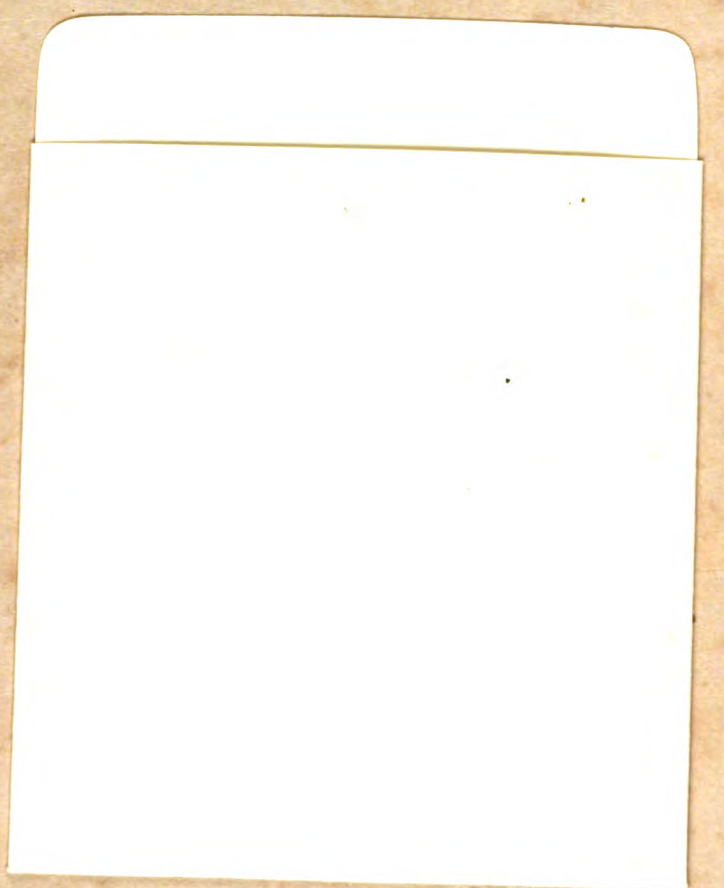


FISCAL YEAR 1945-46

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.

CONTENTS

REPORT

OF THE

DIRECTOR

FISCAL YEAR ENDING JUNE 30, 1946

Gentlemen of the Board of Directors:

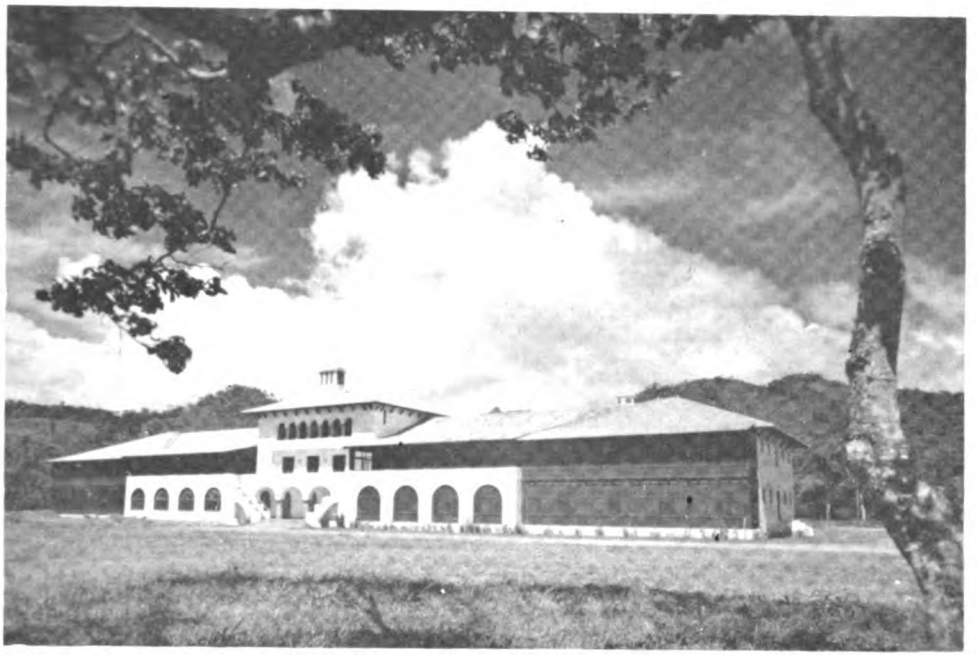
In fulfillment of the provisions of Article III of the Convention of the Inter-American Institute of Agricultural Sciences, I have the honor to submit herewith the Annual Report setting forth the work of the Institute during the fiscal year 1945-46 and containing a budget and statements of the general conditions and financial status of the Institute.

We have not attempted to account in detail for all of the activities indicated in the Third Annual Report of the Institute. Most of the projects then reported are under way or are being studied for initiation when personnel and facilities are such as to assure accomplishments.

The staff is grateful for the understanding and assistance accorded to the work of the Institute by the Board of Directors. During this year of transition we have also realized the great value of association within the established Inter-American System. The guidance and assistance of the Secretary and Treasurer of the Institute and of other members of the Pan American Union Staff are greatly appreciated.

Respectfully submitted,

RALPH H. ALLEE
Director



Central Building of the Institute

One of the Large Faculty Houses Occupied by Department Heads

CONVENTION OR TREATY

The process of signing and ratifying conventions by governments is normally a very slow one, particularly when it involves contributions or quotas. At the time of the publication of this report ten countries have signed and deposited the Convention of the Institute in the Pan American Union and therefore are contributing to the support of the Organization. These are: Costa Rica, Nicaragua, the United States, Honduras, the Dominican Republic, El Salvador, Guatemala, Venezuela, Panama, and Mexico.

The Senate of the Argentine has approved the Convention of the Institute and has transmitted the instrument to the House of Representatives for their approval at the forthcoming regular session of the House on May 1. Another country that may sign and ratify the Convention of the Institute in the near future is Colombia. All efforts are being made to secure the signature and ratification of the other countries that have not as yet done so. Those that have signed the treaty are the following: Costa Rica, Nicaragua, Panama, the United States, Cuba, Ecuador, Honduras, the Dominican Republic, El Salvador, Guatemala, Uruguay, Chile, Bolivia, Venezuela, and Mexico.

INTRODUCTION

Although this is the fourth annual report, the Inter-American Institute of Agricultural Sciences was established officially only on December 1, 1944. Previous to that date plants had been introduced and some breeding work begun, but the period between December 1, 1944 and the end of the fiscal year 1945-46 was largely devoted to the tremendous task of preparing to do research and teaching. Fields, many of which have been unfarmed for some time, have been prepared for experimental plantings and pastures; roads have been built, buildings constructed, and a quantity of plants of value to a research program introduced. Useful observations on the performance of these plants have been made and some research has been possible.

Preparations have been made and some preliminary research initiated with farm animals. Agricultural engineering projects and those in economics and sociology will develop substantially during the coming year.

A group of eight students from six countries have had the unique opportunity of participating in the initiatory phases of the Institute program. They have gained in their professional improvement, commensurate with the contribution which they have made to the building of an effective program for training in research. Teaching, always dependent upon research in a graduate institution, will develop at the Institute as our research projects and facilities develop.

Building the program of a central institution serving the interests of twenty-one countries is in itself a project in social engineering. The idea which must be served, the means of approach, and the organization required are as much the subject of experimentation as are the limiting agricultural problems for the solution of which the Institute was created. We can, however, proceed with this experiment in international collaboration with the conviction that our efforts will be successful.

The ability of science to raise levels of living has been conclusively demonstrated and the methods of translating verified knowledge into human welfare are well established. Progress toward a useful research and educational program, achieved at the Institute during these difficult years, is evidence that this unique international institution can complement national activity to the benefit of all the Americas.

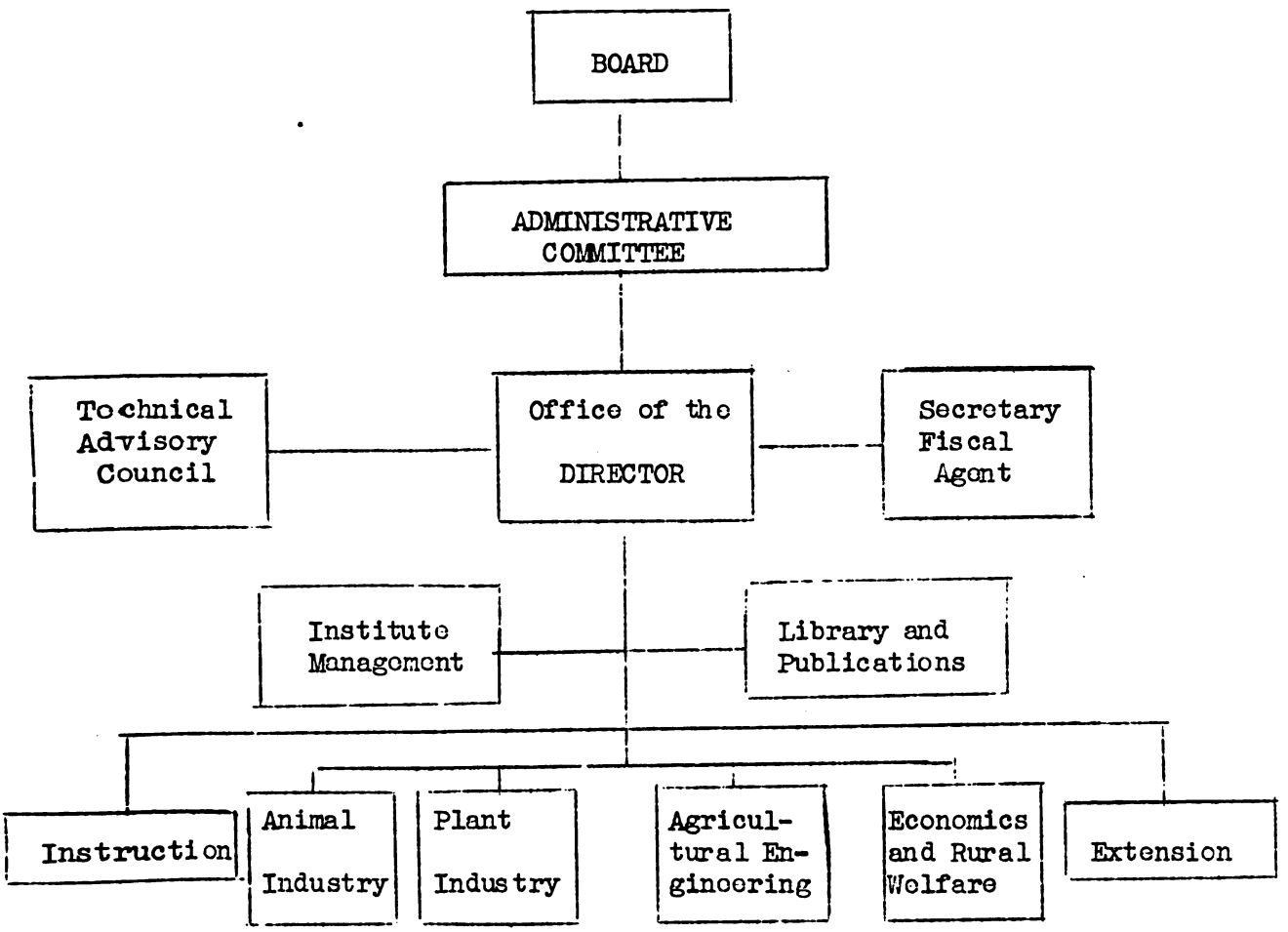
To this end the Institute will:

a. Diagnose problems of a limiting nature in the member countries on the basis of full information on existing conditions and intimate acquaintance with programs under way or planned.

b. Become competent in the applying of the existing resources from within or without the hemisphere.

c. Supplement these resources when necessary and stimulate action with a planned sense of coordination.

The organization of the Institute during the immediate future will be as follows:



Research, extension, and education will all be carried out by the four main departments. The various lines of work organized into projects will involve cooperation by any of the staff required, regardless of the Department to which he or she is assigned.

The specialized functions necessary to insure adequate instruction will for the time being be carried out by the Director, assisted by a committee of the staff.

Extension and extension programs are of such great importance in the member countries that a qualified individual to head this work should be appointed as soon as funds permit. Chemistry, Forestry, and Home Economics and Nutrition should soon be among the main lines of work.

PERSONNEL

At the close of the fiscal year the Staff included:

Ralph H. Allee, Director

José L. Colom, Secretary - Washington, D.C.

Lowell Curtiss, Treasurer - Washington, D.C.

Mariano Anderson, Attorney - San José, Costa Rica

Julio O. Morales, Acting Manager and Economist

Albert O. Rhoad, (Head) Animal Industry

Oscar Echandi, Animal Husbandman

Norton C. Ives, Agricultural Engineering

Joseph L. Fennell, General Horticulture

Ernesto H. Casseres, Vegetable Crops

Hernán Montealegre, Superintendent

George Slater, Superintendent - Gatún Lake, Panama

Earl N. Bressman resigned as Director on January 8, 1946 and was replaced by Ralph H. Allee on May 1. Robert A. Nichols, Rice B. Ober and Robert L. Squibb resigned during the year. Ernesto H. Casseres, previously with W. Atlee Burpee Co., and more recently occupied with further graduate studies at Cornell University, entered the service of the Institute on April 1, 1946. Julio O. Morales, previously Agricultural Economist at the Río Piedras Experiment Station in Puerto Rico, joined the Staff of the Institute on May 1, 1946. Albert O. Rhoad served during the year as Dean of the Faculty, but this position has now been replaced by a committee serving under the Director.

By June 30, 1946, unskilled labor had been reduced to 165 men as compared with 328 employed on July 1, 1945. However, a gradual increase will take place in the number of scientific aides and skilled workmen.

The research and teaching capacity of the Staff was augmented by visiting scientists. Among these the following were at the Institute for a sufficient time to review projects in their respective fields and conduct seminars:

Wilson Popenoe, Director,

Escuela Agrícola Panamericana

Walter N. Bangham, Director,

Plantation Research, Goodyear Tire and Rubber Company

William Vogt, Chief,

Conservation Section, Pan American Union

F. Martin Brown, Entomologist,

Colorado Springs, Colorado, U.S.A.

Plans are being made to have several of the hemisphere's leading scientists in residence at the Institute during the year 1946-47. In addition to guest scientist and temporary members of the Staff specifically invited to participate in the program, the Institute should become an important center for naturalists and others who desire a base from which to study tropical phenomena.

THE ADMINISTRATIVE COMMITTEE

On December 5, 1945 an Administrative Committee was appointed by the Board of Directors to be responsible for the general plan of development and scope of the Institute activities. The present members of the Committee are:

H. Harold Hume, Provost for Agriculture

Dean of the College of Agriculture
University of Florida, U.S.A.

Robert Earle Buchanan, Director

Agricultural Experiment Station, and
Dean of the Graduate School
Iowa State College of Agriculture and Mechanic Arts, U.S.A.

Manuel Elgueta, Director

Department of Plant Genetics
Ministry of Agriculture, Chile

Luis Cruz, B., Under Secretary

Department of Agriculture, Costa Rica

Ralph H. Allee, Director

Inter-American Institute of Agricultural Sciences
member ex-officio

José L. Colom, Secretary

Inter-American Institute of Agricultural Sciences;
Secretary of the Committee

This Committee is to meet in Turrialba as soon as possible after June 30, 1946.

Dining Hall in the Central Building

Entrance Hall and Lounge in the Central Building

CONSTRUCTION AND DEVELOPMENT

The Administrative and Laboratory Wing of the central building is almost completed, the lower floor providing ample office space for the Staff of the Institute and for visiting scientists, and the upper floor being equipped with semi-portable partitions to permit adjustments as the program develops. A general complement of laboratory equipment will be installed with space and services available for several smaller laboratories to be used in cooperative research programs with other institutions, agencies, or concerns.

A general purpose dairy barn, bull barn, seed house and poultry house have been built and work is under way on a roofed working area for beef cattle, including spray chutes, weighing scales, holding pens and other facilities. This 30 x 170 foot shelter will also be used for dairy calves, horses, a slaughter house and some storage for the present. A woodworking shop is being installed temporarily in shelters previously erected for construction purposes, and the main warehouse has been extended to provide more satisfactory space for the machine shop. A complete engineering laboratory, including shops, has been planned and will be constructed as soon as funds are available. Preliminary plans for a dairy test barn and creamery have been completed. Several additional staff residences will be required in the near future. Various small structures for swine and poultry will be built during the coming year.

In order that this Institute be adequate for the needs of the American Republics, new buildings and facilities must continually be added as the program develops and conditions change with all future building being carried out by the Institute's own construction crew. Economy and utility can be combined with adherence to the Central American colonial style which has been used so successfully in the handsome central building and staff residences, and the fine tropical woods, volcanic stone and other local materials should be used whenever possible.

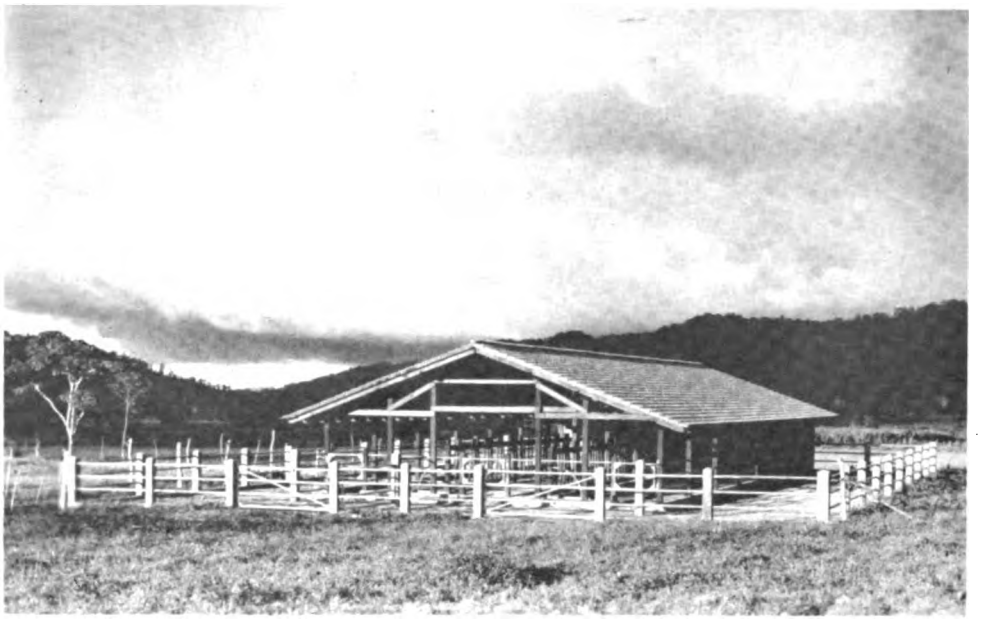
The physical plant of an effective scientific institution is in itself a technical tool. The Institute, however, as a central international establishment, must in the future direct its energies more toward activities which will improve the welfare of farmers and farming than has been possible in the past. A greatly reduced proportion of the total income will go into construction during the coming year and more emphasis can be placed on research and extension talent and on the scientific equipment required to make men efficient. The buildings now in use plus the several additional structures mentioned above will undoubtedly suffice for several years to come.

There are approximately sixteen kilometers (10 miles) of roads on the Institute properties at Turrialba; many of which have been surfaced. Fortunately, there also exists in the region a cinder cone of good road building material. A rock crusher will be installed during the next few months and the roads will be resurfaced so as to permit maintenance with

machinery. As the fields are reorganized for experimental work, many small access roads and paths will also be built.

Although the Turrialba soils are satisfactory for comparative plantings, many changes are required in the field layout in order to permit reliable experimentation. To this end, a topographic survey is being started, the surface stones are being removed, the drainage system must be rationalized to allow development of more regular field lines and some of the steeper slopes are being terraced to permit experimentation with various cultures on this ever present type of terrain. About one hundred hectares (250 acres) now in woods have been designated as a primitive zone and will be left intact for scientific studies of flora and fauna. A complete land-use plan for the entire 1000 hectares (2500 acres) is being made. The American Republics possess in Turrialba a natural laboratory of immense value to science and to farming.

The All Weather Estate of the Institute on Gatún Lake in the Republic of Panama contains about 800 hectares (3000 acres) of land, most of it being in rolling hills slightly more than 100 feet above sea level. Fifteen hundred acres were terraced by the Goodyear Rubber Company, from which the Estate was obtained. This Company also constructed two large comfortable residences and a series of cottages, office and warehouse buildings and docks. All the improved area is served by a tram line. No construction or development work is contemplated at the All Weather Estate for the immediate future. Its fifteen hundred acres of virgin woodland, although not heavily populated with commercial timber, should prove of scientific value.



Rear View of the General Purpose Dairy Barn

Interior of General Purpose Dairy Barn

ANIMAL INDUSTRY

The main objective of a livestock research program for the Americas must be to discover how animal products can be produced at low cost mainly on locally grown feeds. Milk, butter, cheese, eggs, animal fats and meats cannot be purchased by most consumers at present and under existing conditions in quantities sufficient for an adequate diet. To make these nutritious foods available to more consumers, adequate management practices, better pastures and feeds, control of pests and diseases, improved processing equipment and methods, and in some cases more efficient types of livestock will be necessary.

In order to contribute definitely to the solution of this problem the Institute is installing physical facilities and developing pastures as indicated previously in this report. In our judgment facilities for 100 dairy cows, 300 beef animals, 500 poultry, 70 swine, a small flock of sheep and a stud of horses will be required. In addition to a creamery and abattoir, bacteriological, nutritional, climatological and meats laboratories are being planned. As the Plant Industry staff of the Institute increases, the introduction and development of forage crops and experiments in pasture improvement and utilization will be placed on a more systematic basis.

Parallel with the development of these central enterprises a network of cooperative relationships is being established with institutions and individuals in member countries and elsewhere.

Purchase of Livestock

Two Santa Gertrudis bulls purchased from the King Ranch, Texas arrived at Turrialba in good condition on December 29. These are representative specimens of the breed and are to be used in the grading-up program with beef cattle. On March 2, 1946, two Angus-Brahman bulls, purchased from the Essar Ranch, Texas, arrived in good condition. These are excellent specimens of this type and are also to be used in the beef cattle grading-up program outlined elsewhere.

During the months of March and April 1946, 104 chickens showing no indications of improved blood were purchased from 22 different owners in the vicinity of Turrialba. These will serve as foundation breeding stock for the poultry improvement program and genetic material for demonstrational work in animal breeding. These birds are being trap-nested, but not fully fed, in preparation for the first step in selection to be based on weight and egg characters.

Experimental Work

Feeding of coffee pulp silage

Previous experimental work at the Institute with coffee pulp silage as a feed for cattle has indicated this by-product of processing the coffee berry could, when properly supplemented, be fed to steers. Its low palatability required forced feeding and the addition of other feeds to obtain consumption. The early experiments lacked comparative data from which conclusions could be drawn as to its value as a feed. Hence a further study was made.

The 1946 trial resulted in statistically insignificant differences in live weight gains between steers fed coffee pulp silage and the check group, but, although the results were mathematically insignificant, several important facts were evident. Of these the low palatability of coffee pulp silage was very pronounced, necessitating the addition of concentrates to obtain reasonable consumption. The average daily consumption was 39.0 pounds of silage. This appears to be about the capacity for 800 pound steers.

Egg Production and Rainfall

That daylight affects the rate of laying in poultry is well established. This phenomena is indicated in the relationship between egg production and precipitation with the Institute flock for the three full months for which data is available. The rhythmic production during May and June with almost cessation during July follows in a general way the precipitation record of these months. No changes in feeding or management were made during this period.

The flocks were fed adequately, but not for high production during this period; no deaths or sickness appeared in the flocks. The percentage production for the two months of May and June was 11.2 and 9.7 percent respectively. The mean egg weight was 49.6 $\pm$ .68 grams with 13.8 percent variability. The birds gained an average of 0.8 pounds during this period.

Halfbred Brahman Angus Bulls Used in Beef Cattle Breeding Program

Santa Gertrudis Bulls Used in Beef Cattle Breeding Program

Hemoglobin and Thriftiness in Cattle

In the course of separating the Institute herd of 133 common local bred steers into fat steers to be sold, strong steers to be trained as work oxen, and thrifty steers for a feeding experiment, blood samples were taken and hemoglobin percentage estimated by using the Tallquist clinical chart corrected to bovine blood normalcy. This test gave the following results:

18 Strong steers selected as future work oxen	101.4% hb
23 Fat " " for slaughter	99.1% hb
30 Thrifty " " for experiments	94.6% hb
62 Remaining "	93.5% hb

From the above it is suggested that strong, thrifty, and well-doing steers, as selected by experienced judges, have a significant physiological basis for their superior classification in the herd, and further study of the matter thus seems warranted.

Experimental Pastures

An area of 23 acres which was formerly in sugar cane was selected and prepared as an experimental pasture. This area has been divided and planted to 12 different species of legumes in pure stands. The divisions in the area vary somewhat in size but are sufficiently large to be used as fertilizer experimental plots, to serve as a cafeteria pasture, and to provide opportunities to study sward formation in pure and mixed stands of grasses and legumes.

Forage Crop Garden

There are 18 varieties of native and exotic grasses and 17 varieties of legumes growing in the forage garden. Of the grasses, five varieties were added during the 1945-46 season. Likewise six varieties of legumes, mostly native and not botanically identified, have been added.

The following table gives the name or number of the grasses and legumes in the present garden:

Grasses	Legumes
Imperial - Axonopus scoparius	Desmodium leiocarpum
Jaragua - Hyparrhenia rufa	Desmodium nicaraguense
Bermuda - Cynodon dactylon	Desmodium 1 [1]
Amargo - Axonopus [1]	Desmodium 2 [1]
Gingibrillo - Paspalum notatum	Desmodium 3 [1]
Calinguero - Molinis minutiflora	Desmodium 4 [1]
Honduras - Ixophorus unisetus	Desmodium 6 [1]
Elefante - Pennisetum purpureum	Medicago sativa
Guieon - Panicum maximum	Calopogonium mucunoides
Pará - P. purpurascens	Centrosema pubescens
Gamalote - Setaria spp. [1]	Centrosema plumieri
Cabezon [1]	Indigofera endecaphylla
Gris - Paspalum spp. [1]	Pueraria phaseoloides
Rhodes - Chloris gayana	Native legume 1 [1]
Kikuyu - Pennisetum clandestinum	Native legume 2 [1]

[1] - Unidentified or doubtful.

Grasses	Legumes
Blue panic - Panicum antidotale	Native legume 3 [1]
Janeiro - Eriochloa polystachya	Native legume 4 [1]
Sudan- Sorghum vulgare	
(various selections)	

[1] - Unidentified or doubtful

Experiments in Progress

Ground corn vs. ground milo heads as a supplement to steers in pasture.

Studies on the use of water extract of rotenone from fresh roots of derris in the control of tórsalo or nuche grub (Dermatobia hominus) in cattle.

The use of commercial DDT preparations in the control of the cattle fever tick.

Publications

Studies on the Control of the Nuche Fly and Cattle Tick. R. L. Squibb, Journal Animal Science 4 (3) 1945

A New Method for Control of Cattle Tick in Tropical Regions. R. L. Squibb, Journal Animal Science 5 (1) 1946

Controlling Cattle Ticks. R. L. Squibb, Agriculture in the Americas, Jan. 1946

Desmodiums of the Tropics. R. L. Squibb, Agriculture in the Americas, Aug. 1945

Barn Belonging to the Animal Industry Department

A Corner of the Forage Garden

El Empleo de la Pulpa de Café como Alimento de Ganado

R. L. Squibb, Revista de Agricultura de Costa Rica 17 (8), 1945

Evaluation of Species Crosses of Cattle by Polyallel Crossing.

A. O. Rhoad, R. W. Phillips, W. M. Dawson, Journal of Heredity, Vol. 36-12, Dec. 1945.

The Development of a Superior Family in the Modern Quarter Horse.

A. O. Rhoad, R. J. Kleberg, Jr., Journal of Heredity, Vol. 37 - 8, Aug. 1946.

How to Find Animals of High Genetic Worth in Your Beef Breeding Herds. A. O. Rhoad, The Cattleman, in press.

Extension Activities

During the year several members of the staff visited various other sections of Central and South America in the interest of the work of the Institute.

While attending the Third Inter-American Conference on Agriculture in Caracas, Venezuela, July 1945, A. O. Rhoad spoke before a special meeting of the Asociación de Ganaderos de Venezuela on the subject of cattle in tropical areas. His talk was published in the Revista Pecuaria of Venezuela under the title of "Interesante Exposición de A. O. Rhoad."

In August, at the invitation of the Minister of Agriculture of Guatemala, A. O. Rhoad served as one of the livestock judges at the Feria de Agosto in Guatemala City. While in that country he participated in a special conference on a proposed livestock improvement program for Guatemala.

In January of 1946 Oscar Echandi, Assistant Animal Husbandman for the Department visited Panama in order to instruct officials in that country on the cattle tick control method evolved at the Institute.

In March, A. O. Rhoad, at the invitation of the Ministry of Agriculture, served as one of the judges at the Exposición Nacional de Panamá in David. A herd improvement program with one of the largest dairy herds in the vicinity of Turrialba was undertaken by the Department in cooperation with the owners. As facilities and personnel become available a considerable expansion can be anticipated in this type of work, eventually perhaps leading to the development of an organized extension service. Visits to many farms and ranches have been made during the year to study methods and to give suggestions for improvement when solicited.

Correspondence on technical subjects related to the livestock industry occupies an ever increasing portion of time. Some 137 letters to 26 countries were sent out. Of these 121 letters went to 14 of the 21 member countries of the Pan American Union.

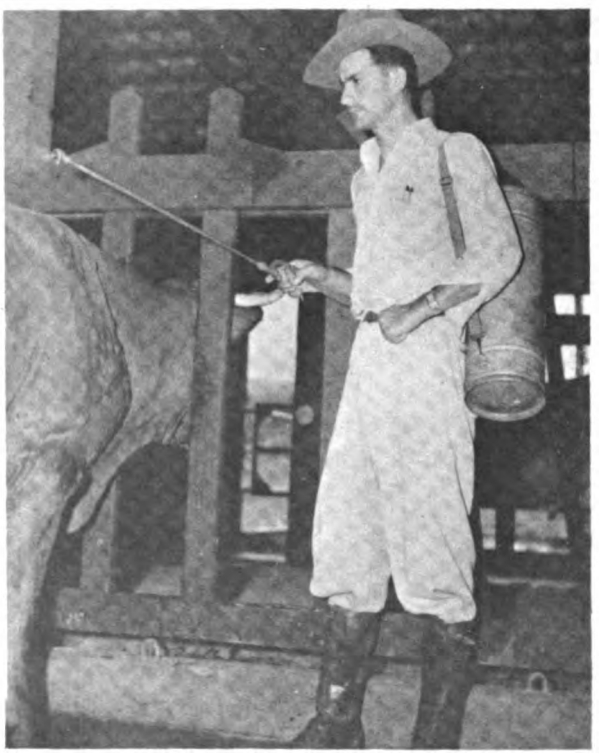
The Animal Program for 1946-47

It is planned to complete the construction of the corrals and to develop the poultry unit to accomodate the immediate needs of the program. Preparations for developing the swine unit will also be undertaken, especially provisions for the growing of feed. The purchase of dairy and beef cattle will be made in order to put into operation the production and research program outlined for these units.

Experimental work on control of cattle tick and tórsalo will be expanded. Further studies on the use of coffee pulp silage as a feed for cattle and studies in animal climatology are planned. Field activities, especially in efforts of area -control of the cattle tick, are planned.

It is our intention to increase the staff by the addition of a qualified veterinarian to assist in the research and field service programs of the Department and also a nutritionist if possible.

Desmodium, A Native Legume of the Forage Garden



Application of Rotenone Solution with Knapsack Sprayer in the Control of Dermatobia hominis (Tórsalo). Note the Infected Area on Shoulder of Animal.

PLANT INDUSTRY

Introduction and Tests

Six hundred and five varieties of field and vegetable crops from many parts of the world have been tried at Turrialba. Useful observations on varietal adaptation, propagation, and cultural requirements have been possible. Furthermore, as an improtant result of the exploratory tests, much material and a series of problems are ready for future research. These introductions have included sixty-four varieties of beans (Phaseolus vulgaris) seventeen varieties of peas (Pisum sativum), twenty-seven varieties of cowpeas (Vigna sinensis), forty-three varieties of soybeans (Soja max), sixteen varieties of lima beans (Phaseolus lunatus and P. limensis), most of the available varieties of peanuts (Arachis hypogaea), the rice bean (Phaseolus calcaratus), the velvet bean (Stizolobium deeringianum), the mung bean (Phaseolus aureus), cubasas (P. coccineus), garbanzo or chickpea (Cicer arietinum), lab lab (Dolichos lablab), pigeon pea (Cajanus cajan), lentils, and broad beans.

The root crops introduced have included four varieties of the sweet potato (Ipomoea batatas), the dasheen or yautia (Calocasia esulenta and Xanthosoma spp.) the yam or yampee (Dioscorea trifida).

Two hundred and ten introductions of grain crops have included corn, eighteen grain sorghums (Sorghum vulgare), Adlay (Coix lacrima-jobi), and eight varieties of rice. Vegetables have included a large proportion of the commercial tomato varieties and several wild sorts, nineteen

varieties of lettuce, seven of cabbage, twenty-one of squash and pumpkin, twenty-seven of onion and leek, watermelons, eleven varieties of peppers, seven of carrots, seven of beets, and forty-two other miscellaneous items.

Trees, shrubs, palms, etc. are being established in a permanent collection of potentially valuable germ plasm. Fourteen hundred varieties and species of fruits, nuts, drugs, and spices, fiber and industrial, and ornamental crops have been established. These include cocaine (Erythroxylon coca), divi divi (Caesalpinia coriaria), ginger (Zingiber officinale), nutmeg (Myristica fragrans), cinnamon (Cinnamomum zeylanicum), cola nut (Cola acuminata), chocolate (Theobroma cacao), ylang-ylang (Canangium odoratum), African oil palms (Elaeis guineensis), abacá or manila hemp (Musa textilis), derris or tuba root (Derris elliptica), quinine (Cinchona spp.), roselle fiber or kenaf (Hibiscus sabdariffa), pyrethrum (Chrysanthemum cinerariaefolium), henna (Lawsonia inermis), tung oil (Aleurites spp.), coffee (Coffea spp.), betel nut (Areca cathecua), avocado (Persea americana), mango (Mangifera indica), guava and relatives (Psidium spp.), mangosteen (Garcinia mangostana), blackberry and raspberry (Rubus spp.), lychee (Litchi chinensis), pulsan (Nephelium mutabile), grape (Vitis spp.), pineapple (Ananas comosus), persimmon (Diospyros spp.), citrus (Citrus spp.), plums (Prunus spp.), anona (Annona spp.), otaheite apple (Spondias cytherea), strawberry tamarind, breadfruit, jackfruit, (Garcinia tinctoria), star apple, surinam

cherry, akee,(Lucuma nervosa), carambola, cashew nut, governors plum, peli nut, ceylon gooseberry, bignay, nance, naranjillo, barbados cherry, and others.

Plant Breeding and Improvement

1. Field and vegetable crops

Objectives: To develop new varieties of food crops which have better practical value to the tropical farmer. Stress is placed mostly on these foods of greatest need in the daily ration; proteins (beans, cowpeas, soybeans, peanuts, etc.), carbohydrates, vitamins, fats, etc.

Cowpea (Vigna sinensis): Leaf diseases are bad with most varieties of cowpea when planted in the humid tropics. Accordingly, more disease resistant and better productive types are needed.

The variety of Two Crop Conch has the most disease resistant vines of any kind yet tested at the Institute. The edible quality is good, but the flowers often do not set full crops and the seeds are a little too small.

Another variety, Sugar Crowder, produces large seeds of excellent quality and the flowers set a high percentage of pods. The foliage of this sort, however, is badly attacked by disease.

Crosses have been made between Conch and various other sorts. From these combinations it is believed that new varieties may arise which will be of greater value to the humid tropics than any existent sort.

On February 23, 1945 crosses were made between Potomac and Conch varieties. One mature pod was obtained from these crosses, and F_1 seed was planted on April 10, 1945.

All F_1 plants had purple flowers. Flowers of F_2 generation have been in the following ratio of colors: tint 15, purple 34, white 14. All tint flowers have produced white seeds with tan eyes, quite similar to Potomac; white flowers have produced white seeds; purple flowers tan seeds. It is believed that the purple flowers are heterozygous group, the tint flowers the homozygous dominant, and the white flowers the recessive kinds. The cross has been very productive in the first and second generations.

In third generation plantings four selections were planted - large white, small white, tan-eye and solid tan. The white seeded sorts are showing most promise.

Large fourth generation plantings are planned. Mass selection for mosaic resistance has been practiced.

More recent crosses between Sugar Crowder and New Era have been made and F_1 plants are now growing. Several unique crosses between the cowpea and the yard long bean (Vigna sesquipedalis) have just been made in an attempt to obtain better disease resistance, but repeated attempts to cross the cowpea with the local Vigna vexillata have all failed. Line selections have been started and indications are that a useful new edible sort may be obtained.

Corn: Corn varieties having greater yields and better resistance to insects and diseases are badly needed throughout the tropics. In this work we are first searching for root-worm resistant qualities. Both field and sugar types are in process of development.

a. Field corn crosses: Crosses between Chirripo No. I (from Costa Rica) and the vigorous and large-eared Maíz breve (from Guatemala) are showing some promise. For root-worm free sections, a cross between Maíz breve and Venezuela I appears to have possibilities. The latter has also been crossed with Chirripo.

b. Sugar corn crosses: Crosses have been made between U.S.D.A. No. 34 sweet corn and Chirripo. Other crosses include No. 34 with Venezuela I and with Costa Rica field corn. Large F_2 populations of all of these crosses are now growing.

No. 243, An Interesting New Grape Produced from a Combination of Vitis shuttleworthii, V. ruftomentosa, and V. viniferi.

Two Selections from a Cross Between the Virginia Bunch and Florida Runner Peanuts, F_5 Generation

c. A mass selection from a pool of superior corn sorts introduced from Central and North America has produced two open pollinated varieties of interest. These should serve as a source of superior germ plasm. The varieties are white and yellow respectively and have substantially out-yielded locally grown corn.

These varieties are a part of the initial work necessary for the establishment of a hybrid corn program. In their present state they may upon further testing prove to have definite commerdial value.

Thirty;two valuable pure lines of white corn supplied by Dr. Walter N. Bangham early in 1946 have been catalogued and maintained.

Peanuts: Among the greatest problems in peanut culture in the tropics are foliage diseases and sprouting of crop during rainy weather. The Florida Runner variety has been found to possess better disease resistance and will not sprout. Also, this sort has a very hard shell which gives better protection against insects. Its one disadvantage is the small size and poor appearance of the nuts. The larger nut kinds, such as Tennessee Red, Virginia Bunch and Virginia Jumbo, either sprout badly in the soil and are much diseased or, as with the two latter sorts, give poor production.

A productive peanut variety with medium large nuts of good appearance and one that is resistant to diseases and will not sprout in the soil is badly needed.

Crosses between the Florida Runner and Virginia Bunch varieties have been made. It is planned, also to cross the Tennessee Red with the Florida Runner and segregates which combine the best qualities of both parent varieties are being selected and propagated.

Crosses between the Florida Runner and Virginia Bunch varieties are now in F_4 generation and show some promise. Two selections, bunch and runner, have been made. In many ways this new bunch selection is superior to any of the twelve standard sorts tested which include Florida Runner, but its one bad character is a high proportion of poorly developed nuts, a character inherited from Virginia Bunch. It is planned to cross this hybrid sort with Tennessee Red, which combination may well give an all-round superior type.

Grain sorghum: Grain crops for poultry and stock feed are badly needed in the humid tropics. None of the temperate climate varieties has given much promise at Turrialba. With such kinds the production is usually low and the seeds mould very badly. Some kinds produce seeds only very sparingly.

Feterita grows and produces well, but the heads are so compact and the seeds so soft that the entire crop is usually lost by mould before it can be harvested. The native broom corns grow and produce fairly well, but their grains are mostly very small and the quality is poor. The need is to obtain better production, more open heads and average sized hard grains of good quality.

Crosses have been made between Feterita and two types of Shallu (one with white and one with black glumes) and between Shallu and Hegari. Other crosses are planned. Shallu has a very open head and a grain considerably harder than Feterita but both are unusually high in protein.

From the original cross between Feterita and Shallu, one hundred and sixty selections are now with mature seed (F_5 generation). More than one hundred F_5 selections have been made and several new and moderately well fixed varieties have been established. These indicate superior qualities of production, quality, appearance and disease resistance of seeds and plants. A few of these new sorts are expected to be ready for distribution within the next year.

Squash: The squash (ayote) is a vegetable of considerable importance in most tropical countries, and when eaten in the young (whole) stage it is a valuable source of phosphorus and

Harvesting Adlay Wheat

possibly other minerals in the diet. With the native kinds, production is low and quality and appearance need to be vastly improved. All are of the vine or running type.

Results here at the Institute and in various other tropical locations have shown that the temperate climate sorts of Cucurbita pepo and C. maxima, such as Golden Crookneck, Patty pan, Acorn, Hubbard, etc., do not succeed mainly because of attacks by stem borers and leaf diseases.

In June 1943 the common Puerto Rican "calabaza" (ayote) was crossed with the African Squash. Third generation selections were then crossed again on a select type of Costa Rican ayote. The improved qualities thus far obtained are: smaller squash with better shaped fruit, brighter color inside and out, thicker meat, improved flavor and texture and higher productivity. All varieties used in this experiment belong to the species Cucurbita moschata. This cross is now in the F_5 generation.

It is planned to attempt crosses of the new hybrid with some of the non-running or bunch kinds of C. pepo since this seems to be about the only possibility of obtaining bunch types suited to the tropics.

Tomato: Tests have indicated that none of the domestic varieties of tomatoes give satisfactory yields during warm, rainy, tropical weather. Of thirty-six well known varieties tested at the

Institute, none has shown promise. A small, semi-wild type (No. 0104), which is occasionally seen in the tropics, gives good production under these conditions, but it has very rough and acid fruits and, for this reason, is of little or no value.

In March 1944 previously emasculated flowers of Cuban Marglobe, a fine flavored, smooth variety, were fertilized with pollen of No. 0104, local rough. This cross, No. 0108, is now in the fourth generation. To date good characteristics have been: good flavor, good color, relative disease resistance of plant and fruit, resistance to insects and adaptability to acid soils and humid growing conditions. Bad characteristics have been irregular size and moderately small fruits. Irregular shape has not been difficult to eliminate.

Plans are now being formulated to cross the No. 0108 with the Norduke variety. The latter is one of the best of a lot of some thirty standard varieties tested, especially from the standpoint of foliage health.

The cross has given considerable promise. Though it has been put into limited commercial production, it is still in the experimental stage. It is expected that one or more new varieties will be ready for general test within the next year.

2. Fruits

Objective: To develop new varieties of fruits having better practical value in warm climates. Special stress is placed upon those fruits that give most promise from the commercial standpoint.

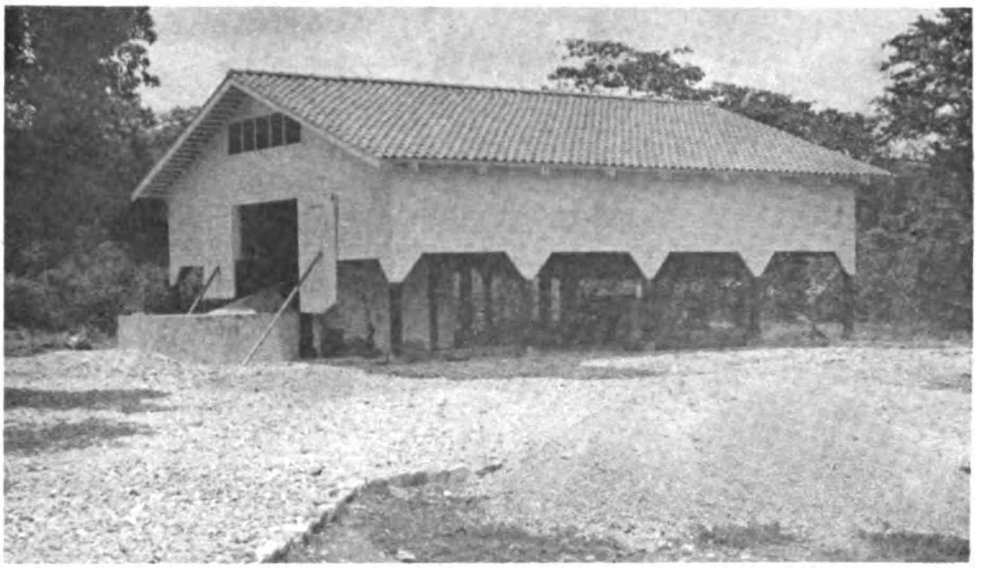
Grape: Grape culture has not been a success in humid tropical regions for the reason that all types hitherto tested were of temperate climate origin required for a temperate climate enviroment. The present program is aimed at the development of a distinctly new class of cultivated vines, which are derived in most part from the wild tropical and subtropical grapes of America. There is no record that such work has ever been attempted previously, but results already strongly indicate that extensive possibilities lie in the field of tropical viticulture.

This project was started by J. L. Fennell in the autumn of 1935 in southern Florida. A comprehensive search has been undertaken throughout the course of the project, with the purpose of obtaining the very best wild parent stock that might exist in the forests of southern Florida, Mexico, the West Indies, Central America and other regions. Some unusually good selections have been obtained and used as breeding parents while twenty-seven wild, tropical and temperate species have been tested.

Approximately 175 cultivated varieties (American and European) have been tested for possible value as pollen parents. In all, about twenty such varieties have been used in breeding. In our test vineyards there are some 1200 different hybrid sorts (F_1, F_2 and double-cross progeny) which have been derived from these crosses. The tropical species most extensively used in these crosses have been Vitis Shuttleworthii, V. tiliaefolia and V. gigas.

A few selections from these crosses indicate great promise for tropical regions. They have been well adapted to Turrialba conditions and they are productive and have quality, appearance and size equal to many of the better North American cultivated kinds. It is expected that a limited amount of plant material will be ready for distribution within one year.

Other preliminary work is being done on watermelons, blackberries and raspberries. Miscellaneous experiments in methods of propagation, application of soil amendments, drainage, erosion control, weed control and cover crops are under way. A considerable increase in research on cane and coffee should be possible soon.



Seed House Belonging to the Plant Industry Department

Surveying Fundamentals Being Explained by Mr. Ives, Chief of the Agricultural Engineering Department to Students Srs. Suáres and Medina.

AGRICULTURAL ENGINEERING

The Agricultural Engineer has been occupied during the year with the task of building the Institute, handling two students, developing an Institute Service (construction, operation, maintenance and repair) and planning the engineering program. At the close of the year, the Institute Services were being transferred to the Institute Manager so as to permit more rapid development of engineering research and teaching. The following basis has been prepared for this program:

Introduction

Engineering has been defined as "the art and science of organizing and directing men, and utilizing the forces and materials of nature for the benefit of the human race". In brief, therefore, an engineer is a specialist in the use of Labor, Power, and Materials, especially as they benefit the human race.

Agriculture has been defined as "an industry devoted to the production of food and raw materials used by the human race primarily for food, shelter and clothing".

Agricultural Engineering, then, is the art and science of engineering applied directly to the industry of agriculture. In view of the foregoing definitions it is obvious that agricultural engineering is concerned with the use of labor, power and materials as they affect agricultural production and rural living conditions.

Viewed broadly, farming, quite in contrast to other major industries, is essentially a two-fold enterprise:

1. It is a business, the objective of which is to earn a living.

2. But farming is also a Way of Life, the objectives of which might well be stated to be the "most abundant life possible." Farming can be entirely sufficient unto itself as can no other industry. However, as is now well recognized, a much higher standard of living for all people can be attained when farming ceases to be self-sufficient.

Considered in the full perspective then, agricultural engineering should treat (1) problems directed toward more efficient production -- the business of farming -- as well as (2) problems directly concerned with the increase in the well being of those engaged in it. Such problems are many and complex. To treat them systematically agricultural engineering activities have been classified into five fields:

1. Farm Power and Machinery

2. Farm Structures

3. Soil and Water Development and Conservation

4. Rural Electrification

5. Farm and Home Utilities

Initial research study at the Institute will be organized and set up to deal with the three major fields (with emphasis on the conditions prevailing in equatorial regions):

1. The application of power and machinery to agriculture.

2. Soil and water development and conservation.

3. Farm building design and construction.

Rural Electrification and Farm and Home Utilities can be grouped with and handled under Farm Power and Machinery and Farm Structure respectively.

Group I: Farm Power and Machinery

1. Situation: In most of the American tropics the preparation, planting, cultivation and harvesting of crops are hand methods. Although machinery for processing these crops has been introduced and quite highly perfected, there is very little machinery used in their production, the machete and ox-cart constituting the extent of mechanization on a great majority of farms. The topography of much of the land and other environmental conditions are undoubtedly factors which have made for such slow progress in the mechanization of primary agricultural production.

Environment and customs play such an important part in human progress in general that any plan for improvement in any field must give due consideration to these factors. Health and living conditions must be improved to create a desire and an ability to adopt and use more advanced methods. Also, more modern methods of agriculture must be employed if those engaged in it are to be able to afford the necessities for these better health and living conditions.

2. Long-time objectives: To increase the efficiency of production and improve the quality of crops through the application of power and machinery and labor-saving methods.

3. Immediate Objectives:

a. To study present cultural practices -- specific operations performed, tools used, man hours of labor required, amount of power and machinery per acre or unit of production, and the labor, power and machinery cost.

b. To experiment with improved practices determined as a result of the above studies.

c. To experiment with the adaptation of selected machines which are now available.

d. To adapt machinery to the prevailing conditions.

e. To determine the need for and help design any special new tools and/or machines.

4. General Plan: Graduate student help will be used ti make detailed surveys and studies on the exact present cultural procedures of selected crops.

Analysis of such studies will be made to determine improved methods and practices and to outline experiments where the proposed improvements will be tried. Initial emphasis will be given to improved hand tools and methods, but long-time objectives will be toward power and machinery methods which reduce labor to a minimum and increase efficiency and quality of production to the maximum.

For tractors, machines and equipment with which to experiment, special effort will be made to enlist the active cooperation of various farm machinery manufacturers and others concerned with the production and handling of crops.

Plan I:

a. The Institute would make an initial study, determine the needs, and outline a plan of procedure for a specific project.

b. This outline would be submitted to one or more selected commercial concerns or trade promotion associations for their study and suggestions.

c. The results of such experiments would be the joint property of the Institute and the cooperating concern to be used as either party should see fit.

Plan II: A commercially sponsored fellowship in which:

a. The Institute and a commercial concern would jointly write the agreement and project outline.

b. The commercial concern would deposit funds ($500 to $2,000 a year) with the Institute to be used to cover all direct expenses of the project. Students may or may not be paid from these funds. Needed equipment, furnished by the cooperating concern and others, would be purchased from and limited to these funds.

c. The Institute would furnish direction and all its research facilities.

d. Results of the experiment would be the joint property of the Institute and cooperating party to be used as either should see fit.

5. Typical Student Research Projects:

a. Job methods analysis study of current practices in the primary production of selected tropical crops--the entire cultural cycles.

b. Experiments in the adaptation and use of modern power and machinery in the culture of a selected tropical crop.

c. Tractor traction studies in tropical soils, climate and rolling to steep slopes.

d. Labor saving machinery and methods of clearing the land of stones, trees, brush, and heavy weed growth.

e. The type, kind, and size of machines needed for the small farm.

f. Pasture renovation and development of machinery for specified conditions.

g. Development of machines and vehicles for use with oxen.

h. Draft of oxen according to size of animal and type hitch.

Group II: Soil and Water Development and Conservation

1. Situation: As compared to temperate zone agriculture, that of the tropics is "steeper". This, coupled with the greater amount and more intense rainfall plus a twelve month season of exposure presents a real erosion control problem in many areas. The wet-dry sections suffer most. Special studies are needed to determine and develop the best methods of control. Also, adverse topographic and weather conditions in certain sections are tremendous barriers to the mechanization of agriculture. Rocks, stumps, extreme slopes, and extreme rainfall or dryness are major conditions to be dealt with. There are, however. vast areas eminently suited to mechanized agriculture which require only drainage and/or irrigation.

2. Long time Objectives:

a. To determine and develop best methods of erosion control.

b. To determine feasible and profitable methods of developing land for mechanical farming.

c. To investigate the kind of drainage most feasible for lowland tropical areas.

d. To develope a phase of land classification which would indicate the type of farming suitable and the feasibility of mechanized agriculture on the land.

3. Immediate Objectives:

a. To determine erosion losses and study methods of control.

b. To determine feasible methods of clearing and developing lands typical of the rocky, high-rainfall areas for mechanical cultivation.

c. To determine the feasibility of tile drainage.

d. To determine the proper coefficients of drainage and the proper depth and spacing of tile laterals.

e. To develop a type of grassed waterways that is adequate for the rainfall and yet convenient for mechanical farming.

f. To determine the cost (labor, power and machinery) of developing the various types or classes of land.

g. To establish land classification criteria for tropical land as they affect engineering developmental problems.

h. To classify all land owned by the Institute under this system.

i. To experiment with irrigation systems on tropical lands.

4. General Plan: Much of the initial work done on this general project of land development and conservation will be part of the Institute's own land development program. Student projects, then could be studies and analyses of these methods, with subsequent plans for improved methods.

5. Typical Student Research Projects:

a. Methods and costs of clearing fields of rock.

b. Exploratory methods of land development in relation to land classifications.

c. Determination of drainage and run-off coefficients for the various lands and areas within convenient reach of the Institute, also feasibility of drainage.

d. Methods for using dynamite most effectively in land clearing and ditching.

e. The design of surface run-off ditches for mechanical farming.

f. The determination of allowable water table heights and duration according to crop.

g. Water power development -- feasibility and methods.

h. Measurement of soil and water erosion losses.

Group III: Farm Building Design and Construction

1. Situation: The nature of farm living conditions and the need for and existence of farm utility buildings differs greatly between equatorial and temperate regions. For some of the large haciendas the farm structures problem is twofold. The first group would be concerned with provision of better living quarters for laborers, that is, the basic standards at the minimum cost. The second group would deal with problems connected with the processing of crops, or what might be called secondary production, not only of the one or two major crops, but also for a more diversified farming program, corn and rice for example.

For the individual farm units or fincas the problems will be somewhat the same in nature but identified with and directed toward much smaller units. Basic or minimum requirements should be determined; then several designs that meet these standards should be developed and tried out. Basic living facilities, such as running water, bath, kitchen stoves and equipment, should be introduced and adapted experimentally in an effort to find the best for the least cash outlay.

2. Long-time Objectives:

a. To establish economically feasible farm home designs that will provide basic living conditions.

b. To determine and provide designs for efficient animal and storage structures for the tropics.

3. Immediate Objectives:

a. To determine insofar as possible or expedient, by special study, surveys, experiments, etc., the economic, functional, structural and esthetic requirements of farm buildings for the tropics.

b. To design, build, equip and critically observe farm houses, dairy barns, poultry houses, meat animal shelters, feed storage buildings, general storage buildings, etc., that will best meet the above requirements.

4. General Plan: The determination of the fundamental requirements of the various farm structures as units, as well as the structural requirements of the various parts of the buildings, such as roofs, foundations, side walls, insulation, ventilation, bracing, etc., should be the first objective. However, studies for this information will naturally go hand in hand with the applied experiments which will incorporate certain types of designs in each and every structure built.

Two general plans may be followed: (1) to find what is possible using only materials available locally, and (2) to incorporate manufactured materials and equipment most feasible for the desired results.

Cooperation of the farm structures industries might well be enlisted in either of the two plans, as outlined under Farm Power and Machinery.

5. Typical Student Research Projects:

a. A method to reclaim and prevent rusting of galvanized sheet metal roofing.

b. Roofs for hot, high-rainfall areas--types of materials, pitch, construction.

c. Foundation and wall construction according to soil conditions, probability of earthquake, cost of materials, amount and type of labor, etc.

d. A study of lumber and lumber production, kinds, strength, their suitability for various purposes, logging methods, sawing, and physical marketing problems.

e. Concrete for the tropics--materials and mixtures.

f. Farm home plumbing and sewage disposal systems.

g. A unit design system for building with one-length lumber.

h. Farm dairy barn design for hot, high-rainfall areas.

i. Farm house design.

j. Kinds of hard surfaced floors--their cost, relative sanitation and durability.

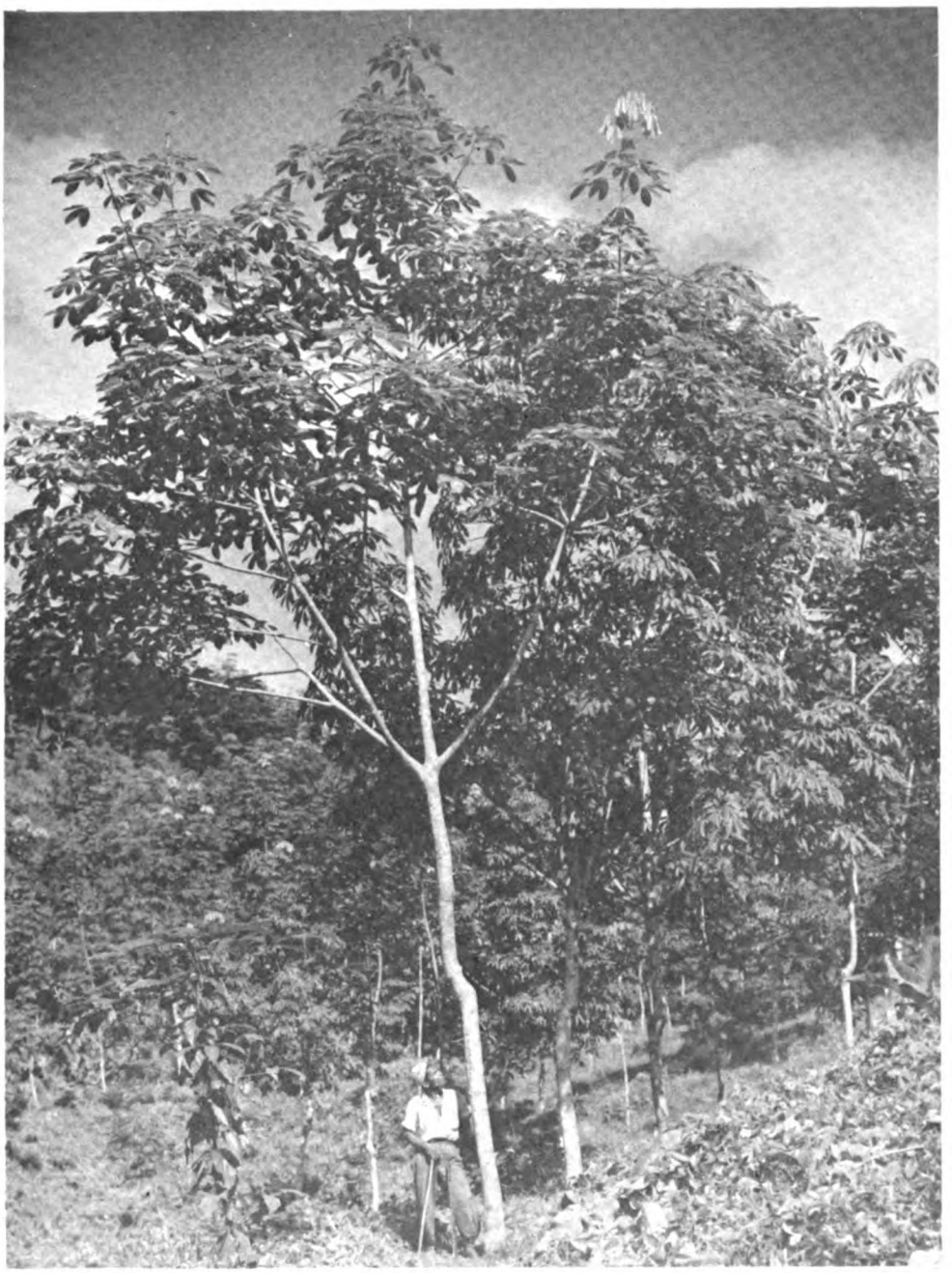
k. Fencing.

l. Farm water supply systems.

m. Dehydration systems and methods for large processing plants and individual farms.

n. Storage of perishable products.

During the year 1946-47 a small number of basic projects in soil and water conservation, farm power and machinery, and house design will be initiated. The entire program will be subject to modification as experience accumulates. This plan is herewith submitted in detail to indicate the kind of sound research and educational work needed to be done in Agricultural Engineering.



A Three-component Rubber Tree: (a) Seedling Root, (b) High-yielding Trunk, and (c) Disease-resistant Top. Rubber Substation in Panama

AGRICULTURAL ECONOMICS AND RURAL WELFARE

Throughout the Americas there is the conviction that their resources must be more efficiently used. Economists can cooperate on the problems involved to a better advantage than those in many other fields since the problems on which they work are most often delocalized. The Institute has an opportunity to provide the means by which the research minds of the hemisphere can make a coordinated approach to the economic problems. Association with these men will undoubtedly open many other fields in which research in economics and rural welfare is necessary.

The Institute will emphasize economic research that is widely usable, adapt methods for all countries to use, and contribute to the development of a common economic vocabulary. Closely related to all projects of the Institute must be studies of the farm home and other rural institutions, the farm population, and the processes of rural life. The following projects are under way or will be initiated during the current year:

1. Study of the handling of coffee in the processing plant (in cooperation with the Institute Engineer).

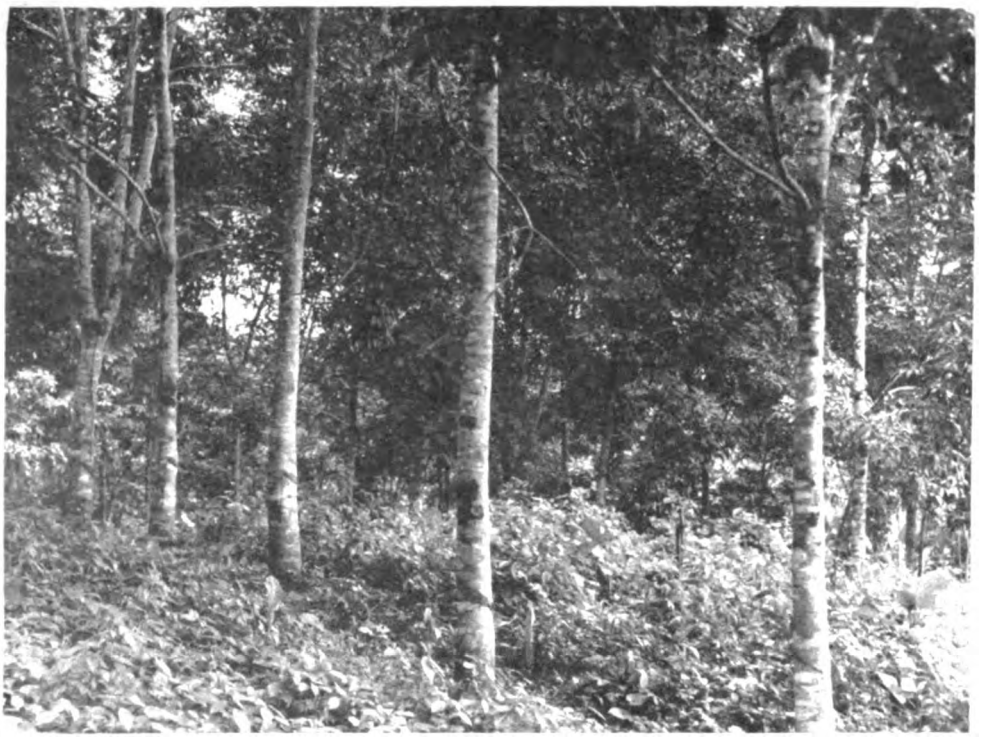
2. Survey of deficiency diseases as they relate to nutrition.

3. A study of farm diets.

4. Study of the effect of inter-cropping on the cost of bringing a rubber planting to producing age.

5. Cost of producing corn.

Other studies involving agricultural credit and cooperatives are being planned. The Institute expects to participate in the drafting of plans, questiionnaires, personnel organization, training of interviewers and other essential field and office workers to facilitate the work of the Western Hemisphere Census of 1950, which will include agriculture and livestock. A good census is basic in agricultural economic work.



Seven-year-old Seedling Rubber Trees at the Rubber Substation

A High-yielding Rubber Tree Being Tapped at the Rubber Substation in Panama

TEACHING PROGRAM

The function of a graduate school is to train students to do research, but until sufficient research projects are operating, the number of students at the Institute will be limited. Students will be selected by the members of the staff during study periods in the various countries. They will be chosen according to their ability to work in connection with research under way at the Institute. A considerable number of future students may well carry out their research projects at the Institute as partial fulfillment of requirements for an advanced degree, the academic requirements for which are taken at another institution.

Teaching will be mainly on an individual basis. However, certain general courses will be offered. These will include Plant Breeding and Experimental Technique. The latter will be a composite course given by the Director and contributed to by staff members in the various fields. A weekly seminar for all staff members and students will continue to be held. At this seminar students will present their research problems. Staff members and visiting scientists will discuss important developments in their respective fields.

Although many students doing research at the Institute will be either registered for degrees elsewhere or will continue to take further academic work in other institutions, the Institute will grant a Master's Degree to certain successful candidates. Only those with adequate academic background and demonstrated interest in research may become candidates for this degree.

The educational program of the Institute was formally inaugurated on January 8, 1946. On this date in the recreation room of the Central Building the staff, student body and invited guests assembled for the opening exercises presided over by Albert O. Rhoad, Acting Director. During the first two quarters eight students were registered as follows:

Name	Country	Subject
Mario Gutiérrez G.	Costa Rica	Corn Breeding
Rodolfo Lambour M.	Guatemala	Grape Culture
Simeón Medina R.	Dominican Republic	Agr. Engineering
Pedro Trujillo G.	Mexico	Grape Culture
Fernando Suárez de C.	Colombia	Agr. Engineering
Raúl Pérez Alcalá	Bolivia	Rubber Culture
Juan M. Muñoz O.	Mexico	Cocoa Culture
Alfonso Uribe H.	Colombia	Rubber Culture

The academic year is divided into four quarters of twelve weeks each. This division facilitates the guest scientist program of the Institute as the quarter beginning on June 20 and extending to September 20 coincides with summer vacation periods of colleges in the Northern Hemisphere, while the quarter beginning on January 4 and extending to March 20 coincides with the summer vacation period of many colleges in the Southern Hemisphere.

The guest scientists, however, may not be limited to their vacation periods alone but may extend their stay over a longer period of the year. Scientists on sabbatic leave may wish to utilize the opportunity to carry on work at the Institute for a period of six months to one year. It is planned that the guest and visiting scientists will become an important phase of the Institute's program in research and teaching.

Dispensary, Store, and Three Laborers Cottages on Hill, Gasoline Shed and Dock at the Rubber Substation, Gatún Lake, Panama Canal Zone

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS (a)

JULY 1, 1945 TO JUNE 30, 1946

CASH BALANCE, JULY 1, 1945			$ 64,200.85
RECEIPTS:			
Miscellaneous:			
Loan by the Pan American Union	$ 10,000.00		
Quota Assessments Paid in Advance (b)	2,870.05		
Collections of Accounts Receivable	1,550.15		
Scholarship - Pioneer Hi-Bred Corn Co.	1,350.00		
Refund of Coffee Picking Expenses and Labor	3,369.39		
Refund of Travel and other Expenditures	669.42	$19,809.01	
Income:			
Governmental Contributions:			
Chile	$5,178.26		
Dominican Republic	1,768.16		
El Salvador	1,862.98		
Honduras	1,378.34		
Nicaragua	1,013.95		
Panama	631.64		
United States	156,233.26		
Venezuela	662.02	$168,728.61	
Sale of Cane (See Note)		26,156.72	
Deposit on Coffee Crop		18,716.59	
Sale of Coffee		386.50	
Sale of Miscellaneous Farm Products		2,583.49	
Sale of Maps and Books		204.25	
Pasturage Rental		186.19	
Tractor Rental		100.22	
Sale of Light and Water - Panama		75.00	
Sale of Animals		765.76	
Sale of Meals		359.26	
Sale of Sundry Materials and Equipment		798.45	
Miscellaneous		5.08	219,066.12
Total Receipts			238,875.13
			$303,075.98

NOTE: Gross sales of cane totaled $27,400.77
Remittances were reduced by $ 1,244.05 representing hauling charges.

(a) Prepared by Wm. Gordon Buchanan & Co., Certified Public Accountants at the request of the Pan American Union, Fiscal Agent for the Institute.

(b) Dominican Republic and Nicaragua

Continued -

DISBURSEMENTS (See Schedule A-1)		$292,674.82
CASH BALANCE, JUNE 30, 1946		$ 10,401.16
REPRESENTED BY:		
Riggs National Bank, Washington, D.C.	$ 5,627.30	
Banco Nacional de Costa Rica, San José, Costa Rica (12,609.71 Colones)	2,247.71	
Estate Manager, Panama Rubber Sub-Station	1,026.15	
Deposit, Naval Supply Depot, Balboa, Canal Zone	1,500.00	$10,401.16

SCHEDULE OF CASH DISBURSEMENTS
JULY 1, 1945 TO JUNE 30, 1946

(Schedule A-1)

	Riggs National Bank Washington D.C.	Banco Nacional de Costa Rica San José, Costa Rica	Estate Manager Panama Rubber Substation	The Collector of the Panama Canal	Total
Department of Animal Industry:					
Labor	$ -	$ 12,983.23	$ -	$ -	$12,983.23
Supplies and Services	1,070.92	855.91	-	-	1,926.83
Purchases of Animals	1,481.21	114.56	-	-	1,595.77
Department of Plant Industry:					
Labor	-	15,892.72	-	-	15,892.72
Supplies and Services	42.49	437.56	-	-	480.05
Department of Agricultural Engineering:					
Labor	-	505.62	-	-	505.62
Supplies and Services	91.51	1.60	-	-	93.11
Operation and Maintenance of Physical Plant					
Roads and Landscape	-	15,919.33	-	-	15,919.33
Light Plant Maintenance and Fuel	-	2,688.62	-	-	2,688.62
Machine Shop	-	194.73	-	-	194.73
Repairing of Buildings and Fences	-	1,768.74	-	-	1,768.74
Repair of Equipment	251.52	1,177.12	-	-	1,428.64
Gas and Oil	-	3,594.37	-	-	3,594.37
Storeroom	-	17.83	-	-	17.83
Labor	-	5,144.56	-	-	5,144.56
Farm Operations:					
Coffee - Supplies and Services	-	12,478.82	-	-	12,478.82
Cane - Labor	-	8,548.28	-	-	8,548.28
Cane - Supplies and Services	-	535.01	-	-	535.01
Other Food Products-Labor	-	2,436.55	-	-	2,436.55
Other Food Products - Supplies and Services	135.26	12.83	-	-	148.09
Labor	-	5,400.77	-	-	5,400.77
Dormitory Operations:					
Feeding Students - Labor	-	89.15	-	-	89.15
Cost of Food	-	1,831.00	-	-	1,831.00
Other Expenses	-	99.06	-	-	99.06
Laundry - Labor	-	86.60	-	-	86.60
Laundry-Supplies &Services	-	214.00	-	-	214.00
Housekeeping Expense-Labor	-	568.91	-	-	568.91
Housekeeping Expense-Supplies & Services	-	39.41	-	-	39.41
Classroom Supplies	121.33	-	-	-	121.33
Total Forward	$ 3,194.24	$ 93,636.89	$ -	$ -	$96,831.13

SCHEDULE OF CASH DISBURSEMENTS
JULY 1, 1945 TO JUNE 30, 1946

(Schedule A-1)
Sheet 2

	Riggs National Bank Washington D. C.	Banco Nacional de Costa Rica San José Costa Rica	Estate Manager Pamana Rubber Substation	The Collector of the Panama Canal	Total
Total Forwarded	$ 3,194.24	$ 93,636.89	$ -	$ -	$96,831.13
Office Expenses:					
Salaries	-	4,033.85	-	-	4,033.85
Supplies & Services	233.26	2,202.58	-	-	2,435.84
Books & Publications	983.23	10.14	-	-	993.37
Local Travel	30.66	1,551.63	-	-	1,582.29
Insurance	-	365.14	-	-	365.14
Communications	-	410.61	-	-	410.61
Medical Expenses	219.83	3,848.64	-	-	4,068.47
Miscellaneous	76.48	1,501.28	-	-	1,577.76
Equipment purchased	1,894.75	2,967.55	-	256.40	5,118.70
Panama Rubber Sub-Station Expense:					
Compensation of Mgr. Including Retirement Contribution	432.00	-	4,104.00	-	4,536.00
Labor Expense	-	-	7,003.91	-	7,003.91
Travel	-	-	308.83	-	308.83
Supplies & Equipment	57.34	-	2,576.15	-	2,633.49
Miscellaneous Office & Plant Maintenance Expense	-	-	993.56	-	993.56
Executive Headquarters Expense:					
Administrative Salaries Including Faculty in Costa Rica	56,151.65	-	-	-	56,151.65
Contributions to Retirement Fund	2,393.09	-	-	-	2,393.09
Travel	6,136.14	2,722.08	-	-	8,858.22
Printing and Translations	600.77	-	-	-	600.77
Miscellaneous Office Expense	2,955.68	-	-	-	2,955.68
Construction Costs	214.97	14,776.47	-	-	14,991.44
Payment Charged to Construction Reserve	65000.00	-	-	-	65,000.00
Refund of Deposit on Coffee Crop	-	4,297.52	-	-	4,297.52
Scholarship Payments	-	900.00	-	-	900.00
Total Forward	$140,574.09	$133,224.38	$14,986.45	$ 256.40	$289,041.32

SCHEDULE OF CASH DISBURSEMENTS
JULY 1, 1945 TO JUNE 30, 1946

(Schedule A-1)
Sheet 3

	Riggs National Bank Washington D. C.	Banco Nacional de Costa Rica San José Costa Rica	Estate Manager Panama Rubber Substation	The Collector of the Panama Canal	Total
Total Forwarded	$140,574.09	$133,224.38	$ 14,986.45	$ 256.40	$289,041.32
Payments on Accounts Payable	1,457.87	-	-	-	1,457.87
Miscellaneous Charges to Accounts Receivable	1,321.13	192.07	-	-	1,513.20
Refund-1944 Coffee Crop Price Adjustment	-	662.43	-	-	662.43
TOTAL	$143,353.09	$134,078.88	$ 14,986.45	$ 256.40	$292,674.82

Exhibit B

STATEMENT OF INCOME AND EXPENSE

JULY 1, 1945 TO JUNE 30, 1946

INCOME:			
Quota Assessments		$168,728.61	
Sale of Coffee		14,805.57	
Sale of Cane		27,108.65	
Sale of Miscellaneous Farm Products		2,583.49	
Sale of Maps and Books		204.25	
Pasturage Rental		186.19	
Tractor Rental		100.22	
Sale of Light and Water - Panama		75.00	
Sale of Animals		765.76	
Sale of Meals		359.26	
Sale of Sundry Materials and Equipment		798.45	
Miscellaneous		5.08	
Total Income			$215,720.53
EXPENSE:			
Costa Rica (Schedule B-1)	$145,149.42		
Panama Rubber Sub-Station (Schedule B-2)	15,475.79		
Washington (Schedule B-3)	71,311.96	$231,937.17	
Applied To:			
U.S. Grant-in-Aid for Construction of Buildings and Other Facilities (Exhibit C)		1,881.40	
Balance Applied to Income			230,055.77
EXCESS OF BALANCE OF EXPENSES OVER INCOME			$ 14,335.24

Schedule B-1
Sheet 1

SCHEDULE OF COSTA RICA EXPENSES

JULY 1, 1945 TO JUNE 30, 1946

DEPARTMENT OF ANIMAL INDUSTRY:		
Labor	$12,972.11	
Supplies & Services	1,937.63	
Purchase of Animals	1,595.77	$16,505.51
DEPARTMENT OF PLANT INDUSTRY:		
Labor	$15,892.72	
Supplies and Services	476.59	16,369.31
DEPARTMENT OF AGRICULTURAL ENGINEERING:		
Labor	$ 505.62	
Supplies and Services	152.62	658.24
OPERATION AND MAINTENANCE OF PHYSICAL PLANT:		
Roads and Landscape	$16,131.58	
Light Plant Maintenance and Fuel	2,688.62	
Machine Shop	194.73	
Repair of Buildings and Fences	1,775.44	
Repair of Equipment	1,998.38	
Gas and Oil	3,812.88	
Storeroom	17.83	
Labor	5,122.28	31,741,74
FARM OPERATIONS:		
Coffee - Supplies & Services	$ 9,109.43	
Cane - Labor	8,548.28	
Cane - Supplies & Services	1,779.06	
Other Food Products - Labor	2,436.55	
Other Food Products - Supplies and Services	148.09	
Labor	5,400.77	27,422.18
DORMITORY OPERATIONS:		
Feeding Students - Labor	$ 89.15	
Cost of Food	2,179.31	
Other Expenses	103.50	
Laundry - Labor	86.60	
Laundry-Supplies & Services	199.31	
Housekeeping Expenses-Labor	568.91	
Housekeeping Expenses-Supplies and Services	39.41	
Classroom Supplies	121.33	3,387.52

(Schedule B-1)
Sheet 2

SCHEDULE OF COSTA RICA EXPENSES

JULY 1, 1945 TO JUNE 30, 1946

OFFICE EXPENSES:		
Salaries	$ 4,033.85	
Supplies and Services	2,585.67	
Books and Publications	1,249.67	
Local Travel	1,462.37	
Insurance	365.14	
Communications	464.09	$ 10,160.79
MEDICAL EXPENSES		10,454.02
MISCELLANEOUS		1,791.32
EQUIPMENT PURCHASED		8,383.17
CONSTRUCTION		18,275.62
TOTAL COSTA RICA EXPENSES		$145,149.42

Schedule B-2

SCHEDULE OF PANAMA RUBBER SUBSTATION EXPENSES

JULY 1, 1945 TO JUNE 30, 1946

PANAMA RUBBER SUBSTATION EXPENSES:	
Compensation of Manager, including Retirement Contributions	$ 4,536.00
Labor	7,003.91
Travel	308.83
Supplies and Equipment	2,633.49
Miscellaneous Office and Plant Maintenance Expense	993.56
TOTAL PANAMA RUBBER SUBSTATION EXPENSES	$15,475.79

Schedule B-3

SCHEDULE OF WASHINGTON EXPENSES

JULY 1, 1945 TO JUNE 30, 1946

WASHINGTON EXPENSES:

Administrative Salaries Including Faculty in Costa Rica	$ 56,151.65	
Contributions to Retirement Fund	2,393.09	$ 58,544.74
Travel		9,232.77
Printing and Translations		600.77
Miscellaneous Office Expenses		2,933.68
TOTAL WASHINGTON EXPENSES		$ 71,311.96

Exhibit C

STATEMENT OF STATUS OF U. S. GRANTS- IN- AID

JUNE 30, 1946

U.S. GRANT-IN-AID - CONSTRUCTION OF BUILDINGS AND OTHER FACILITIES

Receipts:		
Original Amount of Grant	$ 365,000.00	
Refund - Unused Funds - Plans and Specifications	362.73	
Refund of Excess Disbursements	210.21	
Insurance on Claim	5,631.27	$371,204.21
Expenditures:		
To June 30, 1943	$ 25,693.32	
July 1, 1943 to June 30, 1944	288,539.19	
July 1, 1944 to June 30, 1945	55,090.30	
July 1, 1945 to June 30, 1946	1,881.40	$371,204.21
		$ -

NOTE: Refer to previous audit reports for statements of Grants-in-Aid which were fully expended prior to July 1, 1945.

The allocation of expenditures to the various funds were made by officials of the Institute.

Exhibit D

STATEMENT OF GENERAL RESERVE (WORKING FUND)

JULY 1, 1945 TO JUNE 30, 1946

BALANCE, JULY 1, 1945		$ 6,421.71
DEDUCT:		
Excess of Balance of Expenses over Income (Exhibit B)	$14,335.24	
Additional Credit to Construction Reserve to Comply with Terms of Agreement with Office of Inter-American Affairs	10,000.00	
Coffee Crop Price Adjustment-1944	662.43	24,997.67
DEFICIT, GENERAL RESERVE (WORKING FUND) JUNE 30, 1946		$ 18,575.96

QUOTAS OF THE AMERICAN REPUBLICS FOR THE SUPPORT OF THE INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES FOR THE FISCAL YEAR ENDING JUNE 30, 1947 [a]

	Population	Quotas at $1.00 per Thousand	
Argentina	13,909,950	$ 13,909.95	
Bolivia	3,533,900	3,533,90	
Brazil	41,565,083	41,565.08	
Chile	5,289,120	5,289.12	b
Colombia	8,701,816	8,701.81	
Costa Rica	725,149	725.15	
Cuba	4,778,583	4,778.58	
Dominican Republic	1,940,546	1,940.55	b
Ecuador	3,171,367	3,171.37	
El Salvador	1,896,168	1,896.17	b
Guatemala	3,410,762	3,410.76	
Haiti	2,719,474	2,719.47	
Honduras	1,154,388	1,154.39	b
Mexico	21,153,321	21,153.32	
Nicaragua	1,059,805	1,059.81	b
Panama	631,637	631,64	b
Paraguay	1,014,773	1,014.77	
Peru	7,395,687	7,395.69	
United States	158,960,887	158,960.89	b
Uruguay	2,185,626	2,185.63	
Venezuela	3,996,095	3,996.10	b
	289,194,137	$289,194.15	

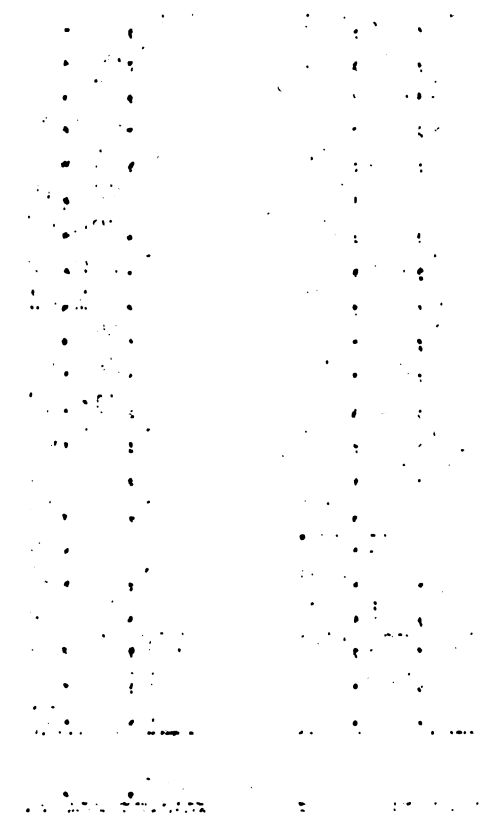
a. - Populations used are those effective for the quotas of the Pan American Union and computations are shown for all the American Republics regardless of expressions of intentions with respect to support of the Institute.

b. - Countries which contributed to the support of the Institute for the fiscal year ended June 30, 1946.

QUOTAS OF THE AMERICAN REPUBLICS FOR THE SUPPORT OF THE INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES FOR THE FISCAL YEAR ENDING JUNE 30, 1948 [a]

	Population	Quotas at $1.00 per Thousand
Argentina	14,130,871	$ 14,130.87
Bolivia	3,533,900	3,533.90
Brazil	41,565,083	41,565.08
Chile	5,389,554	5,389.55
Colombia	8,701,816	8,701.81
Costa Rica	725,149	725.15
Cuba	4,778,583	4,778.58
Dominican Republic	1,940,546	1,940.55
Ecuador	3,241,311	3,241.31
El Salvador	1,934,925	1,934.93
Guatemala	3,546,624	3,546.62
Haiti	2,719,474	2,719.47
Honduras	1,201,310	1,201.31
Mexico	22,178,423	22,178.42
Nicaragua	1,070,475	1,070.48
Panama	631,637	631.64
Paraguay	1,071,689	1,071.69
Peru	7,395,687	7,395.69
United States	159,772,539	159,772.54
Uruguay	2,202,936	2,202.94
Venezuela	3,996,095	3,996.10
	291,728,627	$291,728.63

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.



BUDGET FOR THE FISCAL YEAR

July 1, 1946 - June 30, 1947

Estimated Revenue

There are two principal sources of regular income for the support of the Institute. They are receipt of quotas from the contributing governments and the income from farm operations.

Quotas from the ten governments that have already shared in the support of the Institute total $179,064.58 for the fiscal year. To this it is expected there will be added receipts from other countries that have signed the Convention establishing the Institute and others that have shown some indication of adhering to the Convention.

Income from farm operations is divided into four general classes which are: cane, coffee, other agricultural products and rentals. The estimated gross revenue from these sources is $30,780.00. However, it should be borne in mind that the uncertainties in crop production and in crop prices may make the actual figures vary considerably from the estimate.

Other income from miscellaneous sources in small and uncertain amounts such as that from operating the dormitory and tuition from special students will, it is believed, increase the revenue by at least $1,400.00

From the foregoing observations it will be apparent that the estimated revenue of $211,244.58 exceeds the estimated expenses of $210,390.00 by a small margin.

Estimated Expenses

The accompanying schedule of estimated expenses is submitted with the request that the Board consider them as estimates and that the officers of the Institute be permitted to make reasonable revisions in the light of experience as the fiscal year progresses.

The new Director has had numerous conferences with the respective Department heads and other officers of the Institute concerning the program for 1946-47. As this program develops and after obtaining the results of the deliberations of the Administrative Committee, certain adjustments will likely be made in the program.

In the preparation of this budget careful consideration was given to the income that will be made available during the fiscal year from the receipt of the regular governmental quotas. The possibility that the Institute will be able to obtain financial assistance from other sources for special projects was also considered.

As may be expected, every effort will be made to increase the revenue and to conserve expenses with a view to expanding and improving the services of the Institute to the American Republics and to establishing a small working fund reserve.

Inter-American Institute of Agricultural Sciences

Estimated Expenses

For the Fiscal Year July 1, 1946 - June 30, 1947

I - ESTIMATED REQUIREMENTS OF THE FIELD HEADQUARTERS IN COSTA RICA:

Office of the Director	$16,380.00	
Department of Animal Industry	31,680.00	
Department of Plant Industry	25,680.00	
Department of Agricultural Engineering	5,130.00	
Department of Economic and Social Welfare	3,120.00	
Institute Services	32,016.00	
Farm Operation	16,248.00	
Dormitory Operation	8,100.00	
Library	4,080.00	
Office Expenses	7,680.00	
Travel	7,500.00	
Medical and Social Security Expenses	2,340.00	
Purchase of Equipment	7,416.00	
Construction of Buildings and Appurtenances	8,460.00	
Miscellaneous Expenses	2,520.00	$178,350.00

II - ESTIMATED REQUIREMENTS OF THE EXECUTIVE HEADQUARTERS IN WASHINGTON, D. C.:

Office Staff	$11,340.00	
Travel	1,500.00	
Printing and Translations	1,200.00	
Office and Miscellaneous Expenses including office supplies and equipment, auditing, local transportation, insurance and surety bonds, official meetings, telegrams, cablegrams, postage, express, telephone, and all other expenses not otherwise provided.	3,000.00	17,040.00

III - ESTIMATED REQUIREMENTS AT THE PANAMA SUBSTATION:

Compensation of the Manager, labor, supplies and equipment, and all other expenses at the station.	15,000.00
TOTAL ESTIMATED EXPENSES	$210,390.00

Inter-American Institute of Agricultural Sciences
Chart of Accounts Effective July 1, 1946

A/C NO.	ACCOUNT NAME			
	FIELD HEADQUARTERS			
	OFFICE OF THE DIRECTOR:			
CR-400*	Staff			$16,380.00
	DEPARTMENT OF ANIMAL INDUSTRY:			
CR-401*	Staff		$7,560.00	
402	Labor		8,820.00	
403	Supplies and Services		4,800.00	
404	Purchase and Sale of Animals & Animal Products		10,500.00	31,680.00
	DEPARTMENT OF PLANT INDUSTRY:			
CR-411*	Staff		$14,964.00	
412	Labor		9,720.00	
413	Supplies and Services		996.00	25,680.00
	DEPARTMENT OF AGRICULTURAL ENGINEERING:			
CR-421*	Staff		$3,150.00	
422	Labor		1,380.00	
423	Supplies and Services		600.00	5,130.00
	DEPARTMENT OF ECONOMICS & SOCIAL WELFARE:			
CR-426*	Staff		$2,520.00	
427	Supplies and Services		600.00	3,120.00
	INSTITUTE SERVICES:			
CR-431*	Staff		$3,936.00	
432	Roads & Landscaping			
A	Labor	$5,700.00		
B	Supplies & Services	600.00	6,300.00	
433	Light Plant Maintenance			
A	Labor	$1,260.00		
B	Supplies & Services	4,200.00	5,460.00	
434	Machine Shop			
A	Labor	$4,500.00		
B	Supplies & Services	480.00	4,980.00	
435	Repair of Buildings & Fences			
A	Labor	$600.00		
B	Supplies & Services	600.00	1,200.00	
436	Repair of Equipment			
A	---			
B	Supplies & Services		3,300.00	
437	Gas & Oil - Automotive Expenses		4,020.00	
438	Storeroom		720.00	
439	Watchmen		2,100.00	32,016.00
	TOTAL - Page 6			$114,006.00

A/C NO.	ACCOUNT NAME			
	FIELD HEADQUARTERS (Cont'd.)			
	FARM OPERATIONS:			
CR-441	Coffee - Labor		- -	
442	Coffee - Supplies and Services		- -	
443	Cane - Labor		$10,800.00	
444	Cane - Supplies and Services		- -	
445	Other Land Products - Labor		- -	
446	Other Land Products - Supplies & Services		48.00	
447	Salaries		5,400.00	$16,248.00
	DORMITORY OPERATIONS:			
CR-	Dining Room-Kitchen			
451	Labor	$1,440.00		
452	Food	4,800.00		
453	Other Expenses	300.00	$6,540.00	
	Housekeeping Expenses			
454	Labor	$720.00		
455	Supplies and Services	300.00	1,020.00	
	Laundry			
456	Labor	$240.00		
457	Supplies and Services	300.00	540.00	8,100.00
	LIBRARY:			
CR-461	Salaries		$2,400.00	
462	Supplies and Services		180.00	
463	Books, periodicals and publications		1,500.00	4,080.00
	OFFICE EXPENSES:			
CR-471	Salaries		$4,320.00	
472	Supplies and Services		600.00	
473	Legal Fees		1,800.00	
474	Insurance		360.00	
475	Communications		600.00	7,680.00
	MEDICAL AND SOCIAL SECURITY EXPENSES:			
CR-481	Social Security Tax		$2,040.00	
482	Student Care		300.00	2,340.00
	MISCELLANEOUS EXPENSE:			
CR-491	Cesantía and Pre-Aviso		$1,200.00	
492	Special Student Facilities		120.00	
493	Other		1,200.00	2,520.00
CR-495	Travel			7,500.00
	TOTAL - Page 7			$48,468.00

A/C NO.	ACCOUNT NAME		
	FIELD HEADQUARTERS (Cont'd.)		
	EQUIPMENT PURCHASES:		
CR-500	Dept. of Animal Industry	$300.00	
501	Dept. of Plant Industry	936.00	
502	Dept. of Agricultural Engineering	840.00	
503	Dept. of Economic & Social Welfare	- --	
504	Institute Services	2,640.00	
505	Farm Operations	900.00	
506	Dormitory Operations	360.00	
507	Library	360.00	
508	Office	300.00	
509	Miscellaneous	780.00	$7,416.00
	CONSTRUCTION ACTIVITIES:		
CR-510	Construction Activities Corrals, Fences & Sheds for Animal Industry	$4,980.00	
	Poultry House - Animal Industry	720.00	
	Electric Line to Bodega No. 1	420.00	
	Addition to Machine Shop	300.00	
	Finish Dormitory	360.00	
	Cottage Equipment	1,680.00	8,460.00
	TOTAL - Page 8		$15,876.00
	RECAPITULATION		
	Page 6	$114,006.00	
	Page 7	48,468.00	
	Page 8	15,876.00	
	TOTAL - Costa Rica	$178,350.00	$178,350.00
	EXECUTIVE HEADQUARTERS		
E-1	Staff	$11,340.00	
2	Travel	1,500.00	
3	Printing and Translations	1,200.00	
4	Office and Miscellaneous	3,000.00	$17,040.00
	PANAMA SUBSTATION		
P-1	Salaries - Staff	$4,320.00	
2	Labor Expense	7,020.00	
3	Travel	360.00	
4	Supplies and Equipment	2,400.00	
5	Misc. Office & Plant Maintenance Expense	900.00	$15,000.00

SUMMARY RECAPITULATION

Field Headquarters	$178,350.00
Executive Headquarters	17,040.00
Panama Substation	15,000.00
GRAND TOTAL	$210,390.00

* Personnel in Costa Rica paid in dollars from Washington. Includes salary and retirement deductions.