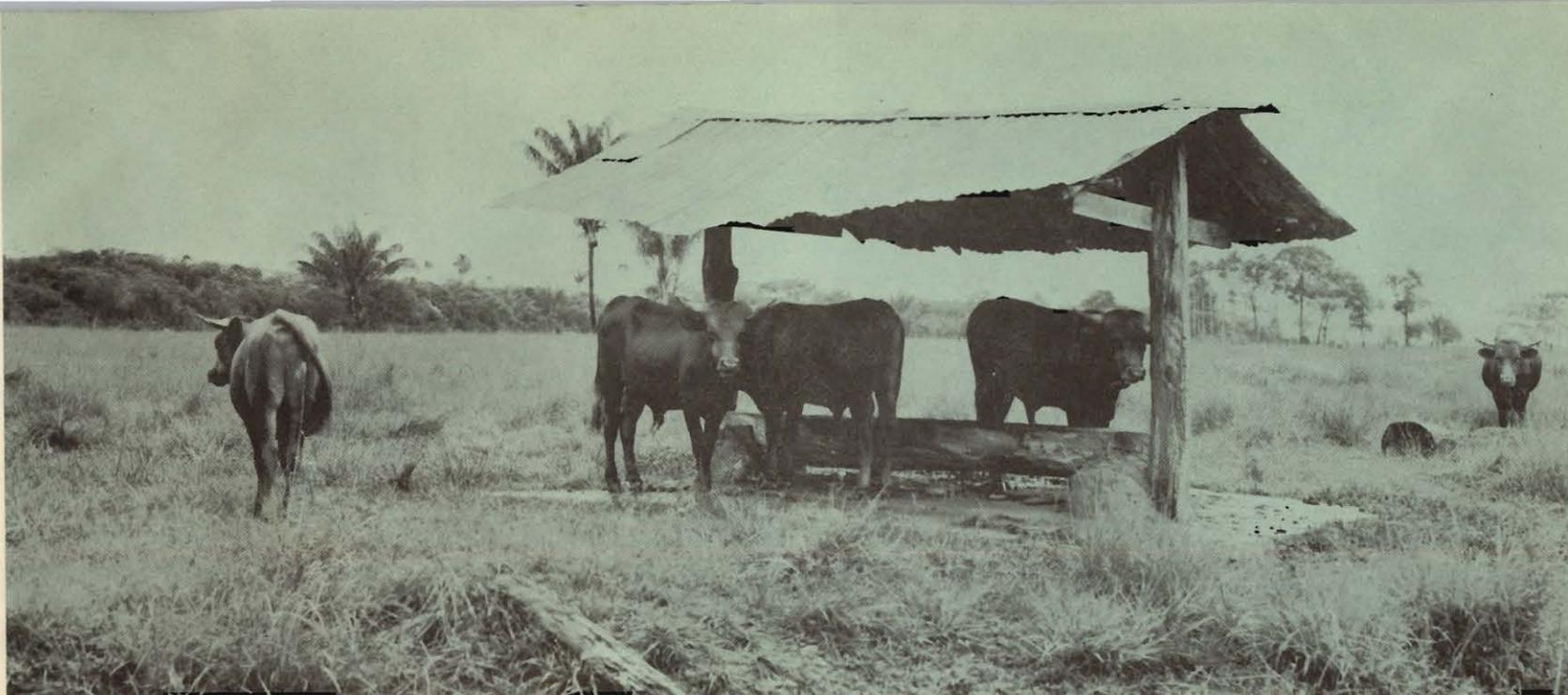
- To provide orientation and communication programs and services for the staff of CIAT.





CIAT's first international conference brought together national leaders in medicine, agriculture, industry and government from nine countries to consider the nutritional potentials of opaque-2 corn for humans and animals.





How to provide animals with low-cost protection from the tropical sun is one of many problems of concern to agricultural engineers.

Related research and technical services

Agricultural economics

Agricultural development leading to economic progress of nations and regions involves decisions relating to public policy, prices and markets, production and farm management, and related institutional factors affecting technological changes. CIAT considers the relative economic potentials of alternative agricultural research programs as well as measuring and predicting the economic returns possible from the application of research results on an area or country basis.

Agricultural economists serve on development teams for specific crop and livestock production systems, and also study signif-

icant issues relating to agricultural policy, common markets, and international trade.

Agricultural engineering

Agricultural engineers face the challenge of identifying a wide range of agricultural engineering problems associated with the efficient production of crops and animals in the lowland tropics and providing information leading to their solution. These concerns include drainage, irrigation, land preparation, tillage methods, mechanization, processing, and storing. In addition, engineers in CIAT and other institutions seek to encourage and facilitate the direct

involvement of manufacturers and distributors of agricultural machinery and technical inputs in research, training and demonstrational efforts.

Biometric services

As biometric services are generally limited among the research organizations with which CIAT cooperates, a major program objective is to demonstrate the value of such services in animal, crop, economic, and social research and to assist in establishing such services. In addition, statistical design and analysis are provided for the CIAT staff, and research leading to the solution of statistical problems is conducted.

Station operations

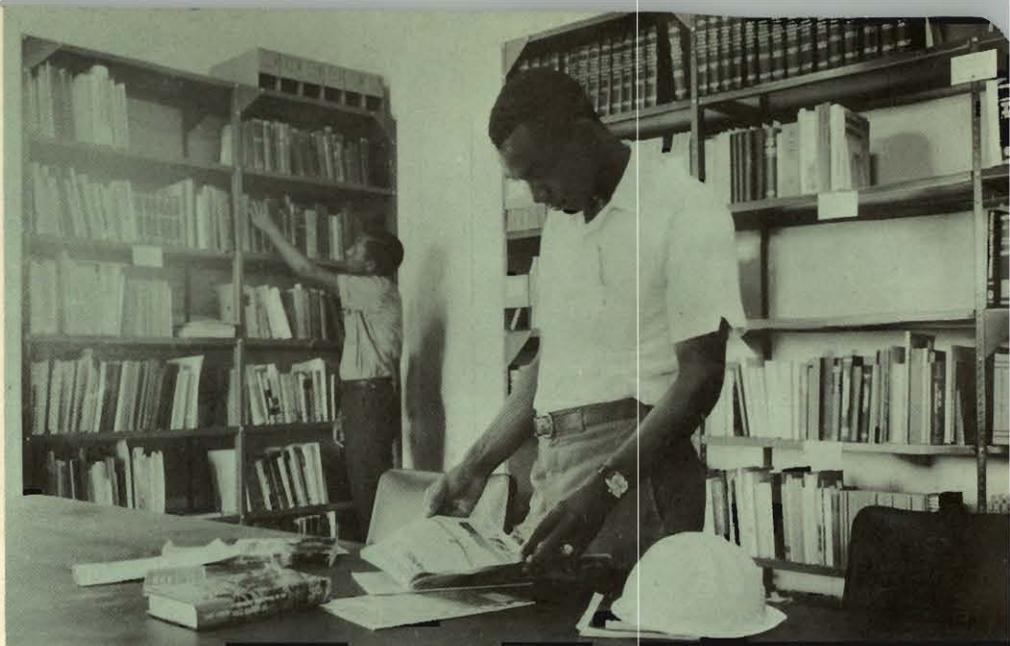
In addition to its major operational role at the CIAT center, the staff will help in the continuing development of national experiment stations where CIAT has cooperative programs. Also, the staff will help develop ways of preparing persons who will be responsible for training farm managers, farm foremen, tractor operators, and other technicians in national programs.

Library and documentation center

The principal objective of the CIAT library is to make available accurate and current information necessary for CIAT's training and research programs. Through exchange of publications with other libraries, the library serves as an international clearing house for the scientific literature relevant to CIAT's programs.

Consultative and training services for other libraries is also a CIAT library activity.

Two rice production trainees from the Dominican Republic use the temporary library facilities established in an old hacienda on the CIAT farm. (Upper right).



Power equipment and land-forming machines help simplify the irrigation and use of cultivated land in the tropics.



CIAT's rice specialist inspects plots of two of his former trainees at the research station where they work in Ecuador. This specialist, formerly a plant breeder at the International Rice Research Institute in the Philippines, is developing, in cooperation with national institutions in Latin America, varieties of rice adapted to the growing conditions and market demands of this part of the world.

A network of international research and training institutions

The Centro Internacional de Agricultura Tropical (CIAT) is one of four international institutions established in recent years to help accelerate agricultural development through concentrated research and training on specific crops and animals. While each institute or center has its own board, director, and staff, close working relationships permit the rapid exchange of genetic materials and information, the conduct of cooperative projects, and maximum utilization of collective staff resources.

Scientists in each institute form multidisciplinary teams to identify specific problems and to seek their solution. Trainees are directly involved in both practical production and technical research operations. Eventually, all institutes will have residence facilities for trainees.

Each institute is located near a national degree-granting college of agriculture or university with which it collaborates in educational programs involving advanced degrees. This enables students to take courses at the college and to their research and field training at the institute.

In addition to their research, training and service activities at their respective headquarters and, in some cases, outlying stations, all of the institutes collaborate closely with national agencies throughout the developing world. A basic operational philosophy of each is to provide scientific and training assistance to help develop and strengthen ongoing national institutions and programs.