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Proposed Program and Budget 1973

CIAT

Centro Internacional de Agricultura Tropical

PROPOSED PROGRAM AND BUDGET

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Revised June 20, 1972

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL
APARTADO AEREO 67-13, CALI, COLOMBIA
CABLES: CINATROP

TABLE OF CONTENTS

PROGRAMS AND PRIORITIES

Programs and Priorities

The Centro Internacional de Agricultura Tropical is directed toward the agricultural and economic development of the lowland tropics. The ultimate goal is to assist directly and significantly in the economic development of the countries of the lowland tropics with particular attention initially to Latin America. Economic development, as used here, is indexed by improvements in real income and the distribution of this income within the society.

CIAT seeks to achieve this goal through research, training, and stimulation and strengthening of national capacities in these areas. The specific action targets of CIAT programs are:

1. AGRICULTURAL DEVELOPMENT, as indexed by increased productivity per person and per unit of area, as well as increased output of the basic food commodities of the area served.
2. INSTITUTIONAL DEVELOPMENT, as evidenced by increased willingness, technical competence, and organizational ability of national institutions to cope with continuing problems related to agricultural and economic development in the lowland tropics.

CIAT concentrates its efforts and resources on two somewhat neglected agricultural products for lowland farming systems---beef and cassava. In addition, in cooperation with several North and South American institutions, it maintains a limited scope program in swine nutrition and management and another in field beans. Other activities include exploratory work in agricultural systems, and cooperative programs for relaying and adapting developments at the International Rice Research Institute (IRRI) in rice and the International Center for Wheat and Maize Improvement (CIMMYT) in maize. Similarly, with the establishment of and development of commodity programs at other centers, CIAT will expect to cooperate similarly, particularly with the International Institute of Tropical Agriculture (IITA) in Nigeria.

CIAT's goal in working with these agricultural products is to develop or improve, as quickly as possible, productive and profitable agricultural production systems for farmers of the lowland tropics, especially in the Western Hemisphere.

Development of these systems, however, takes into account relevant economic and other social issues. Economists consider not only the profitability of production practices on the farm, but also matters of inter-commodity competition, of public policy as it affects development of tropical areas, and of marketing. Of particular concern is the adaptability of the technology to the small farmer.

In cooperation with national agencies, CIAT undertakes research to identify obstacles to rapid adoption of new agricultural technology by various farmer groups and to demonstrate more efficient ways of overcoming these and bringing about technical and social change in rural areas.

The research program is closely integrated with training and communication activities which help mobilize, energize, and qualify the organizations in the lowland tropics which are necessary and instrumental to establishing the production systems developed and to realization of the productivity goals.

Through these combined research, training, and demonstrational efforts, CIAT expects to reduce significantly the time lags which frequently exist between the development of a new variety or agricultural practice and its widespread adoption by farmers.

Successful introduction of new varieties and practices depends upon taking a broad, system-wide approach to development. Critical factors, in addition to the appropriateness of the technology for the intended farmers and areas, include the availability of credit, inputs, advisory or educational services, transportation and communication, and appropriate storage, processing and marketing facilities. Such basic issues are discussed and explored with national agencies when and where appropriate, and are a major concern of conferences and symposia.

Criteria for Commodity Strategies

The commodity emphases of CIAT are dictated by the diverse agricultural production systems and food customs of the countries and areas served.

To make significant impact it is essential to work with the principal commodities likely to be most instrumental in solving the complex problems of a multiple product agriculture. But it will not be efficient, possible, or desirable to move forward with the same degree of program activity with all commodities simultaneously.

The following criteria guide the staff in the selection of individual programs as well as overall strategies:

1. Increase in Real Income. Select programs that can be expected to increase real income. Programs that provide greater increases in real income are preferred to those that provide smaller increases.
2. Time for Program Pay-off to Result. If two programs may provide, over time, the same increase in real income, the one which pays off sooner is preferred.
3. Number of People Served. If two programs offer the same increases in real income, select the one which affects the largest number of people, rural or urban.
4. Income Distribution Effects. Select programs in such a way that they do not worsen the present income distribution patterns. If possible, choose programs in such a way that they give an equal or greater advantage to small farmers than to larger ones.
5. Relationships with Other Agencies. Design programs that complement the work of other agencies.
6. Input of CIAT Resources. Some agricultural problems are by their nature large and complex. Even partial solutions may require large total amounts of resources. CIAT should avoid be-

coming involved in programs or problems which require resources to produce significant results which are beyond the capacities of CIAT and possible cooperating agencies.

7. Nutritional Importance. If two programs, over time, promise dividends about equal in economic return, select the program most likely to improve the diet of people with respect to those food elements most lacking, which in most cases in high quality protein.

8. Market Potential. Weigh all programs in terms of the predicted market for the resulting product, including the transportation, processing, storage, and related factors which may be involved.

9. International Nature of CIAT. Select problems generally important in the lowland tropics, and of these, those least likely to be undertaken by other agencies.

10. Unique Character of CIAT. Concentrate on those commodities and problems for which CIAT is uniquely and strategically situated.

The CIAT staff selects operational methods which maximize the involvement and development of relevant national institutions and enhance the multiplier and demonstrational aspects of its activities. The operational philosophies and approaches of CIAT are particularly instrumental in helping to achieve the Institutional Development target.

CIAT is an action agency for development with resources, staff and administrative flexibility. Its primary job is not to advise, but to act, to be responsible, to take and provide leadership, to coach and train, to stimulate and facilitate, to pioneer and take risks, and to be a vivid, effective demonstration for the guidance of national institutions and organizations.

CIAT tries to develop such rapport and working relationships with national entities as to permit it to work relatively independent of national

priorities, budgets, and affairs. Essentially, this means that, for activities outside of its own station, CIAT negotiates with national authorities agreements to proceed with specific projects -- research, training, development, or preferably some combination of these -- and asks the national entities, public and private, to help in various ways.

This approach assures that the project receives the priority and support it needs, is not diverted, and, most importantly, provides an effective training and demonstration base for assisting national efforts. As an additional dividend, it is expected that this approach and its attendant working relationships will enable the CIAT staff and nationals involved to develop and share a sense of urgency, a personal professional commitment to action, and a dedication to continuity.

With the above principles and procedural policies as a guide, CIAT allocates resources among and within the various commodity programs. In the following sections the progress on these programs in 1971 is summarized, and the objectives and program activities for 1973 are outlined. (For detailed reports on the 1971 program progress and events, see the 1971 Annual Report, now available.)

Highlights of Program Progress in 1971

The following paragraphs present highlights of accomplishments and activities in CIAT's major activities during 1971. These are reported in detail in the 1971 Annual Report.

Beef. In collaboration with the Colombian Institute of Agriculture (ICA) at Carimagua, nine beef cattle production herds using grade Zebus native to the area were established to compare varying intensity beef cattle production systems. Presently available evidence indicates that beef cattle production levels and profitability could be substantially increased using sound pasture management, feeding, breeding, and herd health practices, along with some improved pastures.

One of the major limiting factors to increased livestock production in the interior and coastal plains of South America is the low nutritive value of native grassland. A wide range of genetic material of several important legume species is being observed. Species of the leguminous genera Stylosanthes, Centrosema, Desmodium, Glycine and Pueraria are promising. The addition of a legume to the native grassland pastures to supply the necessary nitrogen for the soil-plant-animal complex is considered the most economical way to produce more beef per unit area at lower cost. Several high-yielding types of Stylosanthes have been identified, including two provisional selections both native to Colombia. Seed of these lines is being increased. Stylosanthes is adapted to low fertility, acid soils and has the ability to extract phosphorus from soils low in this element.

Animal health studies with blood parasites demonstrate that premunition (infected blood and drug theraphy) is the method of choice at present to prevent clinical anaplasmosis and babesiosis in Colombia. This information is being used in field trails at Turipana. The use of premunition has, under controlled conditions, eliminated deaths in cattle moved into endemic zones, and the techniques developed for premunition are safe.

Cassava. Research in cassava was seriously hampered because of an outbreak of a bacterial infection, tentatively a Pseudomonas sp., in the collection and increase plots. This bacterial wilt is common in other areas of Colombia but had not recently been found in the Cauca Valley. To prevent the possible spread of the disease to commercial fields and other cassava collections, a vigorous attempt was made to eliminate the disease in the farm.

A low-cost cassava chipper was designed and built, and the economists surveyed cassava production methods in Colombia. Production costs appear to be equal on flat and sloping land with the techniques currently used.

Cataloging of the germ plasm collection of nearly 2,800 cultivars was begun with various observations being made. Few varieties have produced a higher yield than Llanera, a variety collected by ICA from the Colombian Llanos. Llanera consistently is one of the highest in crude protein content with about 6 percent. Although several other cultivars were found with intermediate to almost equal levels of nitrogen, Llanera was the only cultivar agronomically satisfactory under the conditions tested.

Swine. Seeking an on-the-farm source of protein to balance diets for hogs, the swine nutritionist concentrated on studying economical and practical means for processing cowpeas so as to reduce their digestive inhibiting factors. Soaking was of little value; results with germinated cowpeas were inconsistent, but cooked cowpeas provided a protein that was well used by the pigs even when it was the only source of protein. Growth rates and feed conversion of pigs fed diets based on cooked cowpeas were similar to those of pigs fed standard control diets based on corn and soybean meal.

Food Legumes. Exploratory work in food legumes included limited study of the available germ plasm with dry beans (Phaseolus vulgaris) and

soybeans (Glycine max). Varieties of cowpeas (Vigna sinensis) and mung beans (Phaseolus aureus) have been screened for possible use in the tropics. A soybean study demonstrated that it is possible to increase yield by genetically delaying the date of flowering, allowing the plant to grow larger before reproduction, and delaying the date of maturity. By setting these two character changes as goals, scientists expect to get a taller plant, pods that form higher off the ground, and increased seed yield. This preliminary work will be useful in developing the CIAT program with field beans (dry beans).

Agricultural Production Systems. Data from field surveys, experiences of production trainees on livestock ranches on the north coast and on small farms in the Cauca Valley, and observations of many farming operations in the tropics have helped identify the commonalities of the situations and the possible goals for cooperative efforts with national agencies with respect to agricultural production systems.

Regardless of the size or nature of the operation, it would seem that the agricultural production system goals for the people living on the land might well include the following: (1) Career opportunities in agriculture; (2) year-round adequate diets; (3) opportunity to produce, weekly or monthly, some cash income to supply the necessities they are not able to grow; (4) better housing and sanitation; and (5) improved educational and health facilities.

Rice. Adoption of the new high-yielding varieties of rice reached a significant level in Latin America. Most of the areas previously planted to high-yielding varieties had been in IR8, but the release in early 1971 of CICA 4 and IR22 leads to the expectation that these varieties will rapidly replace IR8 and will, in addition, be grown under many circumstances where IR8 has not.

CICA 4 has been accepted, multiplied and distributed in Ecuador as INIAP 6 and in the Dominican Republic as Advance 72. A sister line is being widely distributed in Peru under the name of Nylamp.

With the mounting interest in Latin America in the new rice varieties and the possible consequences of rapid increases in production associated with their planting, some 200 representatives of 23 countries met in Cali in October to consider the issues associated with rice policies for Latin America.

This seminar provided opportunities for decision makers to expand their horizons so that they can make better policy decisions. More specifically, it indicated ways and means by which rice productivity increases may be achieved on a broad scale and in such a way that these increases and productivity may benefit, in terms of improved real incomes and diets, the greatest number of persons in each country.

Maize. One of the goals is to produce commercial maize hybrids and varieties with wider adaptation for the range of micro-climates in the tropics. Photoperiod sensitivity limits north-south exchange of germ plasm, but field studies in 1971 revealed a simple inherited system for sensitivity — possibly as few as two genes — and this genetic pattern is being tested.

Search for a high quality maize with a flint endosperm continues. Laboratory and biological results are promising, and preliminary studies on nitrogen balance in children confirm laboratory and rat data. The quality of the yellow flint selections is essentially equal to the original floury opaque-2 phenotype. In a white hybrid, H255, selection toward a crystalline endosperm was accompanied by reduced lysine and tryptophane levels as well as a lower biological value when fed to rats. Success in these selections, despite the problems with the white hybrid, indicate that a commercial version of opaque-2 with a more acceptable grain type may be available soon.

Soils. As the availability of reliable inoculants is a major problem in most of tropical America, soil microbiologists have tried to obtain cultures of rhizobium for the forage and seed legumes important to this region. The some 100 different cultures obtained represent the most effective cultures in Australia, United States, Rhodesia and Brazil. These, preserved by freeze-drying, are available for distribution.

Work is now under way in Carimagua to identify acid soil tolerant lines of varieties, for use in crop improvement programs and for release for immediate farm use if such tolerance is combined with acceptable agronomic characteristics.

Work on the CIAT farm micro-nutrient deficiences indicates that zinc, boron and iron are the most serious limiting factors in corn, sorghum and grain legumes. Zinc deficiency is most serious in rice, and the agronomists have obtained spectacular results with minimal applications of zinc in various forms.

Agricultural Economics. The impact of rapid expansions in production of selected agricultural commodities on such factors as price, incomes, income distribution, investment, employment and foreign trade is now being studied. Preliminary data indicate that considerable increases in the demand for meats may be expected. The demand for rice will increase at a somewhat slower pace while that for maize and cassava will increase moderately. Higher income families tend to consume less maize as incomes increase, while low income families tend to eat more of these foods at a modest rate. As their incomes increase, low income families tend to spend a greater proportion of their money for meat than do high income families.

International Activities. CIAT scientists have travelled extensively to become familiar with and to assist with the agricultural problems of various countries. They have exchanged germ plasm, information, and other materials.

Scientists are collaborating or assisting in several countries on beef, swine, rice, and maize projects, in addition to the cooperative work underway in several locations on plant disease, insects, and weed control. There is a constant flow of visitors from the countries to CIAT and from CIAT to the countries.

In addition, during the year, 82 persons from 15 countries participated in CIAT training programs, including 32 as postgraduate interns in research and 25 as production specialists. In addition to the 200 policy makers from 23 countries who attended the Seminar on Rice Policies, 16 scientists from all over the world presented a technical symposium on the rice blast disease to some 100 participants representing most of the rice-growing areas of Latin America. The Andean Zone Maize Conference attracted more than 50 persons from 12 countries.

PROGRAM ACTIVITIES IN 1973

Commodity Program Activities for 1973

Beef Production Systems

CIAT's beef cattle program aims to develop an adequate technological base and to train production-oriented personnel to support an efficient beef cattle industry under the varying conditions found in the tropics.

Research and training programs are currently in progress at the CIAT Center in Palmira, and collaborative programs with ICA at the Carimagua station situated in the Llanos and the Turipana station near Monteria in the North Coast. Technical assistance is being provided in the development of the INIAP beef cattle program in Ecuador.

Projects with outside funding include the Texas A&M University hemoparasite project funded by USAID and visiting scientists from Wageningen. A portion of the USAID funds are used to support graduate training and research in hemoparasite diseases at Texas A&M, and the remainder to support graduate student theses and other research in CIAT. Wageningen provides salary and other perquisites for its visiting scientists.

Most pending projects will be underway at the end of 1972. Some of these will be expanded as new staff are added during the year. This expansion plus partial year appointments in 1972 which become full year appointments in 1973 necessitate some increase in 1973 budget over 1972.

Specific research objectives are: To provide an adequate feed supply; to control disease and parasitism, and to develop economical systems of production.

Pastures, Forages and Utilization. In Carimagua, forage legumes and grasses have been screened for fertilizer requirements, and three fertilization regimes have been used in the establishment of molasses grass (Melinis minutiflora) pastures. Studies will be continued to determine time and fertilizer (especially phosphorous) requirements of best adapted pasture grasses and legumes, as well as methods of fertilizer application.

Molasses grass and Calopogonium muconoides have been successfully established in Carimagua with no mechanical seed bed preparation. These pasture establishment studies will continue, testing selected tillage methods and chemical weed control to reduce costs, machinery requirements, management of residues and control of weeds.

In most countries in tropical Latin America pasture weeds are one of the most important factors limiting pasture productivity. A project, being initiated in 1972, will develop effective and feasible control methods for the most serious brush and grass weed species and integrate these into a pasture establishment, renovation and/or maintenance program.

In view of the low fertility (nitrogen) status of the soils available for beef pasture development, there is a strong emphasis on the fertility building/restoring effect of selected, adapted leguminous forages. Attention is given to methods of establishment, grass-legume compatibility, seasonality of production, dry matter yields and nutritive values in digestibility and intake studies.

A freeze-dried collection of Rhizobium cultures for most tropical legumes of interest is now on hand and is being supplied to collaborators on request. Field and greenhouse testing of cultures will be continued.

Work continues in the screening and evaluation, agronomic characterization, foundation and other seed production of selected tropical legumes and grasses, and field scale seed increase of forage species.

The gene-pool of promising forage species will be increased by introduction from homoclimes (lowland tropics) as well as by systematic collection of indigenous biotypes. It is anticipated that provisional selections of Stylosanthes, Centrosema, Desmodium, Paspalum plicatulum will be available for regional evaluation in 1972.

In collaboration with IICA (Interamerican Institute of Agricultural Sciences) CIAT has been instrumental in organizing a program on the collection and evaluation of tropical forage species. This unified program permits a survey of the

grass and legume germ plasm available in tropical America and provides the basis for the accumulation of materials at CIAT along with genotypes introduced from other tropical countries.

Work in pastures and forages utilization concentrates on optimal use of native grasslands, improved pastures, native and improved pastures interseeded with legumes, and on comparison of selected management practices. Emphasis is on net returns, animal output and efficient land utilization schemes.

Efforts are now being concentrated on the introduction of legumes into the existing grass-pastures and the measurements of animal output from them.

In Palmira, investigations of intensive grazing systems using nitrogen fertilization of Digitaria decumbens and Brachiaria mutica pastures are continuing. In Turipana, a collaborative ICA-CIAT grazing trial is being initiated to determine live weight gain on beef cattle grazing Brachiaria mutica and Brachiaria mutica - legume mixtures. In Carimagua molasses grass and native grass grazing trials are in progress. Several combinations of native and improved grasses with Stylosanthes guyanensis, will be established with and without phosphate fertilizer, and will then be grazed to measure animal performance.

The beef cattle nutrition program emphasizes the nutritional factors limiting reproduction and growth rate with primary attention to minerals, energy and protein. These factors are being studied in relation to native and improved (Melinis minutiflora) pastures. Later this will be expanded to include native pasture - legume and improved pasture - legume combinations.

Beef cattle feeding will also be studied in more intensified farming systems in relation to the feed value and productivity of certain cultivated forages, crops, crop residues and by-products.

Control of Diseases and Parasitism. The primary objective of the CIAT animal health program is to improve reproductive and growth performance and reduce mortality through control of disease and parasitism. Principal attention is given to causes of reproductive failure resulting in lowered calving percentages, and to generally high mortality of calves from birth to weaning.

A primary objective is to establish beef cattle animal health programs which minimize the disease factors limiting production. Locations will be selected where all production losses from disease are monitored and recorded. When diseases are identified which appear to be significant causes of production loss, preventive measures will be instituted with continued monitoring. A total animal health program may therefore be built up which is both applicable and economic to the area, and can be used as a base line for animal health programs in lowland tropics elsewhere in Latin America.

The Texas A&M University hemoparasite project (babesiosis, anaplasmosis, and trypanosomiasis) will be continued. This project has the general objective of developing an effective program to control hemoparasite infections in tropical and subtropical areas and to train Latin American and North American personnel in the field of hemoparasites. Research accomplishments have included: low temperature storage of hemoparasite populations; studies on virulence; establishment of diagnostic methods; studies on the prevalence of infections in the field and the incidence of disease; studies on production loss; and studies on methods of vaccination.

Animal health training now includes in-service training and graduate student theses, and will be expanded to include training courses in diagnostic and other techniques.

Economics. The overall objective is to help develop economical systems of beef production and an adequate market structure to support a beef cattle industry in the lowland tropics that will contribute significantly to the social and economic welfare of the labor, producer and consumer sectors of the areas served.

In addition to supplying an economics input into ongoing animal science projects, the economists will continue to describe and analyze existing beef cattle production and marketing systems in the lowland tropics of Latin America. This work is presently being carried out in Colombia but similar projects in other countries are being promoted through the respective national agencies. This work

is expected to provide basic information on factors limiting beef production and productivity and their economic importance.

Studies will be initiated on certain macro-economic aspects such as the impact of production expansions on employment, income distribution, foreign exchange earning and human nutrition. Possibilities of substitution between beef and pork will be analyzed from the point of view of price relationships, consumer preferences and macro-economic implications. Attempts will be made to initiate research in collaboration with the international lending agencies on the impact of credit on production and productivity.

Given the budget constraints, the time horizon of the above work extends beyond 1973. Time priority will be placed on describing and analyzing existing beef cattle production systems.

Beef Cattle Production Systems. Beef cattle production levels are generally low in the lowland humid tropics of Latin America using traditional management practices. This is particularly so in latosolic grassland areas such as the Colombian Llanos and the Campo Cerrado of Brazil. Preliminary evidence indicates that productivity and profitability could be substantially increased using sound pasture management, feeding, breeding and herd health practices, and using some improvement pastures.

In collaboration with ICA at the Carimagua station, a series of nine beef cattle production herds, using Zebu cattle native to the area, have been established to compare varying intensity beef cattle production systems. Duration of the experiment will be five to six years. Another similar experiment will be set up in 1973.

Cassava Production Systems

CIAT will continue an accelerated cassava research program along the general lines followed in 1972, the basic objective being to develop and disseminate procedures for increasing cassava production on small, intermediate

and large farms in tropical regions, and to do so within an economic framework. Increased cassava production is sought as an energy source for feed and industrial use as well as for human food.

To achieve these goals with a crop as little known as cassava, research and development inputs are required from a number of professional groups. To focus a reasonably broad range of expertise on the problem, CIAT has assigned the part-time services of several of its senior staff to assist those working on cassava plus full-time services of junior staff members from the respective professional groups.

Plant Physiology and Varietal Improvement. The physiology of dry matter production receives major attention. CIAT explores the effects of plant type and planting procedure upon the quantity and manner of light interception and on the production of dry matter. Other studies will identify those types which produce a maximum amount of usable starch in the roots.

Immediate attention to plant propagation and early development is necessary. Tissue culture techniques may eventually contribute, but the current budget is intended to support tissue culture studies only on an exploratory basis. The main approach will be to improve the more traditional techniques.

The 3,000 cultivars in the CIAT collection are being evaluated with respect to physiological efficiency, disease and insect resistance and other features. The aim is to combine high yields with adequate disease and insect resistance. Lines low in cyanide are sought as well as lines with a degree of acid soil tolerance.

Crop Protection. CIAT focuses on diseases of principal economic importance, including bacterial blight, ash disease, Phoma, Cercospora and virus and mycoplasma diseases. Varietal resistance is the principal target.

Insect pests of cassava are numerous, although losses suffered from any of them are relatively less serious than disease losses. When outbreaks occur, however, they can take a heavy toll from particular plantings. The horn worm, shoot fly, stem borer and the spider mite will receive attention.

Agronomy and Soils. Standard techniques for field experimentation with cassava are being developed, and these will form the basis for international trials. Major nutrient requirements (NPK) are emphasized, with particular attention to low fertility soils. The agronomists will be responsible for applying all the techniques developed by other groups, combining them and hence recommending the best practices for cassava production.

Soils specialists will screen 175 varieties for acid tolerance in the soils of the Llanos Orientales in Colombia.

There will be a concentrated effort to detect and determine the areas in which nutrient deficiencies occur in cassava. Methods of correcting these problems will then be assessed.

The nutrient uptake of cassava plants will also be logged using material from the agronomy or physiology experiments so that detailed knowledge of the long term nutrient requirements of cassava can be evaluated.

Agricultural Engineering. Research will concentrate on simple methods for drying and storing cassava for feed or industrial use.

Economics. The economists expect to continue studies to identify and evaluate bottlenecks in cassava production, marketing and consumption. Research will continue on costs of producing cassava under various management systems with different agronomic and pest control inputs. New studies are expected on economic losses during transportation and storage, economic losses caused by price fluctuations, and an analysis of the implications of expanded cassava production on employment, incomes, income distribution and foreign trade.

Additional work is being done in Canadian universities with direct support from Canada, and, in addition, the Canadians are funding certain cassava outreach activities in Latin American countries.

Library. In the case of cassava, the library expects to become a world center. The subject is one which has had rather limited attention else-

where. Additional funds have been requested from the IDRC for developing a document analysis center for cassava. This would routinely provide information from the literature to scientists according to their particular interests. Costs of such a service are not included in this budget.

Swine Production Systems

The goal of the limited scope swine program is to increase pork production in the lowland tropics, making use of locally available feedstuffs. Excellent progress has been made in the development of production packages that have immediate application. Emphasis is now on to the development of on-the-farm protein sources in areas where adequate and economical protein supplements are not available, to the development and testing of production systems on both large and small swine farms, and to the development of production and training centers and personnel within national institutions.

The research, development and training activities for 1973 are summarized as follows:

Husbandry. Major attention will be given to the identification and evaluation of protein sources to supplement available tropical energy sources, with special emphasis on supplying protein where adequate and economical supplements are not available commercially. Secondary to this will be studies to determine the factors limiting cassava utilization by swine and humans and the evaluation of other tropical energy sources for which little if any information is available.

Studies are underway of existing production systems on large and small farms with emphasis on the improvement of these systems for obtaining more economical production.

Training and Outreach. Major effort is being made to extend the scope of the swine program into many potential swine production areas of tropical Latin America. Emphasis is on the training of swine production and research specialists from several countries and to the development of production, research, and training centers within existing national institutions.

Economics. In addition to obtaining information on the economics of existing and recommended production and marketing systems, the nutritional data produced will be evaluated economically to ascertain the feasibility of various diets.

Animal Health. Knowledge of the nutrition and management of swine in Latin America has extended far in advance of knowledge of animal health problems. Not only is little information available but no organization is working extensively in the field. Swine extension programs, therefore, lack this important segment of information. This information will be sought at two levels of management: One on medium-to-large commercial farms where the emphasis will be on the identification of viral and bacterial diseases and, second, on subsistence farms where parasitic diseases are expected to be paramount.

Field Bean Production Systems

CIAT has explored the possibilities and problems of several genera of food legumes as well as several species within the genus Phaseolus. Field beans are widely grown and are basic in the diets of many people in the lowland tropics. Yields, however, are low, particularly with Phaseolus vulgaris, the bean most commonly grown and consumed directly.

CIAT will focus upon the development of improved production systems for field beans, aiming at raising production per unit area and increasing total availability of this important protein source.

Crop Improvement. Field beans are known and consumed throughout Latin America. The field bean originated in the northern part of South America, Central America or Mexico. Thus the greatest diversity in germ plasm as well as broad spectrum pests exists in this region. The potential for severe attacks by one of several diseases and the constant insect threat presently make growing field beans risky.

CIAT has been and will continue evaluating germ plasm available from banks already established elsewhere from which characters can be used in a breeding program. The first task is to reduce the disease threat. Considering the low level of technology used by the majority of bean producers, the incorporation of resistance to diseases within a commercially acceptable grain is one of the ultimate objectives of the breeding/pathology phase of the program. Resistance to bacterial diseases such as Xanthomonas and Pseudomonas is available. Resistance to certain of the virus diseases exists also. Tolerance to rust, Uromyces, has frequently been reported but subsequent observation has indicated that resistance or tolerance seems to be temporary. New races of fungi emerge as a result of gene recombination in the sexual stage or by mutation.

A nursery of resistant strains will be assembled over the next several generations for continued observation and use in breeding programs.

With a healthy nursery, work on one of the more serious problems can begin. This involves plant type. The commercial plant types currently available are probably not the most efficient. The many physiological problems include pod and flower abortion, and apparent low photosynthetic rates.

Crop Protection. The identification of field bean strains resistant or tolerant to the races of Xanthomonas and Pseudomonas prevalent in Colombia will continue. Preliminary observation has indicated several lines resistant to these two bacterial diseases. Work will continue to identify rust resistance or tolerance. To date, of some 3,700 strains observed, only a degree of tolerance has been identified in a few individual plants.

In the case of viruses, there are two approaches to the problem: 1) resistance, which we are seeking, and 2) the control of the insect vectors. We have selected plants which have not shown symptoms of virus when surrounded by virus-infected plants. It will be necessary to determine if these plants are resistant to the virus or to the vector and to define the heritability of this characteristic for use in a breeding program.

Diseases of root and stem are serious and will receive attention.

Resistance to certain insects has been identified in other bean-producing areas. This aspect of bean research has low priority because, if the problem of insects becomes serious, chemicals well-administered can save the crop. This is rarely the case with pathological problems.

Weed control research will validate commercial recommendations of chemical products and assess the competition damage by weed species.

Agronomy and Soils. Agronomic research will be carried on at a fairly low level as several other institutions are concentrating efforts on this area.

Intercropping will be studied. This is a popular agricultural system with small farmers as it provides maximum security against complete crop failure.

Research on the response to methods and levels of micronutrient application will continue, along with efforts to identify insensitiveness to micronutrient deficiences.

Studies on the efficiency and selectivity of strains of Rhizobium for strains of food legumes are under way. The microbiologist hopes to be able to recommend the most efficient strains of Rhizobium for given species, and probably even variety specificity will be determined.

Agricultural Economics. Attempts will be made to initiate research in the following two areas:

1. An analysis of the present and expected future demand structure for the various grain legumes in Latin America and possibilities for export to countries outside the region.
2. An analysis to identify the factors associated with low yields in the various grain legumes in the lowland tropics, their relative importance and the approximate cost of removing these factors.

Agricultural Production Systems

CIAT's work in Agricultural Systems will continue to be exploratory and developmental for the balance of 1972 and into 1973. A primary concern is to clarify and define how the "system concept" can be applied in specific commodity programs as well as to overall integrated farm enterprises.

Activities to date, including discussions with staff members of IITA who have similar concerns and related programs, serve to focus attention on the range of components of a system. These include the technology, the natural environment in which the system operates, and the people involved, as well as the associated inputs and infrastructures.

Such an approach makes it necessary to determine what is the subject of primary focus---the unit of study. The plant breeder, seeking to increase plant productivity, studies the plant, while the agronomist is concerned with production of the plant as a crop. The farm manager is interested in the productivity of the entire farm, and the developer with the economic and social activity of the community in which the farm exists and its products are consumed or marketed. Others express concerns about developing, maintaining or protecting the productivity of an entire ecological area.

Development of an effective approach to agricultural systems in CIAT will depend, in part, on deciding where and how to study existing systems and the range of issues which will be considered. As discussed in the 1971 Annual Report, an efficient farm enterprise often depends on the integration of several commodity production systems into a single unit. Such multi-commodity farm units are important in determining crop rotations, utilization of crop residues and surpluses by livestock, and intensification of labor input while minimizing direct operational and capital expenditures.

As farm size decreases, increased attention must be given to multi-commodity enterprises to achieve a minimum level of living for the farm family.

It also is apparent that certain technological problems can be studied and solved outside of and independent of the situations where the technology will be used. But other technological problems are intimately related to and part of the environment and people involved. It will be difficult, if not impossible, to identify let alone solve such problems outside of the environment and without taking into account the people and the infrastructure.

One view of the Agricultural Production Systems program of CIAT has been as a mechanism whereby new technology arising in various commodity programs is tested on the farm and integrated into practical farm operations. Thus, the swine production procedures on the Colombian North Coast, and the related practices of feed production have been deemed to be components of an "agricultural system," and the situation is being investigated as such. The family-size ranch project for the Llanos Orientales is another example. To a degree, the Agricultural Production Systems of CIAT consists of studies growing out of the various commodity programs.

The process is actually more complicated and far-reaching than a simple progression from the commodity to a system. Again the swine program serves as an example. The principal feed in the North Coast villages is corn, and the protein diet is extremely inadequate. Thus the "system" must be expanded to include a legume, perhaps cowpeas, which is not included among the commodity thrusts of CIAT. We find, then, that work in Agricultural Production Systems draws attention to missing pieces in the available technology and serves as a guide to research strategy.

This feature of the Agricultural Production Systems program may be extremely important in CIAT's future research structure. Taken to a logical point, Agricultural Production Systems might start out by calling for a general examination of potential energy sources for swine in the lowland tropics and end up making a case for a shift in research attention from corn to sorghum or some other crop. No suggestion is offered here that such a

shift should be considered. Rather, the argument is that the Agricultural Production Systems approach could be a major guiding force in directing future research, as well as providing insight on efficient ways to gain farm application of the results.

The Agricultural Production Systems program is not intended to be made up solely of individual projects growing out of commodity thrusts. Instead, a more systematic identification and evaluation of existing systems must be made to identify existing problems and seek areas where improvement is possible or where additional research is needed. Such an analysis will take into account social and economic status, as well as existing environmental conditions. The entire range of the lowland tropical area with which CIAT works is to be considered. Certain areas within the region should be selected for immediate study while others could be set aside for reasons varying from the severity of the climate to the lack of pressing social problems. Thus, certain areas of intense rainfall might be excluded as might uninhabited areas of limited potential.

Areas selected for more immediate study will be subjected to analyses of existing agricultural systems followed by introduction of new technology in selected systems. This is an approach which CIAT has not followed as yet and which will require increased attention, particularly of the social scientists.

The Agricultural Production Systems program must have identified leadership if it is to achieve these objectives. Currently, the program depends upon the part-time input of staff members. No one is assigned to it full-time. As a result, only projects growing out of the commodity projects receive thorough attention, and there is no formal mechanism to focus prompt attention on missing phases of the technology required for these. For example, concentrated attention is needed on the protein needs of the swine industry on the North Coast. Present organizational structure makes it somewhat difficult to provide this input promptly.

To achieve these objectives, CIAT proposes to post a full-time coordinator of the Agricultural Production Systems program in 1973 and to supply him with supporting staff and facilities. A job description is being written for this post. The leader will report to the Deputy Director General who will assist in inter-commodity coordination. The head of the Agricultural Production Systems program will directly control his operational budget and have funds for special resource people. These will be needed in ecology and social sciences.

Existing CIAT staff time in Agricultural Economics should be projected at a higher level in 1973 than heretofore. The project will make particular use of training facilities, including senior staff and trainees. Trainees can assist not only in collecting data but in studying the effects of new technology introduced into existing systems. Support in the statistics area, already included in budget projections, will be important. Looking ahead it seems likely that the Agricultural Production Systems staff should eventually be expanded to include a full time farm management economist.

Until there has been time for further discussions, and possibly a small conference of interested persons from various agencies and institutions, the general objectives for those living on the land of CIAT's program in Agricultural Production Systems will be, as previously stated: To increase the number of attractive career opportunities in agriculture; to provide year-round adequate diets; to increase the weekly or monthly supply of cash, and to improve the level of living and quality of life.

Rice Production Systems

Rice continues to be a limited scope program, depending upon IRRI for considerable support in several research areas. The CIAT rice program has the objective of increasing farm yields in Latin America and confines itself in research to solving problems of a local nature that cannot be resolved at IRRI or elsewhere. The total investment to finance this program is relatively

low. In certain areas, e.g., breeding, agronomy, and training, expenditures remain relatively high. In others, little or no research is contemplated. Specific activities and relative levels of investment for 1973 follow.

Plant Breeding. The breeding program will continue to contribute to increasing farm yields. CICA 4, released in 1971, has been adopted in several countries with outstanding results. Excellent material, now in advanced stages of selection, should result in varieties superior to CICA 4 by 1973, despite being equally susceptible to the blast disease.

Major emphasis (perhaps 90 percent of all breeding effort) continues to be placed on combining blast resistance with superior plant and grain types. Progress has been slow because of a strong association between resistance and inferior plant type. Nevertheless, progress realized indicates that this linkage can be broken.

Breeding costs are low because ICA provides at least 50 percent of the total input. CIAT contributes the program leader, one research assistant, one technician, five laborers, and a modest sum for supplies and maintenance.

Crop Protection. As one full-time senior plant pathologist cannot be assigned to rice, one research assistant with sufficient labor will be assigned to handle the blast testing activities in Corinto. No other pathology work will be undertaken except on an emergency basis.

Although some insect pests are important, the breeding program is presently dealing with the major problem.

A modest initial senior staff input is required for work on weed control in upland rice. To the extent possible, this work will be done in Ecuador or other locations where weeds are a major problem in upland rice.

Agronomy and Soils. A potentially important contribution lies in the field of acid soil tolerance in upland rice. CIAT will undertake this, testing thousands of accessions to identify those which can be used in a breeding program followed by testing segregating progenies.

Agronomy work will be continued with specific attention to line evaluation, varietal multiplication, fertilization and water control as related to new varieties, and development of a farming system for periodically or continuously flooded tropical soils.

Agricultural Engineering. Research will continue on development of a planting system for flooded soils. A sizeable input will be made to provide field services for the agronomy program.

Agricultural Economics. Research will focus on the socio-economic implications of the adoption of the new varieties under various public policies. Attempts will be made to estimate the impact on employment, resource earnings, net farm revenues and risk. Adoption patterns will be analyzed in collaboration with the communication program. Furthermore, alternative ways of using rice for feed and food will be analyzed to identify those which are economically sound under various price relationships.

A study will be initiated to obtain information on present production practices with respect to upland rice. Requests for advice on public policy issues from the various Latin American countries will be met to the extent possible.

Training. The present state of the new rice technology warrants significant inputs for in-service training of research workers and production specialists to extend the benefits throughout Latin America.

Maize Production Systems

The Maize Production Systems team, while limited in size and scope, continues its integrated work in breeding, agronomy, protection and economics. Research has included introduction of new and improved germ plasm from commercial companies and maize programs throughout the world. Short plant selections and brachytic (dwarf) maize introduced from CIMMYT as part of the cooperative progeny testing program performed extremely well in the

Cauca Valley. Work continued on photoperiod sensitivity in three locations, with the collection of information on the interacting effects of temperature and photoperiod. The selection of modified endosperm (flint) kernels from opaque-2 maize continued to meet with success.

Tests in collaboration with the University of Valle to determine the protein efficiency ratio values in rats and nitrogen balance in children showed these hard endosperm selections to be equal in nutritional value to the original opaque maize. In the near future, this selection program should lead to a commercial variety with improved protein quality and a more acceptable endosperm texture.

A preliminary cycle of screening for acid soil and low phosphorus tolerance was completed in Carimagua in the eastern plains. Screening for resistance to stalk borer was initiated.

Plans for 1973 include the following activities:

Breeding and Physiology. Work in selection, crossing, and formation of composite populations will continue to emphasize shorter, earlier, and more efficient plants. The progeny testing trials initiated in 1972 in Rionegro (2100 m), in CIAT (1000 m), in Turipana (40 m) and in Boliche, Ecuador (50 m) will continue to evaluate crosses between selected plants. Results from the first cycle of these progeny tests will be used to recombine the best materials into widely adapted composites which will be tested in 1973.

Photoperiod/temperature work will continue in three locations in collaboration with ICA. A screening trial for resistance to frost and cold temperature will be planted in its second cycle in Colombia, Ecuador and Peru. The cooperative study with Purdue University on the effects of temperature and light on crop growth, maturity and protein quality will continue in three locations in Colombia and one in Venezuela. Results from these studies will lead to wider adaptation of commercial maize and promote greater exchange of germ plasm among programs.

Selections and increases of flint endosperm maize with a biological value equal to opaque-2 will continue to receive high priority. A search for new and more stable modifier genes, and also for new genes which influence protein quality, combines the efforts and facilities of CIMMYT, CIAT, and Purdue University. Progenies from opaque Composite I (CIMMYT) will be planted again in Rionegro (Antioquia) for evaluation and production of a commercial composite for that zone.

Crop Protection. Concentration on entomology is essential because of the serious attacks of insect pests which currently reduce plant populations in the field and limit production. Genetic resistance to Spodoptera and Diatrea is the primary focus of current screening trials, although this is coupled with chemical and biological control in an integrated production package. Mass rearing of these insects will aid in the field screening tests for resistance. Limited work will continue in screening for disease resistance and tolerance of new genetic materials to commonly used herbicides.

Agronomy and Soils. Selection for tolerance to the low pH, low phosphorus conditions in Carimagua will continue in 1973 on a larger scale. Any promising lines identified in the Llanos will be immediately increased for wider testing. Micro-element deficiencies will be studied on the CIAT farm, along with levels of NPK. Low fertility and low plant populations continue to limit maize production. The new shorter plant types which are coming from the breeding program will be tested under increased levels of fertility and plant population per hectare.

Agricultural Economics. The results of a major study on factors limiting maize production in three regions of Colombia are being summarized. A study which will evaluate similar problems throughout the Andean zone is planned for 1973. A study of the factors influencing the adoption of hybrid corn in Colombia, begun in 1972, will be completed.

Regional Collaboration. A newsletter for Latin American maize breeders, initiated in 1972 to promote the regular exchange of information and germ plasm, will continue. Regional trials for the Andean zone will receive more emphasis as we develop interest in the testing of best commercial varieties and hybrids as well as new populations. The Fifth Maize Conference for the Andean zone is scheduled for March, 1973, in Cochabamba, Bolivia. A special workshop in plant protection in January, 1973, will promote the cooperative efforts of breeders, pathologists, and entomologists in evaluating breeding materials.

Training for Research and Production

Training activities provide learning experiences for professionals, some to conduct production-oriented research in their own organizations, while larger numbers become crop or animal production specialists, helping to translate and communicate new agricultural technology.

Of immediate concern is the preparation of individuals to accelerate research on and the application of new technology in their own countries. These trainees help CIAT to develop effective links for the exchange of knowledge about agricultural problems and their solution, and eventually, to build and strengthen effective networks for research and communication among scientists.

The longer-term goals are to increase the numbers of research workers, educators, and extension specialists with competency to identify and solve production problems and the ability to communicate these solutions to farmers and others. CIAT's continuing training role is to provide counsel and assistance where appropriate, to train cadres of individuals to staff existing and new training operations within countries, to offer opportunities for specialized or refresher training for selected individuals, and to help the various institutions develop more adequate resources of teaching and reference materials.

In 1971, 82 persons were enrolled in CIAT's various training activities and 16 of these were continued into 1972. Of the 82, 25 were production specialists, 32 as post-graduate interns in research, 10 as master's degree candidates, 2 as research fellows, and 13 as special students. Fifteen countries were represented in this enrollment.

Plans provide for training of the following categories of persons in 1973:

Post-Graduate Interns. These are young scientists who have completed undergraduate degrees in agronomy, animal science, or veterinary medicine. They receive on-the-job training in production system studies while serving as full-time research interns. Because these men are integral members of the research staff on one-year training appointments, approximately 58 percent of the costs are charged to the research budget and 42 percent to the training program. Twenty-eight of these interns are funded in the budget for 1973.

Livestock Production Specialists. CIAT's first program in this area, an experimental project to develop and test training methods appropriate for this purpose, was completed in 1971 with a follow-up study of the cooperating ranches.

Operational headquarters for this program were moved in early 1972 from Sincelejo to the ICA Research Center at Turipana. Both this program and the crop production specialist training program are quartered in converted facilities made available by ICA.

A new course, 12 months in length, began in June with trainees from Dominican Republic, Paraguay, Venezuela, Honduras, Bolivia, Ecuador, and Colombia. Another course will be started in September, 1973, dependent upon availability of trainees and funds.

The objective is to produce specialists with the scientific, technical, economic, farming, and communication competencies necessary to diagnose production problems of a livestock enterprise and to recommend and implement a package of profitable production practices. They are prepared to

work in the field as individuals or to establish and conduct training programs. Costs of this undertaking are funded in part on a non-core basis by the Inter-American Development Bank and other organizations.

Crop Production Specialists. In February, 1972, CIAT completed its second program with 14 trainees from: Dominican Republic (2), Honduras (1), Costa Rica (2), Panama (2), Ecuador (3), and Colombia (4). Another course, with enrollees from six or more Latin American countries, will be started in September, 1972.

As with the livestock program, the objective of this training is to produce specialists with the scientific, technical, economic, farming, and communication competencies necessary to diagnose the production problems relating to maize, rice, cassava, field beans, and other rotational crops and to recommend corrective measures or a package of profitable production practices. They are prepared to work in the field as individuals or to establish and conduct training programs in their own countries. This program is funded in part on a non-core basis by the Inter-American Development Bank and other organizations.

Research Scholars. A few promising young scientists are selected each year and supported in graduate studies leading to advanced degrees. Through cooperative arrangements with the universities, CIAT scientists serve as advisors, and each scholar does his thesis on a CIAT research problem under the guidance of CIAT staff members. Funds for up to eight scholars are included in the 1973 budget. Present scholars are enrolled at the ICA Graduate School, National Agricultural School of Mexico, University of Florida, University of California, and Cornell University. This type of support is used primarily as a means of developing Latin American candidates for projected CIAT staff positions.

Research Fellows. The proposed core budget for 1973 provides funds for up to three research fellows. These young scientists undertake a one- or

two-year program of special research training. They are expected to contribute substantially to the research productivity of the professional group in which they work in additional to acquiring and perfecting their own specialized skills. CIAT currently has three research fellows, all of whom are working on doctoral dissertation problems in cooperation with the universities where enrolled, i.e., Cornell University, University of the West Indies, and Western Ontario University.

Other Trainees. CIAT maintains a flexible policy to provide unique training opportunities for young professionals from many lands. Through an agreement with Wageningen University in the Netherlands, fourth year animal science students come to CIAT for a year's on-the-job experience in the management of animals and pastures under tropical conditions. Similarly, Wageningen University intends to post one or more of its professorial staff to CIAT in 3- to 5-year tours of duty so that they acquire tropical research and management experience. The second student and first faculty member are already at CIAT and, in both cases, are fully funded by the University.

Through informal arrangements with various universities, doctoral students spend extended periods of time with CIAT doing their dissertation research under the supervision of CIAT senior staff members and on problems of direct interest to CIAT. CIAT's financial responsibilities are limited to helping with the direct research expense. In 1972, three doctoral studies are underway in cooperation with Justus Liebig University,at Giessen, Germany, University of Illinois, and University of Florida.

In addition, four veterinarians are working on advanced programs at Texas A. & M. University under the special USAID-supported project.

Each year CIAT extends summer training opportunities to a few undergraduate college students. Under these arrangements, the student pays his own travel expense while CIAT may provide a minimal stipend to cover costs of board and room for three months. This has averaged about $100 U.S. per

month per student. One student in anthropology this summer will live with the people of the Llanos and document the role of cassava in their lives; another, a senior in geography, will assist with a diffusion study.

Finally, through its contacts and relationships with universities and foundations, CIAT staff members help promising young Latin American scientists identify fellowships and assistantships to pursue advanced work at universities outside of Latin America. CIAT does not finance such programs except in the occasional case of providing travel funds to the place of study.

Conferences and Symposia

Effective agricultural development programs depend, first of all, upon dynamic, well-informed leadership above the technical level. Those who make and influence national policies, control credit and resources, manage manufacturing and distribution systems, and provide transportation, marketing, processing and storage need unbiased sources of reliable data and estimates of production potentials and requirements.

Moreover, agricultural scientists have a responsibility to communicate effectively with this leadership---to make known what agricultural developments are feasible and what policies and facilitation are required to increase productivity.

CIAT plans to include facilities for conferences and symposia, including meeting rooms as well as housing and feeding. Activities contemplated for 1973 and beyond include policy seminars for national leaders, scientific symposia and technical workshops for research workers, short courses for production specialists, and such other events as may be appropriate for representatives of various entities in the total agricultural development system.

While awaiting completion of the new facilities, CIAT has developed and carried out a limited conference and symposia program, using available rooms and services in local institutions and hotels.

With the opening of the new buildings in 1973, CIAT expects to have an around-the-year conference and symposia program, subject to the limitations of financial and subject matter support. The core budget for 1973 includes funds to cover the staffing and operations of a small conference management and promotion staff. In addition, other funds are indicated as minimal to finance inaugural events, a seminar on beef production in the tropics, and a number of workshops and conferences associated with the development of CIAT's commodity programs. As indicated, additional funds will be needed, particularly for participant travel and per diem, to finance all of the activities projected.

Utilization of the physical facilities as an "International Continuing Education Center for Agricultural Development," as envisioned in the original plans, will require special attention over the next few years. As the physical plant nears completion, we shall circulate widely descriptive information and invite various professional groups on agriculture to consider CIAT as a site for meetings as well as special training or planning conferences.

CIAT Organization as Related to Budget

Most staff discussions and all CIAT reports, aside from specific technical releases, are by programs, i.e., beef, swine, rice, corn, cassava crops, field beans, and agricultural systems. Such work as multiple cropping, and certain economic and soil research is considered to be inter-program or agricultural production systems research.

For purposes of efficiency and flexibility, the CIAT staff is organized into a few professional groups, as indicated in the budget tables. For example, scientists concerned with animal production systems are grouped according to their capabilities in husbandry, health, and pastures, and one scientist has been or will be identified as the leader for work on each commodity chosen for emphasis. Where applicable, the percentage of the budget for professional or supporting personnel assigned to work on specific programs

or commodities is indicated in man-years. Coordination of work among professional groups and achievement of necessary focus on program objectives is the responsibility of the director of animal science.

Similarly, the crop and soils specialists are organized into three groups, crop improvement, crop protection, and agronomy, under the supervision of the director for plant science. The directors for animal and plant sciences coordinate work in overlapping fields such as forages, nutrition and biochemistry.

The deputy director general coordinates the supporting work in training and communication, agricultural economics, agricultural engineering, library, and biometrics.

Determination of anticipated CIAT investments in each commodity program (Beef and Cassava, main thrusts; Swine and Field Beans, limited scope; Agricultural Systems, exploratory, and Rice and Maize, relay and adaptive in cooperation with IRRI and CIMMYT) is based on known costs plus estimates of the contributions of each professional group or other CIAT component to each of the programs.

Research and training activities are organized on a commodity basis, with the multi-disciplinary team being composed of such specialists as the situation indicates. Typically, a commodity team includes, besides those from that field, specialists in soils, crop protection or animal health, economics, engineering, training, and such other fields as may be relevant. Thus, the major efforts of all staff members focus on problem-solving research and production-oriented training in relation to specific agricultural commodities. One member of the team, designated as coordinator, has the responsibility of guiding and facilitating the program thrust.

This organization of the staff into professional groups, and the consequent budgeting by group, offers maximum flexibility of staff work on program thrusts, enabling rapid change of direction to meet specific problems

as they occur. Economy of operations is also achieved as staff time can be used flexibly to meet differing peak requirements for field or laboratory work associated with program activities. Numbers of individual budgets are minimized as are the points of growth. Responsibilities of individuals can be revised as necessary, without change of administrative assignment.

The proposed budget is for the calendar year 1973. The data have been developed by the professional staff on the basis of the continuing annual 5-year projections of program and budget.

Salary figures shown in the Schedules in the following section for the senior professional staff -- Scientist ($32,584), Associate Scientist ($26,966), and Assistant Scientist ($23,596) -- represent averages for personnel at these ranks, taking into account base salaries, perquisites, and allowances. The averages include present salaries plus those estimated as being necessary to employ persons for presently vacant positions.

Table O-A (see page 40), shows the projected expenditures for 1973 in relation to the funds available. Of the total expected expenditures of $4,144,000 for all purposes (operational-core, special project and other, plus capital), $3,697,000 are expected to be available from various donors already identified. This leaves a balance of $447,000 to be funded by as yet unidentified donors.

This table also shows a deficit of $589,000 for 1972, the bulk of this being $518,000 for capital. Funds to cover this deficit have not been identified.

(NOTE: The Price Waterhouse & Co. auditors' report for 1971 is reproduced on pages 116-120 of the 1971 Annual Report.)

PROPOSED BUDGET 1973

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

Summary of Financial Data - 1968 1977
(US$ thousands)

I.- Balance Sheet	Actual 1968	1969	1970	1971	Est. 1972	Budget 1973	Projected 1974	1975	1976	1977
Current Assets										
Cash	286	443	959	430	449	449	50	50	50	50
Receivable from Donors	6	13	446	526	526	-	-	-	-	-
Other Receivables	-	1,215	102	198	200	-	-	-	-	-
Inventories	-	-	-	7	-	100	100	100	100	100
Revolving Fund Balances	-	-	-	-	-	50	50	50	50	50
Other Current Assets	-	-	-	2	-	-	-	-	-	-
Total Current Assets	292	1,671	1,507	1,163	1,175	599	200	200	200	200
Fixed Assets										
Operating Equipment	-	299	473	552	-	-	-	-	-	-
Livestock	-	24	44	51	-	-	-	-	-	-
Research Equipment	-	54	213	319	-	-	-	-	-	-
Furnishings	30	92	145	235	-	-	-	-	-	-
Buildings	-	109	474	1,234	-	-	-	-	-	-
All Other	-	66	3	47	-	-	-	-	-	-
Total Fixed Assets	30	644	1,352	2,438	5,813	6,343	6,343	7,436	7,436	7,436
TOTAL ASSETS	322	2,315	2,859	3,601	6,988	6,942	6,543	7,636	7,636	7,636
Liabilities										
Current Liabilities	-	71	74	295	1,175	599	100	100	100	100
Payables to Donors and Sponsors	-	-	25	25	-	-	-	-	-	-
Total Liabilities	-	71	99	320	1,175	599	100	100	100	100
Unexpended Funds and Capital Balances										
Capital Balances	131	1,987	942	3,141	5,813	6,343	6,343	7,436	7,436	7,436
Other Balances	-	256	(426)	140	-	-	100	100	100	100
Unexpended Balances :	-	-	1,887	-	-	-	-	-	-	-
Unrestricted Core	-	-	-	-	-	-	-	-	-	-
Restricted Core	191	-	-	-	-	-	-	-	-	-
Operating Prior Year	-	101	357	-	-	-	-	-	-	-
Total	322	2,244	2,760	3,281	5,813	6,343	6,443	7,536	7,536	7,536
TOTAL LIABILITIES AND CAPITAL BALANCES	322	2,315	2,859	3,601	6,988	6,942	6,543	7,636	7,636	7,636

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE O-A

Summary of Financial Data 1968-1977
(US $ thousands)

STATEMENT OF REVENUES AND DISBURSEMENTS	Actual 1968	1969	1970	1971	Est. 1972	Budget 1973	Projected 1974	1975	1976	1977
Revenues										
Operating Core & Other a/										
Available Funds	146	1,295	1,497	2,525	2,829	3,320	3,678	3,862	3,678	3,752
Unidentified Sources	-	-	-	-	21	143	152	428	1,022	1,224
Special Projects										
Available Funds	-	-	-	128	272	377	50	40	30	30
Unidentified Sources	-	-	-	-	50	104	-	-	-	-
Capital										
Available Funds	162	1,733	2,112	1,793	2,810	-	-	-	-	-
Unidentified	-	-	-	-	518	200	-	1,000	-	-
Required Revenue Summary										
Total Available Funds	308	3,028	3,609	4,446	5,911	3,697	3,728	3,902	3,708	3,782
Total Unidentified Sources	-	-	-	-	589	447	152	428	1,022	1,224
GRAND TOTAL REVENUES	308	3,028	3,609	4,446	6,500	4,144				
Disbursements										
Operating Core	45	947	1,434	2,268	2,850	3,363	3,780	4,190	4,600	4,876
Special Projects	-	-	145	128	322	481	-	-	-	-
Capital	162	482	770	1,302	3,328	200	-	1,000	-	-
Others	-	-	-	172	-	100	-	-	-	-
GRAND TOTAL DISBURSEMENTS	207	1,429	2,349	3,870	6,500	4,144				
UNEXPENDED BALANCES	101	1,599	1,260	576	-	-	-	50	50	50

Note:

a/ Includes revenues for "other" purposes as detailed in Table IV-Note C.

MEMO ITEMS:

Core Program Staff Positions

Principal Staff	12	18	21	28	40	41	43	46	46	46
Research Assoc., Asst. & Post Grad Int.	-	23	38	71	79	95	100	100	110	110
Others	-	95	112	189	252	294	260	280	300	300

TABLE O-A

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE I

Summary of Sources and Applications of Funds, 1968-1977
(US $ thousands)

Sources of Funds	Actual 1968	1969	1970	1971	Est. 1972	Budget 1973	Projected 1974	1975	1976	1977
I.- Operating Funds & Others										
A.- Core Programs										
1.- Unrestricted Grants										
Unexpended Balance	-	28	232	-	-	-	-	-	-	-
New Grants	64	1,006	756	2,144	2,286	2,466	2,558	2,673	2,775	2,844
2.- Restricted Grants:										
Unexpended Balance	-	89	177	-	56	-	-	-	-	-
New Grants	82	133	298	353	423	790	996	1,060	770	770
3.- Earned Income:	-	39	34	7	64	64	74	79	83	88
Available Funds	146	1,295	1,497	2,525	2,829	3,320	3,628	3,812	3,628	3,702
4.- Unidentified Sources	-	-	-	-	21	143	152	428	1,022	1,224
Total Core Funds Required	146	1,295	1,497	2,504	2,850	3,463	3,780	4,240	4,650	4,926
B.- Special Projects:										
1.- Unexpended Balance	-	-	-	-	-	19	-	-	-	-
New Grants	-	-	-	109	212	230	50	40	30	30
2.- Earned Income:	-	-	-	19	60	128	-	-	-	-
Available Funds	-	-	-	128	272	377	50	40	30	30
3.- Unidentified Sources	-	-	-	-	50	104	-	-	-	-
Total Special Project Required	-	-	-	128	322	481	?	?	?	?
TOTAL OPERATING FUNDS REQUIRED	146	1,295	1,497	2,632	3,172	3,944	?	?	?	?

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE I-A

Summary of Sources and Applications of Funds, 1968-1977
(US $ thousands)

II.- Capital Funds	Actual 1968	Actual 1969	Actual 1970	Actual 1971	Est. 1972	Budget 1973	Projected 1974	Projected 1975	Projected 1976	Projected 1977
1.- Unexpended Balances	-	-	1,251	1,342	491	-	-	-	-	-
2.- Grants and/or Allocations	162	1,724	861	343	2,319	-	-	-	-	-
3.- Earned Income	-	9	-	108	-	-	-	-	-	-
4.- Unidentified Sources	-	-	-	-	518	200	-	1,000 a/	-	-
Total Capital Funds	162	1,733	2,112	1,793	3,328	200	-	1,000	-	-
TOTAL SOURCES OF FUNDS	308	3,028	3,609	4,425	6,500	4,144				

Note:

a/ As explained in table II-B- Note A

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE I-B

Summary of Sources and Applications of Funds, 1968-1977
(US $ thousands)

Application of Funds	Actual 1968	Actual 1969	Actual 1970	Actual 1971	Est. 1972	Budget 1973	Projected 1974	Projected 1975	Projected 1976	Projected 1977
I.- Operating										
A.- Core	45	947	1,434	2,268	2,850	3,363	3,730	4,190	4,600	4,876
B.- Special Projects	-	-	145	128	322	481	-	-	-	-
c.- Other	-	-	-	172	-	100	50	50	50	50
Total Operating	45	947	1,579	2,568	3,172	3,944				
II.- Capital										
A.- Expenditures	162	482	708	1,052	3,123	200	-	1,000	-	-
B.- Advances	-	-	62	250	205	-	-	-	-	-
Total Capital a/	162	482	770	1,302	3,328	200				
III.- Unexpended Balances										
A.- Unrestricted Funds	28	239	(82)	-	-	-				
B.- Restricted Funds	73	109	-	66	-	-				
C.- Special Projects	-	-	-	19	-	-				
D.- Earned Income	-	-	-	-	-	-				
E.- Capital Funds	-	1,251	1,342	491	-	-				
Total Unexpended Balances	101	1,599	1,260	576	-	-				
TOTAL APPLICATIONS FUNDS	308	3,028	3,609	4,446	6,500	4,144				

Note:

a/ For more detailed information, see Tables 1 and 2, pages 59-60.

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE II

Summary of Actual and Projected Sources of Income by Donor 1968-1977
(US $ thousands)

	Actual				Est.	Budget	Projected			
I.- Core Program and Other	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
A.- UNRESTRICTED										
1.- Rockefeller Foundation										
Unexpended Balance	-	28	131	-	-	-	-	-	-	-
New Grants	64	506	357	659	720	750	750	750	750	750
2.- Ford Foundation										
Unexpended Balance	-	-	101	-	-	-	-	-	-	-
New Grants	-	500	399	680	720	750	750	750	750	750
3.- US-AID										
New Grants	-	-	-	680	721	841	933	1,048	1,150	1,219
4.- Netherlands Government										
New Grants	-	-	-	125	125	125	125	125	125	125
Total Unrestricted	64	1,034	988	2,144	2,286	2,466	2,558	2,673	2,775	2,844
B.- RESTRICTED										
1.- W.K. Kellogg Foundation										
Unexpended Balance	-	73	113	-	33	-	-	-	-	-
New Grants	82	133	58	203	155	290	250	260	270	270
2.- Government of Canada (CIDA/IDRC)										
Unexpended Balance	-	-	-	-	23	-	-	-	-	-
New Grants	-	-	-	150	268	500	746	800	500	500
3.- Rockefeller Foundation										
Unexpended Balance	-	16	64	-	-	-	-	-	-	-
4.- US-AID										
New Grants	-	-	240	-	-	-	-	-	-	-
Total Restricted	82	222	475	353	479	790	996	1,060	770	770
C.- EARNED INCOME	-	39	34	7	64	64	74	79	83	88
a/ Available Funds	146	1,295	1,497	2,504	2,829	3,320	3,628	3,812	3,628	3,702
D.- UNIDENTIFIED SOURCES	-	-	-	-	21	143	152	428	1,022	1,224
TOTAL CORE FUNDS REQUIRED b/	146	1,295	1,497	2,504	2,850	3,463	3,780	4,240	4,650	4,926

Notes:

a/ Income from Farm Sales and Interest

b/ Includes Funding for Other one time needs as detailed in Table IV-Note C

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE II-A

Summary of Actual and Projected Sources of Income by Donor 1968-1977

(US $ thousands)

II.- Special Projects	Actual 1968	1969	1970	1971	Est. 1972	Budget 1973	Projected 1974	1975	1976	1977
A.- Grantors										
1. W.K. Kellogg Foundation										
New Grants	-	-	-	27	30	60	50	40	30	30
2. Government of Canada (CIDA/IDRC)										
Unexpended Balance a/	-	-	-	-	-	19	-	-	-	-
New Grants	-	-	-	-	82	40	-	-	-	-
3. Rockefeller Foundation										
New Grants b/	-	-	-	-	25	30	-	-	-	-
4. US-AID (Training)										
New Grants	-	-	-	17	-	-	-	-	-	-
5. Interamerican Development Bank										
New Grants	-	-	-	65	75	100	-	-	-	-
B.- Earned Income c/	-	-	-	19	60	128	-	-	-	-
Available Funds	-	-	145	128	272	377	50	40	30	30
C.- Unidentified Donors	-	-	-	-	50	104	-	-	-	-
Total Special Projects Funds Required	-	-	145	128	322	481	50	40	30	30

Notes:

a/ Outreach funds received in 1972 to be spent in 1972 and 1973

b/ Funds for CIAT Guatemala Cooperative Project

c/ Income from Enrollment Fees and Farm Sales, and Core Budget in 1971 in the amount of $8,000

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE II-B

Summary of Sources of Funds by Donors, 1968-1977
(US $ thousands)

III- Capital Fund Sources	Actual 1968	1969	1970	1971	Est. 1972	Budget 1973	Projected 1974	1975	1976	1977
A.- Grants										
1.- Rockefeller Foundation										
New Grants	162	508	788	244	1,569	-	-	-	-	-
2.- W.K. Kellogg Foundation										
New Grants	-	1,216	73	99	-	-	-	-	-	-
3.- Kresge Foundation										
New Grants	-	-	-	-	750	-	-	-	-	-
4.- Unexpended Balances	-	-	1,251	1,342	491	-	-	-	-	-
B.- Earned Income and Other	-	9	-	108	-	-	-	-	-	-
Available Funds	162	1,733	2,112	1,793	2,810	-	-	-	-	-
C.- Unidentified	-	-	-	-	518	200	-	1,000 a/	-	-
TOTAL CAPITAL FUNDS	162	1,733	2,112	1,793	3,328	200	-	1,000	-	-

Note:

a/ Estimated additional capital needed to purchase specialized research equipment and transportation facilities as programs develop, plus possible modification in or increase to physical plant.

1973 BUDGET

TABLE III

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

Summary of Operating Costs by Professional Groups, 1968 - 1977

(US $ thousands)

PROFESSIONAL UNITS	Actual				Est.	Budget	Projected			
I.- Core Program	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Direct Research and Training Units										
Animal Sciences	-	100	246	491	606	708	786	882	969	1.027
Plant Sciences	-	105	278	552	682	845	937	1.053	1.155	1.225
Agricultural Economics	-	10	74	77	169	212	235	264	290	307
Agricultural Engineering	-	61	156	188	109	141	156	176	193	204
Agricultural Prod. Systems	-	-	-	-	-	50	55	62	69	73
Training and Communication	-	100	143	300	416	431	478	537	590	625
General Services Units										
Biometrics	-	-	-	2	28	41	46	51	56	60
Library & Documentation Services	-	22	62	88	82	102	113	126	139	147
Station Operations	-	-	-	-	65	71	79	89	97	103
Physical Plant & Motor Pool	-	-	-	55	143	159	177	199	218	231
Administration	-	110	238	230	260	282	312	351	385	408
General Expenses a/	-	439	237	285	290	321	356	400	439	466
Core Total	45	947	1.434	2.268	2.850	3.363	3.730	4.190	4.600	4.876
II.- Special Projects b/										
Crop Prod. Specialist Training Prog.	-	-	27	88	75	138				
Livestock Prod. Specialist Training Prog.	-	-	93	-	79	91				
Conference and Symposia	-	-	-	40	100	165				
IDRC - Cassava-Swine Project	-	-	-	-	43	54				
CIAT - Cooperation Guatemala	-	-	-	-	25	33				
Opaque-2 Evaluation Project	-	-	25	-	-	-				
Total Special Projects	-	-	145	128	322	481				
III.- Other	-	-	-	172	-	100	50	50	50	50
OPERATING GRAND TOTAL	45	947	1.579	2.568	3.172	3.944				

Notes:

a/ Includes funding of equipment replacement from 1972 to 1977; i.e.: 75 83 88 93 100 106

b/ 1973 Cost includes Overhead Expense Charge

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE III-A

Summary of Core Programs and Special Projects by Object of Expenditure 1968-1977
(US $ thousands)

	Actual				Est.	Budget	Projected			
I.- Core Program	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Personnel Service Costs	7	518	933	1,533	1,848	2,282	2,549	2,864	3,144	3,333
Support of Post Graduate Interns, Research Scholars & Fellows a/	-	-	-	-	147	147	163	183	201	213
Supplies	3	194	149	376	317	334	294	330	362	384
Service Expenses	2	68	62	99	42	55	177	199	218	231
Travel	1	105	169	105	159	172	191	214	236	250
Vehicle and Machinery	1	25	56	88	47	52	-	-	-	-
General Expenses	31	37	65	67	290	321	356	400	439	465
Total Core Program	45	947	1,434	2,268	2,850	3,363	3,730	4,190	4,600	4,876
II.- Special Projects										
Personnel Service Costs	-	-	45	41	117	171				
Stipends and Support to trainees	-	-	62	30	33	42				
Supplies	-	-	18	28	39	51				
Service Expenses	-	-	3	1	9	19				
Travel	-	-	12	26	73	106				
Vehicle and Machinery	-	-	3	1	26	18				
General Expenses, Overhead & Others c/ d/	-	-	2	1	25	74				
Total Special Projects	-	-	145	128	322	481				
III.- Others	-	-	-	172	-	100	50	50	50	50
Grand Total	45	947	1,579	2,568	3,172	3,944				

Notes:

a/ Monthly fixed stipends paid to interns are included under Personnel Service Costs
b/ As detailed in Table IV-Note C
c/ Includes funds to cover transportation expenses and purchase of equipment and vehicles
d/ Includes Special Funding for CIAT-Guatemala Cooperative Project: 1972=$25,000
1973=$30,000

TABLE III-A

1973 BUDGET

TABLE IV

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

Actual and Projected Application of Operating Funds by Commodity Thrusts, 1968-1977

(US $ thousands)

I.- Core Program		Actual				Est.	Budget	Projected			
		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Commodity Thrusts a/	Scope										
BEEF	Main	-	-	-	767	825	1,058	1,156	1,257	1,380	1,463
CASSAVA	Main	-	-	-	307	553	564	634	629	690	731
SWINE	Limited	-	-	-	258	312	332	373	419	460	488
FIELD BEANS	Limited	-	-	-	107	194	303	336	503	552	585
RICE	Relay/Adaptive	-	-	-	394	406	438	485	419	460	488
MAIZE	Relay/Adaptive	-	-	-	203	251	307	336	335	368	390
AGRICULTURAL SYSTEMS	Exploratory	-	-	-	232	309	361	410	628	690	731
Total Core Program		45	947	1,434	2,268	2,850	3,363	3,730	4,190	4,600	4,876
II.- Special Projects b/		-	-	145	128	322	481	-	-	-	
III.-Other c/		-	-	-	172	-	100	50	50	50	50
TOTAL OPERATING COSTS		45	947	1,579	2,568	3,172	3,944	3,780	4,240	4,650	4,926

Notes:

a/ Prior to 1971, CIAT did not report operations on a Commodity basis

b/ Special nature of these activities make projections uncertain

c/ 1971: Operating Deficit 1970 $ 81,930
Equipment additions 90,120
$172,050

1973: General Stores Inventory Rotary Account one-time request $100,000

1974-1977: Minimum Cash-Balance Fund annual requests of $ 50,000

1973 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE V

Summary of Staff Positions by Organizational Unit, at year-end, 1968-1977

Organizational Unit	Actual								Estimated		Budget		Projected							
	1968		1969		1970		1971		1972		1973		1974		1975		1976		1977	
Principal Staff	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term	Reg.	Term
Animal Science	4	-	4	-	5	-	6	-	6	5	6	5	7	5	8	4	8	4	8	4
Plant Science	4	-	6	-	5	1	7	5	7	8	7	8	9	5	9	5	9	4	9	4
Agr. Economics	-	-	1	-	1	-	1	-	1	2	1	2	2	1	2	1	2	1	3	-
Agr. Prod. Systems	-	-	-	-	-	-	-	-	-	-	-	1	2	1	3	2	4	2	5	1
Agr. Eng. & Sta. Oper.	1	-	1	-	1	-	1	-	1	1	1	1	1	1	1	1	1	1	2	-
Training & Communication	1	-	2	-	4	-	4	-	4	-	4	-	4	-	4	1	4	1	4	1
Biometrics	-	-	-	-	-	-	-	-	-	1	-	1	1	-	1	-	1	-	1	-
Library	-	-	1	1	1	1	1	1	1	-	1	-	1	-	1	-	1	-	1	-
Administration	2	-	2	-	2	-	2	-	3	-	3	-	3	-	3	-	3	-	3	-
Total Principal Staff	12	-	17	1	19	2	22	6	23	17	23	18	30	13	32	14	33	13	36	10
Professional Support Staff	-		3		18		40		53		66		70		70		75		75	
Post. Grad. Interns	-		20		20		31		26		29		30		30		35		35	
Others	-		95		112		189		252		294		260		280		300		300	

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

ENCLOSURE A

1973 Core Operating Budget by Commodity Thrusts and Professional Groups
(US $ thousands)

DIRECT RESEARCH & TRAINING PROFESSIONAL GROUPS	BEEF	CASSAVA	SWINE	FIELD BEANS	AGR. PRODUCTIONS SYSTEMS	RICE	MAIZE	TOTAL
Animal Sciences								
Office of the Director	30	-	11	-	2	-	-	43
Pastures & Forages	128	-	-	-	7	-	-	135
Animal Husbandry	120	-	133	-	13	-	-	266
Animal Health	225	-	26	-	13	-	-	264
Sub-Total	503	-	170	-	35	-	-	708
Plant Sciences								
Office of the Director	-	17	-	4	4	9	9	43
Crop Improvement	-	100	-	51	-	69	73	293
Crop Protection	18	63	-	54	17	32	46	230
Agronomy	33	83	-	31	30	76	25	278
Sub-Total	51	263	-	140	51	186	153	844
Agricultural Economics	53	53	18	28	18	28	14	212
Agricultural Engineering	14	21	7	7	49	36	7	141
Agricultural Production Systems	-	-	-	-	50	-	-	50
Sub-Total Direct Research Groups	621	337	195	175	203	250	174	1,955
Training & Communication								
Operations	85	37	26	25	41	38	32	284
Support of Postgrad. Interns, Research Scholars and Fellows	43	21	13	16	13	26	15	147
Sub-Total Training Support	128	58	39	41	54	64	47	431
Total Direct Research & Training Budget	749	395	234	216	257	314	221	2,386
SUPPORT PROFESSIONAL GROUPS								
Biometrics	13	7	4	4	4	6	4	42
Library & Documentation Services	32	18	10	9	11	13	9	102
Station Operations & Tractor Pool	23	12	7	7	7	9	6	71
Physical Plant & Motor Pool	51	28	16	14	17	20	14	160
Administration	89	49	28	25	29	36	25	281
General Expenses	102	55	32	29	34	41	28	321
Total Indirect Support Budget	310	169	97	88	102	125	86	977
GRAND TOTAL	1,059	564	331	304	359	439	307	3,363

ENCLOSURE A

PHYSICAL DEVELOPMENT OF CIAT

Physical Development of CIAT

Headquarters Facilities and Farm

Headquarters for CIAT is a 522-hectare farm located between Cali and Palmira, Colombia, and situated adjacent to one of the national centers for agricultural research of the Instituto Colombiano Agropecuario and one of the agricultural colleges of the National University. It is located approximately five minutes from Palmaseca, the new international airport serving Cali and the Cauca Valley of Colombia.

Construction of the Station Operations building was completed and occupied in late 1971. About half of the space is being used as temporary offices and laboratories pending completion of the principal facilities in 1973.

The 11 outlying field buildings housing Isolation, Necropsy, Small Animal Colony, Green and Screenhouse, plus the Beef and Swine Units, have been completed and occupied.

Construction is now well underway on all of the buildings of the main center complex. The scheduled completion date is March, 1973. The Executive Committee has indicated that the formal dedication and inaugural ceremonies be scheduled for October, 1973,to insure ample time for installation of equipment and furniture and elimination of "settling in" problems.

Until completion of the new facilities, the bulk of the CIAT operations continue in the renovated quarters, plus the laboratories and experimental fields used cooperatively with ICA at its Palmira, Turipana, and Carimagua research centers. In addition, other facilities of ICA at Tibaitata and the Veterinary Research Laboratory, as well as similar facilities at the Universidad del Valle, Cali, are being used. A new dormitory, kitchen and dining hall have been completed by ICA at the ICA Turipana research center on the northern coast of Colombia. This construction enables CIAT to expand its research and training operations in the tropical lowlands.

Background to Capital Budget

The original amount available for buildings, equipment and transportation included $2,758,543 from the Rockefeller Foundation and $1,157,715 from the W.K. Kellogg Foundation. Rising construction costs in Colombia and continuing increases in the prices of equipment and furniture to be imported have made it impossible to complete the project within the original amount available.

With an additional grant of $500,000 from The Rockefeller Foundation, a grant of $750,000 from The Kresge Foundation, interest earned, and capital expenditures made from other miscellaneous sources, the total available capital now amounts to $5,525,931. This amount, however, is $718,455 short of the funds estimated as necessary to complete the initially planned building program.

These facilities, when completed, will be sufficient for the presently scheduled program and staff. Additions of new programs or substantial expansion of existing programs will necessitate consideration of ways to move toward additional construction. The master plans for the physical plant are complete, including structural drawings, for which the architects and engineers have been paid.

A document prepared by Dr. Lewis M. Roberts, The Rockefeller Foundation, and Dr. Lowell S. Hardin, The Ford Foundation, in October, 1966 proposed the establishment of CIAT. They estimated that the costs of constructing and building such a center, with a senior staff of 30 and a junior staff of 37, would be between 4 and 5 million dollars. Soon after, The Rockefeller Foundation with encouragement of other potential donors initiated negotiations with the Government of Colombia. At about this same time, The W.K. Kellogg Foundation expressed an interest in participating in such a development.

Subsequent events were as follows:

1967	October-December	Act of Foundation, Formal Agreement with the Colombian Government, Recognition of CIAT's Legal Status, and Presidential Decree.
1968	May December February	The Rockefeller Foundation allocates enabling funds.
	February	The Government of Colombia initiates process of acquiring land for site of the Center, near Palmira.
	June	Board of Trustees approves CIAT's document, "Proposed Program, Staff and Budget," less work on dairy cattle, at its first meeting, and authorizes CIAT's Director to develop and seek support for a capital development program.
1969	January - October	CIAT obtains use of land for permanent site.
	May	CIAT's Director presents a master capital development plan to Board of Trustees, along with preliminary architectural drawings and financial estimates ($6,214,705).

		He was instructed to prepare a construction plan, in accordance with money then known to be available (Grants and enabling funds from The Rockefeller Foundation, $2,758,543 and grant by The W.K. Kellogg Foundation, $1,157,715), plus Foundation enabling funds became CIAT's original Capital Investment Plan, $3,916,350.
1970	April	Executive Committee approves CIAT's Capital Investment Plan.
	July	Board of Trustees ratifies the Executive Committee's approval.
1971	February	Construction bids received, the lowest being $350,000 in excess of funds allocated.
	March	The Rockefeller Foundation advises CIAT to proceed with construction and that every effort would be made to find or allocate additional funds.
	May	Construction of permanent buildings begins.

Presently available capital funds include the Supplementary Grant 71067 from The Rockefeller Foundation in the amount of $500,000, and $359,673 representing accrued interest from capital grants, plus some funds from other sources.

In May, 1972, The Kresge Foundation granted $750,000 to be used toward the Communications Services Unit. These figures made a total of $5,525,931 available to the CIAT Capital Investment Plan as of June 1, 1972.

Additional Capital Requirements

Beginning in September, 1971, the senior staff of CIAT consisting of 23 regular staff members, and 11 others on special and terminal appointments, critically reviewed the status of the capital program, taking into account construction completed, equipment and furniture on hand, and that deemed necessary to carry out the specific programs of CIAT to which they were assigned. Equipment lists, some of these developed as early as 1967-68, were reviewed, taking into account changes in models and specifications, as well as increases in prices. At the same time, special committees reviewed the lists to eliminate duplications and to consolidate functional requirements so that these could be met with minimum investments in equipment.

An important factor has been the constantly rising price of building materials in the Cali area. Between June, 1969, and June, 1971, the prices of construction materials increased in the amounts indicated: Steel, 13.6 percent; sand, 18.4 per cent; cement, 31.7 percent; brick, 44.9 percent, and wood, 19.5 percent. (Reference: Revista del Banco de la República, August 1971). Similarly, labor costs have increased steadily, given the active commercial, industrial and governmental building programs in Cali.

The original price estimates for equipment and furniture were made in 1968-69 without anticipating the unforeseen delays in getting access to the land and arriving at a final decision on the architectural plan. In the ensuing period, costs have risen sharply, and in some instances, the original equipment is no longer available and has been replaced by more expensive items or models. Following are some typical examples of the rise in equipment prices between 1968-69 and 1971:

Item	1968-69	1971
47-inch hood and base	$ 764	$ 1,390
International centrifuge	975	1,295
Kjeldahl, macro	2,100	2,833
Gas cromatograph	5,000	10,000
Amino acid analyzer	20,000	25,000
National greenhouse E	7,800	12,597
B & L Dynazoom Microscope	745	928
Coli-Parmer Fiberglass glove box	1,160	1,595
Coli-Parmer constant temp. bath	415	620
Beekman DDD spectophotometer	3,570	4,800

At the time the original lists were prepared, many of the professional staff had not been identified or employed. Hence, in some instances, the lists of equipment needed were reviewed, revised, and complemented as the personnel actually responsible for carrying out the work have been employed.

Consequently, an overall revision of the capital budget required for completion of the approved plan resulted in a total of $718,455 yet to be identified.

In summary, the CIAT Capital Investment Plan is as follows:

Total estimated cost (May 1972)		$ 6,244,386
Funds available by sources:		
The Rockefeller Foundation	$3,270,584	
The W.K. Kellogg Foundation	1,396,510	
The Kresge Foundation	750,000	
Other	108,837	
Total available funds		5,525,931
Additional Capital Required		$ 718,455

The following tables show a more detailed analysis of these figures.

Comments About Accompanying Tables

Table 1. Shows the amounts and sources of funds now available, and the manner in which they are budgeted. It also shows the total cost estimate (May 1972) and the additional capital requirement ($718,455) necessary to complete the plan.

Table 2. Shows a summary of capital funding and percentage of work completed on buildings to May 1972. Assuming that the Rockefeller Foundation, the W.K. Kellogg Foundation, and the Kresge Foundation funds are available as needed, only "funds to be identified" are programmed over the next year.

As of May 1, 1972, all of the funds allocated to Site Development, Utilities and Buildings had been committed. Contracts within the budget had been signed, and work was in progress. Unless unforeseen circumstances arise, no variance in these prices is expected.

The architects' fees have been paid, except for the architectural direction (10 percent of the total) during construction and this is being paid monthly.

The additional funds for equipment and shipping are urgently needed because contracts for laboratory benches and other move-in equipment must be contracted, built and shipped by the first quarter of 1973. If this is to be accomplished, contracts must be let early in the third quarter of 1972.

No funds have been or will be committed until actually made available to CIAT.

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT)

Recommended Capital Budget Revision (May 1972)

Table 1

U.S. Dollars

Budget Item	R. F.	W.K.K.F.	Other	Total Revised Budget	To be Identified	Total Cost Est. (May, 1972)
A. Site Development	258,432	-	-	258,432	-	258,432
B. Utilities	554,217	90,000	-	644,217	-	644,217
C. Landscaping	30,668	5,000	-	35,668	-	35,668
D. Buildings	527,953	926,922	750,000	2,204,875	-	2,204,875
E&F. Equipment, Furniture and Int. Decoration	1,300,378	234,626	108,837	1,643,841	718,455	2,362,296
G. Contingencies	226,871	-	-	226,871	-	226,871
G' Shipping	-	30,000	-	30,000	-	30,000
H. Architects	135,880	75,000	-	210,880	-	210,880
I. Interventoria	205,017	32,062	-	237,079	-	237,079
J. Consultants	31,168	2,900	-	34,068	-	34,068
TOTAL	3,270,584	1,396,510	858,837	5,525,931	718,455	6,244,386

Funds Available

Enabling funds	258,543		
RF Grant 69017 and W.K.K.F. Grant	2,500,000	1,157,715	
RF Grant 71067	500,000		
The Kresge Foundation			750,00
Interest earned 1969	7,446	1,641	
1970	4,595	82,209	
1971		51,933	
Operating funds used for capital 1969-1971 and other		103,012	108,837
TOTAL			

Total Cost Estimate	6,244,386
Funds Available	5,525,931
Additional Capital Requirement	718,455
	5,525,931

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL (CIAT)

TABLE 2 — SUMMARY TABLE OF CAPITAL BUDGET — June 13, 1972

U. S. Dollars

Capital Requirements	Funds Available (May/72)	Spent (May/72)	% Com-plt.	Cost (May/72)	Funds to be Identified	Allocation of funds to be identified by quarters		
						3rd Qtr/72	4th Qtr/72	1st Qtr/73
Site Development	258,432	154,000	50	258,432	-	-	-	-
Utilities	644,217	117,411	30	644,217	-	-	-	-
Landscaping	35,668	5,273	20	35,668	-	-	-	-
Buildings	2,204,875	863,480	-	2,204,875	-	-	-	-
Sta. Operations	(187,713)	(187,713)	100	(187,713)	-	-	-	-
Field Buildings	(402,761)	(163,020)	75	(402,761)	-	-	-	-
Main Center	(1,614,401)	(512,747)	30	(1,614,401)	-	-	-	-
Equip. Furn. & Inter. Decoration	1,643,841	857,582	30	2,362,296	718,455	200,000	318,455	200,000
Contingencies	226,871	-	-	226,871	-	-	-	-
Shipping	30,000	-	-	30,000	-	-	-	-
Architects	210,880	205,000	90	210,880	-	-	-	-
Interventoria	237,079	62,062	40	237,079	-	-	-	-
Consultants	34,068	27,900	80	34,068	-	-	-	-
T O T A L	5,525,931	2,292,708		6,244,386	718,455	200,000	318,455	200,000

Funds Available

Rockefeller Foundation	3,270,584
W. K. Kellogg Foundation	1,396,510
The Kresge Foundation	750,000
Other	108,837
TOTAL	5,525,931
Additional Requirements	718,455
TOTAL COST	6,244,386

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DCC 7

Proposed Program and Budget 1974

CIAT

Centro Internacional de Agricultura Tropical

CIAT

PROPOSED PROGRAM AND BUDGET - 1974

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

July 6, 1973

Table of Contents

PROPOSED BUDGET IN RELATION TO CIAT PROGRAMS

STAFFING AND OPERATIONS

The 1974 proposed core budget, as detailed in Table 1, is $4,403,253. This represents an increase of $935,879 over the approved and funded core budget of $3,467,374 for 1973. (Note: The 1973 budget also provides for a one-time allocation of $100,000 to establish a revolving stock inventory account).

Factors Influencing Budget Increase and Distribution

The principal factors responsible for the increase in 1974 are:

		Approx. Amounts
a.	Inflation	$ 173,000
b.	New principal staff positions	101,000
c.	New professional support positions, and	153,000
	New non-professional positions	124,000
d.	Full-year staffing of positions filled during 1973, and promotions	140,000
e.	Expanded conference program	29,000
f.	Full-year operation of new physical plant and increased expenses in support services	105,000
g.	Additional social benefits for support personnel	30,000
h.	Increased travel costs	30,000
i.	Funds to support core program activities in other countries	50,000
		$ 935,000

Background information on the above items is presented in the following paragraphs:

a. CIAT has used a 6 percent of the dollar costs as a standard figure to adjust salaries and other expenses annually in relation to inflation.

Cost of living in Colombia has tended to increase from 15 to 25 percent annually over the past few years, and there has been a steady devaluation of the peso at a rate of about 10 percent a year. Beginning with the budget projection for 1975, a 9 percent inflation factor is used.

b. The growth in commodity program activity manifests itself quickly in increased demands for editorial, graphic, and photographic services and supplies. The difficulties associated with a multi-commodity, bilingual publishing operation necessitate employing an English language scientific writer-editor at the senior staff level. Further the photographer furnished by the Rockefeller Foundation since 1971 to help plan and establish CIAT's photographic services will be charged to the CIAT budget beginning in 1974. Until the photographic operation is fully established, personnel recruited and trained, and levels of performance developed, his services are needed.

The decision to add a plant physiologist to the Field Bean program in early 1973 necessitates budget for such a position. The leader of the Maize program has assumed the position of physiologist and leader of the Bean program while continuing temporarily also to supervise the work in maize. A successor in the Maize program is being recruited in consultation with CIMMYT.

The position of systems engineer in the Agricultural Systems program will be filled on a half-time basis by a scientist who also will supervise the Biometrics program. He is budgeted for one-half year in 1973 during which time he will establish the operational routines in Biometrics while recruiting and training a number of junior professionals.

c. Throughout CIAT, the developing and new programs, such as Biometrics, require additional technical and administrative support. This increases with the development of cooperative projects with national institutions in other geographic areas of Colombia, i.e., Turipana and Carimagua. This will require the appointment of 25 research, training, and information associates and assistants over the 80 such positions budgeted for 1973. The opportunity which CIAT has to carry on

core activities in this way represents a tremendous saving in the capital and operational expenses which otherwise would be necessary for research in these important tropical lowland environments. Further, these junior professionals free senior scientist staff time for travel and outreach projects in other countries and for intensive interaction with research and production trainees.

Similarly, with the growth of the organization, staff, and activities, there is need for more non-professional support staff in nearly every category from custodians to bilingual secretaries.

d. Increases in this category represent the differences between the amounts spent on senior and support staff appointed sometime during 1973 and the amounts necessary to finance these people for a full year in 1974. Cost of personnel promotions are also anticipated here.

e. Opening of CIAT's conference and symposia facilities in late 1973---and the projected schedule of operations for 1974 and beyond---necessitate extensive expansion in the management and support staff, particularly for simultaneous interpreters and conference coordinators. The total indicated budget includes $60,101 for salaries, services and supplies, plus $140,000 for the direct support of participation and related expenses for conferences and symposia associated with CIAT's core program.

f. The added costs of operating on a full-year basis the new physical plant (buildings and equipment) include substantial increases in utilities (electricity, fuel oil, gas), maintenance, janitorial and security personnel, maintenance of more machinery and vehicles. Increases here also reflect the added costs in personnel, accounting and reports, as well as those for telephone, telex, reproduction, postage and related items.

Shown separately from Station Operations and the Physical Plant is an item identified as "Field Operations-Engineering." This represents engineering activities associated with the further development of the experimental farm of

CIAT at Palmira, plus cooperative activities with ICA at Turipana on drainage, irrigation, and land and machinery utilization projects for more efficient cooperative research, training, and production programs at that location. Beginning in mid-year 1973, the CIAT agricultural engineer will concentrate on these engineering projects, one of the first phases of which at the Turipana station involves deep water rice operations. In addition, he continues to advise research programs in other countries on engineering aspects of station development. This includes bringing managers of selected stations to CIAT and Turipana for short periods of specialized on-the-job training.

g. CIAT, conscious of its obligations as a responsible employer, is giving top priority to implementation of personnel welfare programs to supplement those provided by law. This will include a company medical-dental service plan, as well as some assistance in education.

h. The development of projects outside the Palmira area, growth in staff numbers, and increased costs for transportation and per diem result in increased travel costs.

i. As CIAT seeks to develop core program-related cooperative and collaborative projects in other countries, frequently small amounts of money are needed to provide necessary simple equipment or supplies which the local institution is not in a position to fund or import. The ability to finance such initial projects frequently serves as a catalyst in stimulating and encouraging development of projects capable of attracting special outreach funding. As programs mature, additional opportunities for effective work in this matter are expected to materialize.

Factors influencing the increases in direct research costs of $2,166,110 by $396,781 over 1973, by commodity, are as follows:

Beef - Total increase $110,939, 17.5%; inflation, 6.0%; promotions and additional resources, 2.2%; full staffing, 3.9%, and new support positions, 5.4%.

Swine - Total increase $25,144, 13.5%; inflation, 6.0%; promotions and additional resources 0.5%; full staffing, 4.6%, and new support positions, 2.4%.

Cassava - Total increase $59,137, 18.3%; inflation, 6.0%; promotions and additional resources, 0.7%; full staffing, 3.5%, and new positions, 8.1%.

Field Beans - Total increase $87,409, 32.5%; inflation, 6.0%; promotions and additional resources 4.8%, full staffing, 5.4%; and new support positions, 16.3%.

Rice - Total decrease $19,387, 13.8%; with the reallocation of the Agricultural Economics input to Agricultural Systems which accounts for 13.1% and a reduction of other program input.

Maize - Total decrease $14,768, 12.1%; with the reallocation of the Economics input to Agricultural Systems of $17,816 in 1973 and the slight inflationary increase in remaining inputs of $4,207.

Agricultural Systems - As instructed by the Board of Trustees, CIAT expects to move slowly but positively into its Agricultural Systems Program, beginning with a small staff in 1973. The total increase of $148,308 in 1974 reflects plans to increase this staff by providing the full-time inputs of an agronomist, an agricultural economist, one-half time of a systems engineer, plus funds to facilitate the work of a sociologist being furnished by the government of the Netherlands and an anthropologist on a part-time consultant basis. The budget also provides funds for other consultants, as needed, plus the costs of exploratory field surveys. Also included is the inflation factor as well as full staffing and promotion of the personnel appointed or assigned in 1973.

Table I shows, in addition to the direct research costs for each commodity, the Training and Communication costs ($800,597) and the Support Group costs ($1,412,790) as distributed to the commodity programs. Training and Communication and Support Group costs, with a few exceptions, are distributed on the basis of

the percentage of the direct research expenses of each commodity of the total direct research expenses. Training Coordination and Postgraduate Intern costs are distributed on the basis of actual estimated inputs by commodity. There is no charge against Swine for the Soils Laboratory Services.

Distribution of Senior Staff Time and Costs by Program

The distribution of the 31 man-years in 1974 of direct research staff time to the various commodities, as indicated in Table II, reflects the basic change in staff assignments implemented in 1973. Changes introduced in early 1973 were made on the principle that the time of a senior staff member involved in direct research would not be divided among more than two commodities. This leads to a diminished senior staff input into maize and rice and an increase in scientific manpower assigned to beef, cassava, and field beans. Thus, while the professional group identification still remains in CIAT, the major emphasis is upon the commodity team. For management purposes the commodity coordinator takes the major leadership role.

These multi-disciplinary teams are composed of such specialists as the situation indicates. Typically, a commodity team includes, besides those from that particular field, specialists in soils, crop protection or animal health, economics, engineering, training, and such other fields as may be relevant.

Fund requirements for core and restricted core operations in the years 1975 through 1977 are based on (a) the projected development schedule as presented to the Board of Trustees at its meeting in August, 1971, (b) program developments since that time, and (c) average operational costs per senior staff member, taking into account a 9 percent a year factor for inflation.

The staffing projections in 1971 were based on a senior staff of 36 in 1972, with a gradual increase over the following years to a total of 46 in 1976 without an expanded program in food legumes and 53 with an expanded program in food legumes. The other increases over the 36-member base in 1972 were projected for beef, cassava, and agricultural systems.

Sources and Applications of Funds

Table III outlines projected disbursements in 1974 and indicates the sources of funds in prior years, 1970 through 1973. Specific indications of individual donor support for 1974 and beyond is limited to these restricted core and special project activities for which definite commitments already have been made between the donor agency and CIAT. While the Overseas Development Administration of the United Kingdom has expressed an interest in supporting work in two special projects, as indicated, there is no definite commitment pending overall.

The requirements for capital funds, particularly for 1974, are detailed in Section C of this document.

1974 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

SUMMARY OF COSTS BY PROGRAM AND ACTIVITY 1970 - 1977

(US$ THOUSANDS)

CORE PROGRAMS	AUDITED EXPENSES			ESTIMATED BUDGET	CURRENT BUDGET	BUDGET	PROJECTED (5)		
	1970	1971	1972	1973	1973	1974	1975	1976	1977
Direct Research Groups									
Beef			417	621	633	743			
Swine			177	195	186	210			
Cassava	(1)	(1)	309	338	323	382			
Field Beans			114	174	268	356			
Rice			240	249	140	121			
Maize			150	174	121	107			
Agricultural Systems			110	205	72	221			
Sub-Total	754	1,212	1,517	1,956	1,743	2,140			
Training and Communication									
Sub-Total	143	300	371	431	595	801			
Support Groups									
Soil Lab Services (1)	-	-	-	-	54	75			
Biometrics	-	2	4	41	35	91			
Library & Documentation	62	88	77	102	106	129			
Field Operations-Engineering (1)	-	-	-	-	28	56			
Station Operations (2)	-	115	343	71	64	112			
Physical Plant & Motor Pool (3)	-	37	-	159	190	275			
Administration	238	230	314	282	330	374			
General Expenses	237	285	265	321	322	300			
Sub-Total	537	757	1,003	976	1,129	1,412			
TOTAL CORE BUDGET	1,434	2,269	2,891	3,363	3,467	4,353	4,657	5,365	5,365
OTHER (4)	145	90	-	100	100	50	150	150	150
TOTAL (at 1974 constant prices)		2,359	2,891	3,463	3,567	4,403	4,807	5,515	5,515
Price Increase				-	-	-	433	1,038	1,626
TOTAL REQUIRED						4,403	5,240	6,553	7,141

1974 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

SUMMARY OF COSTS BY PROGRAM AND PROJECT 1970 - 1977

(US$ THOUSANDS)

SPECIAL & OUTREACH PROJECTS	ACTUAL			ESTIMATED BUDGET	CURRENT BUDGET	BUDGET	PROJECTED (5)		
	1970 (4-a)	1971	1972	1973	1973	1974	1975	1976	1977
Special Projects									
Crop Production Specialist Training	27	88	39	138	111	124			
Livestock Prod. Specialist Training	93	-	66	91	93	107			
Conferences & Symposia	-	40	42	165	60	-			
Animal Health Entomology	-	-	-	-	-	42			
TPI/CIAT Cassava Storage	-	-	-	-	-	25	See note 6		
Cassava Liaison Canada/CIAT	-	-	-	-	10	-			
Cassava Documentation Center	-	-	-	-	30	-			
Opaque-2 Evaluation	25	-	-	-	-	-			
Deficit prior year	-	-	-	-	38	-			
Sub-Total	145	128	147	394	342	298			
Outreach Projects									
RF-ICTA-CIAT	-	-	-	33	84	76	76		
Cassava-Swine Training	-	-	19	54	47	6			
Sub-Total	-	-	19	87	131	82	76		
TOTAL SPECIAL & OUTREACH PROJECTS	145	128	166	481	473	380	76		

Notes:

(1) Comparative figures for 1970 and 1971 are not available.
(2) Station Operations; was presented in 1970 as part of the Direct Research Group, Ag. Engineering.
(3) Physical Plant and Motor Pool; were previously presented as part of Station Operations.
(4) Other; includes special requests as follows:
  a) 1970: Projects listed under Special Projects in 1970 were then considered a restricted Core Activity.
  b) 1973: $100,000, establishment of the Inventory Rotary Account.
  c) 1974: $ 50,000, Core Activity, outside Colombia
  d) 1975: $ 75,000, Core Activity, outside Colombia
    $ 75,000, establishment of a Rotary Cash Fund Account.
  e) 1976: $150,000, Core Activity, outside Colombia
  f) 1977: $150,000, Core Activity, outside Colombia
(5) Projected: 1974 base year cost of $ 101,233 per Principal Staff man-year plus a provision for an annual price change of 9 percent.
(6) Special Projects: Their special nature makes projections uncertain.

1974 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE II

SUMMARY OF MAN YEARS AND COSTS BY PROGRAMS AND OBJECT OF EXPENDITURE

US$ THOUSANDS)

CORE PROGRAMS BY ORGANIZATIONAL UNITS	ACTUAL						ESTIMATED		CURRENT BUDGET				PROJECTED					
	1970		1971		1972		1973		1973		1974		1975		1976		1977	
	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost	Manyears	Cost
1) Direct Research Groups																		
Beef					417		9.6	621	10.3	632	10.5	743	10.5		12.5		12.5	
Swine					177		2.8	195	3.4	185	3.5	211	3.5		3.5		3.5	
Cassava					309		5.9	338	5.5	328	6.5	382	6.5		8.5		8.5	
Field Beans					114		3.0	174	3.7	268	5.0	356	6.5		8.5		8.5	
Rice					240		3.9	249	2.3	140	2.0	121	2.0		2.0		2.0	
Maize					150		2.6	174	1.3	121	1.0	107	1.0		1.0		1.0	
Agricultural Systems					110		3.4	205	1.1	72	2.5	221	3.5		3.5		3.5	
Sub-total	14.7	754	18.4*	1,212	27.7*	1,517	31.2	1,956	27.6	1,743	31.0	2,140	33.5		39.5		39.5	
2) Training and Communication	4.6	143	4.0	300	4.0	371	4.0	431	4.0	595	6.0	801	6.0		6.0		6.0	
3) Support Groups																		
Soils Lab. Services									1.0	54	1.0	75	1.0		1.0		1.0	
Biometrics				2		4		41	0.5	35	0.5	91	0.5		0.5		0.5	
Library & Documents	1.0	62	1.4	88	1.0	77	1.0	102	1.0	106	1.0	129	1.0		1.0		1.0	
Field Operations-Engineering							1.0		0.5	28	0.5	56						
Station Operations	0.6		0.5	115	1.0	343	0.5	71	0.2	64		112			1.0		1.0	
Physical Plant-Motor Pool	0.4		0.5	35			0.5	159	0.3	190		275						
Administration	2.5	238	2.0	230	3.0	314	3.0	282	3.0	330	3.0	374	4.0		4.0		4.0	
General Expenses		237		285		265		321		322		300						
Sub-total	4.5	680	8.4	1,055	9.0	1,374	10.0	976	10.5	1,129	12.0	1,412	12.5		13.5		13.5	
TOTAL NET CORE	23.8	1,434	26.8	2,267	36.7	2,891	41.2	3,363	38.1	3,467	43.0	4,353	46.0	4,657	53.0	5,365	53.0	5,365
Other				90				100		100		50		150		150		150
Plus: Price Increase Provision														433		1,038		1,626
Professional Support Staff	18		40		60		66		80		95		105		125		125	
TOTAL REQUIRED		1,434		2,357		2,891		3,463		3,567		4,403		5,240		6,553		7,141
BY OBJECT OF EXPENDITURE																		
Personnel		933		1,532		1,958		2,429		2,517		3,092		3,376		3,873		3,873
Supplies		149		376		384		334		344		456		498		571		571
Services		62		99		143		55		56		127		139		160		160
Travel		169		105		239		172		175		311		339		389		389
General Expenses and Others		121		245		167		474		475		417		455		522		522
TOTAL		1,434		2,358		2,891		3,464		3,567		4,403		4,807		5,515		5,515
Plus: Price Increase												-		433		1,038		1,626
												4,403		5,240		6,553		7,141

* Includes visiting & other scientists supported by other institutions.

1974 BUDGET

TABLE III

Page 1

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

SUMMARY OF SOURCES AND APPLICATION OF FUNDS

(US$ THOUSANDS)

	ACTUAL			ESTIMATED	CURRENT BUDGET	PROJECTED			
	1970	1971	1972	1973	1973	1974	1975	1976	1977
SOURCES OF FUNDS									
I - CORE OPERATIONS									
A. Unrestricted									
1. a) Ford Foundation	500	680	720	750	750				
b) Rockefeller Foundation	360	659	720	750	682				
c) USAID	240	680	721	880	875				
d) Government of the Netherlands	-	125	125	125	125				
e) IDA, World Bank	-	-	-	-	210				
f) Swiss Government	-	-	-	-	65				
g) Others - Unidentified	-	-	-	-	-				
2. Total Donors	1,100	2,144	2,286	2,505	2,707				
3. a) Unexpended balance-prior year	131	-	-	-	-				
b) Earned income for year	28	7	82	64	70				
4. Total Unrestricted	1,259	2,151	2,368	2,569	2,777				
B. Restricted									
1. a) W. K. Kellogg Foundation	70	200	155	290	290	280	290	300	310
b) IDRC - Canada	-	150	278	500	500	750	822	-	-
c) USAID	-	-	-	-	-	-	-	-	-
d) Rockefeller Foundation	64	-	-	-	-	-	-	-	-
e) Other	-	-	-	-	-	-	-	-	-
2. Total Donors	134	350	433	790	790	1,030	1,112	300	310
3. a) Unexpended balance-prior year	116	-	56	-	-	-	-	-	-
b) Earned income for year	2	-	-	-	-	-	-	-	-
4. Total Restricted	252	350	489	790	790	1,030	1,112	300	310
C. Gross Core and Other Funds Required	1,511	2,501	2,857	3,359	3,567	4,403	5,240	6,533	7,141
1. Less: a) Unexpended Balance	247	-	56	-	-	-	-	-	-
b) Earned Income	30	7	82	64	70	-			
c) Pledged Funds	-	-	-	290	500	1,030	1,112	300	310
D. Net Core Funds - Donors	1,234	2,494	2,719	-	2,997	-	-	-	-
- CG	-	-	-	3,005	-	3,373	4,128	6,233	6,831

SUMMARY OF SOURCES AND APPLICATION OF FUNDS

(US$ THOUSANDS)

	ACTUAL			ESTIMATED	CURRENT BUDGET		PROJECTED		
	1970	1971	1972	1973	1973	1974	1975	1976	1977
II. - CAPITAL FUNDS									
A. 1. a) Rockefeller Foundation	770	244	807	200	500				
b) W. K. Kellogg Foundation	45	-	-	-	-				
c) Kresge Foundation	-	-	750	-	-				
d) USAID	19	-	-	-	-				
e) Others	9	-	-	-	-				
2. Total Donors	843	244	1,557	200	500				
3. a) Unexpended balance-prior year	1,278	1,488	717	1,894	1,894				
b) Earned income for year	100	71	46	-	-				
B. Total Capital Funds	2,221	1,803	2,320	2,094	2,394				
C. Gross Capital Funds Required	733	1,086	1,426	3,328	2,394	1,500	1,350	1,350	
1. Less: a) Unexpended Balance	-	-	-	-	-	-	-	-	
b) Earned Income	-	-	-	-	-	-	-	-	
D. Net Capital Funds through CG						1,500	1,350	1,350	
E. Total Funds Requested through CG						4,873	5,478	7,583	6,831
III. - SPECIAL PROJECTS AND OUTREACH									
A. Special Projects									
1. a) W. K. Kellog Foundation	-	16	30	60	60	-			
b) BID - IDB	-	65	50	100	130	133			
c) IDRC - Canada	-	-	10	40	40	-			
d) USAID	-	17	2	-	-	-			
e) Animal Health Entomology Project*	-	-	-	-	-	42			
f) TPI/CIAT Cassava Storage Project*	-	-	-	-	-	25			
2. Total Donors	-	98	92	200	230	200			
3. Unexpended balance prior year	-	14	-	-	-	-			
4. Earned and other income	-	7	17	128	112	98			
5. Total Special Projects	-	119	109	328	342	298			
OUTREACH									
1. a) IDRC - Canada	-	63	-	19	9	-			
b) RF - CIAT - ICTA	-	-	-	30	84	76	76		
2. Sub-Total	-	63	-	49	93	76	76		
3. a) Unexpended balance-prior year	-	-	63	35	44	6	-		
b) Earned and other income	-	-	-	-	-	-	-		
4. Total Outreach	-	63	63	84	137	82	76		
Total Special Projects and Outreach	-	182	172	412	479	380			

* Overseas Development Administration, United Kingdom, has expressed interest in possibly providing support.

SUMMARY OF SOURCES AND APPLICATION OF FUNDS

(US$ THOUSANDS)

	ACTUAL			ESTIMATED	CURRENT BUDGET		PROJECTED		
	1970	1971	1972	1973	1973	1974	1975	1976	1977
APPLICATION OF FUNDS									
I. A. Core Operations									
1. a) Unrestricted	1,364	2,094	2,391	-	2,677				
b) Restricted	215	255	500	-	790				
Sub-Total	1,579	2,349	2,891	3,363	3,467	4,353	4,657	5,365	5,365
B. Working Capital and Other 1/	14	90	-	100	100	50	583	1,188	1,776
Total Core and Other	1,593	2,439	2,891	3,463	3,567	4,403	5,240	6,553	7,141
C. Capital Expenditures	733	1,086	1,426	3,328	2,394	1,500	1,350	1,350	-
Total	2,326	3,525	4,317	6,791	5,961	5,903	6,590	7,903	7,141
D. 1. a) Special Projects	2/	128	147	404	342	298	-	-	-
b) Outreach IDRC and RF	-	-	19	77	131	82	76	-	-
Total	-	128	166	481	473	380	76	-	-
Total Applications	2,326	3,653	4,483	7,272	6,434	6,283	6,666	7,903	7,141
II. Unexpended Balance and/or (Deficit)									
A. Core 1) Unrestricted	(105)	57	(23)	-	-	-			
2) Restricted	37	96	(11)	-	-	-			
	(68)	153	(34)	(104)	-	-			
B. Working Capital and Other	(14) 3/	(90)	-	-	-	-			
Sub-Total	(82)	63	(34)	-	-	-			
C. Capital Funds	1,488	717	1,894	-	-	-			
D. 1. Special Projects	-	(7)	(38)	-	-	-			
2. Outreach Activities	-	63	44	-	6	-			

Notes:
1/ For 1975-1977 includes a provision for price increases.
2/ Special Project Activities were funded with core restricted funds.
3/ Accrual for Conferences & Symposia in 1971.

1974 BUDGET

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

TABLE IV

SUMMARY FINANCIAL DATA - 1970-1974

(US$ THOUSANDS)

	ACTUAL			EST.	BUDGET	
	1970	1971	1972	1973	1973	1974
Current Assets						
Cash	959	450	272	449	200	
Receivables from Donors	446	471	499	-	250	
Other Receivables	16	29	73	-	100	
Inventories		7	54	100	120	
Prepaid Expenses			17			
Other Current Assets	86	334	287		100	
Total Current Assets	1,507	1.291	1,202	549	770	770
Fixed Assets						
Vehicles	249	257	314		390	
Revolving Fund Balances	44	51	64	50	85	
Operating Equipment	224	295	313		550	
Land	3	4				
Research Equipment	171	255	329		1,090	
Furnishings & Office Equip.	145	236	369		840	
Buildings	474	1,276	2,359		3,125	
All Other-Books	42	64	116		150	
Total Fixed Assets	1,352	2,438	3,864	6,393	6,230	7,730
TOTAL ASSETS	2,859	3,729	5,066	6,942	7,000	8,500
Liabilities						
Current Liabilities	74	423	288	599	730	
Payable to Donors & Sponsors	25	25	25	25	25	
Total Liabilities	99	448	313	624	755	500
Unexpended Funds and Capital Balances						
Capital Balances:						
Capital	2,829	3,141	4,755	6,318	6,245	
Other	-	-	-	-	-	
Unexpected Funds:						
Core	(69)	-	(12)	-	-	
Unrestricted	-	-	-	-	-	
Restricted	-	77	-	-	-	
Special Projects	-	63	10	-	-	
Earned Income	-	-	-	-	-	
Total	2,760	3,281	4,753	6,318	6,245	8,000
TOTAL LIABILITIES AND CAPITAL BALANCES	2,859	3,729	5,066	6,942	7,000	8,500
Sources of Funds						
Operating Core	1,511	2,501	2,857	3,359	3,567	4,403
Operating Special Projects	-	182	172	412	479	380
Capital	2,112	1,803	2,320	2,094	2,394	1,500
Total	3,623	4,486	5,349	5,865	6,440	6,283
Application of Funds						
Operating Core	1,579	2,359	2,891	3,363	3,467	4,353
Special Projects & Outreach	-	128	166	481	473	380
Working Capital & Other	14	90	-	100	100	50
Capital	733	1,086	1,426	3,328	2,394	1,500
Total	2,326	3,663	4,483	7,272	6,434	6,283
UNEXPENDED BALANCES	1,307	823	866	(1,407)	6	-0-
Memo Items						
Manyears of Core Program Staff:						
Principal Staff	23	27	37	41	38	43
Professional Support Staff	18	40	60	66	80	95
Total	41	67	97	107	118	138

COMMODITY PROGRAM ACTIVITIES

Beef Production Systems

CIAT's beef cattle program aims to develop an adequate technological base and to train production-oriented personnel to support an efficient beef cattle industry under the varying conditions of the tropics. It represents a long-range effort with the ultimate objective of making more effective use of vast areas of relatively undeveloped, unexploited land, either for beef production or more general agricultural enterprises.

Research and training programs are currently in progress at the CIAT Center, and collaborative programs with ICA at the Carimagua station situated in the Llanos and the Turipana station near Monteria in the north coast. Technical assistance is being provided in the development of the INIAP beef cattle program in Ecuador.

Research objectives are: (1) to provide adequate feed supply, (2) to control disease and parasitism and (3) to develop economical systems of production. Particular attention is given to reproduction, recognizing that sustained increases in beef production directly depend on increasing calving percentage.

Training of livestock production specialists and research workers engaged in agricultural development are important parts of the overall program.

Activities with outside funding include the Texas A&M University hemoparasite project, funded by USAID, and visiting scientists from Wageningen University. A portion of the USAID funds support research in hemoparasite diseases at Texas A&M, and the remainder supports research in CIAT. Wageningen provides salary and other perquisites for its visiting scientists.

Pastures, Forages and Utilization. Approximately 80 genotypes of the tropical legume Stylosanthes guyanensis have been assembled and typed. Selection continues for cultivars and species that have desirable growth characteristics and resistance to anthracnose (Colletotrichum sp.).

Introduction, screening and evaluation of other tropical legumes continues. Major emphasis has been placed on the collection and testing of Rhizobia strains to facilitate local production of inoculants. Inoculation and seed pelleting of these legumes is being investigated under acid soil conditions.

Large plots of Stylosanthes guyanensis and Paspalum plicatum, and smaller plots of the other grasses and legumes have been planted for seed increase. This activity is continuing.

Effects of tillage and fertilizer application on establishment of grass and grass-legume pastures at Carimagua receive major attention.

Grazing trials are in progress at three locations. At the CIAT Center, nitrogen fertilization has increased the beef production of Digitaria decumbens (pangola) and Brachiaria mutica (para) pastures. Increasing nitrogen fertilization of pangola from 200 to 800 kg/ha increased liveweight gains from 576 to 943 kg/ha during a 308-day period. With para liveweight gain per hectare was increased from 528 to 718 kg during a 336-day period when nitrogen fertilization was increased from 200 to 600 kg/ha. Returns to total investment in the pangola trial ranged from 6 to 13 percent.

At Carimagua, Melinis minutiflora pastures fertilized with basic slag at the time of seeding were ready for grazing several months before non-fertilized pastures.

However, no differences in liveweight gains have been noted once grazing was begun.

Cattle grazing on Melinis minutiflora gained about eight times more than those on native grass. The cost-benefit ratio is highly favorable with establishment costs of US$23/ha and additional annual returns of US$26/ha as compared to native grass. Another grazing trial is being initiated at Turipana using para alone and in combination with four tropical legumes.

Nutrient balance and intake studies are underway in Palmira to determine nutritive value of grasses and legumes. Addition of a high protein legume to a low protein grass increased total feed intake from 9 to 22 percent. All grazing trials and studies to evaluate grasses, legumes, and grass-legume mixtures will continue in 1974.

Several herbicides were identified for the effective control of annual broadleaf herbaceous plants. Research continues to determine ways to control perennial brush species, undesirable grasses and sedges. A manual for pasture weed identification will soon be published.

Cultivated Forages. A trial is underway at CIAT to determine the productivity and return of intensive systems of growing-finishing cattle on Napier grass.

Control of Disease and Parasitism. The animal health program contributes work towards the eradication or control of diseases limiting beef production. Specific objectives are: (1) to determine the disease status of cattle under low intensity management schemes (2) to identify and monitor changes in health status when improved beef management systems increase cattle population density, and (3) to initiate research when knowledge is lacking on the epidemiology and control of a disease.

Health status was determined in the lot of 438 females from which 224 were selected for the herd systems project at Carimagua. A small prevalence of brucellosis was detected, but no leptospirosis. All bulls were free of vibriosis and trichomoniasis.

Cattle were examined on a private ranch where there have been severe abortion and infertility problems. No reproductive diseases were identified, and causes of the problem have not been determined. Monitoring of the disease status of representative groups of cattle in various environments is continuing.

Studies are in progress to determine the role of wild life species in the epidemiology of cattle diseases.

The hemoparasite project (babesiosis, anaplasmosis, and trypanosomiasis) is supported through Texas A & M University by the USAID and has the general objective of developing an effective program to control hemoparasite infections in the tropics and to train Latin and North American personnel in this field. Results of the first field study, conducted at Turipana, indicated that it was economically advantageous to control these diseases using premunization and chemoprophylaxis.

Work continues to devise new immunizing procedures and to test the efficacy of those presently available. Epidemiological studies are underway to determine where such procedures are needed in the field. This research requires an entomologist (acarologist). The Texas A & M project does not provide for such competency, and there are no persons working in this area in Colombia.

The work of this entomologist would be: (a) To identify and study the bionomics of the ectoparasites infesting cattle in natural and improved pastures, (b) to recommend methods of control, (c) to establish colonies of the main tick species for research and training at CIAT and elsewhere, (d) to train personnel in CIAT in the care and maintenance of tick colonies, (e) to collaborate with ongoing research on control of hemoparasitic diseases, and (f) to participate in CIAT's training activities.

CIAT proposes to undertake studies in this area because of the damage ectoparasites do and the pathogens they may transmit. Initial studies will be carried out by an entomologist (acarologist) to be employed in 1974 on a two-year basis with such special funds as may be made available from a donor agency directly or through action of the Consultative Group. To this end, the amount shown in the Special Projects budget is for the salary, perquisites, and other direct expenses associated with the employing of one scientist whose activities would be supported and integrated within the animal health group. If results of initial efforts indicate the value of continued work in this area, CIAT would seek additional funds to support such core program activities as deemed necessary.

Economics. Major emphasis is placed on the economics of production inputs, practices and systems and characterization of the beef cattle sector in the lowland tropics of Latin America.

Basic data obtained from a north coast survey is helping to establish priorities. More than half of the ranches surveyed were smaller than 200 hectares; 14 percent were larger than 500 hectares. Cow-calf operations predominate. On small farms, about one-third of the total revenue comes from milk; on farms of more than 500 hectares, about 10 percent comes from this source. Stocking rates average about 1.5 animals per hectare.

The possibility of a regional project is being explored with the Ford Foundation to consolidate basic information on the status of the beef cattle industry in the lowland tropics and on basic public policies directly related to agricultural development.

Farming Systems. CIAT's research is directed towards development of production techniques and systems broadly applicable throughout the lowland tropics. Production levels are generally low in the lowland humid tropics where traditional cattle management is practiced, particularly in latosolic grassland areas such as the Colombian Llanos and the Campo Cerrado of Brazil. Preliminary evidence indicates that productivity and profitability could be substantially increased through sound pasture management, feeding, breeding and herd health practices, and by using improved pastures.

The comprehensive production systems research in progress at Carimagua gives major attention to development of a subsistence base so as to provide food and shelter for the family while it is simultaneously establishing a long term cattle operation. Basic food crops considered include beans, cowpeas, peanuts, cassava, rice, corn, sorghum, and plantains. Some of these could also be used to feed poultry and swine.

Nine beef herds have been established to study over a 5-year period the effects of pasture-type, mineral and protein supplementation, length of breeding season, rotational crossbreeding and early weaning. Data are being taken on production, disease incidence, physiological and other variables including those necessary for economic analysis. A similar long-term experiment is contemplated to compare native and improved grass pastures alone and in combination with tropical legumes.

A collaborative survey of small and large farm units is underway with the Fondo Ganadero del Meta to determine the nutritional, physiological and health status of beef cattle herds and to collect general farm data.

Cassava Production Systems

Cassava, Manihot esculenta (Crantz), is a starch-producing root crop of the tropics. Already a food for millions, it is especially promising as an efficient source of food and feed for alleviating expected shortages as the world population increases and as food needs become more acute. CIAT has undertaken a comprehensive series of investigations of cassava designed to improve varieties and production practices, and to disseminate material and "know how" to the regions where they can best be utilized.

Present Status of the Crop

Cassava (manoic, mandioca, yuca) is a short-lived perennial species seldom found except in the cultivated state, but with numerous wild relatives. Although believed to have originated within meso-America or northern South America, its present distribution is between 30°north and south latitudes, at elevations from sea level to more than 2,000 meters. Cassava grows as a woody bush of variable branching habit, and with a height of from 1.5 to 4 meters.

Some of the roots of the plants begin to enlarge 3 or 4 months after planting because of the accumulation of starch. The number and morphology of the storage roots are varietal characteristics, but their size is chiefly related to the age of the plant. Most varieties are harvested after less than a full year's growth to make an annual planting cycle feasible, but varieties that can be harvested 6-7 months after planting are known.

The roots contain a cyanogenic glucoside, linamarin, which when degradated by the enzime linamarase, releases hydrocyanic acid. The peel, which constitutes 10 - 20 percent of the fresh weight, contains a higher concentration of the poisonous substance than do the starchy roots. Depending on the concentration of hydrocyanic acid released from the linamarin the varieties are frequently classified as sweet or bitter. The level of hydrocyanic acid in the flesh varies from less than 10 to over 150 ppm.

Not all varieties of cassava flower freely. The small flowers are borne in racemes with the female flowers maturing before the males.

Fertility is usually high, and seeds are easily produced through open or controlled pollination. However, for convenience, and in order to maintain varietal characteristics, cassava is usually propagated from stem cuttings.

The roots are used as a freshy boiled or fried vegetable, as a flour after drying and milling, or as a paste. The leaves are cooked as a green "spinach." The fresh, dried or partially fermented roots are used as animal feeds. Commercially, the starch is used as adhesives, sizing, and as a substrate for processing. Tapioca is a cassava product.

Because fermentation and putrefaction begin shortly after harvest, cassava can be stored for only a few days in its fresh state. But it can be processed into durable forms by a variety of techniques. It can be dried as chips and stored up to a year with little deterioration. Dried chips can be incorporated into complete diets for animals as a substitute for cereal grains. Flours made by grinding the dried root either with or without prior fermentation treatment are also commonly produced.

Cassava is an outstanding source of calories. The roots contain about 30 to 40 percent dry matter. This consists largely of carbohydrates, relatively small of protein (usually 0.5 to 1.5 percent) and even smaller amounts of fats, vitamins and minerals. Preliminary amino acid analysis of cassava indicates a distribution similar to that of common corn with low levels of methionine. Threonine levels of the protein are twice as high as those of the protein of corn. Analysis of the leaves shows high levels of protein, ranging from 3.7 to 10.7 percent on a fresh weight basis and 21 to 36 percent on a dry weight basis. Of the essential amino acids, only methionine is deficient; excellent levels of lysine (5.6 to 8 percent) have been found.

Most of the crop is grown in small plantings and is consumed on the farm. Africa is the world's largest regional producer; Brazil produces more cassava than any other single country. Compared with the world's average yield of 8.7 tons per hectare, several countries (Brazil, Bolivia, Paraguay, Thailand, Malaysia, Taiwan, Malawi, Mali, and French Polynesia) report national averages ranging from 14 to 22 tons per hectare. When cassava is well-tended as a plantation crop, yields of 25 tons per hectare are considered acceptable, although from 50 to 80 tons per hectare have been reported.

Several factors contribute to the increasing interest in cassava. First, the crop is widely grown and accepted, has a wide range of adaptability and appears to have a great potential in terms of improvement in yield and quality. The role of cassava as food for humans is expected to increase in importance. Second, to an increasing extent, dried cassava is being used widely as a livestock feed. Cassava has been included successfully in diets for pigs, poultry and cattle and is used extensively in Europe where it supplies up to 40 percent of the ration for livestock feed with no serious problems.

The CIAT Cassava Program

Intensive reviews of the literature on a world-wide basis, an international symposium in 1972 which brought together some 25 of the world's scientists most concerned at one time or another with cassava research, and a series of planning meetings with representatives of various countries brought together under the auspices of the International Development Research Centre of Canada and CIAT have stimulated the development of the current cassava program. Priorities have been assigned and general policies developed. The program outlined here serves as a guideline for research activities, and, as such, is conceived as a permanent but flexible framework.

Goals. CIAT's main effort is to provide production packages tolerant to a wide climatic and edaphic variation, that are directly applicable to small scale units, but that can readily be adapted for large scale production. Essential to these goals are the development of new varieties, the improvement of production practices, and the control of pests, diseases, and weeds that limit production. All of these influence one fundamental characteristic, yield. Quality of the product is important and must be emphasized. While maximizing yields, CIAT also emphasizes the conservation of the crop produced by appropriate storage.

CIAT must move the plant materials developed and the information gained outside of its own limited area of direct influence on the farming community. CIAT's approach is four-fold:

(1) By establishing close links with government or other agencies in other countries;

(2) By disseminating information among cassava researchers throughout the world to stimulate further research and transfer of information that ultimately will reach farmers;

(3) By training people who can return to their countries and expedite the spread of new technology and;

(4) By promoting the use of improved varieties and production systems.

Yields. Adequate yields depend on good varieties. The germ plasm collection is being screened for high yielding varieties, for resistance to diseases, for resistance to diseases, for other factors that influence yields, and for quality. Breeding objectives have been formulated for both short and long terms, and practical breeding activities initiated. While it is believed that the same varieties will be useful for human food, animal feed, and industrial use, different varieties will probably be necessary for various ecological zones, climates, and soil types. Varietal tests in diverse locations are important.

It is recognized that breeding goals are influenced from data from many sources. Thus CIAT's physiology group is studying the factors associated with yielding ability, the pathologists are studying disease resistance and simple cultural and sanitary methods of pathogen control, the entomologists insect resistance and control systems, and the weed control group methods of weed control.

Cassava is grown under varied climatic and soil conditions both as a backyard crop and on a larger scale. No one production system will perfectly suit these diverse conditions. First, considering different ecozones, different production methods will be required. CIAT will develop production methods that tolerate a wide range of local conditions; these systems can then be modified for any particular locality by scientists, in many cases trained at CIAT, for that particular area.

The problems of increasing production on large and small scale units are basically similar. But the differences are in the management and engineering

functions, not the biological. The method and ease of application of chemicals, cultivation and populations of parasitic organisms depend on the scale of operations. The majority of techniques developed on small scale labor intensive plots in CIAT should be directly applicable to small scale farm units and should be readily adaptable to the larger scale units. The obvious exceptions to this are related to mechanization and marketing.

CIAT, at present, has no immediate plans to develop mechanized planting and harvesting systems. Cassava harvesting can be both difficult and strenous when soil conditions are poor and varieties have a poor rot shape. Observations at CIAT suggest that by selecting for root shape and distribution, manual harvesting becomes a simple and rapid procedure. The mechanization of insecticide and fungicide application is highly scale dependent; however, CIAT's approach to disease and pest control is through simple cultural and sanitary practices or varietal resistance.

Inputs to the agronomic program are expected from the discipline-oriented groups, including plant physiology, pathology, entomology and weed control. Economic analysis will provide data useful in evaluating production systems and selecting optimum practices.

Quality. The cyanogen in cassava can result in acute toxicity and chronic disease such as goitre or ataxic neuropathy if consumption is high. Processing, or the use of low cyanide clones, reduces the level of cyanide and its precursors but does not eliminate them. While any cyanogen remains, there is a danger of chronic poisoning. Therefore, CIAT is searching for or will develop, as necessary, low or zero cyanogen types.

Cassava contains little protein and even the so-called high protein lines contain no more than 6-7 percent crude protein (Nx6.25) on a dry weight basis. Only about half this nitrogen is true protein, and thus it appears unlikely that cassava can be an effective protein source. The protein contents of new and selected varieties will be established.

Cassava is frequently eaten after fermentation and it may well prove possible to

make a protein-enriched product, using microbial fermentation and inorganic nitrogen, that is useful as an animal feed. The possibility of an enriched fermentation product for human consumption will be considered.

Storage and Marketing. Because of the short storage life of cassava after harvest, the farmer has difficulty marketing his produce. The two approaches to this problem are:

(1) Storage of fresh roots that can later be used for human or animal consumption;

(2) Drying of roots prior to storage.

For both types of storage, low cost processing systems are required that use local materials and skills.

Increased production of cassava appears justifiable only if international and national demands remain strong. CIAT is collecting the basic marketing data necesary to make decisions. Such information will be collected by staff members when appropriate, or through outside experts or agencies, when necessary, with emphasis on both food and feed markets.

Highlights of Progress

Although the complete cassava team has not yet been assembled, scientists working on the crop at CIAT made substantial progress in many areas in 1972 and to date in 1973. In addition, cooperative programs were undertaken with McGill University, University of Guelph, and other institutions in Canada and Latin America.

Plant Physiology. Study of the growth pattern of cassava suggests that cassava can grow continuously, producing more starch as time passes. As the number of roots, stays constant, the yield increase results from an increase in size.

The plant shows a remarkable response to planting density, yields increasing

with mounting density until a well-defined optimum is reached. While the optima differ with varieties, the three varieties tested showed optimum populations for yield between 5,000 and 9,000 plants per hectare. The optimal planting density for total dry matter production is greater than that for root production. This suggests that there is scope for yield increases by changing dry matter distribution at higher plant populations.

Breeding programs have been frequently slowed because sufficient quantities of planting material are not available. A rapid method of clonal multiplication for cassava was developed through the use of mist propagators. For instance, six mature stem cuttings (total of 60 nodes) produced more than 180 shoots in 42 days, a three-fold increase over single node propagation methods.

Plant Pathology. A system of young shoot propagation was used to eliminate the bacteria from the germ plasm bank of more than 2,000 collections. As experiments with bacteria are terminated, the CIAT farm will be completely cleaned. The system of eliminating bacteria is being tested on a commercial farm to assess its effectiveness. If effective, then certified bacteria-free planting material can be made available.

A new disease, which results in superelongation of the internodes of young stems, was identified. This disease appears to be potentially serious, but high levels of varietal resistance have already been found.

Entomology. Striking differences in susceptibility of varieties to thrips were observed. This pests appears to be of great importance under dry conditions.

The horn worm can be effectively controlled using insecticides; however, the economics of control cannot be established until the effects of attack on yield have been determined.

Weed Control. Several potentially useful herbicides and weeding schemes for cassava were identified in tests involving 27 chemicals and four methods of management. These could lead to lower costs of production especially in the early stages of establishing a stand when competition from weeds is severe.

Breeding. The breeding program was initiated in January 1973 and already has produced successful hybridizations. The plant breeder is trying to develop high yielding, disease and pest resistant types that are easily harvested and low in cyanide.

As little knowledge exists on the genetic variability of cassava, a hybridization program, using as much variability as possible, will attempt to obtain improved types while at the same time gaining scientific information on specific genetic characteristics.

Storage and Processing. Research on the storage problem of cassava included tests of a simple and inexpensive on-the-farm method of storing cassava roots in soil-covered piles, similar to those used for storing potatoes. This system needs further testing but the promising results obtained, plus the important implications the storage problem has for marketing cassava, lead to the continuation of this research in 1974.

The basic physical mechanisms that control the drying of cassava chips were investigated under natural ambient conditions. Results are being used to design low-cost, simple methods of on-the-farm drying using solar energy.

Agricultural Economics. A survey among 330 cassava producers in various regions of Colombia described present production systems and provided data on estimated costs of production and labor use. This work is being extended to other cassava-producing countries.

The potential cassava demand for direct human consumption, industrial starch and animal feed is presently being analyzed jointly by the University of Guelph, Canada, and CIAT. The animal feed market looks particularly promising.

Tentative results from an analysis of the economic feasibility of partial substitution of wheat in bread in Colombia suggest that such substitution would not be economically sound at present prices. The economic feasibility of using cassava as an energy source for swine is being studied.

An analysis of the world cassava production and yield trends during the period 1960-68 was carried out on the basis of secondary data. The analysis suggests an increasing production trend of about two million tons annually during the period, because of an increase in cassava acreage of about 200,000 hectares annually.

Research is being initiated on the implications of an expanded production on employment, farm returns, income distribution, and international trade.

Library and Documentation. Cassava literature is estimated at about 3,500 articles produced in the world. The CIAT library has located and ordered more than 3,000 of these documents and about 1,200 already have arrived. A mechanized system of information retrieval is used whereby cards containing the literature citation, the main topics (keywords), and an abstract of each article are produced and distributed to cassava scientists. This system allows for retrospective searches to be made in terms of specific keywords or combinations of keywords.

A comprehensive bibliography based on these abstract cards is being produced in book-form and for distribution internationally in 1974.

Specific Research Projects in 1974

Much of the work started in 1972-73 will be continued in 1974. Among the specific research projects to be completed or initiated in 1974 at CIAT are the following:

1. To determine the effects of variation in plant type on plant spacing requirements.

2. To develop a system for the rapid propagation from vegetative materials.

3. To develop stake storage systems.

4. To define whether the production of carbohydrates per se or the roots' ability to accept carbohydrates limits yield.

5. To find the interactions of plant spacing and different weed control methods with respect to yield.

6. To develop successful integrated weed control methods.

7. To develop and demonstrate methods for eliminating bacteria from heavily infected farms.

8. To evaluate yield losses associated with shoot fly attack.

9. To evaluate the seriousness of horn worm attacks at different growth stages.

10. To screen the germ plasm bank for sources of resistance to thrips.

Among the activities being undertaken by other institutions as part of the CIAT program are the following:

1. To develop a simple, low-cost method of on-the-farm storage of fresh roots. (Brace Research Institute).

2. To produce and describe mineral efficiency symptoms. (University of Guelph).

3. To describe factors affecting variability among varieties with respect to photosynthesis (University of Guelph).

4. To devise methods of producing disease-free planting material by using physical inactivation methods. (Instituto Agronómico de Campinas, Brazil).

5. To characterize African cassava mosaic virus and to help define control methods (McGill University).

6. To define methods of tissue culture than can produce virus-free plantlets. (National Research Council, Canada).

Swine Production Systems

The swine program at CIAT seeks to develop efficient swine production systems capable of providing increased supplies of high quality pork to consumers at reasonable prices while at the same time reducing the risks to the producer and assuring him of a regular income. The program trains professionals to use these systems effectively and how to adapt and extend them to meet local conditions.

Problems of small farms which produce approximately 80 percent of the some 100 million swine produced annually in the lowland tropics of Latin America receive first priority. Husbandry, health and socio-economic factors that limit efficient, economic production are studied by an inter-disciplinary team which focuses on production conditions on both small and commercial swine farms.

In addition, the swine production specialists evaluate feed sources, particularly protein sources that can be grown and used on tropical farms, and assist in the development of national swine production programs.

Husbandry. High feed cost and local unavailability of adequate protein sources continue to limit the economic potential of swine production in many areas of the Latin American lowland tropics. Research emphasizes utilization of available feedstuffs and evaluation of new sources.

Results of studies indicate that fresh bananas should be fed ripe and banana meal be prepared from green bananas for maximum utilization by swine.

Digestibility studies, show that the energy fraction in cassava was highly digestible (3,758 kcal/kg of dry matter) but that the nitrogen fraction represented as crude protein was only 40 percent digestible. High levels of cassava consumption containing high to medium levels of cyanide increase the requirement for both iodine and methionine supplementation in the diet and reduce the utilization of these nutrients for normal body functions. Biological studies have shown that the crude protein in cassava has a value equal to 52 to 59 percent of that of casein. Gains, feed efficiency and efficiency of protein utilization are significantly improved by adding methionine.

Swine production systems based on use of opaque-2 maize have been developed that require only approximately 25 percent as much supplemental protein as that required by sytems based on normal maize.

Results of chemical analyses and of pig and rat feeding trials indicate that cottonseed is a poor source of protein because of the high level of gossypol. Studies are continuing to develop a processing and supplementation procedure that will aid swine producers to make economic use of cottonseed as a protein source.

Trials with rats confirmed previous results that pigeon peas, a potential protein source, must be cooked to be used efficiently. These studies failed to confirm previously published data which indicate that the pigeon pea protein is first limiting in tryptophan and second in methionine. The reverse was found.

Extreme variations were obtained in trials in which cowpeas were germinated before feeding in efforts to eliminate the toxic factors which interfere with protein utilization. Other studies have demonstrated the value of this legume as a supplement to maize and other carbohydrates readily available in the tropics. Even without methionine supplementation, the cowpea effectively improved the all opaque-2 maize by 30 to 40 percent. Studies are continuing to evaluate combinations of cowpeas with cassava, maize and plantains, as well as to establish the reasons for the differences in response to germinated cowpeas.

One study in depth in a small village on the north coast of Colombia has provided a number of insights on the problems of swine production under such circumstances. Because of the poor diets and conditions of sanitation, of more than 300 pigs studied, few weighed more than 20 kg at 6 months and 60 kg at 12 to 18 months. Local pigs fed under the traditional system gained an average of 4 kg each in 56 days and required 9.4 kg of corn (value 18.80 pesos) to produce a kilogram of live weight gain worth 8.50 to 9.50 pesos. Those fed under an improved system gained an average of 26 kg during the same period and required 2.6 kg of improved diet (cost 7.48 pesos) to produce a kilogram of gain.

Studies will continue on these and other farms to develop feeding and management systems. Development of adequate rations based on farm-produced feeds and to management and health practices that will maximize returns to farmers are emphasized.

Animal Health. Knowledge of the nutrition and management of swine in the lowland tropics still extends far in advance of understanding of the animal health problems. Data from studies of 16 farms and 12,600 swine in the Cauca Valley identified the principal problems as diarrhea and pneumonia in suckling pigs, pneumonia and otitis in immature animals, and abscesses, mastitis and abortion in adults.

Observations indicate that infectious diseases tend to be a more serious problem on medium to large commercial farms, but parasitic diseases demand more attention on subsistence and small farms. In both cases, the identification, prevention and control of diseases affecting the young pigs receive priority.

Economics. Economic aspects are considered in all of the nutrition, management and health studies. A linear programming model is being tested on a number of feeds.

Training and Outreach. One of the strategies for extending the program to potential swine-producing regions of the lowland tropics is to develop collaborative programs as well as training production and research specialists to direct these projects. Two Ecuadorians, trained in swine nutrition and research, are now working in the national agricultural research organization, INIAP. A trainee from Mexico is teaching swine production at the Escuela de Agricultura y Ganaderia at Monterrey. A recent master's student (University of Florida) completed his thesis work at CIAT and returned to work in the national swine improvement program of Costa Rica. Another trainee soon will return to his teaching and research position in Bolivia.

With the financial assistance of the IDRC, several outreach projects are planned for Latin American countries.

Bean Production Systems

Beans are the main source of protein for a large segment of the population in Latin America. Consumer prices have reached levels at which they cannot compete with the lower priced, high-yielding cereals. One of the main reasons for this phenomenon are the low yields obtained even with present improved varieties of beans. The national averages of production in Latin America are around 500 kg/ha as compared with 1,400 kg/ha in the United States.

Therefore, efforts to increase bean yields per unit area are essential, but the factors limiting yields are not clear. Through concentrated, multi-disciplinary research it should be possible to determine why yields are low and to establish ways to increase them. This research effort needs strong leadership and, for this reason, a coordinator for CIAT's Bean Production Systems Program was appointed in March 1973. Until a successor is employed in the near future, the bean program coordinator will continue to lead the limited scope Maize Production Systems Program which CIAT carries on in cooperation with CIMMYT.

Breeding. Three thousand and fifty four bean accessions were studied in the location of Palmira at an altitude of 1,000 m, with 24°C as a mean annual temperature and 930 mm of annual rainfall. Among these, 3,010 accessions were of *Phaseolus vulgaris* and 44 were formed by *P. lunatus*, *P. acutifolius*, *P. calcaratus*, *P. angularis*, *P. coccineus*, *Vigna sinensis*, *Vigna radiata*, and *Cajanus cajan*. Twenty-three morphologic characteristics were recorded for most of the accessions. One hundred

and thirty two promising selections were made on the basis of fruiting potential, plant structure, number of clusters per plant, number of pods per cluster, pubescense of the leaves, root system, growing habits, leaf size, as well as others.

The same bean collections are being evaluated in three other environments in 1973 to separate genotypes with high-yield potential, resistance to diseases and pests and to determine adaptation to high tropical temperatures.

Multiple crossing between selected genotypes will be started in 1974. One hundred and eight individual selections previously made in Palmira were planted at the ICA Experiment Station in Turipana (altitude 13 m; 27°C, 1,500 mm rainfall). Heavy rains destroyed 93 percent of these materials but eight selections survived. These may be tolerant to high rainfall conditions; further tests will be conducted. Other major projects include the evaluation of germ plasm at higher elevation (1,500-2,000 m) where climbing beans are grown with corn. The development of the bean collection bank will be continued.

Plant Physiology. A study of the physiological limitations of the bean plant is being initiated this year in cooperation with one or more institutions in Japan and the United States. Cooperative research projects, for which special funding will be requested of the Rockefeller Foundation, are being outlined. These will include studies on growth, photosynthesis efficiency, translocation, interactions among varieties, spacing and nitrogen levels, and varietal comparisons. The objective is to define the potential yielding ability of beans and to determine if the concept of an architecture---as so successfully applied in other crop species--can be applied to

Phaseolus vulgaris improvement. The team coordinator, in addition to his regular coordination activities, will concentrate his research on the more important physiological problems and objectives.

Plant Pathology. Diseases are an important limiting factor in bean production. The literature reports 252 bean pathogens in the tropics and 52 in the temperate zones. Discovery of resistance to several pathogens of economic importance in the tropics needs priority attention.

A survey of bean diseases is underway. There is common agreement that rust (Uromyces phaseoli var. typica), common bacterial blight (Xanthomonas phaseoli), golden yellow mosaic, and the virus complex, in general, are the most important diseases in the root rot group. Other diseases, such as round spot (Chaetoseptoria wellmanii), web-blight (Thanatephorus cucumeris), antracnose (Colletotrichum lindenuthianum), and angular leaf spot (Isariopsis griseola), are of local or regional importance. Planting distance plays an important role in epiphytotics of bean diseases. There are considerable differences in resistance to these diseases among varieties.

The most economical and efficient method of disease control is the use of partially resistant varieties (horizontal resistance). Out of 1,754 populations planted at CIAT, where an epiphytotic of Oidium was present, 241 showed resistance. At another location, where rust was prevalent, 396 collections out of 1,320 showed resistance to the local races of this pathogen.

A nursery of 200 lines was planted in collaboration with the USDA and Michigan State University to test resistance to Xanthomonas phaseoli; 58 were resistant to the common bacterial blight.

Screening methods are being developed to increase reliability and speed of varietal testing. Epiphytotic and ecological studies are being undertaken to devise control and prevention measures.

A seed sanitation program is being started using commercial varieties of various Latin America countries. This program includes the germ plasm bank.

Entomology. A general literature review of insect and related pests revealed 208 species attacking beans in Latin America. After assessing the possible economic importance, varieties will be screened for resistance and the feasibility of chemical control studied.

Agronomy. Trials initiated in 1971 and continued through 1972 showed a surprisingly wide range of varietal tolerance to soil acidity. The most interesting variability was found among the beans. Black beans responded strongly to the first increment of lime, as did cowpeas (Vigna sinensis); non-black beans produced no yield at the 0, 1/2 and 2 ton/ha levels and yields were poor even at 6 ton/ha. These results point to the potential importance of black seeded cultivars of Phaseolus vulgaris as a source of protein production in acid-soil regions.

Intercropping, association and rotational schemes will be studied in 1973 and 1974. These systems are widely used by small farmers to provide security against crop failure.

Research on the response to methods and levels of macro- and micro-nutrient deficiencies will continue through 1973 and 1974.

Soil Microbiology. In Colombia, as in most other countries on the western coast

of Latin America, the inoculation of leguminous plants to promote nitrogen fixation has been little used. A major reason for this phenomenon is the low quality of locally produced inoculants and the death of imported cultures during transit and storage.

During 1972, some 400 isolations were made from nodules of both native and commercially grown legumes. The rhizobia obtained were characterized and preserved by lyophilization. The collection includes more than 100 isolates from P. vulgaris.

Testing of these isolates using small pot and Leonard assemblies is not yet complete. Early tests, however, showed grain yields that differed as much as 100 percent as a result of inoculation.

Acid soil conditions, such as those found in the Llanos Orientales of Colombia, can adversely influence strain survival in the soil and result in nodulation failure.

Seed pelleting with either ground limestone or rock phosphate as the pelleting agent resulted in good nodulation of P. vulgaris and V. sinensis, even at low soil calcium levels.

Of the different species of root-nodule bacteria, the least studied to date has been R. phaseoli. An in-depth study of the interaction of this organism with various bean varieties was undertaken using four strains of R. phaseoli and four contrasting bean varieties. Features examined included time to first nodulation, nodule number, weight and distribution with time, commencement and duration of fixation, and plant dry weight changes.

Noteworthy results were:

1. Soil nitrogen levels inhibited nodulation.
2. There was considerable host plant -Rhizobium interaction, especially in time to first nodule formation, nodule number and weight.
3. Assuming equal seeding rates and proportions of active nodule tissue, the red-seeded varieties would fix more nitrogen/hectare than beans of the caraota type.

Agricultural Economics. An analysis of the present and future demand structure for the various grain legumes in Latin America, as well as the possibilities of exportation to countries outside the region, will be started. Socio-economic factors that may have a bearing on the low yields obtained in most Latin America bean-producing areas will also be surveyed.

International Activities. A seminar to analyze food legume production and research in Latin America was held in February 1973 with 150 participants from more than 20 countries. The roles of various agencies in improving production, marketing and consumer acceptance were discussed. Priorities for research, training, production, and distribution activities were established and the activities of international agencies in relation to national and regional programs explored.

The seminar participants agreed that the Steering Committee of the seminar form a small group to develop the criteria for and mechanics of a cooperative regional network for field bean improvement. This task force has been established and deliberations begun.

Training. Three young scientists were trained in breeding, soil microbiology, and plant pathology, respectively, during 1972. Training activities will be expanded in 1974.

Rice Production Systems

CIAT's rice program concentrates on breeding, agronomy and training. The program is coordinated with IRRI.

New, improved plant type varieties are now either being tried or grown commercially in at least 14 countries on an estimated 358,000 hectares. Some selections, now in the final stages of evaluation, may be released as new varieties before the end of 1973.

The use of plastic tarpolins in the rice blast nurseries at Palmira has made it possible to close down the testing facilities in Corinto and to evaluate genetic lines for blast resistance in areas where it was not possible previously.

A low cost, portable hand-operated thresher was developed by CIAT to improve hand harvesting efficiency. This machine is suited to small farms and could be used in areas of high unemployment and low cost labor.

The use of pre-germinated seed and planting in water favored growth and development of rice and reduced weeds. However, with this method of planting, herbicides must be applied post-emergence to avoid a phytotoxic effect on rice.

The specific activities contemplated in 1974 are outlined below.

Plant Breeding. The breeding program will continue to direct efforts toward developing varieties capable of increasing lowland farm yields. Development of upland varieties and varieties with acid soil tolerance will receive added emphasis.

A major unresolved problem is a blast-resistant variety with acceptable plant and grain characteristics. This would contribute greatly to both lowland and upland rice production.

The breeding program is financed jointly by CIAT and ICA. CIAT contributes the program coordinator, one research assistant, one technician and five laborers. ICA furnishes land, office and laboratory facilities as well as several agronomists and laborers.

Crop Protection. A research assistant under the direction of the plant breeder will evaluate varieties and segregating lines for blast resistance in beds established at Palmira. This work will also be continued in "La Libertad," Colombia, and possibly in Guyana, Brazil and Costa Rica. By working in various locations, information on resistance to a greater number of races of the fungus will be acquired.

An attempt will be made to develop a method of screening a large number of lines for resistance to sheath blight (Corticium sasaki) as this disease is becoming increasingly important in some countries.

Agronomy and Soils. Techniques of growing upland rice will be studied including fertilization requirements, seeding rates, row spacings and drought tolerance. Work will continue to identify acid soil tolerant varieties having good plant type and resistance to rice blast.

Training. Training plays an important role in providing rice technicians to the countries so that new technology can reach an increasing number of farmers. CIAT will continue to train research, extension, and seed production specialists. Rice production courses will also be organized in other countries.

Farming Systems. Large areas of land are periodically or permanently flooded in the tropics. In Asia this land is profitably used for rice production. CIAT will study the possibility of using flooded lands in Latin America for rice production.

Maize Production Systems

The maize team concentrates research on the most critical problems currently limiting farm yields in the Andean zone.

Breeding and Physiology. This work included selecting and testing shorter plant types for the tropics, extending the range of adaptation of individual genotypes, studying factors which affect adaptation (photoperiod and temperature), and improvement protein quality of current maize materials.

The first cycle of testing promising brachytic and short plant progeny was carried out in four locations, La Selva (2,100 m), Palmira (1,000 m), Turipana (40 m) and Boliche (20 m). Data from these tests indicated the most promising selections for the next cycle, in order to allow the use of this source material at elevations ranging from sea level up to at least 2,000 m. These germ plasm sources have been divided into four sub-populations to facilitate genetic manipulation and provide a more directly useful product; white brachytic, yellow brachytic (dwarf types), white short plant, and yellow short plant populations.

Research in adaptation has included a further cycle of testing photoperiod-temperature interaction across three latitudes. Trials in Palmira have been carried out to confirm previous cycles of testing for photoperiod insensitivity.

Protein quality improvement has concentrated on opaque-2 maize with a modified endosperm, including introduction of new germ plasm from CIMMYT and from Peru, selections from Colombian opaques, and recombinations of these sources. Available hard endosperm selections have been tested for protein quality in the laboratory, in children, and in rats and swine. A new system of selection and testing of high-quality maize using microscopic examination of the endosperm, has been designed, tested, and incorporated into the breeding program.

Excessive plant height of maize grown in coastal regions of the Andean zone limits yields by reducing efficiency of grain production and complicating the harvest operation by lodging. Brachytic and short plant selections both with yellow and white endosperm, selected for their yield over a range of climatic (temperature) zones,

are being increased by the half-sib selection scheme to provide sufficient seed of each family for wide distribution throughout the zone in 1974. These progeny trials planted by national programs in collaboration with CIAT will provide further data on range of adaptation and potential of each combination, as well as being a new source of valuable germ plasm with short stature for each participating program. This system is perhaps the most efficient way of successfully introducing new germ plasm of this type within the zone.

By the end of 1973, converted dwarf materials with the modified opaque-2 (hard endosperm) property will be ready for distribution. Available both as a widely adapted variety or source population, and as progeny trials, this material will provide breeders, development projects, and farmers with a high-quality maize which has a more acceptable grain type. A yellow endosperm population will be available for the first season, and a white endosperm version for the second season. These improved quality maize types will be a critical component in the rural development schemes which are striving to increase carbohydrates and protein production with subsistence farmers.

Maize lines selected for insect resistance will be increased and ready for distribution in 1974. This resistance will also be incorporated into other improved short-plant materials, and the wide-scale testing of promising germ plasm will give further information on broad-based resistance to insect pests prevalent throughout the zone.

Agronomy and Soils. Agronomy trials focused on minimum tillage schemes, comparisons of different land preparation and planting systems, and studying boron deficiency in maize. In the eastern plains of Colombia, a screening project to identify maize which is relatively resistant to acid soils and low available phosphorus levels continued through two more cycles. The first promising brachytic selection is being tested with farmers in 1973. A trial initiated at Palmira seeks maximum yields per year from associated and overlapping plantings of maize and field beans, the planned potential being four harvests of maize and four of beans from the same land area per year. Alternative surface drainage schemes for maize production are being tested on the north coast.

Entomology. Screening trials for genetic resistance to the two most serious insect pests Spodoptera sp. and Diatraea sp. continued in three locations. Tests of chemical insecticides and new biological control agents (as well as diets and methods of multiplication for the latter) were conducted. Seasonal incidence was measured in a field with plantings of maize and beans every 15 days.

Minimum tillage and planting systems for maize tested during 1972 and 1973 will be ready for wide-scale trials in 1974. One system which may be used for this development work is the international agronomy trials pioneered by CIMMYT. Modified to suit conditions of the region, simple uniform trials are anticipated to introduce short plants, increased population, improved fertility, and minimum tillage practices. These will be compared to the current schemes of maize culture in a given zone. Maize lines will be selected, increased, and tested on individual farms in the eastern plains of Colombia, and the best 2 to 5 genotypes will be ready for wide-scale distribution and planting in the acid soils zones of Colombia, Ecuador, Venezuela and Brazil where maize is a marginal crop.

Economics. Work in economics during 1972 included production functions, analysis of factors limiting maize production, price and consumption elasticity as compared to other basic food crops when production or income increases. The economic feasibility of partial substitution of opaque-2 maize flour in bread-making as also studied and results showed an economic advantage of substitution at the 25 percent level at current prices of these cereals.

Economic evaluation of factors limiting maize production,in collaboration with agronomists and economists in the countries of the zone,will be initiated. This type of study is critical to objective research planning in each country and for the zone. Direct leadership and participation program personnel will promote a closer working relationship between the regional program and each national effort, as well as encouraging acceptance and use of the results.

International Activities. International work was accelerated with the launching of an informal newsletter, El Maicero, for the zone. Two new series of regional

uniform maize trials were initiated for the Sierra and for the lowlands. Visits to national programs in the zone occupied approximately 25 percent of the coordinator's time. Two conferences and two maize production courses are scheduled for 1973.

International activities will include training in research and development at CIAT, and practical maize production courses both in Colombia and elsewhere. The experience gained during 1973 in two specific production courses at Palmira will be used to cary out these programs in other locations. Progeny trials of short plant and improved-quality maize will be incorporated into the regional uniform trials. Agronomic trials for the Andean zone will be added to the current germ plasm evaluations and introductions.

Agricultural Systems Program

CIAT, at one of its early organization meetings, initiated an Agricultural Systems Program as a research activity. This act recognized the diversity of agriculture in tropical America and the fact that agriculture and rural life in the area could not be improved unless CIAT concerned itself with farming as an integrated system.

The long-term primary goal for the Agricultural Systems Program is to develop a process by which existing farming systems can be identified and analyzed. Participation in and the results of this activity will help scientists develop an understanding of the decision-making process of farmers. Such information and insight will facilitate the selection, development and utilization of agricultural technology for improving rural areas.

These is a clear distinction between developing specific systems and developing a process. The agriculture of the area is so diverse that no one system or no half-dozen systems would serve the region adequately. No one commodity is of such paramount importance that a "miracle" within it would create an agricultural revolution. The principal transferable features of CIAT's systems work would be in the methodology of agricultural systems analysis and technology dissemination.

In this program CIAT intends to focus on the farm unit. Here the operator assembles enterprises into a production, utilization and marketing system. The operator has goals, resources, and certain levels of technology available. Biological and physical factors interact with social, political and economic systems, and the influence of these on the family and production unit is taken into account in research and development activities.

Individual commodity teams will develop specific technology to improve the production, productivity, profitability, etc. of that commodity. For the major commodity programs, CIAT in collaboration with national agencies is developing fully integrated, highly transferable technology such as has been developed else-

where for rice and wheat. The Agricultural Systems team will assist the commodity teams in reaching their production objectives. However, these activities of CIAT should not be confused with the basic work of the Agricultural Systems team which is to focus on the farm unit.

For this work, CIAT is assembling a closely integrated team of specialists in several fields to attack the complex problem of seeking understanding of farm units with particular emphasis on the smaller units. The team will study certain typical farming systems in tropical America, first to identify the relevant components and why and how such systems have persisted over time. Second, the team will seek ways to improve some of these systems in terms of quantity and quality of output, the standard of living which they support, and the realization of other goals of the operators.

The specialities to be represented on the team in 1974 include (1) Agronomy, (2) Agricultural Economics, (3) Sociology/Anthropology, (4) Systems Engineering. Inputs from Agricultural Engineering and the Animal Sciences will be added as soon as possible after the program has collected preliminary data. Their help on a consultancy basis will be sought from the start. Other specialities, such as geography and climatology, may be represented on a temporary or consultancy basis later on.

The Agricultural Systems Program serves a number of functions in the total CIAT program. The more important ones are the following:

1. The team will help individual commodity program teams to achieve their own goals.

Each commodity group will retain primary responsibility for research on production systems built around its commodity or ones in which its commodity predominates. The Agricultural Systems team will be expected to help the commodity groups in planning these studies and by participating in their inter-disciplinary phases. Several disciplines not represented within the commodity group can be drawn upon in this way.

2. The program will conduct studies leading to the optimization of the management of farm units particularly small farms, and would assist in the integration of new technology into existing farming systems.

This multi-disciplinary, multi-commodity area will be the team's primary field of direct operation. Members will first familiarize themselves with existing agriculture in several representative regions within tropical America. These will be in-depth studies of the biological, social and economic phases of the existing agriculture. In carrying out these studies, they will rely heavily upon national agencies to collect pertinent data from groups of "base line" farmers. Emphasis will be on the small family farm but larger units will also be studied both to better understand their operations and problems and to see how they interact with smaller ones. In some cases the team will use training program participants as data collectors. Modern data processing procedures will be essential to the effective management of the mass of data collected in this way.

With these base line data in hand, the team will construct models of farming systems based upon the traditional but utilizing varying levels and kinds of new technology. It will draw heavily upon the commodity teams of CIAT in selecting the particular technology, but it will utilize technology from other sources and on other commodities as needed and available. Through national agencies, the technology thus described will be introduced to selected base-line farmers. The team will monitor the process of introduction and acceptance or rejection. It will attempt to define the reasons for success or lack thereof and would seek alternative types of technology where farmer results indicate the need.

In a still later phase of the operation, the team will participate with one or more national groups in planning and executing regional development projects. The team will attempt to develop a generalized process whereby a developmental organization would apply information coming from research and at the same time

would identify limiting factors and call the attention of national planning agencies and/or biological scientists to them. The team will focus on the necessity for key inputs to be available as well as for the technology to be adequate.

3. The team will provide CIAT management with data and analyses useful in making overall program policy and strategy decisions.

By monitoring the existing situation and the effectiveness of new technology, the Agricultural Systems team will be able to call attention to missing links in the available technology and hence will have a valuable role in planning overall strategy.

When the team has been assembled, or in some cases, while it is being assembled, various of the following courses of action will be initiated, although not necessarily in the order listed:

1. Make a comprehensive review of what is assumed to be a rather limited body of literature which relates the systems approach to agricultural development at the farm and community level.
2. Hold an international seminar of people whom the literature will help identify, with the objective of pooling data and experience, evaluating alternative methods, and assisting CIAT to sharpen the focus on tis own efforts.
3. Create a continuing advisory group to CIAT, perhaps of individuals identified in the seminar, to provide counsel on specific aspects, to help develop linkages with other institutions, and to review the program periodically.
4. Establish the modus operandi for assisting and collaborating with the commodity programs of CIAT to the end that the production systems goals of these programs are efficiently achieved.
5. Explore the possible ways to collaborate with and link with national or regional development programs.
6. In collaboration with national agencies in various Latin American countries
   a) Develop criteria for selecting areas for initial farm unit studies,

b) Determine the area or areas in which the field operations will begin,

c) Collect data from groups of "base line" farmers, and d) Analyze the data.

7. After sufficient time in the field to determine and test possible courses of action to bring about increased productivity, the program would shift to an operational research approach, in which new technology would be introduced and monitored. As much responsibility as possible for these actions would be transferred to relevant national agencies.

8. Whenever the staff deems appropriate, initiate a training program for project leaders and technicians.

9. Continue the operations in the initial study area(s) in conjunction with national agencies, using these for training and demonstration, as well as for evaluation of the process itself.

10. Select new areas for study and adaptation and test of the methods.

11. Publish progress and evaluative reports as appropriate.

12. Collect and analyze data relevant to various lowland tropics areas and problems for the benefit of CIAT staff and management in making decisions relating to overall CIAT programs, priorities, and areas of emphasis.

Training for Research and Production

Training activities provide learning experiences for professionals, some to conduct production-oriented research in their own organizations, while larger numbers become crop or animal production specialists, helping to translate and communicate new agricultural technology.

Of immediate concern is the preparation of individuals to accelerate research on and the application of new technology in their own countries. These trainees help CIAT to develop effective links for the exchange of knowledge about agricultural problems and their solution, and eventually, to build and strengthen effective networks for research and communication among scientists.

The longer-term goals are to increase the numbers of research workers, educators, and extension specialists with competency to identify and solve production problems and the ability to communicate these solutions to farmers and others. CIAT's continuing training role is to provide counsel and assistance where appropriate, to train cadres of individuals to staff existing and new training operations within countries, to offer opportunities for specialized or refresher training for selected individuals, and to help the various institutions develop more adequate resources of teaching and reference materials.

In 1972, 118 persons participated in CIAT's various training activities and 54 of these appointed later in the year were continued into 1973. Of the 118, 58 were postgraduate interns in research, 34 as production specialists, 8 as master's degree candidates, 7 as research fellows, and 16 as special students (less than three months). Twenty countries were represented in this enrollment.

Plans provide for training of the following categories of persons in 1974:

Postgraduate Interns. These are young scientists from Latin America and the Caribbean who have completed undergraduate degrees in agronomy, animal science, or veterinary medicine. They receive on-the-job training in production system studies while serving as full-time research interns. Twenty-nine of these interns are funded in the budget for 1974, at an average of $5,000 each.

Livestock Production Specialists. CIAT's first program in this area, an experimental project, was completed in 1971. Operational headquarters for this program were moved in early 1972 from Sincelejo to the ICA Research Center at Turipana. This program and the crop production specialist training program are housed in converted facilities made available by ICA.

A new course, 12 months in length, began in June 1972 with 17 trainees from the Dominican Republic, Paraguay, Honduras, Bolivia, Ecuador, and Colombia. Another course will be started in September, 1973, dependent upon availability of trainees and funds.

The objective is to produce specialists with the scientific, technical, economic, farming and communication competencies necessary to diagnose production problems of a livestock enterprise and to recommend and implement a package of profitable production practices. They are prepared to work in the field as individuals or to establish and conduct training programs. Costs of this undertaking are funded in part on a non-core basis by the Interamerican Development Bank and other organizations.

During the first six months of 1972, the animal science training staff cooperated with three Colombian universities (Universidad de Antioquia, Universidad Nacional-Medellin and Universidad de Caldas) to help establish field-oriented training programs in the undergraduate curriculum. Programs were outlined for each of the universities as part of their fifth year activities.

Crop Production Specialists. In February, 1972, CIAT completed its second program with 14 trainees from the Dominican Republic, Honduras, Costa Rica, Panama, Ecuador, and Colombia.

As with the livestock program, the objective of this training is to produce specialists with the scientific, technical, economic, farming, and communication competencies necessary to diagnose the production problems relating to maize, rice, cassava, field beans, and other rotational crops and to recommend corrective measures or a package of profitable production practices. They are prepared to work in the fields as individuals or to establish and conduct training programs in their own countries. This program is funded in part on a non-core basis by the Interamerican Development Bank and other organizations.

The ultimate goal of the CPSTP, that is the in-country multiplication of training, has not yet been achieved. Follow-up action has identified obstacles, as follows:

1. The value of guided practical training to provide considerable experience in a short time so as to energize professionals into action has not yet been fully recognized by national institutions. They are oriented to and more likely to take advantage of the frequent opportunities their professionals have to obtain more training in traditional theory courses.

2. Trained personnel are scarce and constant pressures exist to launch national action programs. Thus the national officials tend to assign newly trained personnel to work directly in existing or new field programs rather than to the training of others, an activity which they consider belongs in the universities.

3. Faculties of agronomy in the national universities cling to their traditional forms of education and lack the leadership and financial resources to introduce practical training programs (which they associate with vocational education) into their undergraduate and graduate curricula.

4. The limited number of production-oriented professionals capable of training others has not yet reached a "critical mass" in any country so as to be able to demonstrate to decision makers the value of in-country production training programs.

The training and communication program in 1972 adopted a different approach in preparatory and recruiting actions for the next crop production specialist course, which began March 1, 1973. These activities included obtaining commitment from the national institutions to make, in advance, definite plans for in-country multiplication of the training CIAT offers, and training simultaneously a "critical mass number of professionals" to form a "training team" for a given country.

Members of CIAT's training staff travelled extensively in 1972 to ten countries discussing this idea and identified two, Ecuador and the Dominican Republic, where conditions seemed to be most appropriate for a concentrated effort. As a result, eight Dominicans and seven Ecuadorians were selected to participate in the third CPSTP along with lesser numbers from other countries including Mexico, El Salvador, and Colombia, for a total of 20 participants.

In addition, CIAT staff assisted INIAP in Ecuador with a five-month maize production training program. A similar activity is being planned for the Dominican Republic, the main purpose being in both cases to demonstrate CIAT's practical training approaches and philosophy in order to mobilize in-country resources for the institutionalization of such activities.

Research Scholars. A few promising young scientists are selected each year and supported in graduate studies leading to advanced degrees. Through cooperative arrangements with the universities, CIAT scientists serve as advisors, and each scholar does his thesis on a CIAT research problem under the guidance of CIAT staff members. Funds for up to ten scholars are included in the 1974 budget. This type of support is used primarily as a means of developing Latin American candidates for projected CIAT staff positions, as well as for key positions in national organizations.

Research Fellows. The proposed core budget for 1974 provides funds for up to three research fellows. These young scientists undertake a one- or two-year program of special research training. They are expected to contribute substantially to the research productivity of the professional group in which they work in addition to developing their own specialized skills. CIAT currently has five research fellows, all of whom are working on doctoral dissertation problems in cooperation with the universities where enrolled, i.e., Cornell University, University of the West Indies, Western Ontario University, Michigan State University, and Justus Liebig University, Giessen, Germany.

Other Trainees. CIAT maintains a flexible policy to provide unique training opportunities for young professionals from many lands. Through an agreement with

Wageningen University in the Netherlands, fourth year animal science students come to CIAT for up to a year on-the-job experience in the management of animals and pastures under tropical conditions. The fourth student under this plan is now at CIAT. In July, a similar program was initiated with Wageningen for students interested in rural sociological problems in the tropics.

Through informal arrangements with various universities,other doctoral and master degree students may spend extended periods of time with CIAT doing thesis research under the supervision of CIAT senior staff members and on problems of direct interest to CIAT. CIAT limits its financial involvement to helping with the direct research expense.

Four veterinarians in 1972 worked on advanced degree programs at Texas A&M University under the special USAID-supported project.

Conferences and Symposia

Effective agricultural development programs depend upon dynamic, well-informed leadership above the technical level. Those who make and influence national policies, control credit and resources, manage manufacturing and distribution systems, and provide transportation, marketing, processing and storage need unbiased sources of reliable data and estimates of production potentials and requirements.

Moreover, agricultural scientists have a responsibility to communicate effectively with this leadership---to make known what agricultural developments are feasible and what policies and facilitation are required to increase productivity.

CIAT plans to include facilities for conferences and symposia, including meeting rooms as well as housing and feeding. Activities contemplated for 1974 and beyond include policy seminars for national leaders, scientific symposia and technical workshops for research workers, short courses for production specialists, and such other events as may be appropriate for representatives of various entities in the total agricultural development system.

With the opening of the new buildings in late 1973, CIAT expects to operate an around-the-year conference and symposia program, subject to the limitations of financial and subject matter support. The core budget for 1974 includes funds to cover the staffing and operations of a small conference management and support staff. This new staffing pattern includes professional simultaneous interpreters who between conferences will translate manuscripts for conference papers, publications, and other materials. This part of the core budget totals $61,101.

Looking to the future, it is desirable to put more stability and predictability into the financial structure for conferences and symposia. Under the past system, too much staff time has been spent trying to mobilize additional funds to assure adequate participation, and the efforts have tended to confuse country representatives of various donor agencies.

It will be important, for financial reasons, to keep our conference facilities at near 100 percent occupancy the year-around, but it will be more important that these facilities be available for use in the direct support and extension of the commodity

programs. Activities that pay their own way should not compete with those considered necessary to further the overall mission of CIAT.

In the future, we see the support and operations as forming along these lines:

1. Core support for a limited number of scheduled events considered by the commodity program teams as instrumental to achieving the success of the respective commodity programs. Such events would be planned for and projected in programs of work just as the staff now programs for research projects, postgraduate intern trainees and publications.

2. Direct support from or through Special Project or Outreach Programs for events directly related to such activities, and provided for in these budgets.

3. Conferences and symposia undertaken as "Special Projects" in themselves with full financial support coming from the organizers or sponsors of such events. The criteria of selection here would be (1) compatibility with CIAT's overall mission, and (2) lack of conflict in the use of the facilities with either core-supported or Special Project related events. As with Special Projects, generally, these would carry an overhead or indirect charge.

The base amount included for Core Support in 1974 is $140,000 which is minimal considering that CIAT has six commodity programs plus the Agricultural Systems Research program. This figure represents an average budget of $20,000 a program, this to cover a wide range of large and small events, including workshops, short courses, seminars, conferences, and symposia.

Events planned or tentatively scheduled for 1974 include the following, along with indicated approximate amounts of CIAT support:

January 28-30 --- Annual Meeting, Association Latinoamericana de Malezas (300 persons)	$ 1,000
February 11-14 --- Seminar on Soils and the Development Process in Tropical America, in cooperation with North Carolina State University and the University Consortium on Soils of the Tropics (150 persons)	$ 4,000
February --- Seminar on Increased Beef Production in the Lowland Tropics (150 persons)	$40,000
March 1-June 30 --- Laboratory Training Course in Hemoparasite Diesease Techniques, in collaboration with Texas A&M University (6 persons)	None
March 17-22 --- Symposium on Communication Strategies in Rural Development, in cooperation with Cornell University (75 persons)	$20,000
May --- Panel on Hemoparasite Dieseases of Cattle, in cooperation with Texas A&M University (12 persons)	None
May --- Workshop in Swine Production for Former Trainees (15 persons; 2 weeks)	$ 8,000
June --- Production Short Course in Maize (30 persons; one month)	$ 7,000
July --- Short Course on Rice Production (40 persons; one month)	$10,000
September --- Andean Corn Workshop (25 persons; 5 days)	$ 3,000
November --- Short Course in Bean Production (40 persons; one month)	$10,000
November 15-December 15 --- Short Course on Production, Processing and Distribution of Seeds of Tropical Pasture Grasses and Legumes (20 persons)	$ 8,000
November --- Seminar on Swine Production in Latin America (100 persons; 5 days)	$10,000
Unscheduled --- Working Conference on Agricultural Systems Research (30 persons; 5 days)	$ 7,000
Miscellaneous small conferences, workshops, etc.	$12,000
	$140,000 *

*Represents CIAT finances only; many events will be all or partially funded by other sponsors or participants.
This amount is in addition to the $61,101 budgeted for the core managemente and support staff in conferences and symposia.

Utilization of the physical facilities as an "International Continuing Educational Center for Agricultural Development," as envisioned in the original plans, will require special attention over the next few years. As the physical plant nears completion, we shall circulate descriptive information and invite various professional groups in agriculture to consider CIAT as a site for meetings as well as special training or planning conferences.

Information Services

Original budget plans under-estimated seriously the difficulties of operating a bilingual center. At every stage, this adds to the time, cost, and effort involved. Moreover, growth of the commodity programs has generated a volume of manuscripts.

To service its primary audience in Latin America, CIAT published its materials in Spanish. But as an international center, it serves the world-wide audience in English, including many in the Caribbean area. Therefore, most all of CIAT's publications are produced in both English and Spanish. The most serious problem is the availability of qualified editors, writers and translators to do the work.

As indicated in the section on Conferences and Symposia, CIAT proposes to employ simultaneous interpreters who also will take over much of the translation work now being done outside CIAT on contract.

The remaining problem is to employ a qualified agricultural writer-editor whose mother tongue is English. We are able to find competent persons to handle the Spanish processing, but the English poses a more difficult issue. None of the temporary measures taken over the past three years has provided a satisfactory or permanent solution for the problem. Therefore, we propose employing, at the senior staff level, a person for this work.

CAPITAL FUNDING REQUIREMENTS

I. Summary

This section outlines the capital funding needs of CIAT for 1974 and projects anticipated requirements for 1975 and 1976, as follows:

	1974	1975	1976
Per needs outlined on pages C-10-11	$1,000,000	--	--
To purchase aircraft, C-7	500,000	--	--
Additional laboratories, auditorium, housing, and equipment, C-12		$ 750,000	$ 750,000
Additional equipment and replacement vehicles, C-12		100,000	100,000
Physical facilities, equipment for other work sites in Colombia, C-12		200,000	200,000
Physical facilities, equipment for core operations outside Colombia, C-12		300,000	300,000
Capital Total	$1,500,000	$1,350,000	$1,350,000

Eighteen months ago the CIAT management completed a comprehensive analysis of the capital funding requirements for the further development of the center in relation to the growth of the existing programs and initiation of new ones. This document (dated February 8, 1972) projected a need for $1,000,000 in 1975. Developments since that time now lead CIAT management to advance the capital development schedule by one year and to request $1,000,000 in new funds for expenditure in 1974.

Capital expenditures to this time have been in accord with the decision of the CIAT Board of Trustees to design, build and equip a physical plant within the funds available in July, 1970, from the identified donors. Consequently, the number and size of buildings were scaled back and basic equipment lists trimmed to the minimum. Even so, over the 5 years of planning, construction and equipping, inflation and unexpected expenses necessitated seeking additional funds and further reductions in equipment purchases.

At the same time, CIAT experienced a rapid acceleration in development, growth, initiation of programs, and increase in operating budget. At the outset, only three donors were involved in core and restricted core support. Presently, there are ten donors, including those involved in special projects as well as core support. The present capital budget, intended to provide facilities and equipment for a senior staff of 36 scientists, must now serve a minimum of 43 in 1974. While it will be necessary to squeeze these additional scientists and their staffs into the available office and laboratory space, they need equipment and other facilities unique to their research programs.

Thus CIAT has been in a two-way pressure, to spread the remaining limited funds to complete Phase I to serve the initially established programs of beef, swine, rice, and maize, while at the same time to provide basic facilities for the growing programs in cassava, field beans, and agricultural systems.

This growth is evident in the increase in man-years of direct research staff time in these latter three programs:

In cassava from 1 in 1972, to 5.5 in 1973, to 5.9 in 1974.

In field beans, from 1 visiting scientist in 1972, to 3.7 in 1973, to 4.9 in 1974, and

In agricultural systems from none in 1972, to 1 in 1973, and 2.5 in 1974.

The total scientific staff budgeted for 1974 is 43 not counting at least 7 other scientists assigned or posted to CIAT but not charged in the operational budget. But these scientists do need supporting staffs, working space, equipment and vehicles if they are to be productive.

Finally, although the Board of Trustees has for two consecutive years authorized the Director General to seek funds for the purchase of the aircraft badly needed for safe and efficient transport of the staff to outlying stations, no donors have been identified. Therefore, an additional $500,000 is requested in 1974 for the purchase of this aircraft.

The projections for 1975 and 1976 are the best that can be made at this time, pending further review of the many factors influencing the nature and strategy

of CIAT programs. Among these is a review, requested by the Board, of the ways in which CIAT may work most effectively with IRRI and CIMMYT on meeting the world-wide needs for assistance with rice and maize, respectively. This analysis will be held later in the year. Meanwhile, the recent External Review Team on the beef program of CIAT recommended serious and immediate consideration to establishing in Brazil some aspects of the CIAT core program activities in beef and pastures. Likewise, a review team, supported in part by the Ford Foundation, indicated that Brazil would be a suitable place for upland rice work.

II. Development of CIAT organization and support

The Centro Internacional de Agricultura Tropical (CIAT) has been established to help accelerate the agricultural and economic development of the lowland tropics. Through cooperative and collaborative programs with international, regional and national agencies, it seeks to increase agricultural productivity and production with the objective of improving the diets and welfare of people, both rural and urban.

The idea of CIAT was first proposed in a document prepared by Dr. Lewis M. Roberts, The Rockefeller Foundation, and Dr. Lowell S. Hardin, The Ford Foundation, in October 1966. They estimated that the costs of constructing and building such a center, with a proposed senior staff of 30 and a junior staff of 37, would be between $4 and $5 million dollars.

Subsequently, the W. K. Kellogg Foundation expressed an interest in participating in such a development, and the Rockefeller Foundation was authorized to initiate negotiations with the Government of Colombia. These led to the Act of Foundation, October 17, 1967, a formal agreement, November 7, 1967, recognition of the legal status of the center, December 4, 1967, and a presidential decree, March 7, 1968.

Allocations of enabling funds by The Rockefeller Foundation on May 16 and December 1, 1967, and February 8, 1968, facilitated early planning, as did an allocation of funds, November 29, 1967, by the Ford Foundation to cover expenses of review teams and feasibility studies.

The site for the center, near Palmira, Colombia, was selected in February, 1968, and the Government of Colombia initiated the process of acquiring the land. CIAT acquired access to a portion of the land in January, 1969, and received the final portion in October, 1969. This delayed developing of the land and the construction site.

A document, Proposed Program, Staff and Budget, was presented to the first meeting of the Board of Trustees, June, 1968. The Board approved the general program outlined, less work on dairy cattle, and authorized the director to plan and to seek support for a capital development program.

The director presented a master development plan to the Board of Trustees at its annual meeting in May, 1969, along with preliminary architectural drawings and financial estimates. The cost of building and equipping the master plan was estimated at $6,214,705, and the Board subsequently requested that a new plan, based on the amounts of money then known to be available ($2,500,000 from Rockefeller Foundation and $1,000,000 from the W.K. Kellogg Foundation), be prepared and submitted to the Executive Committee for review and approval. A revised capital investment budget, April 13, 1970, as approved by the Executive Committee, was ratified by the Board of Trustees at the annual meeting, July, 1970. This, plus the enabling grants already made, became the capital budget for CIAT.

Six contractors submitted bids in February, 1971, for the construction of the principal facilities, these ranging from a low of $1,237,148 to a high of $2,107,309. The low bid was in excess of the budget for these facilities by approximately $350,000. When the matter was reviewed with The Rockefeller Foundation in March, CIAT was advised to proceed with the construction, on the basis that every effort would be made by the Foundation to find or allocate additional funds to cover this and subsequent shortages in funds to complete the project.

Reviewing the capital budget at its meeting in August, 1971, the Board of Trustees approved the addition of an aircraft in the original capital program and authorized the director to seek additional funds, as necessary, to complete the construction and equipment of the buildings and facilities approved previously.

III. Capital development by phases

In September, 1971, the senior staff of CIAT at that time, consisting of 23 regular staff members and 11 others on special and terminal appointments, critically reviewed the status of the capital program, taking into account construction completed, equipment and furniture on hand, and that deemed necessary to carry out the specific programs of CIAT to which they were assigned. Equipment lists, some of these developed as early as 1967-68, were reviewed, taking into account changes in models and specifications, as well as increases in prices. At the same time, special committees eliminated duplications and consolidated functional requirements so that these could be met with minimum investments in laboratory, field, and office equipment.

It was necessary to develop a firm set of categories for analyzing the available construction and equipment funds in relation to the commodity programs underway as well as those additional ones authorized by the Board of Trustees. This was done by describing the capital program in terms of phases, as follows:

PHASE I: This represents the facilities to be built and equipped by mid-year 1973 within the identifiable amounts of funds available in 1969, i.e., approximately $3,900,000, including the enabling grants. This consisted of 24 laboratory modules, one station operations building, field units for the animal science programs, one greenhouse, library-information building, administration building, cafeteria and dining rooms, housing (four apartments, rooms for 64 conference guests, rooms for 80 trainees), and associated recreational facilities, and a conference center with amphitheater. These facilities were intended to house and equip 36 scientists and their staffs, and with the operational programs consisting of a full thrust in beef, complementary programs in rice and corn in cooperation with IRRI and CIMMYT, a limited program in swine, and preliminary work in cassava, agricultural systems and food legumes.

PHASE II: This represents (a) additions to and modifications of the physical plant as outlined in Phase I, (b) expansion of the cassava and swine programs consistent with the levels of increased operational budget support, and (c) acquisitions of additional office, field, laboratory and farm equipment commensurate with the projected increase of 10 in the scientific staff to a total of 46.

PHASE III: This represents the undertaking of a full-thrust program in one or more of the food legumes, increased work in agricultural systems, and associated increases in training and communication. In this phase, the scientific staff would be increased by 7, or to a total of 53. Increases in the physical plant would be necessary to house the food legume program and any future growth in other programs. Such expansion would probably include additional laboratory modules, another unit in station operations, an additional greenhouse, plus laboratory and field equipment, and office furniture and equipment. This phase also would include any additional capital requirements to equip programs at outlying stations in Colombia.

IV. Factors influencing increases in capital costs

Analysis of the factors responsible for increases in funds needed to complete Phase I over those originally estimated in the original budget identified the following as being most significant:

A. Architectural Fees. The architectural firm developed a master plan for CIAT buildings and facilities. This plan included many structures which were deleted in arriving at the approved plan now identified as Phase I. Under the terms of the Colombian architectural code, it was necessary to pay for the design and complete working drawings for the following structures not built in Phase I: Auditorium, two additional laboratories of 12 modules each, two apartment units, house for the manager of food and housing services, housing for women trainees, and a number of decorative and connecting construction details.

B. Building Construction. One of the principal factors which affected the budget was the constantly rising prices of building materials in Colombia. Between June, 1969, and June, 1971, the prices of the following construction materials increased in the amounts indicated: Steel, 13.6%; sand, 18.4%; cement, 31.7%; brick, 44.9%, and wood, 19.5%. (Reference Revista del Banco de la Republica, August 1971). Similarly, labor costs increased steadily, given the active commercial and industrial building programs in Cali, as well as for the Pan-American Games.

C. Utilities. Because of changes in plans of the electrical energy supplier, the high tension lines to the building site were relocated at CIAT expense. Lack of paved roads around the temporary laboratories and offices in the Station Operations necessitated purchase of air conditioners. Telephones were unavailable when CIAT moved to the farm-site, necessitating purchase of a limited number of radio-telephones. Cost of the telephone installations were under-estimated, but they are now installed and in operation.

D. Equipment and Furniture. Several factors were involved in the increases in costs of equipment and furniture, as follows:

1. Price estimates were made using catalog prices but without taking into account the unforeseen delays in getting access to the land and arriving at a final decision on the architectural plan. In the ensuing period, costs rose sharply. In some instances, the original equipment was no longer available and had been replaced by more expensive items.

2. At the time the original lists were prepared, most of the professional staff had not been identified or employed. Hence, in some instances, the lists of equipment needed were revised by new staff members upon arrival.

3. Rapid expansions in programs and staff necessitated local procurement of many items, particularly furniture and office equipment at prices considerably in excess of that which would have been possible by buying and importing of these items in quantities.

V. Analysis of air transportation problem

The air transportation problem with CIAT arises from these factors:

1. To fulfill its mission in the lowland tropics, CIAT staff members must work, in addition to the Cauca Valley, in the other major soil and climatic environments which are representative of vast areas of the American tropics.

2. Colombia is a country divided, north to south, by three high mountain ranges. Distances and road conditions make air the only practical way to travel.

3. There is no commercial air service to Carimagua, the ICA research station where it is possible for CIAT to carry out many beef and pasture projects on soils and in environmental conditions typical of vast areas of South America. Further, the commercial air service to Monteria, on the north coast of Colombia where CIAT carries out many of its training programs as well as research projects, is characterized by delays and frequent cancellations. This results in significant amounts of losses in staff time.

4. There is no air charter service in Colombia operating aircraft with single engine ceiling capacity of at least 14,000 feet, the minimum altitude considered necessary for crossing the mountain ranges between Cali and Carimagua or Monteria.

To date, CIAT has carried on its operations, particularly at Carimagua by chartering on a twice-a-week basis a twin-engine aircraft from what is regarded as the most reliable charter company in Colombia. But this aircraft does not have the single engine ceiling capacity deemed necessary for safety. The charter costs are high, amounting to $40,000 in 1972 for a twice-a-week charter Bogota-Carimagua. In addition, CIAT, purchased some $21,000 in commercial air tickets for travel within Colombia.

Consultants who have studied CIAT's needs have proposed two possible solutions: (a) Contract with a charter operator which will purchase, import, and operate for CIAT the kind of aircraft which meets the load and ceiling requirements for CIAT (Beechcraft King Air, pressurized), or (b) CIAT purchase such an aircraft and contract with a commercial airline to furnish pilots and maintenance.

Taking into account a flying schedule of 80 hours a month, CIAT economists have compared the costs of the two plans, as follows: (a) The contract plan would cost CIAT $232,800 a year or $19,400 per month, and a 7-year contract would be minimum; (b) by purchasing either a new or used aircraft, CIAT's costs for operation, maintenance, insurance, and management, would be $90,000 a year or $7,500 per month. Clearly, it would be more economical for CIAT to purchase its own aircraft, but, in the end, the primary criterion is safety, not economy.

The $90,000 a year cost to CIAT with its own aircraft is based on the assumption that grant funds would be available to purchase the aircraft. If capital funds are not available, the only alternate is for CIAT to purchase an aircraft on a pay-as-you-go basis, charging the principal, interest, and other expenses to the core program. A financing arrangement is available through the Import-Export Bank and calculations have been made on the basis of purchasing a used Beechcraft King Air for $300,000. The interest and financing fees over the five-year period would amount to approximately $68,000. Over the 60-month period, the total cost to CIAT for principal, interest, operation, maintenance, insurance, and management would be $13,625 per month.

However the aircraft is ~~obtained, CIAT~~ will contract with AVIANCA, the national airline and the second oldest international airline in the world, to provide qualified and experienced pilots, as well as regular maintenance in its own shops at Bogota and servicing at all airports in Colombia out of which AVIANCA operates.

Moreover, CIAT will be able to offset part of the operational costs by making unused seats and cargo space available at appropriate fees to ICA and other collaborators desiring transportation to these remote areas.

VI. Outline of 1974 Capital Budget Needs of CIAT

1. To reimburse Phase I capital grants for non-budgeted expenditures made to permit interim operations of CIAT, 1969-1973, plus purchase of high priority equipment necessary to support program activities in Phase II and Phase III operations, 1971-73:

° Modification of old farm buildings to serve as temporary offices, classroom, library, dining facilities, information center and dormitory	$ 25,000	
° Modification of Station Operations building to provide temporary laboratories and offices	35,000	
° Temporary electrical, water, and sewage	25,000	
° Purchase initial equipment for cassava and bean programs	35,000	$140,000

Note: These funds will be used to complete the Phase I physical construction program, as follows:

° Completion of Meat Laboratory	$105,000
° Additional roads, landscaping	35,000

2. To purchase additional scientific equipment and instruments to support increased activities and expansion in original commodity programs as well as equipment required for new programs and expanded services, as follows:

° Beef, Swine, Rice, Corn Programs	$145,000	
° Cassava	60,000	
° Field Beans	80,000	
° Biometric Services	10,000	
° Central Laboratory Services	86,000	
° Information Services	55,000	
° Library, including book purchases	70,000	
° Administrative Services	10,000	
° Food, Housing and Conference Services	65,000	$581,000

3. To purchase vehicles to support senior professional staff of 43, plus additional farm and maintenance equipment and tools, as follows:

° Replacement and Additional Vehicles	$170,000	
° Farm Machinery for Training Programs	25,000	
° Maintenance equipment and tools	36,000	$231,000

4. To finance miscellaneous construction and modifications of physical facilities, as follows:

° Modifications to new buildings	$ 25,000	
° Information Booth and Guard Station	5,000	
° Sports and recreational areas	18,000	$ 48,000
Sub-Total, CIAT Headquarters		$1,000,000

5. To purchase an aircraft adequate to meet CIAT's transportation needs in Colombia 500,000

Grand Total $1,500,000

VII. Projection of Capital Budget Needs for 1975 and 1976

As indicated in the summary, CIAT is developing a long-time projection of programs, taking into account at the same time the capital needs of the projected programs. Developments clearly indicate, however, that as Phases II and III of the operational program are implemented, there is an immediate and significant demand for working space and equipment.

Given the rapid increases in the cassava and field bean programs, it is not now possible to house all of the scientists and their staffs assigned to these programs in the new laboratories. Rather than moving out of the temporary facilities in the Station Operations building, work already is underway to use more of this space for laboratories and offices. This, in turn, creates pressures on the activities already in or planning to use the Station Operations space, i.e., farm operations, production training, seed multiplication, and general maintenance support.

Further growth in the conference and symposia program will depend, in part, on the availability of a large auditorium or assembly hall, capable of seating 500 to 750 persons. Some agricultural groups desiring to hold their meetings at CIAT in 1974 and 1975 have decided to meet elsewhere because of CIAT's inability to provide a large enough meeting room. Such an auditorium is in the master plan but was deleted from the Phase I construction schedule.

Consequently, beginning in 1975 and continuing into 1976, it will be necessary to proceed with construction of additional buildings as envisioned in the master plan and for which the architectural work is completed and working drawings available. The buildings to receive priority attention would include two additional laboratory units, another unit in Station Operations, an auditorium, and additional housing of various types.

Expansion of commodity programs and construction of new facilities will, in turn, require additional equipment. At the same time, it will be necessary to replace a certain amount of equipment and vehicles annually.

Although CIAT anticipates that the Government of Colombia will accelerate its capital development programs at Carimagua and Turipana, it is obvious that CIAT must

invest in facilities and equipment unique to the international research and training programs being carried out at these locations. The amounts indicated, $200,000 annually for 1975 and 1976, are considered adequate to implement and support programs for these sites.

The request for funds to construct and equip facilities for core program operations outside Colombia is based on strong recommendations being made by various review groups, in addition to ongoing Board discussions, on the desirability of undertaking certain core operations in other countries, particularly Brazil.

If CIAT moves in this direction, and it appears likely that this will be the decision, it is not reasonable to expect that the host country will be able to provide all of the resources that will be necessary to assure execution of a successful program. It is not contemplated that CIAT would establish per se a station of its own in another country, but negotiate for the opportunity of mounting a collaborative program on a mutually acceptable basis on one or more existing research stations located in the environments important to CIAT research.

E 62

CIAT

Proposed Program and Budget

for

1975

Revised Draft
April 29, 1974

FOR CONSIDERATION BY THE BOARD OF TRUSTEES
AT THEIR MEETINGS MAY 13 – 15, 1974

Centro Internacional de Agricultura Tropical

C I A T

PROPOSED PROGRAM

AND

BUDGET

FOR

1975

REVISED DRAFT

APRIL 29, 1974

FOR CONSIDERATION BY
THE BOARD OF TRUSTEES
AT THEIR MEETINGS
MAY 13 - 15, 1974

TABLE OF CONTENTS

OBJECTIVES AND ACTIVITIES OF CIAT

The mission of the Centro Internacional de Agricultura Tropical (CIAT) is to accelerate agricultural and economic development and to increase agricultural production and productivity 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 seeks maximum results in minimum periods of time. Its operations are characterized by multi-disciplinary approaches, concentrated thrusts, cooperative efforts with national and private entities, and numerous efforts to demonstrate and multiply results.

While CIAT attacks the problems of crop and animal production necessary to increase the quality and quantity of food available, it also is concerned with economic development leading to improved buying power so that urban residents may purchase and thus benefit from the increased production of food.

In its operations, CIAT seeks (a) to be catalytic in the agricultural and economic development of the tropics; (b) to establish and demonstrate a pace-setting level of program excellence; (c) to collaborate and cooperate with national institutions throughout the lowland tropics on research, educational, and extension programs and to facilitate the development of cooperating networks among these institutions; (d) to maintain mutually complementary programs and relationships with other international centers and regional organizations, and (e) to establish and maintain cooperative linkages with agricultural research and training institutions in the developed countries.

CIAT's primary areas of research are beef cattle, cassava, field beans and small farming systems. It also has modest rice and maize programs, strongly linked with IRRI and CIMMYT, respectively. Finally, it has a program of limited scope on swine, this primarily concerned with management and nutrition.

General Activities of CIAT

CIAT concentrates on the agricultural problems of the tropical lowland areas below 3,000 feet elevation and with particular emphasis, initially, on the lowland tropics of Latin America. The general activities of CIAT are designed:

1. To develop and demonstrate production systems for specific crops and animals in specific environments.

2. To develop information and practices for use in bringing into economical production specific lowland areas not presently developed or fully utilized.

3. To develop and demonstrate effective techniques and strategies for the rapid spread and adoption of improved varieties and agricultural practices.

4. To help national institutions to develop staffs, programs, and facilities so that these may handle more effectively present and future research and educational tasks.

5. To provide an information center to process and exchange data and references relevant to the agricultural and economic development of the lowland tropics.

6. To provide a facility to collect, preserve, supply, and exchange plant and animal germ plasm.

7. To provide opportunities for the further training and development of professionals and non-professionals in agriculture at CIAT and elsewhere with specific emphasis upon raising the level of expertise of the indigenous human resources within the context of existing institutions.

THE 1975 BUDGET REQUEST

A. The 1975 budget request is for $5,453,000 for core operations and $750,000 for capital and working capital. This compares with $4,503,000 for core operations and $1,354,000 for capital in 1974. In accordance with a recommendation to the Board, income from the sale of crops and recovery of overhead on special projects will not be utilized until subsequent years. The request for funds is, therefore, equal to the budgeted expenses. The following table sets out the figures:

	1974	1975	% Change
	($ thousands)		
Core - Operations	4,503	5,453	+ 21 %
- Capital	1,354	750	- 45 %
Total	5,857	6,203	+ 6 %

Changes in the Core Operations Budget

B. The following table analyzes the difference between the 1974 and 1975 budgets:

			$ Thousands	% increase over 1974
	1974 budget		4,503	
1)	Cost of full year operation with level of activity assumed for the end of 1974 in the 1974 budget		275	6.1
2)	Inflation - Senior Staff costs	68		
	- Scientific and Supervisory staff costs	47		
	- Other staff costs	93		
	- All other expense categories	236	444	9.9
3)	Expansion of programs			
	a) Additional senior staff		21	.5
	b) Additional scientific and supervisory staff		70	1.6
	c) Additional other staff		59	1.3
	d) Supplies, service, travel, etc.		30	.6
4)	Other increases			
	a) Additional contingency		30	.6
	b) Additional equipment replacement		21	.5
	1975 budget		5,453	21.1

C. The increases in the 1975 budget are explained below (keyed to the numbers in the table above):

1) 1974 will be a year of considerable expansion for CIAT with budgeted expenses increasing by about 30 percent. The original budget for 1974 assumed that most new staff (which account for a large share of the increase) would be hired at the beginning of the year. In practice, because of funding uncertainties and difficulties in finding suitably qualified personnel, most new posts were not filled at the beginning of 1974 and many are still unfilled. Amounts were reassigned elsewhere in the revised budget, mainly to service units. In 1975 the additional cost for the full year operation at the higher level, which will be reached by the end of 1974, is estimated to be about $275,000.

2) Inflation in Colombia has recently been running at about 25 percent per annum. The peso is being continuously devalued at 8-10 percent per annum. Predictions for the future are that inflation in 1974 will continue at 25 percent, drop to 20 percent in 1975, 15 percent in 1976 and 10 percent thereafter and that the peso will continue to devalue at 8-10 percent per annum.

In preparing the 1975 budget it has been assumed that locally paid expenses — salaries, supplies, services, etc. will increase by 20 percent, offset by a 10 percent devaluation for a net increase in dollar terms of 10 percent. Senior staff salaries, which are paid in dollars have been assumed to increase by 8 percent. Travel costs have been assumed to increase at 15 percent per annum.

No salary increases for merit have been specifically budgeted since CIAT does not distinguish between these and increases for inflation and because CIAT has now reached a sufficient size that normal turnover keeps salary levels, excluding inflation, static.

3a) One additional senior staff member is proposed for 1975 to increase the entomology input to the cassava and bean programs. In addition, certain transfers between programs are planned.

3b) Eight additional research associates and assistants to give an additional six manyears are proposed for 1975. This will bring the total of scientific and supervisory staff to 119 which is approximately 2.5 per senior staff member.

3c) 49 additional clerical staff and other support staff (laborers, drivers, etc.) are proposed for 1975.

3d) For the most part increases in travel, supplies and services are for inflation and the full year cost of 1974 increases; the increase noted here is to support the additional staff noted above.

4a) CIAT has never before included a contingency in its budget request. In revising the 1974 budget a contingency of $25,000 was created. For 1975 $55,000 is proposed. This is 1 percent of the budget. Previously any unanticipated expense required a re-examination and shifting of already allocated resources; although this contingency is small in relation to the total budget, it should help in the management of the budget.

4b) Following normal practice in non profit organizations funded on a year-to year basis, CIAT does not charge depreciation of fixed assets to the operating budget. Instead, when an asset has to be replaced, the cost of replacement is charged to the operating budget. The amount budgeted for this is based on a formula which may or may not prove to be suitable. The amount provided is 4 percent of equipment purchased two years previously, 6 percent of equipment purchased 3 years previously, and continuing to rise by 2 percent each year thereafter. The calculation for 1975 is therefore 4 percent of $1,780,000 (the amount of equipment at December 31, 1973 excluding vehicles which appreciate in value).

D. On average, new positions requested for 1975 have each been budgeted for 9 months. This is thought to be realistic. The additional cost for salaries and related costs in 1976 when these positions are filled for the whole year will be approximately $ 50,000 excluding inflation.

The 1975 Capital Budget

E. The capital budget request is $750,000 of which $500,000 is for working capital in accordance with Consultative Group recommendations and $250,000 is for additional field and laboratory equipment. A detailed explanation of this request is given in the section on capital at page 38.

BEEF PRODUCTION SYSTEMS

Resources

Staff

	Manyears 1974	Manyears 1975
Animal Scientist-Coordinator	.7	.7
Pastures and Forages Utilization Specialist	1.0	1.0
Agrostologist	1.0	1.0
Asst. Seed Prod. Specialist	.8	1.0
Assoc. Reprod. Specialist	.3	1.0
Beef Prod. Specialist	1.0	1.0
Hemoparasitologist	1.0	1.0
Parasitologist	.2	1.0
Asst. Bacteriologist	.8	.8
Asst. Pathologist	.2	.2
Asst. Weed Scientist	.5	.5
Soils Scientist	1.0	1.0
Assoc. Agr. Economist	.8	.8
Total Senior Staff	9.3	11.0
Scientific and Supervisory Staff	14.3	18.2

	($ thousands) 1974	1975	% Incr.
Direct Research Costs	700	864	23%

Budget Changes

The 0.5 man-year input in soil microbiology in 1973 has been transferred to beans, and therefore will be discontinued in beef in 1974 and 1975. However it is hoped that special project funding might be identified to support continued soils microbiology research with tropical grasses and legumes. In the meantime, the bean soils microbiology group will provide certain technical assistance in development of the pastures program.

A considerable increase in senior staff time will result in 1975 from the full year effect of positions vacant for part of 1974.

The increase in scientific and supervisory staff is to provide a second research associate in pastures and forages utilization, a research assistant for seed production and a second assistant in weed control. Other increases are for the full year costs of the three senior staff being employed in 1974 and the associates and assistants being added in 1974 and for inflation.

Program Commentary

Vast areas of the lowland tropics in Latin America are suited to cattle raising, given adequate application of existing technology and resolution of production barriers where these exist. There are some 200 to 300 million hectares of low fertility acid soils in Colombia, Venezuela, Brazil, etc., with a potential for marked increases in beef production. Although governments are giving increasing attention to colonization of these areas, there is a lack of fundamental information on development and management of these "allic" soils. This information is desperately needed as a basis for guiding major colonization efforts already underway or now in the planning stage.

Also beef production could be increased in more recent alluvial soils areas, including coastal plains and river valleys, where probably about one-half of the cattle in the lowland tropics are found. Combination beef cattle and crop enterprises tend to predominate in these areas, and milk production from the beef cattle herd provides a significant proportion of the total farm income.

CIAT is attacking the problems of providing adequate year-round nutrition and improving animal health. The third activity is to develop and demonstrate economical and feasible beef cattle production systems. Particular attention is given to family farm units, which include a subsistence and support base to provide food and shelter for the family, and where beef cattle comprise a major proportion of the farm enterprise.

Nutritional deficiencies of grazed forages, particularly during the dry season, result in low productivity. As life cycle production systems on pasture predominate, CIAT emphasizes providing a nutritionally adequate pasture forage throughout the year, with supplementation as necessary to correct deficiencies of the grazed forage.

In Carimagua, which is representative of extensive latosol soil regions, the productivity of molasses grass (Melinis minutiflora) pasture has been four to five times that of native pastures during the rainy season. However, this advantage disappears during the dry season, when animal weight losses occur that often erase a large portion of the weight gains achieved in the previous rainy season. Interseeding of the high protein forage legume Stylosanthes guyanensis in grass pastures along with protein supplementation are being tested as means of curbing these weight losses and their effects on fertility. As most grasses are deficient in phosphorous in particular, mineral supplementation has markedly increased conception and growth rates of cattle grazing both the native and molasses grass pastures.

In animal health, CIAT emphasizes breeding diseases, hemoprotozoan diseases and involvement of wildlife in the epidemiology of diseases affecting cattle and man.

Although malnutrition is the main cause of low calving rates, breeding diseases are often primary causes; other diseases further aggravate the problem. CIAT surveys conducted in the Llanos have encountered significant infections of IBR (infectious rhinotracheitis), leptospirosis and brucellosis, but other breeding diseases have not been found.

In collaboration with Texas A&M University, significant advances have been made in the epidemiology, immunization, antigen sources, diagnostic methods, chemical control and treatment of two hemoprotozoan diseases, anaplasmosis and babesiosis.

Economists in the beef production systems program are determining the implications of technical changes in beef production at the micro and macro levels. This includes studies relating to the economics of beef production systems in savannah regions, a survey of the phosphate fertilizer market, and a pilot benchmark study of the Colombian livestock sector which can be extended to other countries.

CIAT plans to expand somewhat its operations at Carimagua in the Colombian Llanos as the basis for its principal program for beef production on low fertility acid soils. In 1974-75, new projects to be initiated will include: a) establishment, operation and economics of a prototype family farm based on beef production; b) increased attention to seed production of both grasses and legumes; c) a second herd system project to determine fertility and growth rate of beef cattle in life cycle production systems using native and improved grass pastures with and without the Stylo legume; d) use of the Stylo legume and non-protein nitrogen supplements to correct protein deficiencies of dry season grasses; e) control of blood parasite diseases.

In Turipana, existing projects will continue in the establishment, management and evaluation of mixed grass and legume pastures, and in the control of blood parasite diseases.

CIAT's effectiveness in contributing to the development of the lowland tropics will be largely determined by what it can do through and with national institutions. This will require an expanded effort beyond the current outreach activities of the CIAT core program staff. To meet this need, it is proposed that special project funding be sought for the following:

1) Additional staff members in pastures and forages and beef husbandry who would provide multi-country technical assistance on a continuing basis.

2) Establishment of a major outreach program center in a latosol savannah area to permit rapid and efficient application of production technology generated by the base program in Colombia, to serve as a test site for technology presently available and being developed at Carimagua and at other national research centers,

and to serve as a major center for expanded beef production research and training in allic soil areas.

In addition the program looks to special funding for a second economist so that more than one man-year (instead of 0.75) may be devoted to beef.

SWINE PRODUCTION SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Coordinator-Nutritionist	1.0	1.0	Direct Research			
Asst. Nutritionist	1.0	1.0	Costs	246	279	13%
Asst. Bacteriologist	.8	.8				
Asst. Pathologist	.2	.2				
Assoc. Agr. Economist	.2	.2				
Total Senior Staff	3.2	3.2				
Scientific and Supervisory Staff	4.8	6.0				

Budget Changes

The 1974 budget has been revised to show an input of approximately 25 percent of animal health to swine. Previously the division was only 15 percent to swine. The new arrangements reflects more accurately the actual input to swine. In addition, for budget purposes, the animal health group has been divided into the two components, beef and swine. The identification of part of the time of two of the animal health people as swine is to assist the swine program in its day-to-day contacts with the animal health group. These arrangements and the assignment of certain support staff to swine animal health will not mean any change in the working of the group as a team.

No changes are proposed in the senior staff for 1975. An additional senior staff member has been added in 1974 to be funded by an IDRC grant for outreach. This will continue in 1975. The increase in core expenses is for the full year costs of new staff in 1974 and inflation.

Program Commentary

Pig production is an important component of small scale farming in Latin America. Pigs are a form of savings and a source of ready cash and collateral. They can be important to the diet of the protein - deficient majority of tropical farm families. Problems in swine production relate to the slow growth rate of the animal, low reproduction rate and high mortality. CIAT's program aims to improve the productivity of swine raising by small farmers by improving the feeding, husbandry and health of the animals. Improvements will benefit commercial as well as small farmers.

Major emphasis has been placed on the development of feeding systems for small farm units, using feedstuffs produced on the farm, as well as others available locally.

This has included opaque-2 maize, vitreous endosperm high-lysine maize, cowpeas, beans, soybeans, whole cottonseed, Stylosanthes and Desmodium as protein and energy sources, and cassava, plantains and yams as energy sources.

The vitreous endosperm high-lysine maize has given performance equivalent to that produced by the high-lysine soft endosperm maize. The vitreous endosperm type appears to have improved storage qualities and is more readily accepted by farmers.

Cassava is a practical substitute for cereal grains in swine diets. While HCN concentration and moisture content limit consumption, both problems can often be largely resolved by drying the cassava.

Search for protein sources that can be produced on small farms has indicated that either whole soybeans or cowpeas can provide all of the supplementary protein in swine diets. However, both must be boiled for 15 minutes to inactivate anti-digestive factors. Whole cottonseed treated with ferrous sulphate might be a possible protein source where cotton is a major crop. Also tropical forage legumes, such as Stylosanthes and Desmodium, are potential supplementary sources.

Animal health investigations focus on characterizing the spectrum of swine diseases present and their impact on productivity, and the development of herd health programs. Foot and mouth disease and reproductive diseases are especially critical.

In 1974 and 1975, the program expects to complete development and wide-scale testing of life-cycle feeding systems based, to every extent possible, on farm produced feeds. Such systems may entail changes in cropping patterns and introduction of new crops. At the same time, disease control efforts will continue.

Work in economics will also be directed to the improved feeding problems to evaluate feed and work out least cost feed systems. It will also study market and price structures.

The swine program can train three to five swine experts annually, each returning after a year to strengthen a national program.

In terms of knowledge and experience the program is now able to support a number of outreach programs although the senior staffing would have to come from special project support. The core staff has been working with national programs in Colombia and Ecuador. In addition, IDRC support has made possible programs in Bolivia and Costa Rica. Good prospects exist for outreach in 1975 in Peru, Brazil, Paraguay and Guatemala.

CASSAVA PRODUCTION SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Assoc. Physiologist-Coordinator	1.0	1.0	Direct Research			
Assoc. Breeder	1.0	1.0	Costs	388	495	28%
Asst. Pathologist	1.0	1.0				
Asst. Entomologist	.5	.9				
Asst. Weed Scientist	.5	-				
Asst. Agronomist	1.0	1.0				
Asst. Soil Scientist	.5	.5				
Assoc. Agr. Economist	.5	.5				
Agr. Engineer	-	.5				
Total Senior Staff	6.0	6.4				
Scientific and Supervisory Staff	13.0	15.0				

Budget Changes

The 1975 budget is increased by 0.4 manyear of senior staff time. The cassava program is obtaining high yields of cassava which when transferred to farmers' fields could lead to inefficient utilization and severe marketing problems.

Fresh cassava does not keep without spoiling for more than a few days. An agricultural engineer (half-time) is needed to help with the development of simple cassava drying methods and fresh storage technology. Improved technology, in these, would largely eliminate the problems mentioned above.

The insect problems of cassava have turned out to be more complex than was originally thought; there is no doubt that thrips can cause severe yield losses, a fact which was not apparent when the program started. Results on losses from other insects are somewhat equivocal and a request is made for an increase from an entomologist half-time to full-time. If present trials show that these other pests do not cause severe yield losses, this extra input would be better justified in development of processing technology.

Weed control methodology should be sufficiently developed by the beginning of 1975 so that it can become part of the agronomy program, the Assistant Weed Scientist will, therefore, be dropped from the program. The extra support staff for 1975 are to assist additional senior staff and to run screening programs for which techniques have now been developed.

Program Commentary

Cassava is a starch-producing root crop particularly suited to acid tropical soils and widely grown throughout the tropics as food for both humans and livestock and as a source of commercial starch. The potential for increased yields is proven, and the need for them is becoming more acute as world population grows.

A germ plasm bank of about 2,200 collections has been established and this is being systematically screened for agronomic characters, disease resistance, insect resistance, and low cyanide content. Great variability has been found in all characters observed and particularily in preliminary yield evaluation. Several clones have a yield potential well above average; these have been found even before testing of the new hybrids being produced which are expected to combine such characters as high harvest index and leaf area index with disease and insect resistance, low cyanide content, and ease of harvesting.

Yields will need to be stabilized by developing better agronomic practices, as well as disease and insect resistant varieties. Some of the high-yielding types are highly responsive to planting density with yields increasing to nearly 55 ton/ha per year with populations of 10,000 to 20,000 plants per hectare. Control of diseases that attack young cassava plants by dipping cuttings in a fungicide improves establishment, and insectivide applications prevent losses of young plants to cutworm attacks. Effective weed control methods, being developed at CIAT, dramatically increase yields of cassava. A method of rapid propagation of cassava developed will enable large quantities of either new or disease-free stocks to be produced for farmers.

To assess the problems farmers face, an economics survey is underway to study both biological and economic factors limiting cassava yields and its utilization. These data will help in establishing future research priorities.

The need for research on simple post-harvest processing for cassava has become apparent. Cassava roots deteriorate rapidly after harvest; however, when placed in simple straw and soil clamps, they can be conserved for up to two months and after removal from these structures, their shelf-life is also improved. Further research is needed to prevent occasional failures of this system under extreme climatic conditions. Conservation of cassava by drying is also a possibility and a cooperative project has shown that there is a large market for this product. Preliminary trials have described the drying characteristics of cassava chips, and from this effective solar drying systems can be designed.

The cassava program also includes training and a documentation service based on an exceptionally comprehensive bibliography.

The 1975 program will continue the main efforts of 1974, and explorations looking toward the development of cooperative projects outside Colombia are expected to produce concrete results, perhaps in Brazil, Paraguay or Peru. Special project funding will be sought for some additions to the program - for instance: for a socio-economic evaluation of the potentialities of multiple cropping centered on cassava, and to improve methods and facilities for producing and distributing disease-free plant material.

BEAN PRODUCTION SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975
Assoc. Soil Microbiologist-Coordinator	1.0	1.0
Assoc. Plant Physiologist	.5	1.0
Assoc. Plant Breeder	1.0	1.0
Assoc. Plant Pathologist	1.0	1.0
Asst. Entomologist	.5	.9
Asst. Soil Scientist	.5	.5
Assoc. Agr. Economist	.5	.5
Total Senior Staff	5.0	5.9
Scientific and Supervisory Staff	15.0	17.5

	($thousands) 1974	1975	% incr.
Direct Research Costs	380	496	31%

Budget Changes

With the change of coordinator of the team, there will be a period in 1974 in which there will be no physiologist.

For 1975 the addition of 0.4 man-year of entomological work is proposed so that the team can have the full-time participation of an entomologist. Insects, particularly spider mite and white fly, and insect-borne diseases (e.g. virus infections) are some of the most severe factors limiting bean production.

The additional senior staff time will necessitate more support staff. This and a need for more support in other areas is the reason for the increase of manyears in the scientific and supervisory staff.

Program Commentary

Background. Dry beans are an important component of the human diet in Latin America, nearly 35 percent of the world production occurring in this region. The naturally high protein levels in beans are particularly important to middle and lower class families, unable to afford or produce animal protein. Unfortunately, yield levels are so low (550-1200 Kg/ha) that even this source of protein can be too expensive for poor families. CIAT's bean program is intended not only to increase yield potential and stability for dry beans throughout the region, but also to study the economic and sociological implications of technological and yield changes in this commodity.

Program Achievements 1973-74. Major emphasis in the program to date has been to collect and evaluate under varying environmental conditions a large germ plasm base. Studies at three locations (Palmira and Turipana in Colombia and Guayaquil, Ecuador) have already yielded 15 selections with high yield potential and adaptation to each environment.

A major problem has been the frequency of damage by insects and plant pathogens. Much of the germ plasm material has already been screened for resistance to major pests, and varieties selected which are resistant to Empoasca, web-blight, common bean mosaic and bacterial blight. While these varieties and their resistance factors will be incorporated into future breeding plans, the shorter term solution has been to develop chemical control methods and recommendations.

Bean production techniques vary considerably. Agronomists seek to rationalize these differences, emphasizing aspects such as planting density, soil fertility, and common systems for intercropping maize and beans. Promising varieties are in replicated yield trials.

With fertilizers less available and more costly, a limiting factor to higher bean production could be N and P fertilization. Microbiological studies emphasize symbiotic nitrogen fixation by Rhizobium and the influence of endotrophic mycorrhizae on the availability to the plant of soil phosphorous and lower grade phosphatic fertilizers.

If technological advances are to be turned to production increases, each country will need scientists with a background and understanding of production-oriented research. The program has stressed training activities, receiving nearly 20 post-graduate trainees and four doctoral students in the 1973-74 period.

Future Developments. The program aims to develop packages of improved varieties and practices and to spread them through cooperation with national agencies. Varietal development will begin in 1974 with the crossing of high yielding lines obtained in the screening program. The physiology and the plant protection groups will collaborate with the breeder in selecting desirable plant characteristics and disease and insect resistance factors. Pathology will also be concerned in the production of disease-free seed which could be made available to other institutes or national programs.

If maximum yields are to be obtained from these improved varieties, cultural limitations will need to be precisely defined. This will necessitate intensive regional testing as well as further studies of varietal reaction to planting density, fertilization and inoculation.

At the same time it will be necessary that the varieties and practices proposed are acceptable to growers and consumers; that the impact of new technology on the community is understood; and that factors likely to limit the benefits of production increases are minimized. This will be the work of the economics group.

The program is also seeking special fund support for two additional staff to work in collaboration with national entities. They will be responsible for the preparation and distribution of the promising and disease-free breeding lines; for the organization of regional trials outside Colombia; and for the development of zones which could be used to produce clean seed in commercial quantities. A documentation service similar to those already operating in CIAT will be organized, and the team will plan discipline-oriented workshops to spread major technical developments.

RICE PRODUCTION SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Breeder - Coordinator	1.0	1.0	Direct Research			
Assoc. Agronomist	1.0	1.0	Costs	132	153	16%
Total Senior Staff	2.0	2.0				
Scientific and Supervisory Staff	1.8	2.0				

Budget Changes

Changes in the 1975 core budget over 1974 are limited to full year cost of a research assistant being employed mid-year 1974 plus inflation.

Program Commentary

The CIAT rice program is carried out by a rice breeder working at the Palmira Station of the Instituto Colombiano Agropecuario (ICA) adjacent to the CIAT farm, and an agronomist located at the CIAT facilities. A closely unified joint varietal development program is conducted at the ICA Palmira Station. This arrangement informally melds the resources of both organizations giving a relatively large research effort. It also provides a viable mechanism whereby promising materials are evaluated in a country-wide system of regional trials managed by ICA and the National Rice Federation. This information is crucial to the process of releasing new varieties.

The program has been highly successful in the development, multiplication, and diffusion of new rice varieties throughout Latin America. The rice varieties IR8 and IR22, introduced from Asia, and CICA 4, developed at Palmira, are highly successful commercial varieties. Other varieties have been released from CIAT and IRRI supplied breeding populations in Mexico, Cuba, Costa Rica, Peru and Brazil. The rice breeder continues to stress the development of new and improved varieties with a new one to be jointly named and released with ICA in 1974. Particular attention is paid to (a) the development of resistance to blast, a critically limiting factor in rice production, (b) improved grain appearance and milling quality, and (c) greater adaptability over a wider range of geographic latitude.

The agronomist deals especially with the evaluation of promising lines developed by the breeder, with the multiplication and distribution of seed to national programs, tied to the package of improved cultural practices. He also has a large program of training in rice agronomy and seed production.

Despite the modest resources devoted to the CIAT rice program, the returns have been high. Approximately 600,000 hectares or more of irrigated rice land use the new technology based on dwarf varieties. Adoption rates have been high in Mexico, Cuba, Central America, Colombia, Venezuela, Ecuador, Peru and portions of Brazil. Each hectare in the new varieties averages 1 to more than 2 tons of additional production per hectare. In Colombia, with 90 percent adoption in the irrigated sector yields have climbed from 3.0 tons/ha in 1966 to 5.2 tons/ha in 1973. The use of the new varieties has added at least $100 million a year to the economies of the Latin American nations since 1970.

This rapid adoption of the new varieties is clearly associated with the following varietal advantages: (a) extraordinary yield potential; (b) dwarf plant type, resistance to lodging, and responsiveness to fertilizer; (c) excellent resistance to hoja blanca virus and direct feeding by the Sogata planthopper; (d) excellent cooking behavior and fair to good milling characteristics, and (e) broad regional adaptability.

The rice program has been successful in large part because of its massive output of trained research workers. More than 60 agronomists and breeders with CIAT training form a functional network with the CIAT research program in all important American rice producing nations. New materials and methods are evaluated throughout the hemisphere by these people who also have been instrumental in moving the new technology within their countries.

The opportunities for further contributions to rice production in the Americas are enormous. CIAT has recently turned its attention to temperate South America where extraordinary land and water resources for rice production are available. CICA 4 in Rio Grande do Sul, Brazil, at more than 30° latitude, yielded an average of 2 tons more per hectare than all local varieties in eight locations. The same variety was recently planted on 300 hectares in Paraguay with CIAT supervision and seed. These results point to a potential explosion of rice production in temperate latitudes.

Similar potential exists for the humid tropics where several million hectares of prime rice lands, useless for alternative crops at present, are available for exploitation. A modified Asian technology has been developed to put these lands into production. This technology, developed at CIAT, has been tested successfully on the CIAT farm, the ICA Turipana Station, and on commercial rice farms.

The realization of the potential to convert the Americas into a massive rice producer for local consumption and export depends upon administrative decisions to approve and seek funding for special project activities.

The breeder and agronomist require additional senior staff participation in their CIAT-based research activities. Special project funding for an additional agronomist

and an agricultural engineer is requested to extend and multiply the advances achieved to date. These additional staff would concentrate on seed production, weed control and wet land preparation and planting methods.

Apart from additional research needs, the extension of proved technology into the humid tropics would depend upon acquisition of special funding for production-oriented projects in four areas of Latin America. These projects would catalyze and coordinate the efforts of national organizations and international lending agencies in agricultural development using rice culture as a self-financing mechanism.

MAIZE PRODUCTION SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Asst. Breeder-Actg. Coord.	.8	1.0	Direct Research			
Scientific and Supervisory Staff	5.3	4.0	Costs	87	100	15%

Budget Changes

The new maize breeder arrived March 1, 1974. Staff discussions have concluded that the maximum number of research associates and assistants which a senior staff member can efficiently use and supervise is four. Six of the seven authorized positions for 1974 are filled. It is proposed to reduce this number to four by 1975. One of these four scientific staff will be a research associate. Costs will decrease because of this reduction but the decrease will be offset by the full year cost of the new breeder and inflation.

Program Commentary

The program has concentrated its efforts on the most serious factors limiting production in the Andean zone: low productivity, narrow adaptation, low plant populations, and insect damage. Low protein quality (relative to the potential available in opaque-2) is also a problem. Research assistants in breeding, agronomy, physiology, entomology and testing worked toward resolving these problems in five locations in Colombia, and others throughout the zone in collaborative research projects. The program functioned as an integrated part of the international program in Mexico, especially in joint activities such as uniform trials and special topic workshops.

The arrival of a new maize breeder and the International Maize Workshop planned by CIMMYT for April, 1974, will provide an opportunity for CIAT to re-evaluate research results and the current focus of the program. A firm bond of cooperation between CIAT and CIMMYT maize research and training efforts is necessary to assure the rapid distribution and effective utilization of germ plasm in CIMMYT's world collection and population development program.

In addition to the core position for a maize breeder at CIAT, special project funding will be sought for a plant protection specialist and a production agronomist. This team of professionals would then be able to meet the outreach and training needs of the Andean zone and Brazil, and would function as one of CIMMYT's regional

coordination units in the world maize network. CIAT and CIMMYT have opportunity to cooperate in the screening and selection of insect resistant materials that may be conveniently tested under natural infestations already present in Colombia. Spodoptera sp. and Diatraea spp. will receive high priority.

Promising germ plasm sources in the form of composites will continue to be distributed in the zone. These populations combine wider adaptation and a hard endosperm with improved quality, in both yellow and white maize. Agronomic practices such as minimum tillage and residue management will continue to be tested.

SMALL FARM SYSTEMS

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Assoc. Agronomist-Coordinator	.7	1.0	Direct Research Costs	196	246	26%
Assoc. Systems Engineer	.5	.5				
Assoc. Economist	1.0	1.0				
Asst. Agronomist (Protection)	-	.5				
Total Senior Staff	2.2	3.0				
Scientific and Supervisory Staff	4.7	10.0				

Budget Changes

The program now has on board all the senior staff listed above. In addition, a Visiting Scientist (Anthropologist) will be working with the team in 1974 and a rural sociologist, financed by the Government of the Netherlands through FAO, joined the team in March 1974.

As labor use for plant protection at peak times is a serious limiting factor, the plant protection agronomist will study the relationship of cultural practices, income and production in terms of the use of agrochemicals and labor and other agronomic alternatives.

The work of the anthropologist in establishing data gathering mechanisms and training research assistants will be largely complete by the end of his stay at CIAT. Thereafter, the work can be handled by the sociologist and his support staff.

The increase in scientific and supervisory staff is mainly to build up to what is thought to be the required level for the present phase of the program.

Program Commentary

Experiences up to and including 1973 have led CIAT to recast its agricultural systems program more specifically as a small farm systems program. The program is concerned with small family farms as integrated systems; the whole farm unit is studied.

Many small farms are at subsistence levels with limited access to technology and limited ability to run the risks of adopting new methods. There are severe problems

of nutrition, health and education, as well as agricultural productivity. Given the constraints on small farmers, what technology alternatives are best? How can traditional farming systems be modified? Is there a general procedure that can be applied so as to introduce improved technology and more efficient agricultural practices? Answers to such questions would benefit CIAT's commodity programs, national research agencies - and the small farm families.

In October 1973, a planning session was held with 40 participants from CIAT's staff, Universidad del Valle, ICA, and interested international agencies and foundations. The underlying concern of all participants was with the establishment of a team to focus on the understanding of existing farming systems in order that the relevance and impact of new technology on farm family welfare could be planned and predicted.

The fundamental characteristic of present Latin American agriculture is the simultaneous existence of a small, highly commercialized farming sector on one hand, and a numerically large sector of small family farm units which operate at a near subsistence level on the other.

On a large number of small farms productivity has changed little, if at all, over the years. Levels of income, nutrition, health, housing and schooling lag far behind those of the commercial farm sector and much of the urban population. This sector is principally (although not exclusively) concentrated in the less favorable ecological areas, with limited access to transportation, storage, input supplies and credit.

The small farmer has had few if any profitable opportunities. He has evolved farming systems that are often near optimal for the economic, political and ecological environment in which he operates, given the alternatives he can perceive. This essential rationality of the small farmer implies that successful agricultural development requires new production alternatives that are adapted to his environment; that increase his income; that recognize this risky nature of his decision problems, and that fall within the availability of input supplies and stable markets.

National goals of expanded food production and employment opportunities are not incompatible with efforts to promote growth among small farmers. In fact, small farms are an important source of food production in many countries. In Guatemala, which is exemplary of many countries, 84 percent of the farmers own farms of less than 7 ha. that occupy 17 percent of the land in use, yet produce close to 60 percent of the basic grains.

The Small Farm Systems Program of CIAT is a basic research activity charged with understanding the great diversity of agriculture in tropical Latin America. Because CIAT is concerned with the improvement of agriculture and rural life, the

Small Farm Systems Program is oncerned with family farms as integrated systems. The program is concerned with small scale farming in all its complexity and is focused on the farm family. Its primary goal is to develop a process for the identification and analysis of existing farm systems so as to facilitate the utilization of agricultural technology in the development of rural areas.

The objectives of the program in 1974 - 76 are to identify and analyze existing small farm systems and to develop a number of prototype systems. The process will provide guidelines for identifying limiting factors and selecting research alternatives. Then it is hoped to develop a strategy for tackling the problems of small farmers and facilitating the rapid application of agricultural technology in the development of rural areas.

The system team is collaborating with (a) the Instituto Colombiano Agropecuario (ICA) in Colombia and the Instituto de Ciencias y Tecnologia Agricola (ICTA) in Guatemala in their projects to design and implement new agricultural technology and (b) with the swine program and the llanos family ranch (beef) project of CIAT, where the problems of successfully introducing new technology to improve the welfare of the small farm family and others dependent on agriculture will be analyzed. The team will help develop an analytical model for studying the impact of various investment strategies and of technological introductions.

The first steps in 1974 - 76 are to develop: an analytical model for the prototype (beef) farm under test; a description of existing (swine) farming systems as a basis for planning future action; a methodology for describing model farms and for the evaluation of achievements of rural development projects and to demonstrate the application of the methodology through the action program of national economic and planning agencies so as to identify bottlenecks at the macro level (for example, exchange rates, fertilizer prices, taxation). The team will also work with rural development agencies through which it can make its findings available to policy makers. Thereby it will help select or specify cultural practices, crop mixes, levels of input, etc. to be tested on experiment stations or family farms.

The team as constituted in 1974 consists of senior staff in systems engineering, agronomy and economics, who together contribute 2.2 man-years, a visiting scientist (anthropologist) and a FAO financed sociologist together with 9 support staff in these disciplines. For 1975, there will be no increase in the core financed principal staff. However, to enable the program to work more effectively it is proposed to seek special funding for staffing in animal sciences, agricultural engineering and nutrition.

TRAINING AND COMMUNICATION

Resources

Staff	Manyears 1974	Manyears 1975
Leader, Training and Communication	1.0	1.0
Assoc. Coordinator, Training	1.0	1.0
Assoc. Coordinator, Training	1.0	1.0
Editor	1.0	1.0
Information Specialist	0.5	1.0
Photographer	1.0	1.0
Total Senior Staff	5.5	6.0
Scientific and Supervisory Staff	8.7	10.8

	($ thousands) 1974	1975	% Incr.
Direct Costs	703	843	20%

Budget Changes

An additional editor (identified as information specialist), authorized for 1974 and expected to be employed by July 1, 1974, will be full-time in 1975. A training associate, previously in the budget of the Livestock Production Specialist Training Program (a special project funded in part by BID), will be carried as core in 1975 to strengthen the basic training group in animal sciences. An additional editorial associate is being added in 1975 to assist the information specialist and to make his time more useful. Other staffing issues, such as meeting the need for a communication scientist to undertake additional evaluation and communication related research as well as to expand instruction in this areas with trainees, will be delayed until 1976.

Increases in training funds are associated with $5,000 to cover additional insurance expenses on postgraduate interns and an increase of $25,000 in the budget for research scholars and fellows. This is necessary to meet substantial rises in tuition, fees, and travel costs.

Conferences and Symposia are budgeted at $88,000 in core and $52,000 in special project funds from the W.K. Kellogg Foundation for 1974. The amount in the core budget was reduced for 1974 because of the availability of the special funds. For 1975, $110,000 is requested for Conferences and Symposia in the core budget and in addition $108,000 is shown for special project funding for proposed events not considered of top priority for specific commodity programs.

Program Commentary

General

Facilities and available staff time impose definite restrictions on the overall operations in Training and Communication. The present capacity for housing trainees at CIAT is 80, while the conference housing maximum is 64. While larger conference groups can be handled by booking sleeping rooms in Cali, the lack of an auditorium or assembly hall limits the size of any single conference group in air-conditioned facilities to a maximum of 200.

Scientists in the commodity programs must budget their time between research, training, conference participation, and travel and consultation in other countries. As more trainees complete programs at CIAT, the need increases to provide followup support in the countries. Growing emphasis on socio-economic issues involving CIAT commodities emphasizes the need for greater inputs from this area into the training programs.

Finally, a pace-setter for training and communication activities in the future will be the growing outreach programs, and every effort is being made to maintain flexibility so as to be able to respond in this area effectively and promptly.

Training for Research and Production

Training activities at CIAT provide learning experiences for professionals, some to conduct production-oriented research in their own organizations, while larger numbers become crop or animal production specialists, helping to translate and communicate new agricultural technology.

Of immediate concern is the preparation of individuals to accelerate research on and the application of new technology in their own countries. These trainees help CIAT to develop effective links for the exchange of knowledge about agricultural problems and their solution, and eventually, to build and strengthen effective networks for research and communication among scientists.

The longer-term goals are to increase the numbers of research workers, educators, and extension specialists with competency to identify and solve production problems and the ability to communicate these solutions to farmers and others. CIAT's continuing training role is to provide counsel and assistance where appropriate, to train cadres of individuals to staff existing and new training operations within countries, to offer opportunities for specialized or refresher training for selected individuals, and to help the various institutions develop more adequate resources of teaching and reference materials.

In 1973, 159 persons participated in CIAT's various training activities and 74 of these appointed later in the year continued into 1974. Of the 159, 53 were postgraduate interns in research, 58 as production specialists, 15 as master's degree candidates, 12 as research fellows, and 21 as special students. Twenty-four countries were represented.

Plans provide for training of the following categories of persons in 1975.

Postgraduate Interns. These are young scientists, chiefly from Latin America and the Caribbean, who have completed undergraduate degreees in agronomy, animal science, or veterinary medicine. They receive on-the-job training in production system studies while serving as full-time research interns. Thirty manyears of these interns are funded in the budget for 1975, at an average of $5,000 each.

Production Specialists. CIAT presently is involved in the sixth and seventh 12-month courses designed to prepare agricultural production specialists for developing countries. Each year CIAT offers one course in livestock production, the other in crop production.

The objective of these courses is to produce specialists with the scientific, technical, economic, farming and communication competencies necessary to diagnose production problems of a livestock enterprise, or a crop farm, and to recommend and implement profitable production practices. They are prepared to work in the field as individuals or, more importantly, to establish and conduct training programs in their own country.

Costs of these courses have been funded in part on a non-core basis by the Interamerican Development Bank and other organizations.

Research Scholars and Fellows. A few promising young scientists are selected each year and supported in graduate studies leading to advanced degrees; these are identified as Research Scholars. Through cooperative arrangements with the universities involved, CIAT scientists serve as advisors, and each scholar does his thesis research under the guidance of CIAT staff members. This type of support is used primarily as a means of developing Latin American candidates for projected CIAT staff positions, as well as for key positions in national organizations.

Research Fellows undertake a one- or two-year program of special research training, this usually associated with their doctoral thesis research. They contribute substantially to the research productivity of the professional group in which they work in addition to developing their own specialized skills.

A Scholarship Committee of CIAT allocates funds available, $100,000 indicated for 1975, among qualified applicants for scholarships and fellowships.

Other Trainees. CIAT maintains a flexible policy to provide unique training opportunities for young professionals from many lands. For example, through an agreement with Wageningen University in the Netherlands, fourth year animal science students come to CIAT for up to a year on-the-job experience in the management of animals and pastures under tropical conditions. A similar program has been initiated with Wageningen for students interested in rural sociological problems in the tropics.

Through informal arrangements with various universities, other students may spend extended periods of time with CIAT working under the supervision of CIAT senior staff members and on problems of direct interest to CIAT. CIAT limits its financial involvement to helping with the direct research expense.

Conferences and Symposia

CIAT facilities for conferences and symposia include an organizational staff, meeting rooms, equipment, housing, and feeding. Activities contemplated for 1975 and beyond include policy seminars for national leaders, scientific symposia and technical workshops for research workers, short courses for production specialists, and such other events as may be appropriate for representatives of various entities in the total agricultural development system.

The core budget for 1975 includes funds to cover the staffing and operations of a small conference management and support staff. This new staffing pattern includes professional simultaneous interpreters who between conferences translate manuscripts for conference papers, publications, and other materials.

In 1973, the Board indicated the desirability of putting more stability and predictability into the financial structure for conferences and symposia by providing core funds to support a limited number of scheduled events considered by the commodity program teams as instrumental to achieving the success of the respective commodity programs.

The amount included for Core Support in 1975 is $110,000 which is minimal considering that CIAT has six commoditity programs plus the Small Farm Systems Research program. Also shown are a number of other events, estimated to cost $108,000 for which support has not yet been identified.

Preliminary Schedule: Conferences, Symposia, Workshops, Short Courses 1975

		Estimated costs to CIAT	
		CIAT	
Month	Event	Core Funds	Not Funded
February	Weed Control Short Course, in cooperation with Oregon State University. No travel support; 30 persons	$7,000	

Month	Event	Estimated costs to CIAT: CIAT Core Funds	Estimated costs to CIAT: Not Funded
February	Graduate Short Course on the Physiology, Toxicology and Ecology of Vectors of Human and Animal Diseases, sponsored by the Government of Israel. 2-3 weeks; 25 persons		
March	International Workshop on Hemoparasite Diseases of Cattle. 6 days; 25 people (12 CIAT supported)	$10,000	
March/April	Conference on Biological, Technical and Economic Aspects of Multiple Cropping and Mixed Cropping Systems. 5 days; 50 persons		$35,000
July	Conference on Recent Advances in Maize Breeding for the Andean Zone. 5 days; 18 persons		8,000
August	Workshop on Beef Cattle Production (to be held at Belo Horizonte, Brazil) 5 days; 10 CIAT sponsored persons	7,000	
Dates not set	Andean Maize Workers' Workshop (Ecuador) 5 days; 25 persons	10,000	
	Crop Protection Workshop (Field Beans) 3 days; 30 to 40 persons	15,000	
	Workshop on Bean Breeding 3-4 days; 10 persons	5,000	
	Workshop on Crop Science (Field Beans) 3-4 days; 10 persons	5,000	
	Short Course on Agronomic Practices in Cassava	15,000	15,000
	Rice Research Workers' Short Course 5 days; 40 persons	15,000	

Month	Event	Estimated costs to CIAT: CIAT Core Funds	Estimated costs to CIAT: Not Funded
Dates not set	Seminar on Swine Production in Tropics 5 days; 60 persons	15,000	25,000
	Seminar on Agricultural Production Training in Latin America 5 days; 50 persons		25,000
	Miscellaneous small meetings and contingencies	6,000	
	Total	$110,000	$108,000

Information Services

Original plans under-estimated the time, cost and efforts of operating bilingual information services. As commodity programs increase in number and research produces results, more information is generated for processing. Demands are growing for information in a diversity of forms to meet requests of training programs, donor agencies, public information media, conference participants, and institutions in the countries being served.

With its primary audience in Latin America, CIAT publishes its materials in Spanish. But as an international center, it serves a world-wide audience in English, including the Caribbean. Therefore, CIAT produces most publications in both Spanish and English. Qualified writers, editors, and translators are both scarce and expensive. Simultaneous interpreters, between conferences, translate some manuscripts; the balance are done outside CIAT on contract.

Expansions in processing and printing equipment in 1974 and 1975 will enable CIAT to prepare copy for reproduction and increase the production capacity. By mid-year 1974, the photographic processing laboratory will be operational.

RESEARCH SUPPORT GROUPS

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Librarian	1.0	1.0	Direct Costs	833	959	15%
Biometrician	0.5	0.5				
Agr. Engineer	1.0	0.5				
Total Senior Staff	2.5	2.0				
Scientific and Supervisory Staff	14.5	15.8				

Included in Research Support Groups are Laboratory Services, Library, Biometricts, Engineering, Station Operations, Physical Plant and Motor Pool. These are dealt with below in turn.

LABORATORY SERVICES

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Scientific and Supervisory Staff	1.0	1.0	Direct Costs	28	32	14%

Budget Changes

The only increase in the budget is for the full year cost of a technician added in 1974 and inflation.

Program Commentary

Previously there was a unit "Soils Laboratory Services" which provided soils and certain other analytical services to programs. Included in the unit were a senior staff member and support staff who have now been reassigned to the Beef, Cassava and Bean programs. The unit has been increased by the transfer of technicians working on nutritional analyses and a laboratory equipment maintenance engineer. At a later date, wash room personnel will be transferred as well.

LIBRARY

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Librarian	1.0	1.0	Direct Costs	164	191	16%
Scientific and Supervisory Staff	4.0	4.8				

Budget Changes

A research associate and a secretary are proposed as additions in 1975 to handle the increasing workload of acquisitions and cataloging. This budget includes subscriptions to journals as supplies and the photocopying service used by all CIAT programs. Both of these are budgeted to increase substantially because of inflation and increased volume. Book purchases are included in capital.

Program Commentary

The Library has a collection of about 23,000 books and subscribes to about 1,100 journals. The capital request includes $45,000 for the purchase of an additional 2,500 books. The 1975 budget proposal provides for subscription to about 1,200 journals.

Besides the regular function of a specialized library, CIAT's library operates a Documentation Center specializing initially in cassava (supported by IDRC special project funds) but gradually covering other fields. It also provides a current awareness service of journal tables of contents.

BIOMETRICS

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% incr.
Biometrician	0.5	0.5	Direct Costs	84	98	17%
Scientific and Supervisory Staff	3.7	4.0				

Budget Changes

No increases are proposed for 1975 other than the full year cost of a position filled for only part of 1974 and inflation.

Program Commentary

The Biometrics unit was organized in July 1973. In the first months of operation it has concentrated on hiring and training its staff and providing consultation and analytical services to the commodity programs and has begun a collaborative program with ICA (Instituto Colombiano Agropecuario).

The unit is organized as a central service unit responsible for providing design consultation and data analysis services to all of CIAT's research and training activities. A principal function is training as personnel trained in statistics and computing are scarce. The unit is equipped with a Monroe 1860 "desk top" computer and, through ICA collaborative arrangements, uses an IBM 370 model 145 or an IBM 360 model 44 in Bogota for large scale computational requirements.

AGRICULTURAL ENGINEERING

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Agr. Engineer	1.0	0.5	Direct Costs	71	56	-21%
Scientific and Supervisory Staff	1.0	1.0				

Budget Changes

As explained below, it is proposed to reduce the input of the agricultural engineer in this area to 0.5 manyear. No other changes are proposed.

Program Commentary

Beginning in 1974 the Agricultural Engineer is no longer responsible for Station Operations, the Physical Plant and Motor Pool as previously. In 1974 he will devote full-time to the development of the ICA station at Turipaná on which many CIAT experiments are carried out and to assisting national programs in other countries develop their stations. For 1975 this work will require less time so it is proposed that half-time of the agricultural engineer be transferred to cassava.

STATION OPERATIONS

Resources

Staff

	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% Incr.
Scientific and Supervisory Staff	2.8	3.0	Direct Costs	129	154	19%

Budget Changes

No new positions are proposed for 1975. Additional supplies ($16,000) are proposed to cover increased fuel costs and additional inputs as more of the farm is brought into production.

Program Commentary

CIAT operates a farm at Palmira of approximately 520 hectares. All this has been cleared of scattered trees and brush, 36 ha. cultivated without being levelled, 264 ha. levelled for irrigation and leached of excess salts, 36 ha. developed and fenced for grazing trials and 100 ha. put to commercial pastures. Buildings and grounds around buildings cover 36 ha; 50 ha. are devoted to roads, drains, fences, canals and field boundaries. There are 35 km. of all weather gravel roads, 43 km. of drains, 35.5 km. of fence, 22.5 km. of earthlined irrigation canals and 6 km. of concrete lined irrigation canals. A tractor pool has been established.

Station Operations is responsible for maintaining the farm, preparing land for experiments, operating the tractor pool, producing crops on land not used for experiments and keeping land not presently used in good order.

Plans for 1975 include supporting an increased area devoted to experiments and increasing the area used for commercial production of crops. Income from this operation is budgeted to increase from $61,000 in 1974 to $100,000 in 1975.

PHYSICAL PLANT

Resources

Staff	Manyears 1974	Manyears 1975		($ thousands) 1974	($ thousands) 1975	% incr.
			Direct Costs	239	271	13%
Scientific and Supervisory Staff	2.0	2.0				

Budget Changes

Considerable adjustments were made in the 1974 budget to provide sufficient resources in this area. Requirements are still not certain but the substantial increases made in 1974 should prove more or less sufficient. For 1975 it is proposed to increase the staff by adding six people including a painter, a craftsman, a plumber and a gardener, at a total cost of about $8,000.

Other increases from 1974 to 1975 are for the full year cost of six positions filled for only part of 1974 and for inflation.

Program Commentary

Except for a meat laboratory and an additional greenhouse, the main construction phase of CIAT's headquarters buildings was completed in 1973. Work is now in process on the meat laboratory and work will start on the greenhouse when the funding situation for 1974 is clarified.

The Palmira installations consist of 8 main buildings, including laboratories, plus 76 living units on 45,000 square meters of maintained grounds. The gross area of buildings is 22,000 square meters, of which 70 percent is air-conditioned.

Other than electricity for which only an emergency generator is maintained, CIAT provides all its own services. Physical Plant includes resources to run and maintain these services, maintain all buildings and grounds and a security force of 28 people.

MOTOR POOL

Resources

Staff	Manyears			($ thousands)		%
	1974	1975		1974	1975	Incr.
			Direct Costs			
Scientific and Supervisory Staff	-	-		118	157	33%

Budget Changes

This unit, as with Physical Plant, has been considerably strengthened in 1974. For 1975 it is proposed to add three drivers to increase the availability of vehicles. The budget for 1974 includes about $30,000 for gasoline. Gasoline in Colombia currently costs about US$0.15 per gallon. For 1975 it has been assumed that this price will double, and $60,000 has therefore been provided. Other increases are for inflation.

Program Commentary

CIAT operates a fleet of about 130 vehicles. This includes buses, trucks, vans, pickups, jeeps, station wagons, passenger cars and motorcycles. These vehicles are from various manufacturers.

Until recently, the Motor Pool workshop has had practically no equipment with which to work and few handtools. This situation is being rectified in 1974 so that by the end of the year and in 1975 vehicles can be maintained. The workshop performs every type of service on vehicles from supply of gasoline, to preventive maintenance, body repairs and major mechanical repairs. In addition, the Motor Pool provides drivers and vehicles when needed and monitors a rented bus service for the transport of employees from Cali and Palmira.

ADMINISTRATION

Resources

Staff	Manyears 1974	Manyears 1975
Director General	1.0	1.0
Deputy Director General	1.0	1.0
Executive Officer	1.0	1.0
Controller	1.0	1.0
Total Senior Staff	4.0	4.0
Scientific and Supervisory Staff	11.8	12.8

	($ thousands) 1974	1975	% Incr.
Direct Costs	521	593	14%

Budget Changes

One research assistant to strengthen the recently formed Reception Services and a driver for a new delivery van for the Purchasing Section are proposed as additions for 1975. Other increases are for the full year cost of several positions filled for only part of 1974 and inflation.

Not included here but, as explained below, a position which could become part of Administration is the position currently vacant for the Director of Plant Sciences. It has been assumed that the position will be vacant for the whole of 1974 but that it will be filled in 1975.

Program Commentary

Administration consists of the Office of the Director General, the Controller and the Office of the Executive Officer. The Office of the Director General includes two senior staff, the Director General and the Deputy Director General. These officers are responsible for overall management of the Center. The Controller, a senior staff officer reporting directly to the Director General, is responsible for budget preparation and budget management, accounting, internal audit, financial reports and senior staff personnel matters. The fourth senior administrative officer is the Executive Officer. His responsibilities are purchasing, travel, food and housing, storerooms and inventory, security, reception services, and junior staff personnel matters. In addition, the superintendent of Physical Plant and Motor Pool reports to the Executive Officer.

For 1975, a reorganization has been suggested to the Board's Special Committee on Programs and Organizations, involving some realignment of responsibility but no change in the number of senior posts. Positions affected by this proposal would be the Directors of Plant and Animal Sciences and the Leader of Training and Communication. Decisions on the reorganization are expected before 1975.

CAPITAL BUDGET

CIAT's capital budget request for capital for 1975 totals $750,000 as compared with $1,354,000 requested for 1974. $500,000 of the request is for working capital and the balance of $250,000 for equipment, furniture, books, etc.

As programs develop and different problems arise, equipment requirements change. The list below of equipment, etc. requested for 1975 represents additional requirements identified since the 1974 request was prepared, undefined but anticipated requirements, or continuing requirements e.g., books. The following is a listing of items included in the $250,000.

		US$ Thousands
1)	**Plant Sciences Groups**	
	Additional field and laboratory equipment:	
	Cassava - unidentified	5
	Beans - incubators, growth cabinet, flow hood, microscope	6
	Rice - unidentified	5
	Maize - unidentified	2
		18
2)	**Swine**	
	Overhead holding bins	4
	Grain bins and elevators	8
	Feed weight cart	1
	Platform scale	2
		15
3)	**Beef**	
	Weed Control (camera, balances esprayers)	2
	Equipment for meat sciences laboratory scheduled to be completed by the end of 1974	60
	Husbandry - forage harvester	7
		69
4)	**Small Farm Systems**	
	Sundry equipment	2

		US$ Thousands	
5)	Training and Communication		
	Multilith 1250 and accessories	10	
	Addressograph	3	
	Graphotype engraver and plates	2	15
6)	Library		
	2500 books	45	
	Library furniture	5	50
7)	General		
	Typewriters for additional clerical staff	5	
	Furniture for additional staff	30	
	Calculators	6	
	Tools for motor pool, etc.	5	
	Additional vehicles for new staff, visiting scientists and program needs	35	81
			250

The following are brief comments on the items listed above:

1) Most of these programs find it difficult to predict far in advance their requirements for additional equipment, however, from past experience they are convinced that additional items will be required.

2) The items requested for swine are to improve the swine unit at headquarters so that it can better study the nutritional aspects of swine production.

3) The weed control scientist has identified specific needs for his work. A complete and detailed list of the equipment which will be needed for the meat sciences laboratory, which is presently under construction, has been prepared. This equipment will be needed early in 1975. A harvester is needed for nutritional evaluation of forages.

4) The Small Farms Systems team anticipates that it will need some equipment but it is not yet identified.

5) Increase in volume of reproduction demands necessitates acquiring an additional Multilith press to supplement the one such press now installed.

The addressing equipment is needed to replace the originally purchased and now found to be inadequate for the volume of material to be handled. Further, it has been almost impossible to obtain acceptable servicing of the present equipment, resulting in long delays in distribution of reports.

6) The Library currently has about 23,000 books. About another 1,500 will be bought in 1974 and it is proposed to add a further 2,500 in 1975. The purchase of books is classified as capital in accordance with Consultative Group practice when the library is still being built up.

7) With the addition of 58 new staff including 6 clerical staff, additional furniture and equipment will be needed. Already in 1974 we are faced with furniture shortages because more staff are being housed than were anticipated when the buildings were furnished; consequently all additional staff in 1975 will create a need for additional items. The development of the motor pool workshop and new cars will necessitate additional tools. CIAT currently has a severe shortage of vehicles which is expected to continue. Eight additional vehicles are included for 1975. These will be to give cars to visiting scientists, of which we have an ever increasing number, for the new senior staff member and program needs.

Working Capital

The Consultative Group recommends that Centers include in their capital request working capital equivalent to 40 days cash requirements.

In 1973 our budget included $100,000 for working capital for inventories. Based on our 1975 operating budget, 40 days requirements amount to $600,000. Since we have already received $100,000 our request in 1975 is only for $500,000.

This working capital is urgently needed since, with the end of the construction phase during which we had cash available which could be used in operations, we are now often faced with severe cash flow problems.

CIAT

TABLE I

CORE OPERATING EXPENSES

(US$ thousands)

	BEEF		SWINE		CASSAVA		FIELD BEANS		RICE		MAIZE		SMALL FARM SYSTEMS		TOTAL	
	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975	Revised 1974	Proposed 1975
Direct Research	700	864	246	279	388	495	380	496	132	153	87	100	196	246	2129	2633
Training and Communication																
* Instruction, coordination, etc.	126	155	43	48	75	92	71	92	24	29	16	19	40	48	395	483
+ Postgraduate interns	50	52	15	16	35	36	15	16	10	10	10	10	10	10	145	150
* Research scholars and fellows	24	32	8	10	14	19	14	19	4	6	3	4	8	10	75	100
Conferences and symposia	48	22	10	16	4	19	18	26	-	16	5	11	3	-	88	110
Total Training and Communication	248	261	76	90	128	166	118	153	38	61	34	44	61	68	703	843
Research Support Groups																
Laboratory services															28	32
Library															164	191
Biometrics															84	98
Engineering															71	56
Station Operations															129	154
Physical Plant															239	271
Motor Pool															118	157
* Total Operational Support Groups	267	307	92	96	158	182	150	182	50	58	33	38	83	96	833	959
Administration																
Office of the Director General															155	169
Executive Officer															248	289
Controller															118	135
Board of Trustees															16	20
* Total Administration	172	196	59	61	102	116	97	117	32	37	21	25	54	61	537	613
General Expenses, Equipment Replacement and Contingency*	97	130	33	40	57	78	54	77	18	24	12	16	30	40	301	405
	1484	1758	506	566	833	1037	799	1025	270	333	187	223	424	511	4503	5453

* Total cost distributed in proportion to total personnel costs of permanent staff of each program.

Proportions used:

	Beef	Swine	Cassava	Beans	Rice	Maize	SFS
1974	32%	11%	19%	18%	6%	4%	10%
1975	32%	10%	19%	19%	6%	4%	10%

+ Distributed to programs in proportion to estimated number of interns in each program. 1975 proportions assumed to be the same as in 1974.

Controller
April 26, 1974

AVU/ovd.

CIAT

TABLE II

SUMMARY OF MAN YEARS AND COSTS BY PROGRAM AND ACTIVITY

(U.S.$ thousands)

	Actual 1972		Actual 1973		Original Budget 1974		Revised Budget 1974		Proposed Budget 1975		PROJECTIONS 1976		1977		1978		1979	
	M/Y+	COST	M/Y	COST	M/Y	COST	M/Y	COST	M/Y	COST	M/Y	COST	M/Y	COST	M/Y	COST	M/Y	COST
PROGRAMS																		
Beef		417	9.8	661	10.5	743	9.3	700	11.0	864	13.0	1,099	13.0	1,099	13.0	1,099	13.0	1,099
Swine		177	2.7	202	3.5	211	3.5	246	3.5	279	3.5	338	3.5	338	3.5	338	3.5	338
Cassava		309	5.4	330	5.9	382	6.0	388	6.8	495	8.4	633	8.4	633	8.4	633	8.4	633
Field Beans		114	4.4	262	4.9	356	5.0	380	6.2	496	7.9	636	7.9	662	7.9	676	7.9	676
Rice		240	2.3	135	2.1	121	2.0	132	2.1	153	2.1	153	2.1	153	2.1	153	2.1	153
Maize		150	.7	121	1.1	106	.8	87	1.1	100	1.1	143	1.1	143	1.1	143	1.1	143
Small Farm Systems		110	.3	36	2.5	221	2.2	196	3.0	246	5.5	424	5.5	424	5.5	424	5.5	121
Total	27.7	1,517	25.6	1,747	30.5	2,140	28.8	2,129	33.7	2,633	41.5	3,426	41.5	3,452	41.5	3,466	41.5	3,466
Training and Communication																		
Instruction, Coordination, etc.		304	4.0	258	6.0	441	5.5	395	6.0	483	6.0	529	6.0	529	6.0	529	6.0	529
Postgraduate Interns		5		54		145		145		150		155		160		175		175
Research Scholars & Fellows		24		77		75		75		100		85		100		100		100
Conferences & Symposia Support		38		129		170		88		110		150		150		150		150
Total	4.0	371	4.0	518	6.0	831	5.5	703	6.0	843	6.0	919	6.0	939	6.0	954	6.0	954
Research Support Groups																		
Laboratory Services			1.0	48	1.0	92		28		32								
Library	1.0	77	1.0	139	1.0	129	1.0	164	1.0	191								
Biometrics		4	.5	40	.5	91	.5	84	.5	98								
Engineering			.4	38	1.0	65	1.0	71	.5	56								
Station Operations	1.0	343	.2	104		100		129		154								
Physical Plant			.2	171		188		239		271								
Motor Pool			.2	120		72		118		157								
Total	2.0	424	3.5	660	3.5	737	2.5	833	2.0	959	1.5	1,247	1.5	1,257	1.5	1,262	1.5	1,262
Administration																		
Office of the Director General			1.8	125	2.0	108	2.0	155	2.0	169	2.0	169	2.0	169	2.0	169	2.0	169
Executive Officer			1.0	155	1.0	181	1.0	248	1.0	289	1.0	369	1.0	371	1.0	373	1.0	373
Controller			.3	61		86	1.0	118	1.0	135	1.0	172	1.0	174	1.0	174	1.0	174
Board of Trustees				18		12		16		20		20		20		20		20
Total	3.0	314	3.1	359	3.0	387	4.0	537	4.0	613	4.0	730	4.0	734	4.0	736	4.0	736
General Expenses		265		346		288		226		279		356		359		360		360
Equipment Replacement						70		50		71		139		197		272		340
Contingency						-		25		55		70		70		70		70
Other						50												
GRAND TOTAL	36.7	2,891	36.2	3,630	43.0	4,503	40.8	4,503	45.7	5,453	53.0	6,887	53.0	7,008	53.0	7,120	53.0	7,188
Expense Categories																		
Personnel		1,958		2,442		3,092		3,258		3,912		4,904		4,950		4,978		4,978
Supplies		384		586		456		455		562		705		712		715		715
Services		143		318		127		376		446		559		564		567		567
Travel		239		284		311		292		356		446		450		453		453
Equipment		-				70		50		71		139		197		272		340
Other		167				447		47		51		64		65		65		65
Contingency		-		-		-		25		55		70		70		70		70
		2,891		3,630		4,503		4,503		5,453		6,887		7,008		7,120		7,188
Provision for future price changes (8 %)				*		*		*		*		551		1,155		1,818		2,538
TOTAL CORE BUDGET		2,891		3,630		4,503		4,503		5,453		7,438		8,163		8,938		9,726
% Increase				26%		24%				21%		36%		10%		9%		9%

\+ M/Y equals man years of senior staff.
* Included in detailed figures.

Controller
April 26, 1974

AVU/ovd.

CIAT

TABLE III

SUMMARY OF SOURCES AND APPLICATION OF FUNDS

(US$ thousands)

	Actual 1972	Estimated 1973	Revised Budget 1974	Proposed Budget 1975	PROJECTIONS 1976	1977	1978	1979
SOURCES OF FUNDS								
1. Core Operations								
a) Unrestricted								
Ford Foundation	720	750	750					
Rockefeller Foundation	720	682	750					
U.S. A.I.D.	721	880	950					
Government of the Netherlands	125	125	125					
Swiss Government	-	65	-					
Government of the Federal Rep. of Germany	-	56	-					
International Development Aso. (IDA)	-	210	-					
BID	-		900 a/					
Others	-	4	-					
Total unrestricted	2,286	2,772	3,475					
b) Restricted								
W.K. Kellogg Foundation	155	290	280					
CIDA (Swine - Cassava)	278	500	750					
Total restricted	433	790	1,030					
c) Gross Core Operating Funds Required	2,878	3,718	4,468	5,453	7,438	8,163	8,938	9,726
Less unexpended core balances	(77)	12	37	(2)	-	-	-	-
Less earned income b/	(82)	(168)	-	-	76	190	350	(400)
d) Net Core Operating Funds Required from CG	2,719	3,562	4,505	5,451	7,362	7,973	8,588	9,326
2. Capital Funds								
a) Rockefeller Foundation	838	1,779	400					
Kresge Foundation	750							
Swiss Government			70					
United Kingdom (O.D.A.)			60					
International Development Aso. (IDA)			665 a/					
BID			200 a/					
Unidentified sources			59					
Total donors	1,588	1,779	1,354	750	120	150	146	169
Unexpended balance	703	891	275	600	600	600	600	600
Income earned	26	-	-	-	-	-	-	-
b) Gross capital funds required	2,317	2,670	1,629	1,350	720	750	746	769
Less unexpended balance & income	(729)	891	275	600	600	600	600	600
c) Net capital funds required	1,588	1,779	1,354	750	120	150	146	169
3. Total Funds Required from CG	4,307	4,422	5,896	6,201	7,482	8,123	8,734	9,495
4. Special Projects								
a) W. K. Kellogg Foundation	30	77						
BID	50	161	102					
IDRC - Canada	10	30	214	81	7			
U.S. A.I.D.	2		190					
UK - O.D.A.			49					
Rockefeller Foundation		84	102	91	13			
Ford Foundation			50	43				
Others	6	52	231	535	980			
b) Unexpended balances prior year	63	10	104					
Earned income	16							
Total Special Projects	177	414	1,042	750	1,000	1,000	1,000	1,000
5. Earned Income								
a) Retained start of year				76	266	590	750	800
b) Earned during the year	108	168	163	240	350	400	400	400
c) Total available during year	108	168	163	316	616	990	1,150	1,200
6. Total Gross Funds Required	5,372	6,802	7,302	7,869	9,698	10,713	11,484	12,295
7. Less Funds Available b/	967	1,057	505	918 b/	1,216	1,590	1,750	1,800
8. Net Funds Required	4,405	5,745	6,797	6,951	8,482	9,123	9,734	10,495
APPLICATION OF FUNDS								
9. Core Operations	2,891	3,630	4,503	5,453	7,438	8,163	8,938	9,726
Support of special projects	-	-	50	50	-	-	-	-
Prior years' adjustments		24						
10. Capital Expenditures								
Working Capital								
Revolving Funds	-	-	-	500	-	-	-	-
Others	1,426	2,496	1,529	250	120	150	146	169
Total Capital Expenditures	1,426	2,496	1,529	750	120	150	146	169
11. Special Projects	166	305	1,042	750	1,000	1,000	1,000	1,000
Prior years' adjustments		5						
12. Unexpended balances								
a) Core operations - unrestricted	(12)	(37)	2	-	-	-	-	-
b) Working Fund Grant	-	100	100	600	600	600	600	600
c) Capital grants	891	175	-	-	-	-	-	-
d) Special projects	10	104	-	-	-	-	-	-
e) Retained income	-	-	76	266	540	800	800	800
	889	342	178	866	1,140	1,400	1,400	1,400
13. Total Application of Funds	5,372	6,802	7,302	7,869	9,698	10,713	11,484	12,295

a/ These amounts are still awaiting final approval of BID and IDA.

b/ The policy recommended to the Board is that income earned should not be used except for certain specific items until the second year folloding the year in which it is earned.

AVU/ovd.

Controller
April 26, 1974

CIAT

TABLE IV

TABLE OF POSITIONS AND MANPOWER

	SENIOR STAFF				SUPPORT STAFF												TOTAL STAFF			
					SCIENTIFIC AND SUPERVISORY				CLERICAL STAFF				OTHER SUPPORT STAFF							
	POSITIONS		MAN-YEARS		POSITIONS		MAN-YEARS		POSITIONS		MAN-YEARS		POSITIONS		MAN-YEARS		POSITIONS		MAN-YEARS	
	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
Direct Research Groups																				
Director Animal Sciences	1	1	1.0	1.0					1	1	1.0	1.0					2	2	2.0	2.0
Beef	10.3	10.3	8.6	10.2	16	19	14.3	18.2	11	11	9.5	11.0	60	67	51.6	65.2	97.3	107.3	84.0	104.6
Swine	3.2	3.2	3.2	3.2	6	6	4.8	6.0	3	3	2.8	3.0	18	18	17.0	18.0	30.2	30.2	27.8	30.2
Director Plant Sciences	1	1	-	1.0					1	1	-	1.0					2	2		2.0
Cassava	6	6.5	6.0	6.4	13	16	13.0	15.0	3	7	3.0	5.8	53	61	51.8	57.8	75	90.5	73.8	85.0
Field Beans	5.5	6	5.0	5.9	17	18	15.0	17.5	5	5	4.5	5.0	40	46	38.8	44.8	67.5	75	63.3	73.2
Rice	2	2	2.0	2.0	3	2	1.8	2.0	1	1	1.0	1.0	12	14	12.0	13.5	18	19	16.8	18.5
Maize	1	1	.8	1.0	7	4	5.3	4.0	1	1	1.0	1.0	13	13	13.0	13.0	22	19	20.1	19.0
Small Farm Systems	2.5	3	2.2	3.0	9	10	4.7	10.0	3	4	1.7	3.8	5	13	3.5	12.5	19.5	30	12.1	29.3
Total Direct Research	32.5	34	28.8	33.7	71	75	58.9	72.7	29	34	24.5	32.6	201	232	187.7	224.8	333.5	375	299.9	363.8
Training and Communication	3	3	3.0	3.0	7	8	6.7	8.0	8	8	7.6	8.0	3	4	3.0	4.0	21	23	20.3	23.0
Information Services	3	3	2.5	3.0	2	3	2.0	2.8	5	5	4.8	5.0	11	12	10.3	11.8	21	23	19.6	22.6
Research Support Groups																				
Economics General Service Group									7	7	7.0	7.0	2	2	2.0	2.0	9	9	9.0	9.0
Laboratory Services					1	1	1.0	1.0					6	6	5.2	6.0	7	7	6.2	7.0
Library	1	1	1.0	1.0	4	5	4.0	4.8	3	4	3.0	3.8	8	8	8.0	8.0	16	18	16.0	17.6
Biometrics	.5	.5	.5	.5	4	4	3.7	4.0	3	3	3.0	3.0					7.5	7.5	7.2	7.5
Engineering	1	.5	1.0	.5	1	1	1.0	1.0	1	1	1.0	1.0	3	3	2.5	3.0	6	5.5	5.5	5.5
Station Operations					3	3	2.8	3.0	3	3	3.0	3.0	21	21	21.0	21.0	27	27	26.8	27.0
Physical Plant					2	2	2.0	2.0	2	2	1.2	2.0	75	82	74.2	80.2	79	86	77.4	84.2
Motor Pool									3	3	3.0	3.0	26	29	25.0	28.2	29	32	28.0	31.2
Total Research Groups	41	42	36.8	41.7	95	102	82.1	99.3	64	70	58.1	68.4	356	399	338.9	389.0	556	613	515.9	598.4
Administration																				
Office of the Director General	2	2	2.0	2.0	1	1	1.0	1.0	4	4	4.0	4.0					7	7	7.0	7.0
Executive Officer	1	1	1.0	1.0	9	10	8.8	9.8	35	35	31.4	33.8	7	8	6.0	8.0	52	54	47.2	52.6
Controller	1	1	1.0	1.0	2	2	2.0	2.0	16	16	13.8	16.0					19	19	16.8	19.0
Food and Housing					4	4	4.0	4.0	15	15	14.5	15.0	50	49	49.5	49.0	69	68	68.0	68.0
Grand Total	45	46	40.8	45.7	111	119	97.9	116.1	134	140	121.8	137.2	413	456	394.4	446.0	703	761	654.9	745.0

Controller
April 26, 1974

AVU/ovd.

Proposed Program and Budget