FISCAL YEAR 1947 - 48

# ANNUAL REPORT

OF

# THE INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES


Executive Headquarters

Pan American Union
Washington, D. C.

Field Headquarters

Turrialba, Costa Rica

Rubber Substation

Gatún, Canal Zone

Pan American Union
Washington, D. C.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

# REPORT OF THE DIRECTOR

## FOR THE FISCAL YEAR ENDING JUNE 30, 1948

Gentlemen of the Board of Directors:

In fulfillment of the provisions of Article III of the Convention of the Inter-American Institute of Agricultural Sciences, I have the honor to submit herewith the Annual Report setting forth the work of the Institute during the fiscal year 1947-48 and containing a budget and statements on the general condition and financial status of the organization.

This year included several significant developments in the process of equipping the Institute for its tasks. Of major importance was the initiation of extensive improvements in the facilities for work with animals, including the near completion of the creamery, research laboratory, poultry and swine units, and various other minor buildings. The beef and dairy herds were increased.

In January 1948 the Inter-American Cacao Center began its active program for cacao improvement, and research on the use of newer chemical compounds, such as herbicides, fungicides, insecticides, and growth regulators, was started. Competent staff members were added to direct this work. These new projects were aided considerably by grants from various organizations, including $158,000 from the American International Association for Economic and Social Development and annual appropriations of $50,000 and $9,500 respectively from the American Cocoa Research Institute and the Standard Oil Development Company.

There was a marked increase in contacts and cooperation with agricultural workers in member countries. The Institute is becoming an active center for promoting relations between scientists and stimulating the continuity and effectiveness of their work. To extend the services of the Institute to all countries of the hemisphere, we are moving in the direction of more fundamental studies. Installations were completed for measuring soil and water run-off, which is the basic research needed in order to make sound conservation plans. Some accomplishments were made in setting up a meteorclogical station, and in this the Institute has become a weather reporter for the United States Weather Bureau. Similarly, ecological and botanical studies must be advanced beyond the plant collections and geographical studies which have been possible to date.

Fundamental research was initiated in the structure and functioning of rural communities. This project involves an integrated socio-economic approach to the understanding of rural communities, utilizing most of the resources of the Institute at one time or another. Related to these studies is the necessity of building on them a sound system of extension methodology. An extension service was organized during the year. We were also fortunate in arranging for cooperation with one of the few university departments of Sociology and Anthropology which is outstandingly competent in the analysis of rural social problems. This was effected through a contracted agreement with the Social Research Service of Michigan State College in the United States of America.

The task before us, if we are to assure the optimum development of all the research and educational services of the hemisphere, is so great that all possible resources for assistance must be utilized. Continued collaboration, for instance, has been received from the United States

Department of Agriculture, the Rockefeller Foundation, and the Food and Agriculture Organization of the United Nations. The Institute is particularly fortunate in enjoying a sound working relationship with the Pan American Union and, through it, with the other specialized organizations of the inter-American system.

It is clear that the Institute must continue to increase its functions as the central research and educational organism of the American States. As the countries improve their national institutions and as the world-wide organizations increase their ability to assess and list the world's resources of manpower and information, we can increase our effectiveness in getting the jobs done that will result in higher standards of living and sounder national economics.

The understanding and assistance accorded to the Institute by the Board of Directors are greatly appreciated by the staff. We are always grateful for your suggestions in regard to the improvement and expansion of the work of the Institute so that it may best serve the American people through the application of science and scientific method to the problems of farming and rural life.

Respectfully submitted,

Ralph H. Allee
Director

## STAFF OF THE INSTITUTE

1947-48

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|---|---|
| Ralph H. Allee | Director |
| José L. Colom | Secretary |
| Lowell Curtiss | Treasurer |

### PLANT INDUSTRY DEPARTMENT

| | |
|---|---|
| Manuel Elgueta | Chief |
| Joseph L. Fennell* | Horticulturist |
| Guillermo Bonilla | Horticulturist |
| Ernest H. Casseres | Olericulturist |
| Hernán Granados | Assistant |
| Mario Gutiérrez | Plant Breeder |
| Lucy Hastings | Botanist |
| Jorge León | Botanist |
| J. J. Ochse | Horticulturist |
| Ora Smith | Physiologist |
| H. C. Thompson | Horticulturist |
| Frederick L. Wellman | Pathologist |

Inter-American Cacao Center

| | |
|---|---|
| George F. Bowman | Chief |

### ANIMAL INDUSTRY DEPARTMENT

| | |
|---|---|
| Albert O. Rhoad | Chief |
| Oscar Echandi | Assistant |
| Jorge Granados | Assistant |

### AGRICULTURAL ENGINEERING DEPARTMENT

| | |
|---|---|
| Norton C. Ives | Chief |
| Otto Stadsklev* | Assistant |
| Gregorio Alfaro | Assistant |
| Luis E. Balma | Assistant |

### DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL LIFE

| | |
|---|---|
| Julio O. Morales | Chief |
| Marta Coll Camález | Home Economist |
| Charles P. Loomis | Rural Sociologist |

### EXTENSION SERVICE

| | |
|---|---|
| D. Spencer Hatch | Chief |

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* Messrs. Fennell and Stadsklev have since left the service of the Institute.

## LIBRARY AND PUBLICATIONS

| | |
|---|---|
| Angelina Martínez | Librarian |
| Virginia Morales* | Library Assistant |
| Arthur Watts Allen | Publications |

## OFFICE STAFF

| | |
|---|---|
| George M. Slater | Business Manager |
| James Foreman* | Assistant to the Business Manager |
| Wilhelmina C. Hayes | Secretary to the Director |
| Martha I. Pera* | Assistant to the Registrar |
| Anna Marie Dye | Purchasing Agent and Assistant to the Secretary |

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* Mrs. Morales, Mr. Foreman, and Miss Pera have since left the service of the Institute.

## ADMINISTRATIVE COMMITTEE

The Administrative Committee of the Institute, established by the Board of Directors in December 1945 and entrusted with the responsibility for the general plan of development of the organization and the integration of its program of research and education, met twice during the year. The activities of the Institute were reviewed and plans for future programs were made during these meetings held in Turrialba from November 13 to 15, 1947 and in Washington, D. C. from March 25 to 28, 1948.

The present members of the Committee are the following:

H. Harold Hume, Provost, (Chairman of the Committee)
College of Agriculture
University of Florida
Gainesville, Florida

Robert E. Buchanan
Research Professor
Agricultural Experiment Station
Iowa State College of Agriculture and Mechanic Arts
Ames, Iowa

Mariano Montealegre, Director,
Instituto de Defensa del Café de Costa Rica
San José, Costa Rica

Ralph H. Allee, Director of the Institute (member ex-officio)

José L. Colom, Secretary of the Institute (secretary of the Committee)

It is hoped that two additional members may be appointed to the Committee during the coming year.

## STATUS OF THE CONVENTION

At the close of the fiscal year the following ten countries had ratified the Convention under which the Institute operates and were contributing to the support of the organization: Costa Rica, the Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, the United States, and Venezuela.

Those countries which had signed the treaty but not yet ratified were: Bolivia, Chile, Cuba, Ecuador, and Uruguay. Colombia signed the treaty just after the end of the fiscal year, on July 23, 1948, and it is anticipated that this country will soon take the necessary steps to ratify the Convention. The treaty has been ratified by the Argentine Senate, but final approval by the Chamber of Deputies is still pending. Reports indicate that Haiti is taking the necessary steps to sign and ratify the Convention in the not too distant future.

It is hoped that those countries which have not taken definite action in regard to the Convention of the Institute will see fit to do so at an early date, since the purpose of the organization is to benefit the agricultural welfare of all the American Republics.

## PLANT INDUSTRY DEPARTMENT

Manuel Elgueta

### PERSONNEL

The Department had the following personnel changes during this year:

Mr. George F. Bowman was engaged as Chief of the Inter-American Cacao Center. He was formerly in charge of the cacao research program in the United Fruit Company.

Mr. Mario Gutiérrez returned to the Institute after two years' absence in the United States on two scholarships, one from the Institute of International Education, and the other from the Rockefeller Foundation. Mr. Gutiérrez has just started the corn program at the Institute.

Mr. Napoleón Murillo resigned to accept a government position. We regret this loss because he was a very capable and interested worker.

At the initiation of the Cacao Program we were fortunate in having the help of Dr. Allen G. Newhall, pathologist from Cornell University, who spent six months working on cacao diseases.

The work done during the year on the different projects is as follows:

### INTRODUCTIONS AND FORAGE PLANTS

Jorge León

By the end of the fiscal year , 419 plant introductions from various parts of the world had been received. Most important among these are species of Theobroma, several bamboos from Puerto Rico, legume forage plants from several countries, and a collection of shade trees from Brazil.

We have now thirty-one species of gramineas belonging to the most important grasses of the tropics and sixty species of leguminous plants for cover crops and forage. Observations on growth and date of cutting are being taken.

## FERTILIZATION TRIALS

Project No. 82

a. Cowpea trials: Date of sowing: August 1, 1947

Date of harvest: November 5 and 25, 1947

P. was observed to have a very noticeable effect on vegetation of plants; however, the final result did not show significant differences.

b. Sorghum trials: Date of sowing: September 17, 1947

First harvest: November 8, 1947

Total harvest: 412.6 Kgs.

Highly significant (1%) N. and P. and interaction P x Ca.

Interaction N x P significant to 1% level.

Second sowing: January 8, 1948

Second harvest: March 8, 1948

Only Ca and P x Ca significant at 5% level.

Subproject No. 42a Compost application

a. Cowpeas: Date of sowing: August 1, 1947

Date of harvest: November 5 and 25, 1947

Significant differences of complete formula at 1% level over check. No effect of compost.

b. Sorghums: Date of sowing: September 17, 1947

Date of harvest: November 8, 1947

No significant effect of compost. Chemical formulae.

Significant effect at 1% level over compost and check.

Second sowing: January 8, 1948

Second harvest: March 9, 1948

. Chemical formulae 5% significant over compost but not over check.

## GENERAL HORTICULTURE

Joseph L. Fennell

Since the following report represents the termination of Mr. Fennell's five and a half years of Institute employment, a summary is given of the progress made during this period. His work will be continued by other members of the staff.

### Sorghums

Four new grain sorghums, "Enana", "Belleza", "Especial", and "Ocho", have been developed by breeding, and they resist humid tropical conditions better than any varieties tested here. Yields and results at Turrialba have been most outstanding, and reports from tests in other parts of the tropics are most encouraging for a wide range of adaptability and usefulness. A subproject of this sorghum work has recently been established to develop varieties with special value as human food.

Cowpeas

Five new and promising cowpeas (Vigun sinenis) have been developed: "Canelo", "Garbancito", "Azul", "Chinito", and "Chinegra". Some of these have pronounced resistance to powdery mildew and to mosaic. Production has been superior to practically all introduced or previously existent kinds. The new varieties have been accepted on the open market in competition with beans.

Corn

Mr. Fennell's corn project has included crosses between primitive Indian corns and various tropical improved kinds. Two sorts, one white, and one yellow, have shown some superiority in vigor, better root system, tendency toward two ears per stalk and ear size. A sweet corn of the same general parentage as the two starch varieties described above has shown good production and fair quality. The above corn material is nearing the stage of sufficient perfection to allow distribution for testing.

Grapes

Several of the best tropical grapes produced have been established and are now available for limited distribution.

Peanuts

A new peanut line selection developed from a cross of Virginia Bunch with Florida Runner is showing considerable promise, notably in freedom from sprouting before or during harvest. This material is now ready for testing.

Tomatoes

One new selection of tomatoes, which has shown adaptability to certain tropical conditions, has been widely distributed. Reports from many tests in other parts of the world have been encouraging. A more recent subproject with tomatoes is now in the process of developing varieties with better resistance to Late Blight, which is one of the most limiting factors to tomato production in tropical America. Some progress has been made.

Other Work

In addition to the foregoing, importations and collections of fruits, vegetables, field crops, drug plants, etc. have been tested. Sixteen official publications on projects of Institute work have been published in magazines issued in the English, Spanish and Portuguese languages. Contacts have been made with agriculturists in many parts of the world which have given rise to many valuable seed importations.

## VEGETABLE CROPS

E. H. Casseres

### Potatoes

The potato work is carried out mostly in the Cartago potato region on the slopes of the Irazú volcano.

Project No. 39 Studies with Potatoes (Solanum tuberosum)

Subproject No. 1: Performance study and increase of new improved varieties. This collection was sown at two different altitudes. Possible varietal differences have been noted with reference to adaptation. Resistance to

Phytophthora infestans will be tested during the next crop.

A collection of progenies produced by potato breeders in other sections is also under study.

Subproject No. 2: Performance study and increase of the common native varieties and wild species.

a. The Estrella, Morada Blanca, and Morada Negra, under observation in our small plantings and on farms, are the best varieties of Costa Rica in that order. A small test on cutting seed potatoes showed that they tuberize well in Turrialba and apparently produce the same number of plants as whole seed when grown in the highlands.

b. Samples of the following kinds have been obtained:

| Non commercial here | Wild |
|---|---|
| Chilena | Sample from Estación Nacional de Agricultura, Guatemala |
| Forastera | Sample from Irazú volcano region, Costa Rica (Solanum longiconicum) |
| Boston | |
| Holandesa | |
| Alemana | |
| Zamorano Red | |
| Zamorano White | |
| Guatemala Barcenas | |
| Guatemala market | |
| Cachikel, Guatemala | |

Subproject No. 3: Improvement of the Estrella variety by clonal selection for high yield and type.

Potatoes from one hundred superior plants selected under optimum conditions were planted out early in 1948 to study their production and type.

Subproject No. 4: Storage losses of potatoes due to Phytophthora infestans and other diseases under different conditions.

Leader: José Santos Aguirre, Graduate Assistant from Mexico, under

direction of Dr. F. L. Wellman. Measurement of losses by weight and number of tubers at five elevations with laboratory determinations of causal organism was in progress at the close of the year.

Subproject No. 5: Virus transmission

The testing of leaf roll susceptible healthy stocks next to plants known to be infected was carried out to study the method of virus transmittal or reason for its apparent inability to exist in the higher potato areas. Planting materials were sent by Dr. K. H. Fernow to test the finding of Barrus, Smith and Casseres that apparent absence of aphids in cooler highland should make it suitable place for production of certified or mother stock seed tubers.

## Other Vegetable Crops

Project No. 40 Fertilizing Vegetable Crops

Subproject No. 1: Fertilizing Potatoes
Location: Cartago Potato Region

a. Two completed factorial experiments summarized for the 1946-47 Annual Report showed that N and P increased yields significantly while K was ineffective. Two additional experiments are in progress in other areas.

Subproject No. 2: Fertilizing Sweet Corn
Location: Institute. Sown: August 25, 1947
Harvested: December 3, 1947

Dry corn measured for data. Fertilizers broadcast on plots and worked in. Data being studied.

Subproject No. 3: Fertilizing Cabbage
Location: Institute. Set out: December 8, 1947
Harvested: February 9 to March 11, 1948
Variety: Early Flat Dutch. Data being studied.

Project No. 62: Standardization of Native Vegetables
Location: Institute

Subproject No. 1: The Formation of Superior True Breeding Lines of Pumpkin (Ayote, Cucurbita sp.) by selfing.

a. Different types and qualities appear at the Institute and elsewhere from seed of this popular nutritious vegetable.

b. Twenty-five mature open pollinated ayotes of different size, shape, color and quality were selected. From seventeen fruits 125 ayotes once selfed have been produced. From four fruits "lines" inbred twice with a total of fifteen fruits have been obtained. Seed from twelve additional open pollinated fruits was planted.

c. The mature fruits after storage, were cut for testing, cooking quality and replanting of best lines. Notes also taken on production of young "fresh vegetable" stage fruits.

Subproject No. 2: Improvement of a local pimento type sweet pepper resistant to Cercospora by mass selection.

a. An imported variety like California Wonder produces one crop and quickly dies. This pimento-shaped pepper is long lived and resistant to the main fungus disease, and although of medium size, is readily sold. Yield records kept on two 60 foot rows. Mass Selection No. 3 for increased yield, size, and type underway.

Subproject No. 3: Maintenance of collection of varieties of peppers (10) (Capsicum), Chayotes (12) (Sechium), Yuca (6) (Manihot), and plantains (2) (Musa)

Yield data and varietal characteristics are taken. Of general interest to students, visitors, and for distribution.

Subproject No. 4: Effect of age of cutting, variety and spacing on the yield of yuca (Cassava).

Set out by former student, Alfonso Uribe. Data under study.

Project No. 63: Variety Tests of Imported Vegetable
Location: Institute

Subproject No. 1: Adaptation studies of type varieties of six main vegetables in row plantings.

a. Snap beans: Yields from four bi-monthly plantings during November and December, 1947 gave superiority to Tendergreen over Stringless Black Valentine and Refugee US No. 5; to Sure Crop Wax over Pencil Pod Block Wax.

b. Lettuce: Slobolt is vastly superior to Grand Rapids. It is truly non-bolting and of high quality. Deer Tongue is the most uniform, grows fast, is of good quality, bolts fairly soon, but is desirable. Imperial 44 heads up a week earlier than Great Lakes but bolts rapidly, while the latter has a long harvest period; both are quite variable.

c. Cabbage: Early Flat Dutch was the best of seven varieties followed by Jersey Queen and Green Acre. Marion Market was very poor. The trial was made under very adverse conditions. New trials are in progress.

d. Onions: Of four short-day varieties Early Yellow Globe appears to be the best to date, but all seem very slow in bulb formation. All are infected with purple blotch, Macrosporium porri.

e. Squash and Pumpkin: Thirty-one varieties listed by Burpee showed marked differences in resistance or tolerance. Bush and all "summer" types succumbed early to mosaic and powdery mildew. It appears as a possibility that the native Ayote is highly resistant or tolerant to the aforementioned diseases. Squash borers, Diabrotica beetles, and Choanephora, a flower rot, are also important limiting factors.

f. Tomatoes: A factorial experiment to measure yields of Marglobe, Bonny Best, Rutgers and local lines is under way.

Subproject No. 2: Production of seed from superior plants of known varieties.

Although varieties which are considered standard in the United States should have little variability, in several cases when grown under tropical conditions they appear to vary considerably in their adaptability. To take advantage of such variations, if they are genetic, an effort is being made to produce seed from the better plants.

a. Lettuce seeds freely here. Selected plants of Imperial 44, Great Lakes, Mignonette and Deer Tongue are under observation for possible seed production.

b. Cabbage of the Early Flat Dutch variety, while producing well, showed a great deal of variation in type. Twenty-six plants have been selected and kept to produce seed.

c. Onion bulbs resistant to pink root fungus were selected by Dr. A. G. Newhall from the Louisiana variety in a commercial planting near San José. Four were stored at 40° F. for three weeks in an effort to secure bolting promptly. They were then planted at two different localities.

## CORN

### Mario Gutiérrez

Mr. Mario Gutiérrez returned to the Institute from Iowa State College in May, 1948. The corn program will have as its objective a study of different breeding methods, giving emphasis to a simplified methodology that can be used in other countries which have not enough facilities for the elaborate modern methods of corn breeding.

## CACAO

### George F. Bowman

As was mentioned before, Mr. George F. Bowman took charge of the cacao work in January 1948. The whole cacao program was agreed upon at a Conference of the Inter-American Technical Cacao Committee held at the Institute in September and October, 1947. The Conference was attended by representatives of nine cacao producing countries, besides representatives from the American Cocoa Research Institute, the United States Department of Agriculture, and the Atkins Gardens of Cuba.

The cacao program is aided by funds supplied by the America Cocoa Research Institute. An experimental cacao farm of 119 acres has been put at the disposal of the Institute by the United Fruit Company.

We were fortunate at the initiation of this program in September, 1947, to have the help of Dr. Allen G. Newhall, pathologist from Cornell University. Dr. Newhall made a survey of the diseases of the cacao trees in Costa Rica.

## Dr. Allen G. Newhall's Report on his Cacao Experiments

During the six months ending April 1, 1948, satisfactory progress was made in cataloging the more important diseases of cacao occurring in Costa Rica and in determining the causal organisms, their life cycles, and the symptoms they produce. In addition, the potency of a number of fungicides has been tested against their spores in the laboratory, and to a limited extent against Phytophthora in seed beds.

The disease causing more loss of marketable crop than all others combined is the Phytophthora pod rot caused by P. faberi (P. palmivora). It is estimated that fifty percent of the pods were lost from the attacks of the fungus on many plantations in Costa Rica between September 1 and December 31, 1947. Pods of any size were subject to attack and at any point from stem to tip. The causal fungus was isolated, not only from pods but from the embryos of seeds within diseased pods, from the blackened tips of chupons suffering from wilt, from cankers found on twigs, and from the soil collected beneath trees thirty-five years old.

Pods inoculated with spores or living cultures of Phytophthora faberi were sometimes completely infected in eight or ten days. Spores of the fungus were produced on pods in moist chambers in as short a time as five days after inoculation; ten out of fourteen healthy pods became infected in five or ten days when placed on moist, naturally infested soil in the laboratory under conditions which certainly indicate that this fungus, like several of its relatives, does live on soil.

Using a spore suspension in water, obtained by washing, scraping or brushing sporangia from the surface of diseased pods, infection was obtained

by atomization on young cacao seedlings that resulted in the gradual death of the leaves, of growing point, and the ultimate death of eight-week-old seedlings. Infection was also obtained on the growing tips of young hevea twigs. From the work of Reinking, Rorer and others, Phytophthora faberi is known to be the cause of a serious bud rot of coconut, and to be able to infect several other plants, such as seedlings of annonas, manog, santol and fruits of the tomato and papaya. This is one reason for not recommending the use of hevea or coconuts as shade for cacao in regions where Phytophthora pod rot occurs, which is in most of the tropics.

The following fungicides have been tested on glass slides for their ability to inhibit the germination of spores of Phytophthora faberi, of Diplodia theobromae and Colletothricum theobromicolum. Phytophthora is the most important pathogen, and sulphur has long been known to be ineffectual and copper very toxic against it, so only one organic sulphur compound was tested--Fermate. Many of the newer organic fungicides containing zinc or chlorine, which are currently being tested in the United States, were tried. The copper compounds used included Bordeaux mixture (4-4-50,2-2-50, and 1-1-50); Tenessee Tribasic (53% copper) at 4, 2 and 1 lb. per 100 gal.; Copper A Compound (copper oxychloride, 45% Cu) at 4, 2, 1 lb. per 100 gal.; Yellow Cuprocide (88% Cu) at 2, 1 and 1/2 lb. per 100 gal.; Puratized III (4% Cu) at 1 part in 150, 300, 800 and 1600.

The organic fungicides and their active ingredients included Dithane Z78, zinc ethylene bisdithiocarbamate (65%); Parzate, zinc ethylene bisdithiocarbamate (70%); Fermate, ferric-dimethyl-dithiocarbamate (76%); Phygon, dichloro-napthoquinone (98%); Spergon, tetrachloro-parabenzoquinone (48%);

Spergonex, tetrachloroparabenzoquinone; Puratized, phenyl mercuritriethanol ammonium lactate (5%).

These were employed at three strengths, the one commonly recommended, and two dilutions one-half and one-fourth this strength. For Dithane Z78, Phygon, and Spergon we began with 1 lb. to 100 gal.; with Parzate and Zerlate, 2 lbs., and with Fermate, 3 lbs. The spore germination test indicated that the copper fungicides were much more effective than any of the others. In a special series of seven modifications of Puratized compounds, containing different quantities of copper and mercury, the copper was decidedly more effective than mercury. On the other copper fungicides, Bordeaux, even 2-2-50, was more effective than the others in these laboratory tests. In some tests, Parzate showed up fairly well, but Dithane and Phygon were not very effective.

In one non-replicated test of seven fungicides on 180 seedlings sprayed one day and inoculated the next with a spore suspension of Phytophthora, the best protectants included Parzate at 2 lbs., Tribasic, 4 lbs., and Yellow Cuprocide, 1 1/2 lbs. in 100 gal. Bordeaux, 2-2-50, was less effective, whereas Dithane Z78 at 1 lb., Zerlate at 2 lbs., and Puratized III (4% Cu) at 1 to 300 were not much better than the average of the seven check plots. The Bordeaux was made up with a rather poor grade of lime, procured locally. In view of the difficulties surrounding the making of a first class Bordeaux of its poor keeping qualities, and of the need for a prepared fungicide ready for use, more work along fungicide testing lines is worthwhile, particularly with any new organics or compounds containing copper, such as Bouisol, Copper 8 quinolinolate, copper trichlorphenate, copper naphthenate, and glyoxalidines, Sinox and Elgetol.

Several ways of culturing the fungus to obtain fresh sporangia of Phytophthora for inoculation purposes were tried, such as agar, peanut shells plus dextrose, potato plugs and streamed cacao pods. None was as effective or satisfactory as cacao pods, ripe or green, washed and held in moist chambers for a week after incoulation. It was found essential to employ freshly formed sporangia, which develop near the margin of advancing lesions. Sporangia two or more days old germinate very poorly. They can be wiped or washed from a pod with a clean cloth, and in 24 hours a fresh crop of viable sporangia may be secured. This may be done several times, which makes one pod useful as a source of inoculum for a week.

By counting the number of sporangia found on an area about 4 sq. mm. (935) and by multiplying by the total area of the pod (480 sq. cm.) it was calculated that an average-sized pod can give rise to from 5 to 10 million sporangia, each of which may contain from 20 to 25 zoospores capable of initiating infection on pods, leaves, or chupons in a few hours in the presence of a thin film of moisture. Even if less than 1/100th of 1% are able to find and infection court, there still may be hundreds of infections initiated by one well-placed diseased pod. It is obvious that removal of diseased pods once, twice, or even four times a month is inadequate to keep down such fast forming and vast quantities of infectious inoculum. A good protective fungicide barrier is probably cheaper and more effective in the long run.

Pod Rots Other Than Phytophthora Found in Costa Rica

Colletrothricum and Diplodia pod rots are commonly found, as well as others as yet not identified. Monilia pod rot had not been found. Diplodia seems to

occur only on mature pods and is of relatively little economic importance, although it has been isolated from twigs and probably is of considerable importance in connection with dieback and twig blight, which are common in neglected plantations.

The best name for Diplodia pod rot is Dry Sooty Rot, because in later stages the pod is covered with a deep layer of black, sootlike spores. In early stages, which occur usually at one end of the pod, the brown discolored tissue is soon made rough, almost like coarse sand paper, by the eruption of multitudes of closely packed minute fruiting bodies of the fungus pushing their way up through the epidermis of the pod. The rot advances almost as rapidly as that caused by Phytophthora. The spores also germinate in a matter of a few hours and are produced in prodigious numbers. However, so far it has not been found to cause the great losses that Phytophthora does.

In the spore-germination tests with fungicides mentioned earlier, Diplodia theobromae appeared to be more easily inhibited by a greater variety of fungicides than Phytophthora. In addition to Bordeaux 2-2-50, Phygon, Zerlate, Yellow Cuprocide, and Fermate were rather effective, whereas Dithane, Spergon, and Puratized were not. It seems likely that good cultural practices, which include pruning and spraying for Phytophthora, will probably eliminate this disease completely. It is said to be only a wound parasite.

Pink Rot or Anthracnose

The fungus causing the Anthracnose pod rot, Colletothricum theobromicolum, has been found attacking pods of all sizes. It causes a depressed or sunken circular dry rot that turns from light to dark brown. Later, on the surface

of these spots, a layer of light yellowish to pinkish spores breaks through the epidermis, giving a bright dusty appearance over the dark brown background.

This fungus has been found in Costa Rica to be the cause of a great deal of spotting and dry marginal burning of cacao leaves. It has been repeatedly isolated from fruits, leaves, and twigs, and when spores are sprayed on seedlings the young leaves in two weeks' time break out with small dark brown circular spots, lesions on the veins, and marginal necrosis. From these lesions the same fungus has been re-isolated. Older green leaves seem to be less susceptible, and much of the infection that results in ragged brown-margined, shot-holed leaves is believed to have taken place when the leaves were much smaller. Spores require a much longer time to germinate than do those of Phytophthora or Diplodia (15 to 30 hr.). Anthracnose on leaves seems to be worse on trees exposed to sunshine and in neglected plantations, where it causes considerable loss of effective foliage, but nevertheless, even in these cases, it is not a very serious pod rot. Anthracnose can flourish under drier conditions than Phytophthora or Diplodia pod rots.

The name "anthracnose" has been employed locally for the spotting of pods of all ages caused by the stings of an insect now believed to be the result of feeding by Monolonium capsid bugs. In this ailment the spots are dark brown, remain uniformly about 2 mm. in diameter, often have a scabby surface and at times a whitish center caused by the growth of a mold (Fusarium sp.). The fungus is superficial and the spots do not grow larger and are only about 2 or 3 mm. deep. They are definitely of insect origin and should not be confused with the fungus pod rot. There are two other pod spots resembling that caused

by Colletothricum, one of which is distinguishable by its slightly darker color and by the fungus fructifications, which are black and densely packed pycnidia developing in the sunken lesion. The other is a superficial dry rot covered with white mold of the causal fungus (Fusarium sp.)

There is circumstantial evidence that the Colletothricum that causes leaf spot and anthracnose of seedlings may have its origin in the soil. It may even be the same fungus as the one commonly attacking coffee. When seeds are sown in sterilized soil or in soil not previously used for coffee growing, they have come up and remained quite free from leaf spot for months; but when grown in soil taken from between coffee trees they have suffered from much leaf spot from an early age. However, this needs further testing. Anthracnose will probably be controlled by the same methods mentioned before--pruning and spraying and fertilizing as for Phytophthora. Spore germination tests on slides sprayed with fungicides have been too erratic to be dependable to date.

Another pod rot, found but once recently at La Lola, seems to be caused by an undetermined, fast rotting dark gray-green fungus that is not a Monilia species. It can attack young and old pods and needs further study. Pycnidia form under the dense green velvety mat of mycleium on inoculated fruits in 8 or 10 days, and in pure culture. They are black and contain oval, sub-hyaline single-celled spores, similar in size and shape to immature Diplodia conidia. In the early stages of fructification, the appearnace of the velvety mat of mycelium, and the manner of spore formation, might suggest Monilia, but recent, unpublished studies on Monilia in Venezuela show that it is not the same disease.

Seedling Disease Control

Cacao seedlings have been found to be subject to several stem rots, apparently of soil origin. Brown lesions occur at or beneath the soil line, sometimes deep enough to cause stunting and even death. From these lesions a Rhyzoctonia, a Fusarium, and one other black pycnidial producing fungus have been isolated. Time has not yet permitted proving their pathogenecity, but a test of several fungicides, including Dithane Z78, Parzate, and Fermate applied to the upper 1 1/4 inches of soil by raking it in at the rate of 1 gm. per square foot just before sowing seed in an outdoor seed bed indicated Fermate might give almost complete control.

Other diseases of minor importance encountered either at La Lola or the Institute include a root rot, perhaps caused by a species of Rosellinia, and the well-known thread blight cuased by Corticium (Pellicularia) koleroga, which grows over twigs and large leaves, causing the latter to droop, drop off, and hang by the string-like threads of the causal fungus.

Insect Pests of Cacao

Although no work with the insects found on this crop has been done by the writer, during the past six months sufficient evidence of insect damage to pods and twigs has been observed to indicate that the principal pests include some species of Monalonium or capsid bug, one or two leaf hoppers, several ants, aphids, and thrips. Insect pests are not responsible for the plight in which the cacao industry of this hemisphere finds itself, but they no doubt do considerable damage, and some of them constitute a threat as possible vectors of virus diseases, notably swollen shoot, and as probable

disseminators of the spores of many of the fungus diseases to which this crop is subject.

Immunization Studies by Crossing

Theobroma simiarum is native to Costa Rica and grown on the Institute grounds. Not much is known about its genetic consitution or the genes for resistance it may harbor. Seedlings are being grown, and four of them have been inoculated once with spores of Phytophthora faberi, but no infection has been observed. Further inoculations with all the fungi occurring on cacao should be made. Without waiting for these results, and to take advantage of the specialized training and interest of Mr. Juan M. Muñoz, he was encouraged to undertake the crossing of T. cacao with T. simiarum. Hundreds of hand pollinations were made, and to date eight successful crosses of T. simiarum on T. cacao have been obtained. Two of these have since dropped off. None were successful when pollen of T. cacao was used on T. simiarum, although two or three self pollinations out of 60 made on the latter are holding on. It is believed that this is the first time this cross has ever been made, and although the parental stock used is not perhaps of a high order from the standpoint of quality and yield, it has demonstrated the feasibility of making such a cross. The chromosome number of both species has been found by Mr. Muñoz to be the same--20. Had pollen from Clone 221, which is a heavy setter, been used, the results might have been more striking. Progenies from this cross should be critically studied, as no one can foretell at present the value of the outcome. It may result in the introduction of some valuable genetic blood into the cacao germ plasm bank.

## INTER-AMERICAN CACAO CENTER

The Technical Cacao Conference organized the Inter-American Cacao Center at the Institute to stimulate research on and development of cacao production throughout the hemisphere and to train personnel in this field. Its main work is carried out on the cacao farm (La Lola) in the lowlands of the Atlantic region. There is also a cacao section at the Institute where work in propagation, selection, etc. is being done.

Experimental work has been started on the lowland farm. Various installations required on the farm, including propagators, are being completed. Spray and duster machines are on order.

### Investigations

The following investigations are under way:

Turrialba

a. Fungicide screening and seedling resistance tests

A nursery of seedlings was planted in long beds, five rows wide. These beds are being divided off in small blocks, and the plants in each block are being sprayed with a fungicide or concentration of fungicide to be tested. The whole bed is then thoroughly covered with an active spore suspension of Phytophthora palmivora. This inoculation is repeated until we kill or nearly kill the untreated check plants and the plants treated with some fungicides. Those fungicides affording excellent protection will be give field tests later.

In conjunction with the above tests we are attempting to find out if a correlation exists between resistant trees and their seedlings. In the long beds described above we have planted three of the five rows with seeds from trees of known resistance and the other two rows with seeds from extremely susceptible trees. At the point of marginal control we may find a difference between these two types. If so, this would indicate that seedling selection trials may be reduced and simplified by knocking out 95 percent or more by means of spore suspensions.

b. Skinned versus unskinned seeds

Since planting of seedlings will continue for a long time in spite of all we can do to promote vegetative propagation, and since some seeds will always be planted to develop new clones, we have made a test of one of the traditional seed treatments. Alternate rows across a narrow bed were planted with whole seeds and seeds from which the seed coat had been removed. Fifty replications were made. Skinned seeds germinated more quickly, but we are making weekly growth measurements now to see if the plants from unskinned seeds will overcome this initial advantage.

c. Tests of climatic effects on quality

As fruit ripens on our clonal plants at Turrialba (2,000 foot elevation) we are sending samples for flavor tests for comparison with the same clones grown at sea level. While very little difference has been noted in favor of the Turrialba flavor, there is a considerable advantage in yield per pod.

La Lola

a. Plant performance, pruning, fertilizer, minor elements

On the lowland farm each of nine students was given twenty trees for detailed recording. Ten of these trees were in an unpruned section and two of the ten trees were pruned. All ten were cleaned of parasites and old pods. Another ten trees per student are in an area severely pruned by the students themselves. Each tree was given a different treatment, and the treatments were randomized by starting each student with a different number. In each set of ten the treatments were as follows: Tree 1, check; 3, N,P,K, 7-7-7 monthly 1/2 pound per tree; 2, same as 3 plus pruning in unpruned section; 4, check, plus pruning in unpruned section; 5, copper sulphate 1/2 pound per tree, once; 6, zinc sulphate 1/2 pound, once; 7, Borax 1/2 pound per tree, once; 8, sulphur 1/2 pound per tree, once; 9, iron sulphate, 1/2 pound per tree, once; 10, Esminel, 1/4 pound per tree monthly. Esminel (essential minor elements) has the following analysis:

| | |
|---|---|
| Copper oxide | 7.81 % |
| Manganese oxide | 18.41 % |
| Zinc oxide | 4.26 % |
| Iron oxide | 2.85 % |
| Boric oxide | .54 % |

At the time these 180 trees (20 per student) were chosen the students took a complete series of records on each tree. Each week a further set of growth and fruiting records is taken.

In addition to these data the students tag new pods formed

each week and record the length and volume each week. Volume measurement will be made by immersing the hanging pod in a brimming beaker of water and measuring loss. Within a week we also expect to start weekly spraying of the No. 1 trees in the pruned section with strong DDT to see what effect will result from elimination of insects.

Student Projects

As a student evinces interest in some problem that is considered of practical value, he is helped to plan his project and assemble the necessary equipment. He then submits a corrected program and starts his work. He is required to make a monthly progress report and suggestion list, and he will make a final report or write a thesis at the end of his year.

a. Investigation of causes for variations in locally produced cacao

A list of producers has been secured from local chocolate makers, buyers, and bankers, with a classification of the product of each grower as fine, medium, or poor. From these lists we have picked out four of the best, four of the poorest, and four medium. By spending some days on each of these twelve farms data is obtained on the following points: elevation, climate, soil, drainage, age of trees, condition of trees, types of cacao, frequency of harvest, maturity of fruit, time from harvest to break and from break to fermentation bin, complete description of fermentation, drying procedure, storage facilities and procedure.

The object is to find out which simple methods or treatments, if any, will improve the general quality of Costa Rican sun-dried cacao.

b. Effect of pH on seedling growth and susceptibility to fungus infection

Bins of soil have been stabilized at pH 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, and 16 seeds planted in each. So far the best growth appears to be at the neutral point or nearly there. Later these plants will be sprayed with spore suspensions to test susceptibility.

Results of this test will aid in choosing land for cacao and for selecting fertilizers and possibly soil rectifiers.

c. Vegetative propagation

This is a large project, and it grows every day. We are trying every possible method of rooting cuttings as well as some that look impossible. Techniques of grafting, budding, and layering are also being tested. Cuttings of various types and ages of wood are being planted with leaves attached, with leaves reduced by different amounts, and with leaves removed. They are being planted in sand, soil, soil and sand, and soil and wood mould, and just wood mould. The planting is done in bins, in beds, in detritus under trees, and the plants are being covered with leaves, cloth, glass, and cello-glass. Hormones and root stimulants are being tried.

The indications are now that the three students working on propagation will soon develop a simple, effective method for planting cuttings in a nursery bed, surrounding them with boards, covering with cheese-cloth or cello-glass, and watering only twice a week. This sort of method would be feasible for the independent

grower, either large or small. One student is also developing a budding technique that will, it is believed, give good results with buds from small twigs placed on stock of six or eight times the diameter. This will speed up considerably the multiplication rate from selected trees.

d. Flowering and fruit setting

Data are being collected on all the phenomena involved in flowering, pollinization, and self incompatibility. The hour of opening, hour of pollen ripening, time of abscission, insects present, etc., are observed on self-compatible and incompatible clones. Viability of pollen and speed of pollen tube growth are being observed. Methods of hand pollinization are being tested, and the value of different clones as pollen-parents is being observed.

We may be able, if we know the flowering habits well enough, to work out a simple method of setting more fruit at a more desirable season.

e. Effect of shade on young plants

Duplicate nursery beds were planted under 25 percent, 50 percent, and 90 percent shade, and in full sun. By height and diameter observations we hope to determine the conditions that promote the most vigorous growth at each stage. By microscopic and, if possible, chemical observations we also hope to get some indication of the reasons for variation in growth at different light intensity levels. We shall also find out, we believe, what makes a seedling or chupon

form a crown at high or low level.

f. Fermentation

Boxes of various types are being set up and thermometers prepared for a test of simple equipment for use in farm fermentation. We are looking for the simplest, cheapest, most durable box and the easiest method of handling it to give the highest and most uniform temperature in the best aerated beans. Use of nitrates and ammonia will be tested to speed up yeast action, and insulation of various kinds will be employed.

g. Investigation of Phytophthora palmivora

A complete study of this fungus has been started, with the idea in mind that if we are familiar enough with the disease we shall recognize its weak points. The study may take a number of years, but the disease is serious enough to warrant the time. The questions we have been trying to answer are these:

(1) What is the time involved in each of the steps from sporangia to sporulation, to settling of zoospores, to formation of germ tube, to penetration of pod and consequent inviolability?

(2) Does air drying at any of these stages kill the pathogen or only suspend its growth?

(3) If air drying kills, how soon?

(4) Can the pathogen penetrate undamaged or healed pods? Is there a clonal variation in this susceptibility?

(5) Can pods be inoculated from bits of infected stem tissue even though no spores are found?

(6) Do sporangia or chlamydospores retain their viability long enough to permit transmission of infection by air currents, or must they be removed and transported in free water?

More questions present themselves every day, but these are the ones we are trying to answer now.

Verification must await the final conclusions of the project, but the following hypothesis best fits observations to date. Initial spreading from a focus of infection is by rain splashing from pod to pod and from pod to twig. Bits of cankered twig and branch washing down on new pods spread it again, but no transmission through the air is possible. From tree to tree the spores are splashed when trees interlace, or infected twigs and leaf petioles are carried by occasional storms. Floods carry infected pods or twigs over long distances and infect low-hanging pods. From these, splashing to higher pods, chupons, and twigs carries the fungus slowly up the tree.

We have produced infection in moist chambers from small bits of wilted chupons, but so far we have not been able to produce it by shaking or blowing spores from pod to pod. In plates exposed inside heavily infected trees we have found no Phytophthora colonies. Sporangia brushed from a pod to a slide and watered sporulated weakly or not at all. In field spraying we can obtain full control right up against heavily infected neighboring trees.

If the hypothesis proves tenable it will change the control picture completely. Our effort will be to eliminate all the inoculum possible from a given farm or area instead of spraying at intervals to protect from drifting spores. The practice, then, would be to prune heavily and spray with a highly

concentrated Bordeaux or other fungicide, possibly two or three times in the space of week. After that we might be able to leave the farm unsprayed for a year or more until the inoculum could build up again.

It is expected that two additional staff members and an enlarged group of graduate assistants will be applied to the cacao program during the coming year.

## SUGAR CANE

Project No. 70

Collection: Date of first planting: May, 1947
89 varied specimens from Costa Rica, Puerto Rico, Colombia (Palmira), and Summit Gardens, Canal Zone have been established.

The collection comprises varieties of interest for future work. The following species are represented: S. officinarum, S. barberi, S. sinense, S. spontaneum, S. robustum. All varieties are under close observation. Those of apparent commercial possibilities are being increased to be tested in variety trials.

Project No. 83 Variety trial with and without fertilization

Date of planting: August 29, 1947
Total period: 52 months
10 varieties--2 treatments--2 times of harvesting (12 and 16 months)

A study about germination differences due to varieties and treatments was made. There were significant differences at 1% level between varieties, a 5% level among treatments and interaction, varieties x treatments.

Project No. 95 Maturity trial.

Complement of the former

Two blocks were reserved for monthly harvesting on 10-24 months.

Project No. 104

Initiated: December 22, 1947
To complement former study

N, P, K, Ca and 3 minor elements were applied.

Project No. 68 Sugar cane fertilization

Initiated: January 1947
Harvested: February 1948

This trial was made on two patches of sugar cane of different ages--8 months and 4 months old. Fertilizers, N, P, and K were applied. The results reported correspond to the 8-months-old plants. 23 Kgs. of $P_2O_5$ per Hec. gave significant increase in cane over check at 5% level and significance at 1% level on sugar production per Hec. over check. The complete formulae gave significance on the 5% level only for sugar production over check.

Seed Production of Varieties

Some exploratory observations were made as a basis for the future breeding program. Several varieties were examined as to the production of fertile pollen. Some crosses were also made to gain ability in this work.

## COFFEE

Project No. 37 Renovation of old plantation by cultural treatments and fertilizers

Initiated: November 1946

This trial combines eight fertilizer treatments in three doses each, with four different cultural practices. The first crop was harvested as a uniformity trial; the second crop was harvested from August to October, 1947 in five different pickings.

Big differences were determined, as can be seen in the tables below:

| Cultural treatments | Kgs. per plot |
|---|---|
| Shoveling | 516.03 |
| Cultivator | 559.88 |
| Cover crop | 713.10 |
| Weed chopping | 683.33 |

| Fertilizer treatments | Kgs. per plot |
|---|---|
| N | 350.30 |
| P | 333.75 |
| K | 290.35 |
| NP | 321.53 |
| NK | 332.33 |
| PK | 332.14 |
| NPK | 314.11 |
| Check | 260.21 |

The determination of significance in measurement of yield differences will be facilitated as the shade intensity and other conditions not under test become more uniform.

Project No. 87 Shade effect on an old plantation

Initiated: November 1947

This trial has been arranged in split plot. Major treatments are four shade intensities--no shade, half normal, normal and free shade. Minor plots are fertilizing and pruning. As in the former case the harvest of August--October 1947 was taken as a uniformity trial which will be used to correct future results and increase their accuracy.

Project No. 99 Factorial fertilizer trial in Old Finca

Initiated: December 1947

Sixteen treatments were carried out in two blocks.

Project No. 42c Compost in Old Finca

Initiated: December 1947

This was related to the former by the check and complete formulae.

Project No. 86 Effect of transplanting two stages of seedlings: "Copita" and "Avejon" under 3 different shades.

Initiated: June 1947

Several countings have been made. Final counting will be made later, taking the number of plants and growth. The beneficial effect of shade is apparent.

Project No. 42b Compost in nursery beds to see effect on: (1) germination; (2) vigor, and (3) disease under shade and no shade.

Initiated: September 1947

No effect of compost was shown on germination. After five months a count was made by uprooting five rows from the ten of each plot, counting the plants, weighing them with and without roots, and measuring them. No significant difference was found between compost and checks. These countings were made in plots under shade. The others were in too poor a condition for data of germination and loss of plants.

Project No. 93 Collection of varieties and species.

Material has been brought in to form a collection for breeding purposes. Small trees of the species Canefora, Robusta, Stenofila and Excelsa have been planted, as well as trees of different varieties of Arabica. A selection was made on the Montecristo Farm of about seventy genetically different trees, and cuttings of each were brought in for vegetative propagation. Most of them are rooting.

Seed of the Coffee Nacional (El Salvador), Maragocype, and Blue Mountain are being germinated.

## COMPOST ELABORATION

Project No. 42 Indore process of Compost elaboration

Initiated: June 1947.

Several piles are in preparation. Some have already been used in the different trials. Compost elaboration cost is about ¢ 8.80 per ton (5.7¢ = $1.00). Analyses have been made with the following results which show a great uniformity:

| Sample | Moisture | No. % | $K_2O$ | $P_2O_5$ |
|---|---|---|---|---|
| 1 | 43.53 | 0.31 | 0.11 | 0.43 |
| 2 | 47.83 | 0.37 | 0.13 | 0.35 |
| 3 | 47.67 | 0.34 | 0.13 | 0.39 |
| 4 | 51.65 | 0.32 | 0.14 | 0.32 |

Management of the Cabiria Farm

The management of this farm, where the farm trials are located, was made under contract. The Department took over its management in May 1947 in order to facilitate testing of the results of the trials on a commercial basis. The area in coffee of this farm is about 45 hectares.

## PHYTOPATHOLOGICAL PROGRAM

This program is under the supervision of Dr. Frederick L. Wellman of the United States Department of Agriculture in a cooperative relationship with the Costa Rican Department of Agriculture and the Institute. The purpose of this program at present is to carry out work on some of the most important diseases of plants in Costa Rica, with special attention to coffee and cacao.

Dr. Wellman and his associates and assistants are working on the following investigations:

1. Omphalia flavida (Gotera or Ojo de Gallo) is known to be the most important coffee disease in the Western Hemisphere.
   a. Field studies: Effect of shade in relation to disease; studies of perfect and imperfect stages in the field; occurrence and ecological relationships of the disease.
   b. Laboratory studies: Development of the fungus in pure culture studying effects of different nutrients and pH reactions of media; development of perfect and imperfect stages of the organism; morphological studies of the organism and its mycological relationships. (It appears that its generic position needs re-evaluation.); effect of differences in light intensities and colors on its growth and development; a study of the habit of luminescence.
   c. Epidemiology: Method of dispersal by rain drops; rapidity of spread; importance of imperfect and perfect forms in relation to distribution; insect relationships; infection phenomena and length of time required for anchorage of infecting bodies.
   d. Control: Methods of field hygiene; elimination of infection sources; chemical and natural methods of removing diseased leaves; biological elimination of the organism in leaves dropped to the ground.
2. Pellicularia koleroga (koleroga or araña) is an important disease of coffee in localized areas in coffee growing countries all over the

world. Studies of the organism in pure culture, its morphology and effects of chemicals, ecological relationships.

3. Rosellinia spp. (Maya or root rot) is found on coffee in both hemispheres and has extremely serious effect in local areas. It has cause abandonment of farms in numerous countries. Studies on host range, occurrence, methods of isolation, characters of the fungus in pure culture, identification of the species of the organism most important in Costa Rica.

4. Phytophthora palmivora (formerly P. faberi)(pod rot of cacao) is the most important disease of cacao in Costa Rica and causes from 30 to 90 percent of the losses in the crop annually. Work is done in collaboration with the Cacao Center, and laboratory studies are made on cultural characters and epidemiology.

5. Seed treatment studies for control of diseases of plants in the seed bed and in the field. This work is being carried on primarily by Miss Lucy Hastings. The following crops are being studied: beans, maize, coffee, cacao, grain sorghum, kenaf (fiber roselle), peanuts, and sesame. The work consists of: (1) laboratory determinations on the diseases naturally carried on the seeds; (2) laboratory determinations of the soil borne diseases; (3) control of disease organisms on seeds by laboratory tests with chemical treatments; (4) control of diseases by chemical seed treatments tried in the greenhouse. Studies also include methods of seed treatments to prolong the life of seeds stored under ordinary conditions.

6. Miscellaneous culture studies and collections. A collection is being made of dried specimens of the most important diseases of plants occurring in the region of the Institute. In addition the most important of these fungi and bacteria which act as causal agents are being isolated and put into a collection of pure cultures for study. There are several hundred such cultures and it is probably the largest single such collection of pure cultures for study. There are several hundred such cultures and it is probably the largest single such collection of cultures in the American Tropics.

USES OF CHEMICALS IN CROP PRODUCTION

The Standard Oil Development Company has established a fund for the purpose of having studies made at the Institute on the action of chemicals on the production of crops. With this fund it has been possible to obtain the assistance of Dr. Ora Smith, Professor at Cornell University, who is in charge of the program and who visits the Institute three times a year. The actual work is carried out by three graduate students with Esso Fellowships; two from the United States, and one from Venezuela. During the absence of Dr. Ora Smith, Dr. Frederick L. Wellman supervises this work.

The reasons for undertaking this work and its objectives are as follows:

1. Weeds occur wherever crops are grown and compete with the crop plant for plant nutrients, moisture, light, and other necessary growth factors. Weed control by usual methods of cultivation is injurious to the crop plant roots and is slow, expensive, and consumes much man labor, which usually is available in insufficient quantity. It is our purpose to study the effects

of various concentrations, time and method of application to the soil, seed, and plant of many promising chemicals on the control of weeds in economic crops of importance in the tropical and temperate regions of Mexico and Central and South America.

2. During the next few years several millions of cacao cuttings will be rooted and placed in permanent plantations for high quality and quantity production. At present 40 to 50 percent of the cacao cuttings fail to produce roots and hence are discarded.

Several root promoting chemicals have been applied successfully to many species of plants. It is our purpose to study the effects of various growth substances or hormones on the rooting of cacao cuttings in an effort to decrease the percentage of discarded plants.

3. Flowering of the coffee plant in many areas occurs over a period of several months; likewise, the berries ripen during a period of three to four months later in the season. To avoid loss of a portion of the crop by over-ripeness and subsequent shattering, it is necessary in some areas to pick the crop 7 to 10 times in one season. It would be extremely valuable to coffee growers if the plant could be induced to flower over a shorter period of time and subsequently to mature the berries over a shorter period, or if the ripe berries could be prevented from shattering until a later harvest could be made. It is our purpose to study the effects of application of various hormone-type chemicals for the purpose of cutting costs and losses during coffee harvest.

4. We propose to study the effects of the hormone samples submitted on any phase of plant growth with the possibility of their application to

stimulation of stem and foliage growth, hastening growth and maturity, stimulation or hastening of flowering and fruiting, etc.

5. The prevalence of and damage done by insects and diseases to economic crops probably is greater in tropical areas than in other portions of the world. Many insecticides and fungicides which have proven effective control materials in temperate regions are unsuitable for control of some of the insects and diseases which occur in the tropics. It is our purpose to study the effects of the chemicals on the plants and on the control of various insects and diseases prevalent on the important economic crops of the American Tropics.

During the reported year the main work has been done on herbicides. The following supplements have been developed.

Supplement No. 1. Pre-emergence application of herbicides to corn and beans

Sixteen chemicals were applied singly and in combination resulting in 58 chemical treatments as pre-emergence applications to corn and beans. Two concentrations of each were applied and at two periods after preparation of the soil. The factorial arrangement resulted in 232 treatments. Counts and weights of the various species of weeds were made at several intervals. Data are too voluminous to submit herewith. Results of note are (1) time of application of the herbicides in relation to time of land preparation is very important. Control of weeds was much more thorough when the herbicides were applied 17 to 18 days after land preparation than when application was made 3 to 5 days after preparation. (2) Application of herbicides at the high rate or concentration resulted in better weed control than the low rates or

concentrations. (3) Weed control was much more thorough by application of petroleum products combined with 2,4D, Sinox General or Dow Contact Herbicide than by herbicides of either group when applied alone.

Supplement No. 2. Post-shoveling application of herbicides to coffee

The same chemicals and combinations as in supplement No. 1 were applied at one concentration 10 days after shoveling compared with 28 days after shoveling. A second application was made some time later when considered necessary. There was a total of 232 treatments. Counts of numbers of weeds were made at intervals during the season.

Results of note are: (1) Application of herbicides 28 days after shoveling resulted in much more satisfactory weed control than application 10 days after shoveling. (2) Weed control was more thorough by application of petroleum products combined with the other herbicides than by herbicides of either group when applied alone.

Supplement No. 3. Control of weeds in sugar cane

Eight hydrocarbons and nine emulsified hydrocarbons were compared with several other standard herbicides for weed control in recently planted sugar cane. These herbicides were applied before sufficient germination of weed seeds and resultant control was unsatisfactory in all treatments.

Supplement No. 3A. Control of weeds in sugar cane

The same materials were applied in another area of sugar cane after the weeds and grass were approximately one foot in height. Results indicate that for best control the herbicides should be applied when the weed seeds have germinated and the weeds are several inches tall.

Supplement No. 4. Control of weeds in potatoes

Several chemicals were applied as pre-emergence herbicides to potatoes. Virgin land was fitted for this experiment, and resultant weeds and grass were not representative of cultivated areas. Weeds consisted largely of Bermuda grass.

Supplement No. 5. Selective control of weeds in carrots

Applications of Varsol No. 1 and Varsol No. 2 were compared with hand weeded and untreated carrots. Remarkable differences were noticeable, Varsol No. 2 being best. Since weeds in the tropics grow so rapidly, it is planned to set up another experiment counting pre-emergence with post-emergence applications compared with only one application or none. This work appears to be very promising.

Supplement No. 6. Control of weeds in rice

2,4D at several concentrations was applied to rice at two stages of growth. Excellent control of broad-leaved weeds and most of the grasses was obtained with no injury to the rice when two pounds of 2,4D per acre was applied to rice about 12 inches tall. Yields will be obtained at harvest.

Supplement No. 7. Control of weeds in bananas, cacao and African oil palm

These experiments will be conducted soon on the plantings of bananas and cacao of the Institute. No work is now contemplated with African oil palm.

Supplement No. 8. Control of weeds in Hevea rubber

Three undiluted hydrocarbons and their emulsified forms were applied alone and in combination with 2,4D and Dow Contact herbicide to low growth under young rubber trees.

Very good control of weeds and grasses resulted from applications of 2,4D combined with Aromatic Tar H and Solvesso 150 and 2,4D in combination with emulsified Aromatic Tar L.

Supplement No. 9. Control of weeds in Crotalaria

Three undiluted hydrocarbons and their emulsified forms were applied alone and in combination with 2,4D, Dow Contact and Sinox General to short weed growth into which the Crotalaria was drilled. None of the chemicals nor the combination controlled the grasses and weeds without also injuring the Crotalaria.

Supplement No. 10. Control of weeds in Hevea rubber

2,4D, Dow Contact Herbicide and Sinox General were applied singly and in combination at two concentrations to weeds and grasses in a rubber planting. Best control of weeds was obtained from applications of 2,4D combined with Dow Contact at the low and high concentrations and 2,4D alone at the rate of 3.2 lbs. per acre.

Supplement No. 11. Control of weeds in corn, squash, carrots, cowpeas, and pueraria

Four undiluted hydrocarbons and four emulsified hydrocarbons (25%) were applied alone and in combination with 2,4D, Dow Contact herbicide, and Sinox General as pre-emergence sprays to the above listed crops.

Best control of weeds was obtained with the following chemicals when in combination with 2,4D: Aromatics HB, Aromatic Tar L plus Solvesso 150; Aromatic Tar H plus Solvesso 150; emulsified Tar H plus Solvesso 150; Dow Contact Herbicide and Sinox General. 2,4D resulted in some injury to carrots and squash. Of the eight hydrocarbons best control of weeds was obtained from Aromatics HB.

The predominant weeds were commelina, Ipomea (sp.) Portulaca, oleracea, Bidens pilosa, and Emilia segittata.

Supplement No. 12. Post shoveling application of herbicides to Hevea rubber

Five hydrocarbons were applied alone and in combination with several commercial herbicides to shoveled areas in Hevea rubber several days after shoveling. In every case better control of weeds and grasses was obtained where herbicides were applied 6 to 11 days after shoveling than when applied one day after shoveling. Best control of weeds and grasses was obtained with the following combinations: (1) Aromatics HB plus Sinox General, (2) Aromatics HB plus Dow Contact, (3) Aromatic Tar L, Solvesso 150 plus Dow Contact, (4) Aromatic Tar L, Solvesso 150 plus Sinox General, and (5) Varsol No. 1 plus Sinox General at late application.

Supplement No. 13. Post slashing application of herbicides to grasses in Hevea rubber

Three of the most promising hydrocarbons were applied at several concentrations alone and in combination with Sinox General one month after the grass was cut low in Hevea rubber. This experiment has not been in progress long enough for any conclusions to be made on weed control.

Supplement No. 14. Chemical weed control in corn and beans

To repeat and modify No. 1.

Supplement No. 15. Post shoveling application of herbicides to Coffee

To repeat and modify No. 2.

Supplement No. 16. Chemical weed control in sugar cane

To repeat and modify No. 3 which gave unsatisfactory results.

Supplement No. 17. Pre-emergence and post-emergence application of chemicals to control weeds in carrots

To repeat No. 5 which gave very promising results.

Supplement No. 18. Killing potato vines with chemicals

Fifteen chemicals were applied.

Supplement No. 19. Pre-emergence application of herbicides on beans.

To repeat No. 1.

All these last trials were not completed at the time of this report and their results must be analysed in a special report.

Also some work has been started in fungicides for the control of Phytophthora infestans in potatoes. Positive screening is under way on a series of the newer compounds of possible fungicidal or insecticidal value.

## ANIMAL INDUSTRY DEPARTMENT

Albert O. Rhoad

The annual report of the Animal Industry Department for 1946-47 was closed with the following statement: "An extensive construction program and the acquisition of livestock and other facilities will be the major effort of the Animal Industry Department during 1947-48. Various experiments especially the control of Dermatobia hominis (tórsalo or nuche) will be expanded." During the fiscal year 1947-48 the Department held closely to this plan as is indicated below. Aside from this the Department was called upon to give direct assistance to the livestock improvement programs of five member countries.

### CONSTRUCTION PROGRAM

On July 1, 1947 the first spade was turned in a comphrensive construction program within the Department which was made possible by the generous grant of funds from the American International Association of New York. When the construction program is completed and the necessary flocks and herds are on hand, the Department will be an economic unit within the Demonstration Farm and will, at the same time, possess sufficient animals to carry on its function in the Institute's experimental program.

During the twelve month period from July 1, 1947 to June 30, 1948 the following construction and improvements have been completed or are soon to be completed.

Poultry Unit

This includes a central poultry building 43 feet by 21 feet of mortared bricks with rooms for incubation and brooding, feed and egg storage, office and miscellaneous items. The unit also includes three frame laying houses each 20 feet by 24 feet and one single-sire flock house. To accommodate the flocks six large poultry yards, two for each laying house, and eight small yards have been constructed. There remain to be constructed seven small shelters for single-sire flocks and for pens of cockerels. In May 1948, the three laying houses were stocked with six-week old pullets of the Plymouth Rock, New Hampshire Red, and White Leghorn breeds. Incubators and brooding equipment and other minor items are also on hand.

Swine Unit

This includes a central mortared brick building 83 feet by 28 feet with farrowing pens, fattening pens, feed room, and record room. The unit also has a swill feeding floor and shelter. Adjacent to the central buildings are five two-acre hog pastures. The swine unit is not stocked at the present because of lack of piping to take water to this unit.

Beef Cattle Corrals

This includes a central open frame structure 160 feet by 30 feet and twelve adjacent pens, a spraying chute, a cutting chute, and cattle scales, a records room, and a feed room. An unloading chute and manure pit remain to be constructed.

Creamery

This is a modern type creamery 60 feet by 40 feet with estimated daily capacity of 350 gallons of milk. It is about 80 percent completed at this writing.

Implement Shed

This is a frame structure 70 feet by 22 feet for the housing of farm equipment. It includes a farm tool shed and farm shop. At this writing it is about 70 percent completed.

Quonset Hut

This is an all steel structure 48 feet by 12 feet for the storage of sacked feeds and other produce subject to spoilage because of high humidities. One section of this hut has a built-in drying floor. It is about 80 percent completed.

Box Silos

Four brick and mortar semi-submerged roofed box silos 38 feet by 20 feet by 10 feet over-all have been built and placed in operation. They are close by the corrals for convenience of silage distribution.

Calf Barn

This is an open frame structure 60 feet by 20 feet divided into four sections for convenience of feeding calves of different age groups. Adjoining the barn are three calf paddocks for grazing and exercise.

Electric Power Line

A power line 5,500 feet long has been constructed connecting the central power unit of the Institute to this Department. Further construction will be necessary to carry electricity to the various units within the Department.

Herdsman's Residence

This is a frame house with 1,780 square feet of floor space located near the center of activities of the Department.

Pasture Fences

About fifteen kilometers of new fence have been constructed and an equivalent length of old fences repaired during the fiscal year. This does not include the special poultry fencing referred to above. Work has also been started on placing concrete fence posts along main road through the Department. All outlying fences are built with live posts.

Pasture Improvement

Approximately fifty-five hectares of new pasture have been prepared. These were formerly sugar cane fields that were abandoned for about four years and were therefore grown up to dense brush and briars. They were converted into pasture because of the large amount of stone in them or because of steep slopes.

The previous report announced the completion of a milking barn, bull barn, and general warehouse and an extension program of pasture improvement. A slaughterhouse and meat laboratory have been planned for construction during the coming year.

## ACQUISITION OF EQUIPMENT AND LIVESTOCK

### Purchase of Equipment

During the year a Farmall A-type tractor with moving attachment, plow and disc harrow, an Allis Chalmers 5-foot combine, and a Leitz No. 140 feed mill, a livestock scale, four-wheel tractor trailer, and a Fargo 1/2 ton pick-up truck were added to the equipment of the Department.

### Purchase of Livestock

It has been possible to establish the herds on a more adequate basis for production and research. This is evidenced in the following tables which show the livestock inventory as of June 30 for 1947 and for 1948.

Livestock Inventory June 30, 1947 and 1948

| Class (all ages) | June 30 1947 | June 30 1948 | Increase |
|---|---|---|---|
| Dairy Cattle | 0 | 62 | 62 |
| Beef Cattle | 70 | 125 | 55 |
| Steers | 104 | 134 | 30 |
| Horses | 7 | 7 | 0 |
| Poultry | 89 | 459 | 370 |

The above table is particularly significant as it indicates the start of the dairy herd. This herd is composed of seven purebred Holstein Freisian, seven purebred Brown Swiss and the remaining forty-eight of selected local dairy stock from the tropical lowlands. Of the increase of fifty-five head

in the beef cattle breeding herd, eleven are imported purebred Brahmans. The remainder are additional selected native cows for use in the grading up trials with Santa Gertrudis, Zebu Angus, and Zebu bulls. This year the purebred flocks of poultry were also started, as stated previously in this report.

The construction program and purchase of animals is about eighty percent complete. It is anticipated that the construction and purchases will be completed in the early months of 1949.

## THE RESEARCH PROGRAM

Recognizing that the control of Dermatobia hominis (commonly known as tórsalo, nuche, berne or skin bot) is a major health problem with livestock, especially cattle, in Central and South America. Work was continued and expanded in efforts to find a practical solution. Some results of the investigations have been reported in previous annual reports. During the 1947-48 fiscal year several internationally known entomologists and parasitologists have visited Turrialba for consultation and study of the problem. The animal parasitologist, Dr. E. T. Swanson of the Florida Experiment Station, and Drs. E. W. Laake and John T. Creighton, entomologists from the United States Department of Agriculture and the University of Florida, respectively, have studied the problem. Dr. Creighton remained for two months and made a number of preliminary studies. The experimental work in 1947-48 has been mainly on the use of many new and improved insecticides. As this work is still in progress, results are not available at this time. The current program includes the following:

Experiment No. 1 - Group test using four prepared sprays applied to six groups (two infested animals for each group) at weekly and bi-weekly intervals.

Experiment No. 2 - Group test using nine prepared sprays spplied to sixteen groups at different time intervals and with different methods of applying.

Experiment No. 3 - Toxicity tests using eighteen chemical combinations on extracted larvae submerged at varying time intervals.

Experiment No. 4 - Herd test No. 1 applying commercial spray with high pressure sprayer to group of eight infested steers every three weeks.

Herd test No. 2 applying spray every ten days.

Herd test No. 3 four small herds with three spray combinations and check, treated every three weeks.

Experiment No. 5 - Tolerance tests on cattle of various known toxicants. Note: four mature animals have died thus far in these tolerance tests.

Various insecticides or combinations are showing some promise but it is too soom to make conclusive statements.

The Value of Coffee Pulp Silage as a Feed for Cattle, 1948

This feeding trial is a continuation of previous studies at this Institute with coffee pulp silage. It was also the research project of Dale E. Madden, a graduate student in the Department.

The following is a summary of the 1948 trial:

Two groups of ten steers each were fed on a comparative type feeding trial. They were three to five year old steers of a local type, graded "common" as feeder steers. The check group received a ration consisting of Napier grass, concentrates, and a mineral mixture. The second group of steers received the same ration in which sixty-seven percent by weight of the Napier grass was replaced by coffee pulp silage. The differences were measured by live-weight gains and the amounts of feed consumed.

Previous trials have shown the coffee pulp silage to be of low palatability and that increased consumption may only be obtained by the addition of highly palatable feeds, in this trial by the addition of cottonseed meal and molasses.

The groups were placed in dry lots and fed at regular intervals. Average daily coffee pulp consumption per steer in the silage group over the 77-day period was 49.5 pounds. Maximum consumption was obtained during the latter part of the trial, with consumption up to 63 pounds of coffee pulp silage per steer per day, in addition to consumption per steer per day of approximately 31 pounds of Napier grass, six pounds of molasses, and five pounds of cottonseed meal.

Total live-weight gains for the trial were 505 pounds for the check group and 492 pounds for the coffee pulp silage group. This represents a daily gain per steer of .73 pounds and .71 pounds, respectively. Daily TDN consumption per steer was 16.6 pounds for the check group and 13.1 pounds for the silage group. Average daily consumption of coffee pulp silage per

steer for Group II (silage) was 49.5 pounds or equivalent to 5.5 pounds silage consumed daily per hundred pounds live-weight.

Analysis of the experimental data indicates no significant difference between the two rations. It was concluded, therefore, that coffee pulp silage is not superior to Napier grass as a roughage for cattle.

The final results were based on nine animals in each group, since one animal had to be removed from each group--one from the coffee pulp group because it refused to eat the silage ration, and a steer from the check group because it developed a tumor. Two animals in the coffee pulp group developed a skin irritation and loss of hair over parts of the body, which were attributed to the feeding of coffee pulp silage, but with no definite proof that coffee pulp was the causative factor.

From the results of this study and previous critical studies at this Institute coffee pulp silage cannot yet be recommended as a cattle feed. It may possibly be improved through different methods of processing and/or feeding that might add to its efficiency. However, it is apparent that even though methods are found to increase the efficiency of the coffee pulp silage, this would have to be greatly increased to make it economically feasible, particularly in areas of abundant year-round natural forage.

Table 1, Results

| | Group I Check | Group II Coffee Pulp |
|---|---|---|
| Number of animals | 9 | 9 |
| Average of initial weight (lbs.) | 889.7 | 878.7 |
| Average final weight (lbs.) | 945.8 | 933.3 |
| Total gain/steer (lbs.) | 56.1 | 54.6 |
| Days on feed | 77 | 77 |
| Daily gain/steer (lbs.) | .73 | .71 |
| TDN in daily ration per steer (lbs.) | 16.6 | 13.1 |
| Gain/100 lbs. TDN consumed | 4.39 | 5.44 |
| TDN consumed/100 lbs. gain | 2,277.8 | 1,839.6 |
| Total coffee pulp silage consumed (lbs.) | | 34,286.3 |
| Total coffee pulp silage consumed/head (lbs.) | | 3,809.6 |
| Total coffee pulp silage consumed/head/day/100 lbs. weight | | 5.5 |

Analysis

| | | |
|---|---|---|
| Mean final weight (lbs.) | 945.8 ± 66.8 | 933.3 ± 61.0 |
| Standard deviation (lbs.) | 200.3 ± 47.2 | 182.9 ± 43.1 |
| Coefficient of variability (%) | 21.2 ± 5.0 | 19.6 ± 4.6 |
| Difference of the means | 12.5 ± 90.4 | |
| | Insignificant | |

Genetic Studies: The Genesis and Genetics of the Santa Gertrudis Breed of Beef Cattle

In February 1948 the author visited the King Ranch of Texas, U. S. A. and obtained the basic information and data for this study. The following

is a summary of this work:

The Santa Gertrudis breed of beef cattle originated through necessity of finding a beef type animal better suited than existing types to the climatic and range conditions of south Texas. It is the first distinctly American breed of cattle and developed through a breeding plan set up and supervised by Robert J. Kleberg, Jr., manager and part owner of the King Ranch.

The Santa Gertrudis breed is the result of a species cross of Bos indicus males on Bos taurus females, the former represented by the American type Brahman and the latter by purebred beef-type Shorthorn. The breed was developed from the first cross generation, but because the Brahman bulls used were three-fourths to seven-eights Bos indicus the breed is considered as three-eights Brahman and five-eighths Shorthorn.

Several distinct periods are recognized in the development of the breed. The period from 1910 to 1918 was exploratory when the O'Connor halfbred Brahman Shorthorn bull was placed with a herd of Shorthorns and the performance of his offspring compared under range conditions with the straight bred Shorthorn and Hereford cattle. Because the performance of the Brahman X Shorthorns was superior to the other cattle, the cross breeding program was extended in 1918 to include all purebred Shorthorns on the ranch. Within the Brahman X Shorthorns a program of selection for beef type and red color was initiated with the object of developing a new breed from their progeny.

Early in the augmented crossbreeding program a Brahman bull of the Guzerat type named Vinotero sired a red bull calf out of a one-sixteenth Brahman cow that was to mark the real beginning of the breed. This outstanding

bull became known as Monkey. A program of closebreeding and linebreeding to Monkey and his offspring was initiated and has continued to the present. To facilitate this program a unique system of single-sire and multiple-sire herds was set up that contributed greatly to the rapid establishment of the breed. The Santa Gertrudis was officially recognized as a new and distinct breed in 1940. The breed derives its name from the Santa Gertrudis division of the King Ranch.

An analysis of fifty-five recent pedigrees indicated that the coefficients of inbreeding and relationship within the Santa Gertrudis breed and twenty-five years from Monkey, the sire of the breed, is about twenty percent. This is about equal to the 1810 intra-breed coefficient of relationship as reported for the Shorthorn breed twenty years from Favourite.

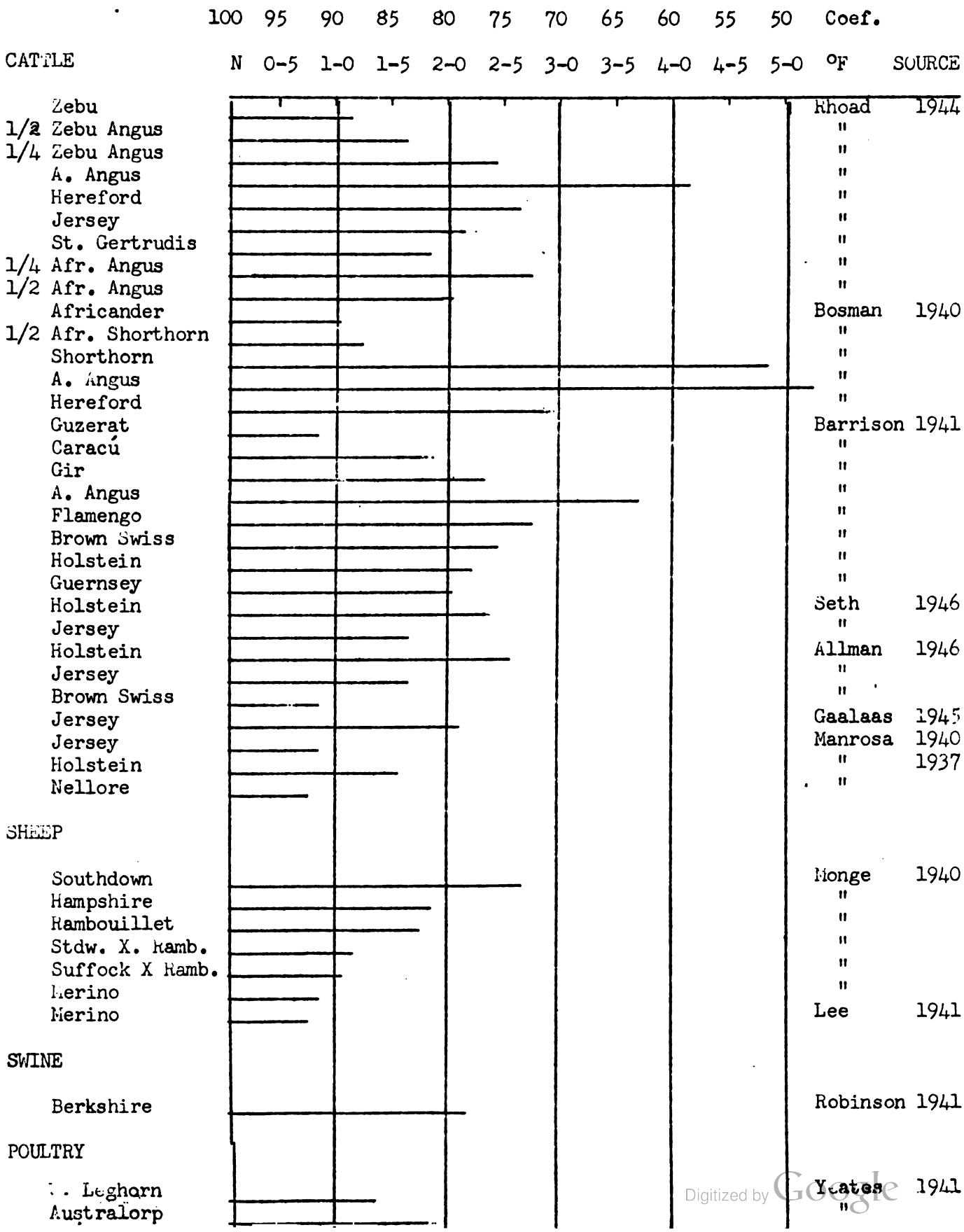
Physiological Studies: Breed Differences in Adaptability to Tropical Climates

This was a review of the experimental work done in various parts of the tropical world on the physiological reaction of various classes of livestock to tropical climate conditions. The summary of this work is presented in Figure I.

## EXTENSION ACTIVITIES

During the 1947-48 fiscal year the Chief of the Department was officially called upon to give service to five of the member countries. In December 1947 he went to Venezuela to give an opinion on the O'Campo tropical dairy livestock improvement project then under consideration by the Government of Venezuela. On this same trip he officially visited the Dominican Republic to study the development program of the National Agricultural School under

Figure I Heat Tolerance as Measured by Deviation of Body Temperature Above Normal °F



construction in that country. In March 1948 at the official invitation of the Government of Panama he acted as judge of livestock at the National Fair in Chirriquí. In April at the official invitation of the Government of Cuba he acted as judge of livestock at the National Livestock Exposition in Havana. In this same month and at the invitation of the State of Florida in the United States, he addressed a cattlemen's field day at the Range Livestock Experiment Station, Ona, Florida.

Also in April when visiting in Kingsville, Texas, the Chief of the Department addressed the agricultural student body of the Texas Technological College in that city.

## PUBLICATIONS 1947-48

1. "Breed Differences in Adaptability to Tropical Climates." A. O. Rhoad - in press. This paper was prepared at the invitation of the 1° Congresso Internazionale di Fisio-Patologia della Reproduzione Animale, Milan, Italy.

2. "The Genesis and Genetics of the Santa Gertrudis Breed of Beef Cattle." A. O. Rhoad - in press. This paper was prepared at the invitation of the Eighth International Contress of Genetics, Stockholm, Sweden. It is to be presented as a demonstration at this congress and will be published later in the Journal of Heredity.

3. "Colombia Improves its Native Cattle II - The Blanco Orejinegro". A. O. Rhoad. La Hacienda, November 1947.

## THE KING RANCH GRANT

In June 1948 the Animal Industry Department of the Institute was the recipient of a grant of funds from the King Ranch of Texas, U.S.A. amounting to $33,000.00. Twenty thousand dollars of this grant is designated for the construction and equipping of an animal climatological laboratory and thirteen thousand for the construction and stocking of a horse breeding unit.

In addition to the grant of monies the King Ranch will make available five brood mares and a stallion of their strain of Quarter Horses and also fifty to seventy-five head of high-grade Santa Gertrudis cows with normal complement of purebred Santa Gertrudis bulls.

## THE ANIMAL PROGRAM FOR 1948-49

The Department will still be in an active construction program during the forthcoming year, but it is anticipated that the research program will also be enlarged especially as it refers to the control of Dermatobia hominis.

August 25, 1948

## AGRICULTURAL ENGINEERING DEPARTMENT

Norton C. Ives

### INTRODUCTION

Increased quality and quantity of food and fiber production, with the accompanying increased well-being of agricultural workers in the American Tropics, are dependent largely upon the introduction and application of modern science and technology and the education of all peoples.

Where agriculture thrives, other industries and arts follow, and agriculture thrives when the production per worker is qualitatively and quantitatively high. The application of engineering to agriculture is directly concerned with increased quality and quantity of agricultural production through land development--soil and water development and conservation, drainage, irrigation, and erosion control--and mechanization--the application of power, machinery, and structures in all phases of crop and livestock production, processing, and preservation.

Certain factors, some of which are quite undefinable, have made present day tropical agriculture one in which a poorly paid, uneducated peon swinging a machete constitutes by and large the primary production mechanism, and problems resulting therefrom are indeed complex in nature. However, quite in contrast with some other tropical regions of the world, the American Tropics are relatively undeveloped agriculturally, and vast potential developmental possibilities exist.

For the American Tropics there is still time in the course of human population growth to establish a permanent, efficient system of agriculture.

However, this will surely require the full application of modern agricultural science and technology, and time is growing short to do this.

In a "sure-fire" agricultural educational system there will be need for more or less three groups of workers which might well be described as:

1. straight-line scientists
2. agriculturists out on the farm front, and
3. engineers and economists interpreting and applying basic research results toward workable, practical solutions, or serving in a sense as the connecting links in both directions between the scientists and the agriculturists.

The agricultural engineer is greatly dependent upon the proper orientation and presentation of problems from the field workers as well as upon research findings of the agricultural scientists. The economists need to direct and check for economic feasibility.

There is an apparent school of thinking in certain groups working in the Americas that mechanization of agriculture in tropical areas will inevitably result in great loss of natural resources, especially top soil and soil fertility. While this may be a fair conclusion based on cursory observation, basically there need be no conflict between soil conservation and mechanization. There is, however, a gross lack of fundamental research to show best agronomic practices in a mechanized system for a permanent grain, food and strategic crop agriculture in tropical regions, but that fertility can be maintained in tropical soils is evidenced by the farmers of forty centuries in some of the densely populated tropics of the Far East.

Successful mechanization will require proper land use classification and enforcement based upon facts derived from adequate experimentation in the various soil regions. Some of the best tropical lands lack only drainage

and/or irrigation to fit them well for an efficient mechanized agriculture. Even for a perennial tree-type agriculture, such as coffee, cacao, oil palm, rubber, or abacá, many problems occur in the mechanization of the harvesting and processing, as well as in certain field operations such as spraying for insect or weed control.

The highly important human factor of mechanization has been shown to require primarily some "sure-fire" training methods and facilities. The economic feasibility will depend largely upon the solution of the above-mentioned factors, although some careful direction will be needed for its most effective application.

## PROGRAM OF WORK

Due to the lack of certain scientific personnel at the Institute the program in Agricultural Engineering has of necessity been devoted to basic research in both land development and mechanization. The application of engineering technology to soil and water culture requires basic scientific information on soil, climate, land, and general agricultural conditions for the regions involved.

Experimental projects have been initiated in soil erosion and drainage, and a quite detailed topographic survey of the Institute's one thousand hectares is nearing completion. On the basis of this, soil and land survey classification can be made accurately.

Some basic and applied research in grain drying and storage is under way. This will remain a major research project of the department until attainment of a satisfactory solution.

Detailed plans for a more extensive Agricultural Engineering Department including personnel, facilities, a detailed building plan, and a list of equipment have been prepared, and in the absence of funds allotted to it, special effort has been made to secure funds to bring it into being. Such basic facilities are needed before any real progress can be made in the application of engineering technology in the Institute's program.

## PROGRESS OF WORK

Research has been initiated and/or advanced in the following four projects.

1. Erosion Project
2. Drainage Project
3. Lumber Study
4. Grain and Bean Drying and Storage Project

### Erosion Project

Construction of a series of erosion control plots was completed in January, 1948. This series of plots consists of two sets of four plots each on exactly 16 percent and 45 percent slope, with a third set of fifteen 3 M. plots on an average of 45 percent slope, the slope varying slightly from top to bottom. A series of triplicated cultural practices using corn as a common crop is being studied on twelve of these plots with cane on the other three. The first two sets contain check plots and plots to be used for other special tropical crops.

Rainfall and soil run-off are observed. Most significant results to date are the decimals of one percent of water run-off that have been observed for rains up to 4.25 inches in twelve hours with no apparent differences between the bare and grassed plots. This shows these soils to be quite resistant to

erosion, although some soil wash has been observed where stair steps were constructed by the workman between the plots. Yields of cane and corn from these plots are average for the region, indicating fair to good soil fertility.

Complete chemical and physical analyses of these soil profiles are being made through cooperation of the Agronomy Department of Cornell University.

Drainage Project

A sub-surface tile drainage system was installed on an experimental basis on a poorly drained field near the entrance of the Insitute. A 90° V-notch weir and concrete stilling tank was installed at the outlet, and rows of vertical holes were dug in lines at right angles to the tile lines in order to afford study of the ground water fluctuations. Tile laterals were spaced 50, 100, and 150 feet apart. The system was completed and ready for observation in November, 1947.

Significant results to date show that no surface flooding occurred between any of the laterals for a rainfall intensity of 6 1/2 inches in two days, 4.25 inches of which fell in twelve hours, and the rate of draw-down measured at the midpoint between tile laterals appeared to be adequate for the crop of corn on the ground at the time. The maximum run-off rate observed during this storm was 1.57 inches per twenty-four hours.

There had been considerable question as to the drainability of this soil profile due to its rather high clay content and the existence of an unoxidized and apparently impermeable clay layer at a depth of 18 to 20 inches. With adequate aeration provided by drainage and deep rooted leguminous crops to be incorporated as green manure, it is hoped that both the top soil and

soil profile will develop favorably. This tile drainage study will be continued for another year at least with additional laterals installed in another section of the field which, due to its extremely poor fertility, was abandoned by the Plant Industry Department for field plot use, although it is ideally located for such use.

Lumber Study

This study consists of the determination of the principal physical properties of a group f about thirty-five commercially important species of lumber from this region. Costa Rica, for example, is estimated to have over three-quarters of its land area in forests, but, as typical of tropical forests, there is no uniformity of stand of any one species in any given area, although there is a quite definite regional occurrence of species. During a day's run, a sawmill may saw over a dozen different kinds of wood.

These preliminary studies, nearly completed at this writing, include:

1. specific gravity determinations--green basis and dry basis
2. shrinkage coefficients radial and tangential
3. rates of drying
   a. under roof
   b. in sun (following custom in region)
   c. at 105° C (in laboratory oven dryer)
4. resistance to decay (fully exposed to soil and weather conditions at Turrialba)
   a. cold soaked with pentachlorophenol
   b. untreated
5. absorption and penetration of 5 percent solution of pentachlorophenol in kerosene according to time and pressure--cold treatment
6. gluing characteristics at high moisture content--using resorcinol glue which sets at room temperatures
7. equilibrium moisture contents
8. crushing strength--green and at equilibrium moisture content
9. calibration check of a commercial electrical type wood moisture meter

Common names of the various species of trees are being obtained according to local experts, and samples are being kept for later identification.

Grain Drying and Storage Project

Initial studies have been made of local conditions as to weather, possibilities of sun drying, moisture contents of grain at time of harvest, local storage methods and customs, and the performance of different types of drying plants now in operation in Costa Rica. A rather complete study was made on the performance of the ear corn drying plant constructed and operated by the Institute of Inter-American Affairs at Guacimo in the Atlantic coastal plain area. The construction and operation of the new terminal elevator in San José which is equipped with a large continuous type dryer, fumigation and pneumatic equipment, is being watched with interest. These so-called "grain silos", eighteen in number, have a total storage capacity of a little over a quarter of a million bushels.

A small experimental ear-corn crib was built and filled with corn at approximately 24 percent kernel moisture to study possibilities of crib storage of ear corn for short periods in this region.

A movable wooden grain bin with two 500-bushel bins has been designed to be used as a batch type dryer and for subsequent storage. The bin will be vapor flow resistant through the use of asphalt roofing under the floor and on the sides and roof. In addition, a thousand-bushel steel bin with perforated false floor to provide a plenum chamber has been presented to the Institute by the Butler Manufacturing Company to be included in the grain storage studies.

One of the new type integral portable pressure atomizing spray jet-type oil burning dryers has been purchased to be used as an Institute dryer especially for experimental work. Special studies of drying sacked rice, as harvested by combines in the wet-dry region in the Pacific coastal plain area of Costa Rica, are planned in cooperation with two large operators in this region.

Grain sorghum, rice, and corn will be among the first crops to be dried and stored under these weather conditions. Subsequent work will include coffee and cacao beans in an attempt to make a highly efficient small batch-type dryer.

Other Accomplishments

1. Tropical House Plans

A detailed design and set of plans have been developed for a tropical off-the-ground style house, 36 x 40' with a basement floor entirely usable but enenclosed, except for the servant's quarters. As a result of experience in building two of these houses at the Institute, a revised seven-page detailed plan has been prepared and is available for limited distribution upon request.

It is a three-bedroom house, especially designed for construction with native lumber. All interior and exterior walls are made of 1 1/2-inch edge-glued vertical panels. The plans also show an open front porch addition and an alternate four-bedroom, 36 x 46' floor plan. Basic material requirements for the 36 x 46' floor plan are approximately 18,000 board feet of lumber, 40 cubic yards

of concrete, and 2,000 square feet of roof tile underlaid with asphalt roll roofing.

2. New Trailer

A two-wheel dump-type general-purpose rubber-tired trailer was designed for small to medium sized tropical farm hauling requirements. Two such trailers have been built and field tested at the Institute. The design provides for the trailers to be pulled, one or more in tandem, by a tractor, truck, or jeep, and by connecting a stub tongue it is highly suitable for a yoke of oxen. It is made of welded angle iron for the frame and edge-glued 1 by 3 inches into panels or sections for the sides, bottom, and endgates. It can be used without endgates and cross ties for hauling cane, loading up to 2 kilogram tons. With the endgates it becomes a grain tight box having a capacity of two cubic meters at a height of a little over a meter (108 cm.). A set of four 2 x 2 inch glued-laminated wooden arches covered with light-weight aluminum sheets will make it rainproof with a protected hauling capacity of five cubic meters under the roof. The welded-steel, glued-wood construction makes it light in weight (500 pounds) yet strong and rigid. The chassis consists of a commercial 2-inch square steel axle equipped with wheels for 16-inch tires.

A one-sheet detailed plan showing its construction has been prepared and is available for distribution upon request.

3. Lagoon Drainage

A "quadrilla" of five laborers worked for three months, from February through April, cleaning and digging the outlet ditch to the lagoon area. Using hand methods and dynamite for rock they were able to lower the channel bottom to grade for about half the distance to the lower end of the lagoon. This work will be continued for the proper development of this 160 to 200 acre lagoon area.

## FUTURE PLANS

Insofar as possible, major effort will be given to research and developmental work in grain drying and storage. Further work toward the development of the Agricultural Engineering Department must await the procurement or allotment of additional funds.

September 6, 1948

## DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL LIFE

Julio O. Morales

### INTRODUCTION

The program of the Department has been oriented along lines which promise more direct and faster improvement in labor productivity. The problem of low labor productivity is basic in the achievement of higher levels of living and is of concern to all segments of society. Farmers express this problem by saying that their business is unprofitable because of the low productivity of their laborers. At the same time laborers complain about low wages and poor living conditions. Consumers find that prices of basic foodstuffs are too high. Government officials are concerned about the low levels of production and consumption of the country. All these are manifestations of the same basic problem--low labor productivity. To be more specific, prices of corn in Costa Rica as a general rule are higher than in the United States in spite of the fact that farmers in the United States usually make profits producing corn while most Costa Rican farmers get little or no profits. Nor are the Costa Rican corn growers helped by the fact that they pay much lower wages. There is so much more labor consumed to produce the same amount of corn in Costa Rica that its production returns a much lower wage to the laborer, leaving little or no profit to the farmer, even though he sells it to the consumer at a higher price. The plant breeder and agronomist can alleviate the situation by greatly increasing yields, but even such marked contribution would leave the bulk of the situation unsolved.

As labor is not only the principal item of cost of agricultural pro-

duction (usually accounting for over half of total costs) but also represents the ultimate factor in consumption, there is a very close association between low labor productivity and low levels of living.

Many leaders of the Americas have observed that there is a wide difference in levels and standards of living between the more developed and lesser developed countries of the hemisphere. Some of them have also observed that there is a wider difference between the level of living of the people of the more developed and lesser developed countries of this hemisphere today than there was between that of the Europeans and of the Incas when Columbus discovered America. In other words, the gap is getting wider. It is generally accepted that the resources of the hemisphere should be mobilized to change this trend.

Many American countries have already developed and put into effect programs designed to alleviate this situation. They have also met in conferences to tackle the problem together. Many of those concerned with these programs, however, complain that the social scientists have failed to provide them with basic principles which should guide the elaboration and operation of these programs.

Considerably more research is needed before the social sciences are able to understand well enough the principles which govern the social and economic evolution of a community let alone of a whole country. Although amazing progress has been made in the last few decades, more basic research on the growth process of a community and its stimulation through education has to be conducted.

Therefore the research program of the Department has been channelled toward the improvement of levels and standards of living along two principal

courses: (1) Improving labor productivity by improving man himself and (2) Improving labor productivity through better organization and management of farming enterprises.

Research, to be of value, has to be taken to the people. The Department is primarily concerned with methods of conducting research and the consumers of this type of information are other scientists working primarily in colleges, experiment stations, and other institutions performing similar services. The avenues to convey this information to them are principally technical bulletins and articles, conferences, and resident instruction. Usually a certain amount of resident instruction is required to provide the core around which the others can be tied. Alumni very often can be trusted to carry a good share of the distribution job. In relatively new fields such as economics and rural sociology, alumni help is indispensable. Therefore the emphasis of the Department has been altered to put more emphasis on resident instruction.

## RESEARCH PROGRAM

The research program of the Department has been organized around five projects:

### Community Project

The general objective of this project is to determine the economic and social growth process of the family and the community under the influence of a scientifically guided intense educational program. At the same time we shall test the effectiveness of the methods used in determining the basic problems of the community at any particular time as well as that of the various educational devices used.

The Turrialba community will be studied by a team composed of five scientists in the fields of economics, home economics, sociology and

anthropology, health and nutrition. This team has been organized and the work has been divided in the sub-projects which follow:

## Rural Sociology and Anthropology Sub-Project

Leaders: Charles P. Loomis
Reed Powell
Julio O. Morales

Objectives:

1. To find out what constitutes the community of Turrialba (Delineation of the Turrialba community).
2. To work out the association patterns of the informal prestige and congeniality groupings, using a sample procedure.
3. To study the institutional structure of the Turrialba community and the effectiveness of the services rendered.
4. To study the ecological structure of the community.
5. To study the effects of the educational program on the attitudes and opinions of the people.
6. To analyze the class structure of the community.

Progress to date:

1. Emphasis has been placed upon obtaining a knowledge of the area and a vision of how best to proceed with the project. In this respect the following have been made subjects of investigation:
   a. Services offered by the Turrialba area
      (1) The town itself
      (2) The surrounding caseríos and barrios (settlements)
   b. Institutions rendering these services and the manner in which they function.

Plans for the immediate future:

1. To obtain more knowledge about and a greater vision of the Turrialba area.
2. To formulate, together with other members of the team, a schedule covering the following aspects:
   a. General information
   b. Delineations of locality groupings
   c. Association patterns
3. To delineate the Turrialba community and work out the association patterns of the people based on the data obtained in the schedule.

## Home Economics Sub-Project

Leaders: Marta Coll
Dr. Guillermo Lejarza
Julio Morales
Dr. Laura Lee Smith

Objectives:

1. To appraise the real needs of the community in relation to health, housing, nutrition, family living, and education.
2. To determine which are the most effective methods for obtaining the desired information.
3. To determine which educational devices are most effective for channeling and putting into actual practice a program aiming to improve the level of living of the community.
4. To test the effectiveness of the efforts devoted to the attainment of the objectives of the program and to study the interaction of the Home Economics program with those of other fields.

Progress to date:

1. A survey of the literature is under way.
2. A compilation of food analyses and other useful information related to other fields of study is under way.
3. Questionnaires on nutrition, health, child care, family history are being worked out and some have been tested.
4. General information related to the community is being collected.
5. Arrangements are being made with the Health Department of Costa Rica so as to use the services of the doctor of the health unit and the facilities available at the Turrialba Health Center and the Social Security hospital of Turrialba in the study of the health problem.

Plans for the immediate future:

1. To finish the review of the literature available and compile additional information which may be useful.
2. To gather and get acquainted with information in relation to attitudes, behavior, and other forces which determine group action in the community.
3. To develop questionnaires which will be used in the collection of the data related to the different fields of study included in the survey.
4. To study and collect data on health habits, vital statistics available, medical, dental, and hospital facilities available and the extent to which these facilities are being used, and the reasons for not using them when needed.
5. To help in analyzing the data collected.

6. Upon analysis of the data, to help in channeling properly an educational program based on the needs appraised and the social organization of the community.
7. To develop interest of the community in the work that will be done.
8. To enlist the cooperation of the different organizations and institutions of the community, and support and stimulate spontaneous community programs which seem to contribute to the solution of the problems observed.

## Census Sub-Project

Leaders: Julio O. Morales
Jorge León

Objectives:

The census of the central district of Turrialba has two purposes:

1. To obtain the necessary information to serve as a basis for other phases of the community project.
2. To gain experience in methods for the census of the Americas of 1950. In relation to this last point this census could provide valuable information on the following points:
   a. How to take agriculture and population census together
   b. How to make, with economy, a de-facto and de-jure census at the same time.
   c. How to coordinate the population, agricultural supplement, and agricultural questionnaires.

Progress to date:

1. Cartographic and geographic work
   a. General map of the area (topography, 50 meters contour lines).
   b. Map of the area and division in enumeration areas.
   c. Map of the town and adjoining area, with houses and stores marked.
   d. Sketches (for the use of the enumerators) of all the enumeration area in the rural part of the district, and of the blocks in the urban part.
   e. Delineation of the political boundaries of the district.
2. Questionnaires
   a. These questionnaires were made for the population, agriculture and agricultural supplement sheets.
   b. Questionnaires were discussed with a national organization (Asociación Costarricense de Estadística) which is very much interested in the national census for 1950, with officials of the Costa Rican Secretary of Agriculture, and representatives of different organizations interested in the census (banks, Coffee Board, etc.).

c. Questionnaires for agriculture were tested with the cooperation of four farmers, and some improvements were made following their suggestions.

3. Instructions
Complete instructions and definitions for the enumerators were completed covering these questionnaires.

4. Organization
Arrangements were made with the local education supervisor to use the teachers as enumerators, and permission was obtained from the Secretary of Education to let the teachers work as long as necessary to take the census information.

5. Financing
Several arrangements were made to finance the census through the help of certain local institutions (banks, Coffee and Sugar Boards, etc.) and the Costa Rican Government. The expenses are estimated at $2,000.

6. Coordination
   a. With local institutions (as those mentioned above).
   b. With international institutions, such as the Inter-American Statistical Association.

Plans for the immediate future:

1. To take field information in August.
2. To proceed with analysis of the data.

## General Economic Sub-Project

Leaders: Julio O. Morales
W. E. Keepper
Jorge León

Objective:

1. To gather basic economic information on the community necessary for the achievement of the general objective of the Community Project, covering:
   a. Information on the geography and geology of the area has been collected.
   b. Soils--Very little information is available.
   c. Climate--Meteorological data have been collected and partially analyzed. Records on daily rainfall, maximum and minimum temperatures, etc., are currently obtained.
2. Human conditions. The following information has been obtained:
   a. History of the settlement since 1530. The historical development of the community has been established along general lines.
   b. Land use in 1838--Complete information was obtained on the land use for that year (cacao was the main crop, followed by coffee and pastures).

c. Land use in 1887--For this year an old map showing the land use was obtained (cacao had disappeared; pastures were predominant),
d. Agricultural development since the construction of the railroad (cane and coffee more important; considerable production of bananas for few years).
e. Present land use. A map of the distribution of the eight main cultures was made, and another showing the land tenure. This gives enough material to start a classification of types of land use in the area.

Plans for the immediate future:

1. To analyze the data obtained in the census and relate it to data already collected on land use.
2. To study plot and garden management problems of selected families.

Study of Coffee Processing Plants (Beneficios)

This is a "work simplification" study to be conducted in cooperation with the Agricultural Engineering and Plant Industry Departments of the Institute. The general objective is to determine ways of improving the efficiency of coffee processing plants.

Leaders: Julio O. Morales
Jorge León
Francisco Gómez

Progress to date:

1. The coffee processing plants (beneficios) of Costa Rica have been located on a map.
2. Information has been obtained on the amount processed by each plant for each year since 1940-41. A detailed study of this information has been made in order to determine fluctuations in volume of operations and the causes for these fluctuations. Very interesting information has been obtained as to biennial bearing and of intensity of yearly variations in yield for the various producing areas of the country. An article will probably be published covering these findings.

3. The information of the Census of Coffee Processing Plants taken in Costa Rica for the year 1936 has been obtained and analyzed. The above information has helped to orient the study along more practical lines and will be basic in the selection of the sample of plants to be studied.

Plans for the immediate future:

1. To keep the information on the amount processed by each plant up to date.
2. To conduct a preliminary survey of a number of processing plants to determine the relative importance of the various operations (depulp, ferment, dry, etc.) and of the various items of cost of processing (labor, wood, interest, depreciation, etc.).
3. Select the beneficios to be studied in detail.
4. When Mr. Gómez returns from Michigan State College in January 1949, proceed with the detailed study of each plant.

Study of Panela (Raw Block Sugar) Processing Plants

This study is similar to the one above. Aside from gathering some data on these plants in Costa Rica, the work has been postponed until the student who will use this project for his thesis arrives.

Study of Rubber Intercropping

This project was initiated in order to determine the economic advantages of establishing rubber plantations by intercropping as compared to the conventional way of letting the grass grow between the rows of trees.

Progress to date:

In an article entitled "Intercropping Assists Economic Establishment of Rubber Plantations" the advantages and disadvantages of the practice are discussed. This article will be published by the Institute in the near future. The conclusions could be summarized as follows:

1. Intercrops, if properly selected, yield a profit over all costs, which might help to finance the costs on young rubber plantations. In addition some fixed costs of the plantation are spread over a broader base by charging part of these costs to the intercrops.
2. The percent of trees that had to be replanted was lower in intercropped lots. The percent of successfully topbudded trees in lots of three year old trees was much higher in intercropped lots.
3. By June 1947, when trees in intercropped lots had already shaded the entire area, measurements showed that intercropped lots were approximately a year ahead in growth as compared to non-intercropped lots of the same age.
4. Cover crops were more cheaply and readily established in intercropped lots.

5. A saving of $24 in rubber weeding costs per hectare for the period of 1942-46 was secured by intercropping. The principal saving was obtained in the practice of general slashing, costs of other rubber weeding operations remaining about the same.

Study of Farm Organization and Management of Coffee Farms

This project will make use of available data kept by some coffee farmers for many years to determine farm organization and management problems through the period for which data is available.

Progress to date:

Very useful data have been obtained from three large coffee farms for periods ranging from 15 to 40 years.

Plans for the immediate future:

Dr. W. E. Keepper will be primarily devoted to getting this project established on a firm, permanent basis.

Study of Prices of Agricultural Products

The objective of this study is to determine the seasonal and long-term fluctuations of the principal agricultural products and to determine the relationship of these fluctuations in prices of closely related agricultural products, such as between panela (raw block sugar) and refined sugar prices. The understanding of these fluctuations will help considerably in explaining shifts in organization of farms as well as providing many basic economic facts on many economic aspects, such as effects of seasonal production on prices and storage.

Progress to date:

1. The books of a local wholesale merchant were secured and information on seasonal and long-term price movements of corn, beans, sugar, and panela was taken out for the years 1925-45. A list of other wholesale merchants was made in order to obtain similar data from them.
2. Data on the prices at sales of grain and livestock in Costa Rica have been secured and will be kept up to date.

Plans for the future:

Work on the project will be postponed until a student comes who wants to use it for his thesis. Stress during the coming year will be placed on the Community study, the Coffee Processing Plant study and on the study of Farm Organization and Management of Coffee Farms.

## INSTRUCTION

We have arrived at the conclusion that instruction in the Department will fall principally in two categories:

1. For students having the basic course work. They will be primarily interested in conducting a research project they may or may not want to use for their thesis here or elsewhere.
2. For students not having the basic course work. An orientation course of three or four months will be given to them, including intensive training in English. (A selection of readings and discussions has been made for this orientation course. It was successfully used with Mr. Francisco Gómez). After this orientation course, the student will go to a university to take the courses he needs, returning to the Institute after this training prepared to do a research project as indicated above.

   The Department conducted the Statistics Course 202 for all Institute students and some Technical Assistants.

## OTHER ACTIVITIES

Dr. Phil S. Eckert, Head of the Department of Economics and Rural Sociology of Montana State College devoted four months of his leave to the selection of readings in Farm Management. These selections were made in order to provide basic information in Farm Management to students of the Schools of Agriculture, such as the ones at Zamorano, Honduras, and Divisa, Panamá. Dr. Eckert is trying to get the selections translated. While the selections were made primarily for use at the practical farm school level, they make good supplementary readings for agricultural college students.

Professor W. I. Meyers' collection of 139 volumes of selected bulletins, covering a good part of the outstanding bulletins in the field of Agricultural

Economics published during the last twenty years, was secured during the year for the Economics and Rural Life Section of the Institute Library. This addition considerably strengthens this section.

## PERSONNEL

The Staff of the Department was increased during the year by Mr. Jorge León, Assistant, and Miss Marta Coll, Home Economist. Dr. Phil S. Eckert came to the Institute for six months and Dr. Paul Morrison, Geographer from Michigan State College, devoted two months to the study of Land Use of District No. 1 of Turrialba. Dr. Charles Loomis and Dr. Laura Lee Smith spent one one month each at the Institute in connection with the Community Study. Arrangements have been concluded to bring Professor W. E. Keepper of Pennsylvania State College for a whole year. Miss M. E. Lemaire will be with us during June and July to study a geographical problem relating to the Department's research program.

## COOPERATION

The Department has established cooperative relations with Michigan State College whereby the work of conducting the Sociology and Anthropology Sub-Project of the Community Study becomes a combined responsibility of the Institute and Michigan State College.

During the present year, Miss Hoyt and Miss Thomas from Iowa State College established relations with this Department, and we assisted them in preparing the questionnaire and revising the plans for a Labor Policy Survey to be conducted among a number of Guatemalan coffee growers.

The Head of the Department attended the meetings of the International Statistical Association and of the Commission for the 1950 Census of the

Americas held in Washington last September. Close cooperation has been established in matters relating to 1950 Census plans between the Inter-American Statistical Institute and this Department.

Our plans for the Turrialba Census have been strengthened by having all the plans accepted and revised by the Costa Rican Statistical Association. This action has led to the organization of a Technical Committee which will work with this Department in the activities of planning and conducting the trial census. The same close relations have been established with the principal national agencies concerned with the various phases of the Community Study.

Our relations with the Facultad de Agricultura of Medellín, Colombia have been strengthened after the visit of Messrs Carlos Madrid and Gregorio Beltrán of the Institute. Plans are also being discussed to cooperate more closely with the Federation of Coffee Growers of Colombia.

## EXTENSION AND VOCATIONAL EDUCATION

C. R. Kellogg

### VOCATIONAL AGRICULTURE

This report will of necessity be brief. It covers preparatory activities only. When the students arrive, they will find ample opportunity for study and practical work in various fields of agriculture. We consider it essential that methods of extension and vocational training be studied and that leaders in these fields be developed.

#### Animal Industry

Students will be able to carry on both studies and practical work in dairying, with the most modern and suitable buildings, a small but adequate herd of dairy cows, both imported and local, and their work will include the care of the dairy cows and also of the dairy products. A herd of beef cattle will give them practice in the production of meat and in the care of meat animals. Buildings for housing the pigs are completed and the pastures are in order, although the animals have not yet arrived. The poultry houses are complete, the yards seeded to forage crops, and the poultry stock has been ordered and will be here almost any day. A young man, a graduate from the Escuela Agrícola Panamericana will be here very soon to help in the poultry work, all of this providing for specialization in this field for those who wish it.

#### Plant Industry

1. Vegetables. Over six acres of vegetables, containing varieties from abroad as well as local varieties, are at the disposal of the students of vocational agriculture and other areas are available for planting. Training

will be given in the planting and cultivation of vegetables, control of insect pests and plant diseases, marketing, etc., and technical advice is available for those who wish to specialize in vegetable culture.

2. Field Crops. In another part of the Demonstration Farm, experiments are under way on a fairly large scale, to improve the tomato, peanuts, sweet potatoes, potatoes, beans, etc., and these will be available for teaching practical and experimental methods of cultivation of field crops.

3. Sugar Cane, Coffee and Cacao. The grounds of the Institute contain large fields of sugar cane, and several sugar mills in the immediate vicinity offer to the student opportunities for scientific studies and practical work in all phases of the industry. The same applies to the production of coffee and the newly organized work in the planting of the cacao makes possible practice in this field, as well as scientific studies.

4. Grain Crops. Several varieties of sorghum, both for forage and for grain, are being produced, and this should be included in a curriculum for the agriculturist.

5. Fruit Trees. Seedling trees will be ready for budding or grafting by the next season, but in the meantime, there are available various local plants to be used in practice in these arts. A small citrus area has been planted and other fruits will be planted.

6. Grape Culture. Very interesting and important work is being carried on in the cultivation of grapes adapted to tropical conditions, and the students in vocational agriculture may take part in this program.

7. Beekeeping. The only class in vocational agriculture now in progress is a class in beekeeping. Four colonies of bees, purchased locally, are being used for instruction and some experimental work in tropical beekeeping. The

class is a voluntary one, outside the regular schedule, and includes two members of the staff and five students.

## EXTENSION WORK

A very important phase of the work will be that of extension. This has been initiated in two places. In Cervantes, connection have been made with the teacher of an agricultural school. Extension work there should be successful, for the teacher is much interested in practical agriculture and already has a small garden, some animals, poultry and bees, and all that is needed is some help to get improved agriculture into the homes of his students and the other villagers as well.

A second contact has been made with another agricultural teacher in the village of Tuis. This man already has a school garden, in which the students took part during the last term, and is waiting for the students to return from vacation in order to start a new school garden. We took him a large number of seedling plants, which he will use not only for the school garden but for the villagers in neighboring homes.

Visits have been made to a number of other villages and <u>fincas</u> and plans made for additional work.

## RURAL DEMONSTRATION CENTER

We regret that the program of the Rural Demonstration Center has not yet begun, as this should prove to be one of the most important and far-reaching enterprises of the Institute. It calls for a complete agricultural and social unit within the limits of the 50 acres to be dedicated to this project. Here the vocational students will be housed and trained, with buildings, animal enclosures, gardens, etc., all on a scale that can

be copied by villagers and from which they can also learn the best methods of scientific agriculture. Further, it will be developed into a cultural and educational center for the villagers living within reach, its function being to raise the living standards of the community to a higher level. At the same time it will be an example to be copied by other countries and regions.

The Noche Buena Rural Center will include the following units:

Ten Units to be Developed First

1. Model house for middle class farmer.
2. Students' house.
3. Play fields.
4. Apiary.
5. Improvements of roads.
6. Exhibition and work building.
7. Work with the eight families now residing at Noche Buena.
8. Tool and work shop.
9. Fruit trees to be planted all around the grounds.
10. Equipment for above.

Twelve Units to be Developed Later

1. Shelter and corrals for demonstration animals.
2. Shelter and yards for poultry.
3. Pasture fences for demonstration animals.
4. Fence along the road - make it more attractive.
5. Water supply.
   a. Over all supply
   b. Demonstration use of spring
   c. Demonstration well
   d. Demonstration cistern
   e. Demonstration small hydraulic ram
6. Lighting.
   a. Possible hook-up with Dairy Division of Institute.
   b. Simple rural lighting
      (gas, gasoline, petroleum, electricity, etc.)
7. Model house for small farmer.
8. Demonstration gardens.
9. Strip cropping demonstrations.
10. Steep hillside erosion control.
11. Community kitchen for processing food.
12. Pick-up truck for Center.

## LITERATURE

As indicated, much time has been spent in library work, preparation of outlines and guides of study, directions for specific problems, etc., so that when the students arrive, work can begin in the fields which they may choose, either as a class, or individually.

Further, work has been going on in the preparation of a simple and concise bulletin on beekeeping. The first part is now being mimeographed and the rest will soon be done. As soon as this one is finished, a second bulletin, dealing with vegetable gardening will be started and another one on poultry culture. These mimeographed bulletins, in Spanish, will be used in farmers' classes in the neighboring villages.

## SUPPLEMENTARY INFORMATION

D. Spencer Hatch

Thirteen students successfully passed the final examinations on Rural Reconstruction and Extension in the Methods of Science Course.

Plans are being completed for training in Vocational Agriculture which will begin in September 1948. A prospectus has been prepared for courses in Agricultural Economics and Farm Management; Agronomy; Animal Husbandry and Dairy Industry; Poultry Husbandry; Rural Engineering; Rural Reconstruction (including Rural Demonstration Centers and Extension Services). A group of students for these courses is expected from Venezuela about September 12.

Extension studies are being conducted to acquaint ourselves better with conditions and with the people in different parts of Costa Rica. Everywhere we receive a cordial receiption by the rural people, and we are already able to work out some small services for them. The arts and crafts and possible

home industries, especially those suitable for profitable employment of spare time, are being studied. There is already interest in these, and some work has been started.

We await only the necessary funds to enable us to go ahead with the development of the Noche Buena Rural Demonstration Center, the basis for our Extension Services. The apiary has been increased to eighteen swarms.

## INSTRUCTION PROGRAM

### STUDENTS REGISTERED AT THE INSTITUTE

### FROM JULY 1, 1947 TO JUNE 30, 1948

The following students, who had enrolled in 1946, finished their studies in the academic year 1947 and 1948:

Rodolfo Lambour M. - Guatemala

Plant Industry Department. Certificate of work completed, July 8, 1947. Report: "El Clima Tropical y su Influencia sobre el Cultivo de la Vid".

Juan Muñoz O. - Mexico

Plant Industry Department. Completed requirements for the degree of Magister Agriculturae, June 26, 1948. Thesis: "Estudios Cromosómicos en el Género Theobroma L".

Pedro Trujillo G. - Mexico

Plant Industry Department. Completed requirements for the degree of Magister Agriculturae subject to his being granted the Ingeniero Agrónomo degree from Mexico, July 8, 1947. Thesis: "Consideraciones sobre la Vid de Clima Templado en Clima Tropical".

Alfonso Uribe H. - Colombia

Plant Industry Department. Certificate of completion of studies, July 19, 1947. Permission granted to use report for Ingeniero Agrónomo thesis at Facultad de Agronomía, Medellín, Colombia. Report: "Aspectos Técnicos en la Producción de Caucho Hevea".

The following students were registered during the academic year 1947-48:

José S. Aguirre - Mexico

Plant Industry Department. Completed requirements for the degree of Magister Agriculturae, August 18, 1948. Thesis: "Pérdidas de Almacenaje de Papas en Ciertas Regiones de Costa Rica, C. A., en Relación con la Temperatura y al Phytophthora infestans (Mont.) de Bary".

Humberto Barquero M. - Costa Rica

Plant Industry Department. Studies in classification, identification, and methods of controlling fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation. Special project: Survey of harvesting and processing procedures among the small farmers of Costa Rica.

Louis Blanchet - Haiti

Plant Industry Department . Effect of soil reaction on the growth of coffee seedlings and germination of seeds. Mr. Blanchet left on May 10, 1948 due to illness.

Leonardo Cabrera V. - Mexico

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation.

Monod Dejean - Haiti

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation. Special project: Flowering and fruit setting habits of cacao trees.

Guadalupe Escamilla S. - Mexico

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in pruning and methods of rehabilitation. Special project: Propagation methods of cacao.

Milton E. Gertsch - United States of America

Plant Industry Department. Completed requirements for the degree of Magister Agriculturae, August 27, 1948. Thesis: "A Study of Weed Control with Aromatic Oils and Herbicides in Beans and Corn in a Tropical Rainfall Area".

Dale E. Madden - United States of America

Animal Industry Department. Completed requirements for the degree of Magister Agriculturae, August 16, 1948. Thesis: "The Value of Coffee Pulp Silage as a Feed for Cattle".

W. Lee McFarlane - United States of America

Plant Industry Department. A study of the relationship between rainfall and sunshine to the flush of growth, flowering, and harvesting of coffee. Mr. McFarlane will also have a research project on cacao.

Vicente Martínez V. - Mexico

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation. Special project: Determination of the relation between pH of soil and vegetative growth of cacao seedlings. Also experimentation with methods of fermentation and other procedures in cacao processing.

José I. Núñez G. - Venezuela

Plant Industry Department. Thesis topic: "A Study of the Control of Weeds in Corn by the Use of Herbicides".

Luis A. Paredes P. - Ecuador

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in pruning and methods of rehabilitation. Special project: Propagation methods of cacao.

Santiago Porcella III - United States of America

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation. Mr. Porcella left on July 9, 1948 to go to Liberia to establish cacao plantations for the Liberia Company, Inc.

Reed M. Powell - United States of America

Economics and Rural Life Department. A community study.

Manuel Salazar H. - Nicaragua

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in propagation, pruning, and methods of rehabilitation. Special project: Investigation of the life history and normal reactions of Phytophthora palmivora.

Ralph Segall - United States of America

Plant Industry Department. Fungicide control of Sigatoka disease of bananas, of Omphalia disease of coffee, and Phytophthora palmivora of cacao. Cultural study of Rosselinia root rot of coffee.

Ángel VonBuchwald - Ecuador

Plant Industry Department. Studies in classification, identification, and control methods of fungus diseases of cacao. Preliminary studies in pruning and methods of rehabilitation. Special project: Propagation methods of cacao.

Francisco Gómez - Colombia

Economics and Rural Life Department. After preliminary studies here Mr. Gómez left in March 1948 to go to Michigan State College for a nine-months' period.

## SEMINARS

### OCTOBER 1947 THROUGH JUNE 1948

| Date | Subject | Leader |
|---|---|---|
| **First Quarter** | | |
| October 20 | Cacao improvement program at the Institute and in Ecuador | Dr. Robert Fowler, Ecuador and U.S.A<br>Dr. Ralph H. Allee<br>Dr. Manuel Elgueta |
| " 22 | New aspects of genetic breeding of corn | Dr. S. Horowitz, Venezuela |
| " 27 | Hylean Amazon Project | E. J. H. Corner, UNESCO |
| November 3 | "Tórsalo" control experiments at the Institute | Albert O. Rhoad |
| " 10 | Chemical weed control | Milton E. Gertsch (student) |
| " 17 | Costa Rica's program for supporting farm prices | Dr. Phil S. Eckert, Montana State College |
| " 24 | Report on current research on potatoes | Ernest H. Casseres |
| December 9 | Beans--classification and value | Joseph L. Fennell |
| " 15 | Drainage | Norton C. Ives |
| " 22 | Inspection of forage grasses and discussion of their value | Jorge León |
| " 29 | Composting | Guillermo Bonilla |
| **Second Quarter** | | |
| January 5 | Rubber | Dr. Russell Seibert, U. S. Department of Agriculture |

| Date | Subject | Leader |
|---|---|---|
| January 9 | Development of the sugar cane industry | Dr. Julius Matz U. S. Department of Agriculture, Panama |
| " 24 | Agricultural ecology | Dr. G. Azzi, Venezuela |
| " 26 | Some diseases of coffee | Dr. Frederick L. Wellman, U. S. Department of Agriculture |
| " 27 | Agricultural ecology | Dr. G. Azzi, Venezuela |
| " 31 | Agricultural ecology | Dr. G. Azzi, Venezuela |
| February 2 | Control of "tórsalo" with commercial insecticides | Albert O. Rhoad |
| " 9 | Physiological reactions of selective herbicides | Dr. Ora Smith, Cornell University |
| " 16 | Vegetable variety trials | Ernest H Casseres |
| " 18 | Agricultural production units in Costa Rica | Padre S. Núñez, Rerum Novarum |
| " 23 | Agricultural extension in China | C. R. Kellogg |
| March 1 | Land use in Turrialba Canton District I | Dr. Paul Morrison, Michigan State College |
| " 2 | Cacao pod rot and other diseases of cacao | Dr. A. G. Newhall |
| " 15 | Tropical tomato | Joseph L. Fennell |
| " 22 | Chromosomes of cacao | Juan Muñoz (student) |

Third Quarter

| | | |
|---|---|---|
| April 5 | Cacao research in Trinidad | Dr. M. L. Langford, U. S. Department of Agriculture |
| " 8 | Lumbers of Costa Rica | W. R. Barbour |
| " 12 | World cacao situation | Dr. F. J. Pound, Trinidad |
| " 26 | Soil erosion measurement studies | Norton C. Ives |

| Date | Subject | Leader |
|---|---|---|
| May 3 | Program and plans of the Institute of Inter-American Affairs | H. M. Gabbert |
| " 10 | Nutritional program of Puerto Rico | Miss Marta Coll |
| " 17 | The development of the Santa Gertrudis breed of cattle | Albert O. Rhoad |
| " 24 | Rubber investigation program of the United States Department of Agriculture | Dr. Ernest P. Imle |
| " 31 | Rehabilitation of the cacao industry in Latin America | George F. Bowman |
| June 7 | An economic study of Liberia | Sanitago Porcella III (student) |
| " 14 | Mitosis | Dr. Franz Schrader, Columbia University |
| " 21 | Chemical control of seedling diseases | Miss Lucy Hastings |

## ORTON MEMORIAL LIBRARY

Angelina Martínez

It is encouraging to be able to report an increase in the circulation of library materials and a definite tendency on the part of both staff members and students to make better use of the library facilities. Publications are now received from most of the agricultural experiment stations and departments of agriculture in the Americas, as well as from many institutions in other parts of the world.

### Personnel

Mrs. Virginia Morales and Mrs. Emilia Rodríguez joined the library staff in July 1947, the former as Assistant Librarian (part-time) and the latter as full time clerk. Mrs. Morales resigned effective June 30, 1948.

### Ordering and Acquisitions

Some 304 books were ordered and 260 were acquired through donations. Four hundred twenty-seven pamphlets were ordered and about 526 were received from departments of agriculture and experiment stations. The total of library holdings, including pamphlets and periodicals, stands at a little over 13,000.

### Cataloging and Circulation

Seven hundred forty-five sets of Library of Congress cards were ordered, and 954 books were cataloged, bringing the total number of cataloged books in the library to 1,666. A total of 4,108 cards were added to the records, making a total number of 8,676 cards.

There was an increase in circulation of 961 over last year. One thousand nine hundred thirty-five volumes were charged out of the library during the year.

Reference Materials

The reference collection was consulted more often than during the previous year, and the following bibliographies of literature in the library were compiled: cacao, coffee, and potatoes. A bibliography on corn will soon be ready. One thousand two hundred twenty-eight articles were indexed.

A total of 201 periodicals are checked in regularly. One hundred eight of these come from the United States and Great Britain. Sixty-two are paid subscriptions and the others are complimentary or sent to us on an exchange basis. Dr. Robert E. Buchanan, member of the Institute's Administrative Committee, donated to the library several sets of unbound back volumes of some important journals.

One hundred seventy-five volumes were bound in San José, and a few more pieces of furniture were made at the carpentry shop.

Library Finances

The library was assigned $8,450.00 allocated as follows:

| | |
|---|---|
| Salaries | $4,335.00 |
| Equipment | 500.00 |
| Supplies & services | 615.00 |
| Books, periodicals, etc. | 3,000.00 |
| Total | $8,450.00 |

Instructions on the Use of the Library

A course on the use of the library resources was given by the Librarian during the first quarter of the school year (October - December 1947), and a set of rules and regulations was adopted by the Library Committee.

Languages

Spanish and English were simultaneously given during the first and second quarters of the school year, October 1947 to March 1948. Mrs. Wellman and Mrs. Gertsch taught English, and the Librarian taught Spanish.

Future Plans

There are definite gaps in our journal collection that will have to be filled in if we are to give the best possible service. The acquisition of back volumes of important journals is one of our main projects for the coming year.

We have realized the importance of maintaining closer relations between our library and the libraries of agricultural institutions in the Americas, and we propose to try to work out a program by which such cooperation may become possible in the near future.

Exhibit A

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS

## FOR THE PERIOD

## JULY 1, 1947 TO JUNE 30, 1948

| | | | |
|---|---|---|---|
| CASH BALANCE, JUNE 30, 1947 | | | $ 4,218.94 |
| RECEIPTS: | | | |
| Miscellaneous: | | | |
| Quota Assessments Paid in Advance | $ 827.21 | | |
| Collections of Accounts Receivable | 19,415.73 | | |
| American Cocoa Research Institute Grant | 50,000.00 | | |
| Demonstration Farm and Vocational Unit Grant | 133,000.00 | | |
| Esso Research Fellowship Grant | 9,500.00 | | |
| Advances by Business Manager, Costa Rica | 2,970.31 | $215,713.25 | |
| Income: | | | |
| Quota Assessments | $169,021.10 | | |
| Sale of Cane | 28,381.91 | | |
| Sale of Coffee | 3,546.25 | | |
| Sale of Miscellaneous Farm Products | 4,933.67 | | |
| Pasturage Rental | 216.84 | | |
| Sale of Medical Supplies | 1,996.43 | | |
| Sale of Books | 86.00 | | |
| Sale of Stone | 30.30 | | |
| Sale of Animals | 5,427.47 | | |
| Sale of Meals and Laundry | 14,324.35 | | |
| Sale of Rubber Seed | 1,140.00 | | |
| Sale of Houses | 219.00 | | |
| Gain on Exchange | 17,958.00 | | |
| Miscellaneous | 45.06 | 247,326.38 | 463,039.63 |
| | | | $467,258.57 |
| DISBURSEMENTS (Schedule A-1) | | | 459,763.67 |
| CASH BALANCE, JUNE 30, 1948 | | | $ 7,494.90 |
| REPRESENTED BY: | | | |
| Riggs National Bank, Washington, D.C.: | | | |
| A.I.A. Grant Account | $ 588.15 | | |
| Institute Regular Account | 2,528.89 | $ 3,117.04 | |
| Banco Nacional de Costa Rica, San José, Costa Rica (741.37 colones) | | 130.65 | |
| Petty Cash Fund - Costa Rica | | 3,897.13 | |
| Estate Manager, Panama Rubber Sub-Station | | 318.67 | |
| Advance to La Lola Cacao Farm | | 31.47 | $ 7,494.90 |

Schedule A-1
Sheet 1

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## SCHEDULE OF CASH DISBURSEMENTS

## JULY 1, 1947 TO JUNE 30, 1948

INSTITUTE

| | | |
|---|---|---|
| Office of the Director: | | |
| Staff | $15,228.79 | $ 15,228.79 |
| Department of Animal Industry: | | |
| Staff | $ 8,400.00 | |
| Labor | 2,085.87 | |
| Supplies and Services | 210.83 | |
| Student Maintenance | 458.82 | |
| Miscellaneous | 9.52 | 11,165.04 |
| Department of Plant Industry: | | |
| Staff | $21,100.01 | |
| Labor | 20,752.90 | |
| Supplies and Services | 2,767.11 | |
| Student Maintenance | 1,152.02 | 45,772.04 |
| Department of Agricultural Engineering: | | |
| Staff | $ 9,607.68 | |
| Labor | 5,144.53 | |
| Supplies and Services | 2,781.22 | |
| Student Materials | 30.13 | 17,563.56 |
| Department of Economics and Rural Welfare: | | |
| Staff | $ 7,340.00 | |
| Clerical Salaries | 1,657.00 | |
| Supplies and Services | 467.41 | |
| Travel | 729.29 | |
| Student Maintenance | 632.88 | 10,826.58 |
| Department of Education and Vocational Unit: | | |
| Staff | $ 660.00 | |
| Travel | 2,314.33 | 2,974.33 |
| Total Forward | | $103,530.34 |

Schedule A-1
Sheet 2

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| INSTITUTE, Continued | | |
| Total Forwarded | | $103,530.34 |
| Institute Services: | | |
| Roads and Landscaping: | | |
| Labor | $ 2,886.97 | |
| Supplies and Services | 118.84 | |
| Light Plant Maintenance: | | |
| Labor | 1,653.46 | |
| Supplies and Services | 4,513.12 | |
| Machine Shop: | | |
| Labor | 4,756.97 | |
| Supplies and Services | 179.97 | |
| Repair of Buildings: | | |
| Labor | 1,482.91 | |
| Supplies and Services | 628.77 | |
| Repair of Equipment: | | |
| Labor | 112.24 | |
| Supplies and Services | 4,563.81 | |
| Gas and Oil | 4,808.09 | |
| Storeroom | 671.95 | |
| Watchmen | 290.05 | 26,667.15 |
| Farm Operations: | | |
| Coffee: | | |
| Labor | $ 258.34 | |
| Supplies and Services | -290.09 | |
| Cane: | | |
| Labor | 5,723.10 | |
| Supplies and Services | 1,895.46 | |
| Other Land Products: | | |
| Labor | 187.12 | |
| Supplies and Services | 69.74 | |
| General Labor | 1,514.60 | 9,358.27 |
| Total Forward | | $139,555.76 |

Schedule A-1
Sheet 3

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| INSTITUTE, Continued | | |
| Total Forwarded | | $139,555.76 |
| Dormitory Operations: | | |
| Dining Room: | | |
| Labor | $ 2,322.57 | |
| Supplies and Services | 13,037.66 | |
| Snack Bar | 27.53 | |
| Miscellaneous | 280.43 | |
| Housekeeping Expense: | | |
| Labor | 1,419.08 | |
| Supplies and Services | 1,231.34 | |
| Miscellaneous | 12.43 | |
| Laundry: | | |
| Labor | 513.54 | |
| Supplies and Services | 200.79 | 19,045.42 |
| Library: | | |
| Staff | $ 3,512.51 | |
| Office Supplies | 720.99 | |
| Supplies and Services | 745.20 | |
| Books and Periodicals | 1,491.59 | 6,470.29 |
| Office Expenses: | | |
| Salaries | $14,122.22 | |
| Supplies and Services | 3,819.33 | |
| Legal Services | 1,800.00 | |
| Insurance | 1,936.42 | |
| Communications | 1,383.43 | 23,061.40 |
| Medical and Social Security Expenses: | | |
| Social Security Tax | $ 2,793.64 | |
| Student Care | 188.95 | 2,982.59 |
| Total Forward | | $191,115.46 |

Schedule A-1
Sheet 4

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| INSTITUTE, Continued | | |
| Total Forwarded | | $191,115.46 |
| Miscellaneous Expense: | | |
| Cesantia and Pre Aviso | $ 1,299.67 | |
| Students' Facilities | 94.85 | |
| Travel | 12,368.84 | |
| Miscellaneous | 1,590.91 | 15,354.27 |
| Equipment Purchased: | | |
| Plant Industry | $ 8.14 | |
| Agricultural Engineering | 373.12 | |
| Institute Services | 807.91 | |
| Farm Operations | -21.39 | |
| Dormitory and Residences | 4,011.18 | |
| Library | 351.57 | |
| Office | 1,894.38 | |
| Laboratory | 1,575.45 | 9,000.36 |
| Construction: | | |
| General | $ 351.92 | |
| Dormitory Divisions | 1,490.20 | |
| Laboratory Installations | 1,056.90 | |
| Servants' Houses | 431.05 | |
| Casitas | 2,283.78 | |
| Addition to Faculty Residence | 2,445.75 | |
| La Lola Cacao Farm Residence | 5,279.25 | |
| New Institute Houses | 11,926.36 | 25,265.21 |
| Total Forward | | $240,735.30 |

Schedule A-1
Sheet 5

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $240,735.30 |
| DEMONSTRATION FARM | | |
| Department of Animal Industry: | | |
| Labor | $10,438.33 | |
| Supplies and Services | 2,162.38 | |
| Purchase of Animals | 19,976.81 | |
| Miscellaneous | 1,116.92 | 33,694.44 |
| Department of Plant Industry: | | |
| Supplies and Services | $ 54.91 | 54.91 |
| Department of Education and Vocational Unit: | | |
| Staff | $ 1,100.00 | 1,100.00 |
| Institute Services: | | |
| Machine Shop: | | |
| Labor | $ 26.03 | |
| Repair of Equipment: | | |
| Labor | 54.19 | |
| Supplies | 83.05 | |
| Gas and Oil | 769.49 | 932.76 |
| Farm Operations: | | |
| Supplies and Services | $ 2.14 | 2.14 |
| Office Expenses: | | |
| Legal Services | $ 400.50 | 400.50 |
| Equipment Purchased: | | |
| Animal Industry | $ 7,061.63 | |
| Farm Operations | 1,871.66 | 8,933.29 |
| Total Forward | | $285,853.34 |

Schedule A-1
Sheet 6

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| DEMONSTRATION FARM, Continued | | |
| Total Forwarded | | $285,853.34 |
| Construction: | | |
| Creamery | $10,497.42 | |
| Manager's Residence | 6,051.40 | |
| Central Poultry Building | 2,922.57 | |
| Laying Houses | 1,345.21 | |
| Sire Flock House | 160.57 | |
| Central Hog House | 3,544.22 | |
| Fattening Pens | 1,843.56 | |
| Portable Houses | 111.01 | |
| Beef Corrals | 9,198.49 | |
| Electric Installations | 3,510.95 | |
| Fences | 6,377.58 | |
| General Bodega | 20.94 | |
| Silos | 976.57 | |
| Calf Barns | 1,580.35 | |
| Implement Shed | 1,753.93 | |
| Slaughter House | 778.66 | 50,673.43 |
| VOCATIONAL UNIT | | |
| Department of Education and Vocational Unit: | | |
| Staff | $ 2,640.00 | |
| Travel | 1,443.88 | |
| Supplies and Services | 473.48 | |
| Miscellaneous | 503.66 | 5,061.02 |
| Equipment Purchased: | | |
| Dormitory and Residences | $ 329.77 | 329.77 |
| Total Forward | | $341,917.56 |

Schedule A-1
Sheet . 7

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $341,917.56 |
| CACAO PROJECT | | |
| Staff | $ 6,042.52 | |
| Student and Technician: | | |
| Salaries | 1,632.52 | |
| Maintenance | 3,465.58 | |
| Travel | 1,881.93 | |
| Clerk and Data Analyst | 1,295.85 | |
| Equipment and Supplies | 5,919.53 | |
| Local Transportation | 30.80 | |
| International Transportation | 1,342.77 | |
| Institute Overhead | 906.19 | |
| Cacao Expense | 1,683.87 | |
| Books and Periodicals | 37.22 | 24,238.78 |
| ESJO PROJECT | | |
| Student Salaries | $ 1,182.09 | |
| Student Maintenance | 1,202.05 | |
| Labor and Student Social Security Payments | 1,004.58 | |
| Equipment and Supplies | 2,251.95 | |
| Travel | 931.07 | 6,571.74 |
| ESTATE MANAGER, PANAMA RUBBER SUB-STATION | | |
| Labor | $ 2,987.35 | |
| Travel | 110.80 | |
| Supplies and Services | 181.37 | 3,279.52 |
| Total Forward | | $376,007.60 |

Schedule A-1
Sheet 8

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF CASH DISBURSEMENTS

JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $376,007.60 |
| EXECUTIVE HEADQUARTERS, WASHINGTON, D.C. | | |
| Administrative Salaries | $10,689.17 | |
| Travel | 771.80 | |
| Printing and Translations | 437.92 | |
| Expenses of Executive Offices and Miscellaneous | 3,126.64 | 15,025.53 |
| Miscellaneous Charges to Accounts Receivable (Net) | | 17,102.16 |
| Payments on Accounts Payable | | 20,087.83 |
| Repayment of Pan American Union Advance | | 25,000.00 |
| Inventory Purchases - Costa Rica | | 4,385.77 |
| Sundry Unclassified Deferred Expenses | | 131.42 |
| Expenses of Prior Year Charged to Working Fund Reserve | | 2,023.36 |
| TOTAL DISBURSEMENTS | | $459,763.67 |

Exhibit B

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## STATEMENT OF FUND ASSETS

## JUNE 30, 1948

| | | |
|---|---|---|
| **INSTITUTE GENERAL FUND** | | |
| CASH AND RECEIVABLES: | | |
| Petty Cash Funds | $4,026.63 | |
| Cash in Banks | 2,980.12 | |
| Accounts Receivable, Net Amounts Due from Students, Faculty, and Staff Members | 7,439.66 | $14,446.41 |
| INVENTORY OF CONSTRUCTION SUPPLIES | | 4,385.77 |
| FIXED ASSETS (No Values Shown in Accounts See Note) | | - |
| SUNDRY DEFERRED CHARGES | | 131.42 |
| | | $18,963.60 |
| **DEMONSTRATION FARM AND VOCATIONAL UNIT FUND** | | |
| CASH IN BANK | | $ 588.15 |
| DUE FROM INSTITUTE GENERAL FUND (Contra A) | | 20,180.79 |
| FIXED ASSETS (No Values Shown in Accounts See Note) | | - |
| | | $20,768.94 |
| **AMERICAN COCOA RESEARCH INSTITUTE FUND** | | |
| DUE FROM INSTITUTE GENERAL FUND (Contra B) | | $24,509.25 |
| | | $24,509.25 |
| **ESSO RESEARCH FELLOWSHIP FUND** | | |
| DUE FROM INSTITUTE GENERAL FUND (Contra C) | | $ 2,625.48 |
| | | $ 2,625.48 |
| TOTAL FUND ASSETS | | $66,867.27 |

Exhibit B

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## STATEMENT OF LIABILITIES AND RESERVES

## JUNE 30, 1948

### INSTITUTE GENERAL FUND

| | | | |
|---|---|---|---|
| **LIABILITIES:** | | | |
| Accounts Payable, Outstanding Purchase Commitments | | $ 25,407.56 | |
| The Demonstration Farm and Vocational Unit Fund (Contra A) | | 20,180.79 | |
| The American Cocoa Research Institute Fund (Contra B) | | 24,509.25 | |
| The Esso Research Fellowship Fund (Contra C) | | 2,625.48 | $72,723.08 |
| **DEFERRED CREDIT:** | | | |
| Quota Assessment Income Collected in Advance | | | 827.21 |
| **INSTITUTE GENERAL RESERVE:** | | | |
| Balance, June 30, 1948 (Schedule B-1) | | | - 54,586.69 |
| | | | $18,963.60 |

### DEMONSTRATION FARM AND VOCATIONAL UNIT FUND

| | | | |
|---|---|---|---|
| **DEMONSTRATION FARM AND VOCATIONAL UNIT RESERVE:** | | | |
| Balance, June 30, 1947 | | $ - | |
| Addition: Total Grants During Period | | 133,000.00 | |
| | | $133,000.00 | |
| Deductions: | | | |
| Transfer of Prior Year's Charges Against Institute General Reserve | -$ 2,537.31 | | |
| Excess of Expenditures Over Income for the Period (Exhibit D) | - 109,693.75 | - 112,231.06 | $20,768.94 |
| | | | $20,768.94 |

### AMERICAN COCOA RESEARCH INSTITUTE FUND

| | | | |
|---|---|---|---|
| **AMERICAN COCOA RESEARCH INSTITUTE RESERVE:** | | | |
| Balance, June 30, 1947 | | $ - | |
| Addition: Total Grant for the Period | | 50,000.00 | |
| | | $ 50,000.00 | |
| Deductions: | | | |
| Transfer of Prior Year's Charges Against Institute General Reserve | -$ 71.33 | | |
| Expenditures for the Period (Exhibit E) | - 25,419.42 | - 25,490.75 | $24,509.25 |
| | | | $24,509.25 |

### ESSO RESEARCH FELLOWSHIP FUND

| | | | |
|---|---|---|---|
| **ESSO RESEARCH FELLOWSHIP RESERVE:** | | | |
| Balance, June 30, 1947 | | $ - | |
| Addition: Total Grant for the Period | | 9,500.00 | |
| | | $ 9,500.00 | |
| Deduction: Expenditures for the Period (Exhibit F) | | - 6,874.52 | $ 2,625.48 |
| | | | $ 2,625.48 |

TOTAL LIABILITIES AND RESERVES $96,867.27

STATEMENT OF FUND ASSETS, LIABILITIES, AND RESERVES
(Exhibit B)

N O T E

Under the accounting procedure followed by the Institute the costs of acquisition of equipment and construction of buildings and improvements have not been capitalized.

Schedule B-1

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## SCHEDULE OF INSTITUTE GENERAL RESERVE

## INSTITUTE GENERAL FUND

## FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | | |
|---|---|---|---|
| BALANCE, JUNE 30, 1947 | | | -$37,256.15 |
| Additions: | | | |
| Excess of Expenditures Over Income for the Period (Exhibit C) | | -$19,681.83 | |
| Expenditures Applicable to Prior Year Applied Against Institute General Reserve | | - 2,179.69 | - 21,861.52 |
| | | | -$59,117.67 |
| Deductions: | | | |
| Gain on Trade-In of Official Cars | | $ 1,922.34 | |
| Transfer of Prior Year's Charges Against Institute General Reserve: | | | |
| Demonstration Farm and Vocational Unit Reserve | $2,537.31 | | |
| American Cocoa Research Institute Reserve | 71.33 | 2,608.64 | 4,530.98 |
| BALANCE, JUNE 30, 1948 | | | -$54,586.69 |

Exhibit C

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## STATEMENT OF INCOME AND EXPENDITURES

## INSTITUTE GENERAL FUND

## FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| **INCOME:** | | |
| Quota Assessments | $169,904.79 | |
| Sale of Cane | 28,381.91 | |
| Sale of Coffee | 3,546.25 | |
| Sale of Miscellaneous Farm Products | 2,585.88 | |
| Sale of Medical Supplies | 1,996.43 | |
| Sale of Books | 86.00 | |
| Sale of Stone | 30.30 | |
| Sale of Animals | 5,377.33 | |
| Sale of Meals and Laundry | 14,296.48 | |
| Sale of Rubber Seed | 1,140.00 | |
| Sale of Houses | 219.00 | |
| Gain on Exchange | 17,958.00 | |
| Miscellaneous | 45.06 | $245,567.43 |
| **EXPENDITURES:** (Schedule C-1) | | |
| Office of the Director | $ 15,228.79 | |
| Department of Animal Industry | 11,171.66 | |
| Department of Plant Industry | 45,849.80 | |
| Department of Agricultural Engineering | 17,773.86 | |
| Department of Economics and Rural Welfare | 11,198.57 | |
| Department of Education and Vocational Unit | 2,974.33 | |
| Institute Services | 27,937.67 | |
| Farm Operations | 9,368.82 | |
| Dormitory Operations | 19,153.98 | |
| Library | 6,548.94 | |
| Office | 23,095.55 | |
| Medical and Social Security | 2,982.59 | |
| Miscellaneous | 18,845.86 | |
| Equipment Purchased | 9,720.22 | |
| Estate Manager, Panama | 3,332.02 | |
| Executive Headquarters, Washington, D. C. | 13,688.86 | |
| Construction | 26,377.74 | 265,249.26 |
| EXCESS OF EXPENDITURES OVER INCOME | | -$ 19,681.83 |

Schedule C-1
Sheet 1

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

INSTITUTE GENERAL FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Office of the Director: | | |
| Staff | $15,228.79 | $ 15,228.79 |
| Department of Animal Industry: | | |
| Staff | $ 8,400.00 | |
| Labor | 2,085.87 | |
| Supplies and Services | 210.83 | |
| Student Maintenance | 458.82 | |
| Miscellaneous | 16.14 | 11,171.66 |
| Department of Plant Industry: | | |
| Staff | $21,100.01 | |
| Labor | 20,752.90 | |
| Supplies and Services | 2,844.87 | |
| Student Maintenance | 1,152.02 | 45,849.80 |
| Department of Agricultural Engineering: | | |
| Staff | $ 9,607.68 | |
| Labor | 5,144.53 | |
| Supplies and Services | 2,991.52 | |
| Student Materials | 30.13 | 17,773.86 |
| Department of Economics and Rural Welfare: | | |
| Staff | $ 7,340.00 | |
| Clerical Salaries | 1,657.00 | |
| Supplies and Services | 467.41 | |
| Travel | 1,101.28 | |
| Student Maintenance | 632.88 | 11,198.57 |
| Department of Education and Vocational Unit: | | |
| Staff | $ 660.00 | |
| Travel | 2,314.33 | 2,974.33 |
| Total Forward | | $104,197.01 |

Schedule C-1
Sheet 2

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

INSTITUTE GENERAL FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | | |
|---|---|---|---|
| Total Forwarded | | | $104,197.01 |
| **Institute Services:** | | | |
| Roads and Landscaping: | | | |
| Labor | $2,886.97 | | |
| Supplies and Services | 118.84 | $ 3,005.81 | |
| Light Plant Maintenance: | | | |
| Labor | $1,653.46 | | |
| Supplies and Services | 4,843.10 | 6,496.56 | |
| Machine Shop: | | | |
| Labor | $4,756.97 | | |
| Supplies and Services | 179.97 | 4,936.94 | |
| Repair of Buildings: | | | |
| Labor | $1,482.91 | | |
| Supplies and Services | 628.77 | 2,111.68 | |
| Repair of Equipment: | | | |
| Labor | $ 112.24 | | |
| Supplies and Services | 4,840.36 | 4,952.60 | |
| Gas and Oil | | 5,472.08 | |
| Storeroom | | 671.95 | |
| Watchmen | | 290.05 | 27,937.67 |
| **Farm Operations:** | | | |
| Coffee: | | | |
| Labor | $ 258.34 | | |
| Supplies and Services | - 290.09 | - 31.75 | |
| Cane: | | | |
| Labor | $5,723.10 | | |
| Supplies and Services | 1,906.01 | 7,629.11 | |
| Other Land Products: | | | |
| Labor | $ 137.12 | | |
| Supplies and Services | 69.74 | 256.86 | |
| General Labor | | 1,514.60 | 9,368.82 |
| Total Forward | | | $141,503.50 |

Schedule C-1
Sheet 3

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

INSTITUTE GENERAL FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | | |
|---|---|---|---|
| Total Forwarded | | | $141,503.50 |
| Dormitory Operations: | | | |
| Dining Room: | | | |
| Labor | $ 2,322.57 | | |
| Supplies and Services | 13,037.66 | | |
| Snack Bar | 27.53 | | |
| Miscellaneous | 280.43 | $15,668.19 | |
| Housekeeping Expense: | | | |
| Labor | $ 1,419.08 | | |
| Supplies and Services | 1,339.90 | | |
| Miscellaneous | 12.48 | 2,771.46 | |
| Laundry: | | | |
| Labor | $ 513.54 | | |
| Supplies and Services | 200.79 | 714.33 | 19,153.98 |
| Library: | | | |
| Staff | | $ 3,512.51 | |
| Office Supplies | | 720.99 | |
| Supplies and Services | | 752.70 | |
| Books and Periodicals | | 1,562.74 | 6,548.94 |
| Office: | | | |
| Salaries | | $14,122.22 | |
| Supplies and Services | | 3,851.90 | |
| Legal Services | | 1,800.00 | |
| Insurance | | 1,936.42 | |
| Communications | | 1,385.01 | 23,095.55 |
| Medical and Social Security: | | | |
| Social Security Tax | | $ 2,793.64 | |
| Student Care | | 188.95 | 2,982.59 |
| Total Forward | | | $193,284.56 |

Schedule C-1
Sheet 4

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

INSTITUTE GENERAL FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $193,284.56 |
| Miscellaneous: | | |
| Cesantia and Pre Aviso | $ 1,299.67 | |
| Student Facilities | 94.85 | |
| Travel | 15,494.04 | |
| Miscellaneous | 1,957.30 | 18,845.86 |
| Equipment Purchased: | | |
| Plant Industry | $ 8.14 | |
| Agricultural Engineering | 943.46 | |
| Institute Services | 807.91 | |
| Farm Operations | - 21.39 | |
| Dormitory and Residences | 4,074.99 | |
| Library | 351.57 | |
| Office | 1,894.38 | |
| Laboratory | 1,661.16 | 9,720.22 |
| Estate Manager, Panama: | | |
| Labor | $ 2,987.35 | |
| Travel | 163.30 | |
| Supplies and Services | 181.37 | 3,332.02 |
| Executive Headquarters, Washington, D.C.: | | |
| Administrative Salaries | $10,689.17 | |
| Travel | 771.80 | |
| Printing and Translations | 437.92 | |
| Expenses of Executive Offices and Miscellaneous | 1,789.97 | 13,688.86 |
| Total Forward | | $238,871.52 |

Schedule C-1
Sheet 5

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

INSTITUTE GENERAL FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $238,871.52 |
| Construction: | | |
| General | $ 433.62 | |
| Dormitory Divisions | 1,490.20 | |
| Laboratory Installations | 1,056.90 | |
| Servants' Houses | 431.05 | |
| Casitas | 2,283.78 | |
| Addition to Faculty Residence | 2,445.75 | |
| La Lola Cacao Farm Residence | 5,279.25 | |
| New Insitute Houses | 12,957.19 | 26,377.74 |
| TOTAL EXPENDITURES | | $265,249.26 |

Exhibit D

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

STATEMENT OF INCOME AND EXPENDITURES

DEMONSTRATION FARM AND VOCATIONAL UNIT FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| INCOME: | | |
| Sale of Miscellaneous Farm Products | $ 2,347.79 | |
| Pasturage Rental | 216.84 | |
| Sale of Animals | 50.14 | |
| Sale of Meals | 27.87 | $ 2,642.64 |
| EXPENDITURES: (Schedule D-1) | | |
| Department of Animal Industry | $34,055.04 | |
| Department of Plant Industry | 54.91 | |
| Department of Education and Vocational Unit | 6,171.62 | |
| Institute Services | 932.76 | |
| Farm Operations | 2.14 | |
| Office Expenses | 400.50 | |
| Equipment Purchased | 18,630.06 | |
| Construction | 52,089.36 | 112,336.39 |
| EXCESS OF EXPENDITURES OVER INCOME | | -$109,693.75 |

Schedule D-1
Sheet 1

# INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

## SCHEDULE OF EXPENDITURES

## DEMONSTRATION FARM AND VOCATICNAL UNIT FUND

## FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | | |
|---|---|---|---|
| **Department of Animal Industry:** | | | |
| Labor | | $10,438.33 | |
| Supplies and Services | | 2,274.50 | |
| Purchase of Animals | | 20,171.81 | |
| Miscellaneous | | 1,170.40 | $ 34,055.04 |
| **Department of Plant Industry:** | | | |
| Supplies and Services | | $ 54.91 | 54.91 |
| **Department of Education and Vocational Unit:** | | | |
| Staff | | $ 3,740.00 | |
| Travel | | 1,443.88 | |
| Supplies and Services | | 475.53 | |
| Miscellaneous | | 512.21 | 6,171.62 |
| **Institute Services:** | | | |
| Machine Shop: | | | |
| Labor | | $ 26.03 | |
| Repair of Equipment: | | | |
| Labor | $54.19 | | |
| Supplies and Services | 83.05 | 137.24 | |
| Gas and Oil | | 769.49 | 932.76 |
| **Farm Operations:** | | | |
| Other Land Products: | | | |
| Supplies and Services | | $ 2.14 | 2.14 |
| **Office Expenses:** | | | |
| Legal Services | | $ 400.50 | 400.50 |
| Total Forward | | | $ 41,616.97 |

Schedule D-1
Sheet 2

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

SCHEDULE OF EXPENDITURES

DEMONSTRATION FARM AND VOCATIONAL UNIT FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Total Forwarded | | $ 41,616.97 |
| Equipment Purchased: | | |
| Animal Industry | $16,428.63 | |
| Farm Operations | 1,871.66 | |
| Dormitory and Residences | 329.77 | 18,630.06 |
| Construction: | | |
| Creamery | $10,497.42 | |
| Manager's Residence | 6,074.14 | |
| Central Poultry Building | 2,922.57 | |
| Laying Houses | 1,345.21 | |
| Sire Flock House | 160.57 | |
| Central Hog House | 3,544.22 | |
| Fattening Pens | 1,843.56 | |
| Portable Houses | 111.01 | |
| Beef Corrals | 9,381.72 | |
| Electric Installations | 3,510.95 | |
| Fences | 6,377.58 | |
| General Bodega | 1,054.44 | |
| Silos | 976.57 | |
| Calf Barns | 1,580.35 | |
| Implement Shed | 1,753.93 | |
| Slaughter House | 955.12 | 52,089.36 |
| TOTAL EXPENDITURES | | $112,336.39 |

Exhibit E

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

STATEMENT OF EXPENDITURES

AMERICAN COCOA RESEARCH INSTITUTE FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | | |
|---|---|---|
| Staff | | $ 6,042.52 |
| Student and Technician: | | |
| Salaries | $1,632.52 | |
| Maintenance | 3,465.58 | |
| Travel | 1,881.93 | 6,980.03 |
| Clerk and Data Analyst | | 1,295.85 |
| Equipment and Supplies | | 7,095.71 |
| Local Transportation | | 30.80 |
| International Transportation | | 1,342.77 |
| Institute Overhead | | 910.65 |
| Cacao Expense | | 1,683.87 |
| Books and Periodicals | | 37.22 |
| TOTAL EXPENDITURES | | $ 25,419.42 |

Exhibit F

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

STATEMENT OF EXPENDITURES

ESSO RESEARCH FELLOWSHIP FUND

FOR THE PERIOD JULY 1, 1947 TO JUNE 30, 1948

| | |
|---|---|
| Student Salaries | $1,182.09 |
| Student Maintenance | 1,202.05 |
| Labor and Student Social Security Payments | 1,004.58 |
| Equipment and Supplies | 2,315.33 |
| Travel | 1,170.47 |
| TOTAL EXPENDITURES | $6,874.52 |

## REPORT OF THE SPECIAL COMMITTEE OF THE BOARD OF DIRECTORS ON THE BUDGET FOR THE FISCAL YEAR 1948-49

We, the undersigned members of the Special Committee of the Board of Directors of the Inter-American Institute of Agricultural Sciences, met at the Pan American Union on July 8, 1948 to consider the budget prepared by the Director of the Institute for the fiscal year ending June 30, 1949 and, after careful study and discussion, have the honor to submit the following report with the recommendation that it be approved.

The estimated income of the Institute for the fiscal year 1949 totals $412,018, consisting of $291,818 in revenue from public sources and $120,200 from private grants for special projects. Funds received from private sources are accounted for separately.

The Institute's revenue of $291,818 from public sources is made up of $183,309.43 in current quotas from the American Republics, $35,333.50 from delinquent quotas, and $73,175 from the sale of farm produce and miscellaneous income. Estimated revenues from public sources for the fiscal year 1949 represent a net decrease of $767 under such estimates for the fiscal year 1948.

The following countries have deposited instruments of ratification at the Pan American Union, and their current quotas for the support of the Institute are as follows:

| | |
|---|---|
| Costa Rica | $ 771.50 |
| Dominican Republic | 2,059.11 |
| El Salvador | 1,977.85 |
| Guatemala | 3,606.21 |
| Honduras | 1,201.31 |
| Mexico | 22,226.55 |
| Nicaragua | 1,082.44 |
| Panama | 687.95 |
| United States | 145,396.87 |
| Venezuela | 4,299.64 |
| Total | $183,309.43 |

Income in the form of special grants from private institutions and individuals consists of the following:

| | |
|---|---|
| American Cocoa Research Institute grant | $ 50,000 |
| American International Association for Economic and Social Development | 25,000 |
| DuPont Fellowships grant | 2,700 |
| Esso Fellowships grant | 9,500 |
| King Ranch grant | 33,000 |
| Total | $120,200 |

Expenditures from the above grants are contemplated in the amount of $115,270 for training fellowships and special research projects, leaving a balance of $4,930 to be transferred to the general funds for administrative overhead.

The estimated expenditures, exclusive of funds from private sources to be used for projects, totals $272,818, leaving a balance of $19,000 for retirement of prior year indebtedness. A supplementary schedule and textual justifications by departments indicate in detail the intended objects of expenditure. The Committee recommends, however, that the Director be authorized, subject to the approval of the Treasurer, to transfer appropriated funds from one category to another in order to achieve a balanced development of the program throughout the year.

In conclusion, the Committee wishes to assert its conviction that a strong nucleus of income from the quotas is essential to the continued development of this productive service to the American States. Special grants, while most helpful in the development of new projects, may not be solicited for the regular expenses of the Institute. The Committee recommends that the Board consider the necessity of obtaining ratification of the Institute's

Convention by the several countries that have not yet completed this formality.

(Signed) _____
Ambassador Representative of the Dominican Republic

(Signed) _____
Ambassador Representative of the United States

(Signed) _____
Ambassador of Costa Rica

July 8, 1948

# BUDGET SUMMARY

## FISCAL YEAR 1948-49

### ESTIMATED INCOME

| Public Revenue | 1949 | |
|---|---|---|
| National Quotas | $ 218,643 | |
| Produce and Miscellaneous | 73,175 | $ 291,818 |
| Private Grants | | 120,200 |
| TOTAL | | $ 412,018 |

### ESTIMATED EXPENDITURES

| | | |
|---|---|---|
| **General Institute** | | |
| Public Funds | $ 254,633 a/ | |
| DuPont Fellowships | 2,700 | |
| Esso Fellowships | 8,650 | |
| King Ranch Grant | 33,000 | |
| Deduct Salary, Cacao Center | -5,000 | $ 293,983 |
| **Demonstration Farm** | | |
| Public Funds | 23,875 | |
| American International Association | 25,000 | 48,875 |
| **Vocational Unit** | | |
| Public Funds | 18,240 | 18,240 |
| **Inter-American Cacao Center** | | |
| Public Funds | 5,000 | |
| American Cocoa Research Institute | 45,920 | 50,920 |
| TOTAL | | $ 412,018 |

a/ Includes $4,080 from the American Cocoa Research Institute grant and $850 from the Esso Research Fellowships grant transferred to the General Institute for administrative overhead.

ESTIMATED REVENUE FROM PUBLIC SOURCES

| Source | 1948 | 1949 | | |
|---|---|---|---|---|
| | | Demonstration Farm | General Institute | Total |
| National Quotas: | | | | |
| Current year | $196,998 | ----- | $183,309 | $183,309 |
| Delinquent | 22,382 a/ | ----- | 35,334 | 35,334 |
| Sale of Produce: | | | | |
| Cattle | 10,075 | $ 1,125 | ----- | 1,125 |
| Milk | 10,500 | 7,000 | ----- | 7,000 |
| Poultry | 400 | 500 | ----- | 500 |
| Eggs | 270 | 3,000 | ----- | 3,000 |
| Swine | ----- | 1,500 | ----- | 1,500 |
| Cacao | ----- | 5,000 | ----- | 5,000 |
| Coffee | 4,750 | 900 | 6,500 | 7,400 |
| Fruits and vegetables | 600 | 1,900 | ----- | 1,900 |
| Sugar cane | 32,000 | 1,500 | 12,000 | 13,500 |
| Firewood | 1,000 | ----- | ----- | ----- |
| Other Products | 1,210 | 1,250 | ----- | 1,250 |
| Pasture rental | 400 | ----- | ----- | ----- |
| Meals and Laundry | 12,000 | ----- | 15,000 | 15,000 |
| Miscellaneous | ----- | ----- | 16,000 | 16,000 |
| TOTAL | $292,585 | $23,675 | $268,143 | $291,818 |

a/ Includes $14,131 estimated revenue from republics not having ratified the Institute's Convention but having indicated an intention to contribute to its support.

ESTIMATED EXPENDITURES OF PUBLIC FUNDS

| Object | 1948 | 1949 | | | |
|---|---|---|---|---|---|
| | | Demonstration Farm | Vocational Unit | General Institute | Total |
| Office of Director | $ 13,650 | ----- | ----- | $ 14,438 | $ 14,438 |
| Departments: | | | | | |
| Plant Industry | 40,903 | $ 6,855 | ----- | 50,132 | 56,987 |
| Animal Industry | 13,000 | 14,020 | ----- | 7,560 | 21,580 |
| Agricultural Engineering | 23,000 | ----- | ----- | 15,913 | 15,913 |
| Agricultural Economics and Rural Life | 16,520 | ----- | ----- | 17,400 | 17,400 |
| Vocational Education and Extension Service | 4,102 | 1,350 | $18,240 | 4,240 | 23,830 |
| Library | 7,950 | ----- | ----- | 7,000 | 7,000 |
| Office of Registrar | ----- | ----- | ----- | 1,000 | 1,000 |
| Institute services | 28,635 | 400 | ----- | 25,500 | 25,900 |
| Farm operations | 13,563 | 850 | ----- | 9,000 | 9,850 |
| Dormitory operations | 15,140 | ----- | ----- | 23,700 | 23,700 |
| Office expenses | 13,450 | ----- | ----- | 21,650 | 21,650 |
| Medical and social security | 2,400 | ----- | ----- | 3,500 | 3,500 |
| Travel | 13,800 | ----- | ----- | 10,000 | 10,000 |
| Miscellaneous | 2,800 | ----- | ----- | 3,000 | 3,000 |
| Equipment | 23,100 | 400 | ----- | 6,100 | 6,500 |
| Construction | 19,500 | ----- | ----- | 1,500 | 1,500 |
| Panama Substation | 3,000 | ----- | ----- | ----- | ----- |
| Washington office | 17,040 | ----- | ----- | 14,000 | 14,000 |
| Prior year obligations | ----- | ----- | ----- | 19,000 | 19,000 |
| TOTAL EXPENDITURES | $271,553 | $23,875 | $18,240 | $254,633 | $296,748 |
| Deduct transfers from private grants .... | ----- | ----- | ----- | -4,930 | -4,930 |
| TOTAL PUBLIC FUNDS | $271,553 | $23,875 | $18,240 | $249,703 | $291,818 |

## DETAIL OF ESTIMATED REVENUE

### QUOTAS OF THE AMERICAN REPUBLICS FOR THE FISCAL YEAR 1949 a/

| Republic | Population | Quotas at $1.00 per thousand |
|---|---|---|
| Argentina | 16,107,870 | $ 16,107.87 |
| Bolivia | 3,854,100 | 3,854.10 |
| Brazil | 41,565,083 | 41,565.08 |
| Chile | 5,475,057 | 5,475.06 |
| Colombia | 8,701,816 | 8,701.82 |
| ★ Costa Rica | 771,503 | 771.50 |
| Cuba | 5,051,850 | 5,051.85 |
| ★ Dominican Republic | 2,059,113 | 2,059.11 |
| Ecuador | 3,241,311 | 3,241.31 |
| ★ El Salvador | 1,977,849 | 1,977.85 |
| ★ Guatemala | 3,606,205 | 3,606.21 |
| Haiti | 2,719,474 | 2,719.47 |
| ★ Honduras | 1,201,310 | 1,201.31 |
| ★ Mexico | 22,226,551 | 22,226.55 |
| ★ Nicaragua | 1,082,439 | 1,082.44 |
| ★ Panama | 687,952 | 687.95 |
| Paraguay | 1,144,731 | 1,144.73 |
| Peru | 7,991,777 | 7,991.78 |
| ★ United States | 145,396,871 | 145,396.87 |
| Uruguay | 2,218,968 | 2,218.97 |
| ★ Venezuela | 4,299,638 | 4,299.64 |
| TOTAL | 281,381,468 | $281,381.47 |

a/ Populations used are those effective for the quotas of the Pan American Union, and computations are shown for all the American Republics regardless of expressions of intentions with respect to support of the Institute.

★ These countries have deposited ratifications, and their quotas for the fiscal year 1949 amount to $183,309.43. It is also expected that contributions will be received from countries that have not ratified the Convention at the beginning of the fiscal year.