REPORT ON THE

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MEETINGS OF THE ADMINISTRATIVE COMMITTEE OF THE INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

HELD IN TURRIALBA, COSTA RICA

MARCH 28-31, 1949

Pan American Union
Washington, D. C.

Gentlemen of the Board of Directors:

I take pleasure in submitting herewith the Report of the Administrative Committee of the Inter-American Institute of Agricultural Sciences on the meetings held in Turrialba from March 28 through 31, 1949. The Committee discussed with the respective staff members the various phases of the work which they are carrying out and exchanged ideas and suggestions as to the future program of work of the Institute.

You will note from the attached reports on the different Departments that considerable progress has been made in the kind and number of projects which are being undertaken in Turrialba. However, the necessity of obtaining more ratifications to the Convention and thus greater financial support is still a primary concern of the Committee.

Respectfully submitted,

H. Harold Hume

H. Harold Hume, Chairman
Administrative Committee

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The March 1949 meetings of the Administrative Committee were attended by the following:

H. Harold Hume, Provost, College of Agriculture, University of Florida, Gainesville, Florida (Chairman)
Robert E. Buchanan, Research Professor and retired Director, Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa
Mariano Montealegre, Instituto de Defensa del Café de Costa Rica, San José, Costa Rica
Ruth Quintanilla, Mexico City (by invitation)
Ralph H. Allee, Director of the Institute
José L. Colom, Secretary of the Institute

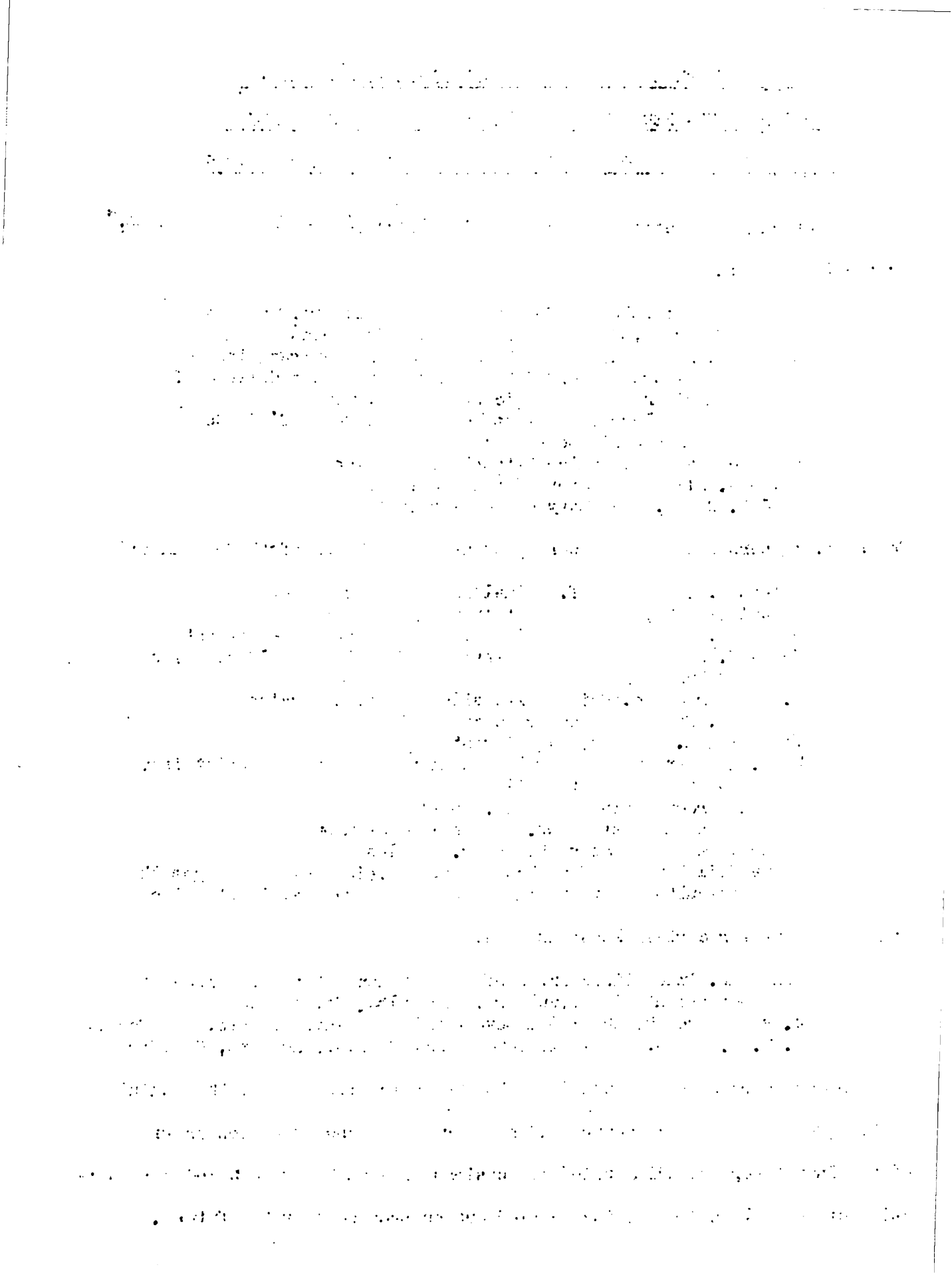
The staff members listed below were present for sections of the meetings:

Albert O. Rhoad, Chief, Animal Industry Department
Manuel Elgueta, Chief, Plant Industry Department
Norton C. Ives, Chief, Agricultural Engineering Department
Julio O. Morales, Chief, Department of Agricultural Economics and Rural Life
D. Spencer Hatch. Chief, Extension Education Services
George F. Bowman, Director, Cacao Center
Frederick L. Wellman, Pathologist
W. E. Keepper, Agricultural Economist, Visiting Scientist from Pennsylvania State College
Antonio Arce, Assistant to Dr. Morales
Jorge León, Analyst in Dr. Morales' Department
Juvenal Valerio, Assistant to Dr. Morales
Marta Coll Camalez, Home Economist, Visiting Scientist from the Agricultural Experiment Station at Mayaguez, Puerto Rico

Others present for certain sessions were:

Ernest P. Imle, Director, Rubber Experiment Station, United States Department of Agriculture, Turrialba, Costa Rica
J. van Overbeek, Shell Oil Development Company, Modesto, California
H. W. Slotboom, Shell Oil Development Company, Modesto, California

In accordance with the usual custom, the March meetings of the Administrative Committee were concentrated on the research and education program of the Institute, including brief discussions of each Department and consideration of special projects being carried out or proposed for the future.



SPECIAL PROJECTS

Library

The proposed expansion of the services of the library, as a result of a survey of library resources of Mexico, Central America, Panama, and Colombia, undertaken by Dr. Ralph R. Shaw, Librarian of the United States Department of Agriculture, and sponsored by the Rockefeller Foundation, was the first subject to be discussed. Dr. Allee advised the Committee that the establishment of a Scientific Communications Service, which would provide agricultural technicians and institutions throughout Latin America with available published material on agriculture and allied subjects, was being contemplated, and a formal request for the necessary funds to carry out the program had already been presented to the Rockefeller Foundation.

The expansion of the library's services would, however, bring up the problem of additional space for the library. The advisability of constructing another dormitory and using the present Central Building for offices and laboratory facilities was discussed. It was considered advisable to have the library in a separate building some day, though this would be a project for the distant future.

Technical Meeting on Extension

Plans were discussed for a Technical Meeting on Extension which would be held jointly by the Food and Agriculture Organization of the United Nations and the Institute for a period of about ten days, beginning on the twenty-third of August. Extension workers from the governments of the American Republics as well as various organizations dealing with and interested in problems of extension would be present. Twenty-five to thirty delegates in all would be expected to attend. Various factors involved in

extension work would be discussed, and it was hoped that this might be the first of a series of periodic meetings on extension. Perhaps, with leaders in the field present, principles that all would recognize as valid, could be determined.

Engineering Project and the Point Four Program

The possibility of expanding the facilities of the Agricultural Engineering Department, including the construction of a new building to house this department, the acquisition of a considerable amount of farm machinery and equipment, and the inauguration of a program for the training of technicians in the methods of using farm power and machinery to best advantage, was discussed. This project would be possible only if additional funds should be made available outside the regular budget of the Institute. The project had been discussed with the Ford Foundation and also with the International Bank for Reconstruction and Development, but no promise of funds was definite as yet.

Consideration was also being given to including the engineering project under the Point Four Technical Assistance Program proposed by President Truman in his inaugural address. A request for $200,000 has been made, and should this sum be forthcoming from the Point Four Program, it was considered possible that the Organization of American States might provide an additional $15,000 or $20,000. If acted upon favorably, this project should be started on July 1, 1950.

FAO-Institute Joint Extension Program

Should the Point Four Program become a reality, the possibility of extensing the rural centers begun by Dr. D. Spencer Hatch to the rest of the world as well as to the Western Hemisphere would be considered.

Meeting of Directors of Experiment Stations and Those Concerned with Agricultural Education

The holding of a meeting of Directors of Agricultural Experiment Stations, Directors of schools of agriculture, and Deans of colleges of agriculture in the Middle America region had been under consideration for some time. It was proposed that representatives of twelve or thirteen institutions would be invited to attend and hoped that the meeting could take place around the sixteenth of August, or just before the Extension Meeting. The Directors of the schools had already been requested to make suggestions in regard to this education meeting, and it was hoped that this might be the beginning of a series of meetings of Directors of schools of agriculture.

Coffee Program

The proposed expansion of the coffee work of the Institute through the establishment of an Inter-American Coffee Center at Turrialba had been recommended by the Inter-American Economic and Social Council of the Organization of American States, as discussed in a previous meeting of the Administrative Committee. It was hoped that the additional funds could be obtained from various organizations interested in the production and marketing of coffee. A minimum of $20,000 was considered necessary for urgent work on coffee cultivation and diseases affecting the plant.

Tropical Biological Center

The University of Michigan had suggested that this hemisphere has great need for a Tropical Biological Center, and correspondence has been carried out between Professor Steere of this University, the Institute, and others, on such a project. The facilities of the Institute could be used for this purpose if additional funds were supplied.

Plant Breeders Meeting

Last year a meeting on corn was held at the station maintained in Antigua, Guatemala by the Iowa State College of Agriculture and Mechanic Arts. Dr. Wellhausen of the Rockefeller Foundation in Mexico was appointed Chairman of the committee to organize a meeting for this year, and Dr. J. G. Harrar, Field Director for Agriculture of the Rockefeller Foundation, had asked if the Institute would be willing to sponsor the meeting. It would be held before the fifteenth of September in Mexico, which would be the host to the group. A maximum of fifty plant breeders were expected to attend. It was proposed that Dr. Harrar approach the Minister of Agriculture of Mexico on the matter; Dr. Allee would to go Mexico to see about arranging for the meeting there; and the Institute would send out the invitations. This meeting might, also, be the first of a series of meetings of plant breeders.

FIELD TRIP AND SEMINARS

On the morning of March 29 the Administrative Committee took a field trip, which gave the members an opportunity to see the research and experimental work of the Institute acutally being carried out, and in the afternoon they attended seminars given by Marta Coll Camález on "Family Health Problems in the Turrialba Community" and by Dr. Johannes van Overbeek, Head of the Plant Physiology Department of the Shell Oil Company, Inc., Modesto, California, on "Plant Growth Regulators".

DISCUSSIONS WITH THE SHELL OIL DEVELOPMENT COMPANY

Prior to the meeting of the Administrative Committee, the Director and the Secretary of the Institute held a series of discussions with Dr. Roy Hansberry, Director of the Agricultural Laboratory, Special Products

Department, Shell Oil Company, Modesto, California; Dr. Johannes van Overbeek, Head of the Plant Physiology Department of the Modesto Laboratory; and Dr. H. W. Slotboom, representing the Biocide Sections of the Shell Company's research laboratories in Amsterdam, Holland, with regard to the Company's desire to find a site in Latin America for the establishment of a proposed Shell Oil Development Tropical Research Station. The Company, Dr. van Overbeek and Dr. Slotboom indicated, would like to find a site which would be most suitable from the standpoint of physiographic conditions in general, but it would also prefer to be associated with an institution such as the Institute. They planned to conduct basic research, with secondary emphasis on screening trials, and to operate their own station rather than grant funds for research on a contract basis.

After these preliminary discussions in Washington, Dr. van Overbeek and Dr. Slotboom visited Costa Rica in the course of their survey of potential sites for their research station and met with the Administrative Committee in Turrialba on March 29. The Committee had previously discussed a possible association with the Shell Oil Development Company and had agreed that, if the established policy of the Institute concerning participation in research with industrial concerns is respected, it would be desirable to augment our services to the American Republics by such a cooperative enterprise. This policy involves the following:

1. The Institute will undertake in such cooperation only projects which are consistent with the established objectives of the Institute.
2. The Institute must have complete freedom in the choice of personnel and other factors involved in administration.
3. The Institute must have the right to publish or in other ways make the information obtained available to member countries.

The plan of the Shell Oil Company Company presents a possibility different from any considered previously, since the Company desires merely to rent for its purposes such facilities as land and buildings, and to be associated with the Institute at the staff level, on the basis of two independent agencies. The Administrative Committee agreed that the supplying of such a facility would be appropriate if sufficient reimbursement were received to compensate the Institute for any direct expenses and, in addition, to supply some funds for operating our established program.

At the end of their study, Drs. van Overbeek and Slotboom seemed to have the following impressions:

1. They did not desire to make permanent capital investments because the Company is experimenting in the utility of the tropical station and has planned an initial five-year period for this purpose.
2. Dr. van Overbeek, at least, felt that their center should be near San José because of the possibility of finding rentable buildings and also because he believed staff members would be more satisfied in or near a city. He is also very much interested in pineapple problems, and the commercial pineapple area of this country is in the San José- Grecia area.
3. Both, however, felt that it would be greatly to their advantage to be associated with the Institute either by having the privilege of utilizing the Institute library and conferring with its staff through visits, with a possible center in San José, or by contracting for facilities in the San José area which might eventually become a substation of this Institute. The latter proposition was considered unfeasible by the Committee since a substation of this Institute would seem to be more useful closer to the Pacific coast, in the more typical irrigation area.

4. Dr. Slotboom, at least, seemed to have some feeling that the Shell Company might make a temporary arrangement to start their research with headquarters here at Turrialba and allow the director chosen for their program to make his own permanent arrangements.

In the final discussions with the Shell people, the following were indicated as some of the facilities of the Institute which might be of interest:

1. Staff privileges, including duty and tax exemption (if this could be arranged with the Costa Rican Government); use of the Institute library; consultation with our staff members; and use of the laboratory as available.
2. Shop and repair services at cost.
3. The handling of labor payrolls, social security formalities, and legal services.
4. Land for plot work.
5. Cooperation on projects when feasible for both parties.
6. Extension contacts with local farmers and with the American Republics in general.
7. Food and lodging for visitors at Visiting Scientists rates.

DISCUSSION OF REPORTS OF THE DEPARTMENT HEADS

On Wednesday morning, March 30, the Administrative Committee started to take up the work of each Department of the Institute. Dr. Hume, Chairman of the Committee, advised the Department Heads that the Committee was interested in the following three things: "(1) What you have done; (2) What you have gotten out of it; and (3) Your future plan of approach." Mr. Elgueta reported on the general work of the Plant Industry Department,

and this was followed by reports on the Cacao Center by George F. Bowman and the work done in the laboratory and on coffee pathology by Frederick L. Wellman. Dr. Morales then proceeded to give his report on the work of the Department of Agricultural Economics and Rural Life.

Agricultural Economics and Rural Life

The Committee was particularly interested in the trial census which Dr. Morales' Department had made in the Turrialba area and the application its questionnaires and methodology would have to the 1950 Agricultural Census. Dr. Morales said he received a great deal of cooperation from the community and from the Church in taking this census. Mr. Colom stated that it was hoped that a more elaborate coffee census could be taken in connection with the 1950 Census, and that if this methodology could be applied to other countries, the job would be relatively simple. Dr. Morales was of the opinion that an agricultural and population census might also be taken, as well as a coffee census. He explained that no agricultural census had ever been taken in Turrialba and his Department had to do everything from the beginning. Dr. Allee commented on the fact that a tremendous amount of effort is being put into the 1950 Census by the United States Department of Agriculture, UNESCO, and the Inter-American Statistical Institute through fellowships and training schools, but that Dr. Moreles and his assistants, Professor Valerio, Jorge León, Antonio Arce, and Marta Coll Camález had contributed a great deal to the basic research required for this task.

Dr. Keepper reported on the Farm Management work he was doing at the Institute, including the coffee sub-project. He stressed the importance of making efficient use of human labor and stated that mechanization is not the only answer to the problem. He also discussed the training program

which the Institute is carrying on. The work in farm management has been brought down to the level of Dr. Hatch's extension trainees, and they have been supplied with scientific training on how to administer the farm and solve the financial problems involved, including the way to get credit and how to use it soundly.

Dr. Allee made four statements at this point, summing up the value of the census work and the coffee agreement made with Colombia by the Department of Economics and Rural Life, as follows: (1) There is a definite relation between social science, research, and extension as being worked out by Dr. Morales and Dr. Hatch and also between the gathering of sound data, training of people, and the establishment of methodology. (2) The implications of the agreement with Colombia should be applied to all the work of the Institute. (3) The strategy of relations which have been developed in this program with the universities of the hemisphere, not only as regards the training of people where other resources can be capitalized, but in the utilization of staff with years of experience, is very important. The Institute is training men to do research when they return to Medellín, Cali, and elsewhere. (4) Next to Mexico, the Institute has had more contacts with Colombia than any other country in the hemisphere except Costa Rica--in number of students registered, number of visitors, projects, etc. And yet Colombia is not supporting the Institute. Dr. Allee pointed out, however, that the Institute obtains valuable ideas from such an association, and it is the policy of the Institute to cooperate willingly with the twenty-one American Republics whether they have ratified the Convention or not. The scientific approach cannot be compartmentalized. It would be a disservice to the hemisphere and to the Institute itself if the organization were not to continue working with the entire hemisphere.

Extension Services and Applied Rural Science Training

Dr. Hatch explained that his service is the newest part of the Institute to be organized. At this time, he said, a great deal of interest in the Extension Service was being taken by Dr. H. Belshaw, Director of the Rural Welfare Division of the Food and Agriculture Organization of the United Nations. It was the general feeling that the Institute's Rural Center and Extension Training should be carried out to other countries as part of President Trumen's Point Four Program. Along this line of thinking, the Institute had sent a plan to FAO involving strengthening the existing personnel, providing additional housing, and eventually sending teams of workers out to set up a center in another part of the world. This center, the Institute felt, should be in South America or the Caribbean area, however, whereas FAO felt that it should be in the Near East. The Institute in Turrialba would continue to be the training place; teams of workers would spend a period of time in Turrialba, and some of the Institute's trained staff members would go out with them to help establish centers elsewhere. All this, of course, would depend on financial support of the Point Four Program for personnel and the ability of the countries concerned to provide land, buildings, and equipment.

Dr. Hatch explained that the Institute's Center is to be the people's own center, completely copiable, and the Institute is teaching the way and the method. Dr. Allee mentioned the fact that while the Institute's Extension Service may affect directly the welfare of a thousand people a year—a relatively small number—if it can in the course of a year make five other Extension Services more efficient through the above-mentioned proposed program, it would be very worth while. The method of approach is important, and research is the method needed. The relationship between

social science and extension is important; consultation with member countries to help them establish their extension approach is also important, as is the training of people to do this extension work. While the Institute is not intended to do undergraduate work, which is a national and not an international task, there is a tremendous amount of research to be done on the approach to be used and on the type of persons the member countries will have to use for their extension work. Therefore, the Institute has undertaken the task of training Vocational Students who will be taught to train people in their own countries to do this work.

The foremost essential in the extension organization is the approach to the rural community, particularly those types of communities in Latin America. It must be an integrated approach; helath problems, education problems, religious problems, dietary problems, etc., all enter into the life of a community. What is needed first is a point of vantage from which to work. The Institute is therefore not developing a model farm for this purpose, but rather a farmer's type of farm center from which men can work and to which farmers may come. The rural center scheme offers a place to demonstrate, a place to sell the farmers and farm families, a place to show some definite projects in plants and animals.

Mr. Colom told the Committee that he had received many requests for the results of the work being done in Turrialba. Extension, he added, is badly needed and is more attractive to most people than basic research. The work being done by Dr. Hatch's Service, he continued, is very important, not only in itself, but because it is a quick method of getting results. A contrast between this year and last year can be seen, and five of the twenty vocational students at the Institute may continue to study more and later teach others to work with their hands.

Dr. Buchanan indicated that extension and research work are both fundamentally research. Work in the field to get data to pass on is essential. Social science, he added, has suffered in the past because it did not have the same kind of laboratory tools. Out of this work must come a great deal of fundamental knowledge concerning sociology, and this will have its application in all the American countries. The exact techniques may not all be applicable, but the fundamental concepts of how you go about reaching the people in communities is just as good fundamental science as plant science.

All agreed that the results of the Institute's work must be interpreted on all levels. They must reach the finca owners and the workers as well. A combination of basic research and applied research is necessary, and it is a good thing for the Institute to have both basic research and a means of carrying the results out to the farms. Dr. Hume ably summed the matter up as follows: "We are interested in results of research that will accrue to agriculture. You cannot get those results across without dealing with the people. Until you do get those results across into the minds and hands of the people, you have done nothing."

Field Trip to the Animal Industry Department and Projects of the Agricultural Engineering Department

In the afternoon of Wednesday, March 30, the Committee made a field trip to observe the breeding herds and the tórsalo control work which was explained by William Neel, graduate assistant in the Animal Industry Department. The beef breeding herds include Santa Gertrudis animals, Nicaraguan cows, and Brahman-Angus bulls. The tórsalo project includes a chemical laboratory with cages for finding eggs on vectors. The animals are also exposed to different pasture conditions and then brought back so that the

tórsalo development may be watched. The Committee saw the new horse barn, quonset hut, hog pens, slaughter house, dairy barn, creamery, climatology and nutrition laboratory, and poultry houses. The dairy herds include Brown Swiss, Jersey, Holstein, and native Costa Rican cows. The cornerstone of the climatology and nutrition laboratory was laid on February 7. It will be a greenhouse arrangement with solar radiation. The horse barns and stables were constructed with funds provided by the King Ranch and shelter horses supplied by the same ranch. A feeding and sanitation project was under way in the swine unit; no breeding program was in progress at the time. The poultry houses include incubators and brooders, and the flocks contain New Hampshire Reds, Plymouth Rocks, and White Leghorns, as well as native birds. Mr. Dennelley, Manager of the Demonstration Farm, demonstrated the use of the bulldozer to take rocks off the land surface and cultivate feed crops.

Mr. Ives' projects, which were visited by the Committee, included his drying unit, portable bin for grain storage, and weather project. He described the methods being used to dry and store rice in sacks and corn in the Butler bin donated to the Institute, and explained the problems of weevils and high moisture in the tropics. He demonstrated his community drier--the tractor or ox cart type drier--which uses the batch system of drying and reduces labor to a minimum, and explained that there are three types of driers--the sack drier, the bin type drier, and the trailer type drier.

TEACHING PROGRAM

On Thursday, March 31, the Committee took up the discussion of the teaching program of the Institute. Dr. Allee explained that each student gives a seminar early during his stay at the Institute, and then at the

completion of his work, he gives a review and his conclusions on the work. The Registrar, Mr. Ernest H. Casseres, passed out lists of the students enrolled for the Second Trimester of the 1948;49 academic year and stated that there were at that time fifty-four students in residence, which is far beyond the residence limits of the Institute. Most rooms had four beds. Forty-five students could be accommodated upstairs if necessary, however.

The Announcement of Study Program for the group of students expected to enter on October 1, 1949 was reacy to be sent out, and Dr. Allee expected to receive a hundred or more applications from students, which indicated a need for additional funds and staff members. Of the fifty-four students in residence, 21 were Cacao students, 19 were in Dr. Hatch's group of vocational students, 3 held Esso fellowships, and one held a DuPont fellowship; the rest were studying in the several Departments of the Institute, including two Economics and Rural Life students who were then in the States taking special courses. It was explained that the number of students in the first two groups was so large because the Institute had funds from the American Cocoa Research Institute and the American International Association with which to handle them. The vocational students also get general agricultural training and are under the responsibility of Dr. Hatch. In a few years, Dr. Allee explained, the Demonstration Farm will bring the Institute enough income to support all the students under the AIA grant.

Degrees

Five students, Mr. Casseres reported, had already completed their requirements for the Master of Agriculture Degree; a sixth student was still waiting for a statement from the University of Mexico before receiving his degree from the Institute. The requirement that a student have a

Bachelor's degree or the equivalent before receiving a degree from the Institute, has been a problem, Mr. Colom explained, particularly with reference to students from Mexico. Two students were awaiting their Institute degrees because of a requirement at Chapingo that they have a certain amount of experience in the bield before getting a degree from that university. Dr. Allee further explained that the Mexican institution tells the boys that they have passed their courses but that they must have experience in the field for a year and then go back and take an examination in order to get the degree. The Institute has accepted these boys after they left the Mexican institution, but if it gave them the Master's degree before they got their Bachelor's degree from Chapingo, that would be making light of Chapingo's requirements. Therefore, the policy of the Institute has been to tell these students after they go back to Chapingo and get their degree, the Institute will confer the Master's degree on them.

The Committee considered it essential that the students stand by the Institute and believed that some kind of an understanding could be reached with the Dean at Chapingo in regard to the above-mentioned Mexican students. It was agreed that the Institute staff could work out some arrangements so these students might get their degrees and that the whole basis for the admission of students to the Institute might be brought up by the Director at the next meeting of the Administrative Committee.

Requirements for Admission of Students

Dr. Buchanan stated that it was his opinion that there was no reason for the Institute to require that a student have previous agricultural training before his admittance to the Institute provided that he had some training equally as useful, such as a major in botany or engineering. Dr.

Allee explained that the present policy of the Institute is to say that a student should have a Bachelor's degree or the equivalent, and the Institute determines what the equivalent should be. No student is accepted as a candidate for anything until he has had a month's orientation at the Institute. At the end of the orientation period and after a meeting with the advisory committee, the student may decide to go home, to work on at the Institute and better prepare himself in a particular field, to become a candidate for a degree at the Institute, or to work at the Institute and register elsewhere for the doctorate. The Institute must decide on the best course of training for students whom it takes under its auspices, even though it may be criticized for following such a policy.

Discussion of Courses Offered

Messrs. Elgueta, Hatch, Bowman, Morales, and León were called upon to describe their course work, distribute outlines of specific courses, and copies of examinations. The method of holding conferences with members of the staff in the particular field being covered was explained; for example, Mr. Rhoad would be asked to give lectures on animal nutrition and breeding, Dr. Thompson on growth in plants; Mr. Casseres on research in seed, and Dr. Morales on the social sciences. Dr. Buchanan suggested that the students be told, in the Institute's textbooks, "what is fact, what is fancy, and what is gossip". Dr. Morales commented on the need for teamwork with other countries, the need for balanced research, and the need for coordination and even translation. The Institute should unify the solutions to problems and organize them for all countries. Dr. Allee recalled that a number of Committee meetings had discussed this matter, and accordingly the Institute's research and teaching work had been organized around the four realities--plants, animals, human beings, and engineering.

The Committee considered the importance of calling attention to the significant work Mr. Ives has been doing in the field of grain drying and storage in the tropics. It considered the publication of the paper he presented on the subject at the FAO Conference held in Palmira, Colombia. Mr. Ives, however, stated that FAO would compile the material of the Conference, including the material he furnished, and would publish the Proceedings of the Conference including his paper. The advisability of the Institute's also publishing the material to give it a wider audience was considered; perhaps this might be done by the proposed Library and Publications Service. Mr. Ives suggested the calling of a technical conference in Turrialba to discuss the whole problem of storage, but the Committee considered the fact that there have been a multiplicity of conferences, many going on simultaneously. Dr. Allee suggested that such meetings of technicians as might be held at the Institute could be called "symposia" of people in specialized fields--extension, agricultural education, plant breeders, etc.

Need for Textbooks

The need for textbooks was brought up by Jorge León when he explained his taxonomy course. Many students lack the background for the course and have language difficulties. There is also a definite lack of good textbooks on the subject; the best one on taxonomy for tropical plants is in English, and some students find it difficult to read the English textbook.

The Committee agreed that translations of textbooks into Spanish as well as original works are needed, and some of this material might be prepared at the Institute. The texts should be short, with a format somewhat similar to the Farmer's Bulletins of the United States Department of Agriculture. They should have from 75 to 100 pages and should appear mostly

in Spanish, a few in English. An editor should be in charge of the work, but the body of the texts should be written by specialists who have worked in and know the tropics. Dr. Allee proposed that a little fellowship assistance might be given as a stimulus to authors to get the material out. It was agreed that the texts should be simple regardless of the level at which they were aimed.

INSTITUTE JOURNAL

The Committee next took up the question of the Institute Journal. It was agreed that a size of 7 x 10 inches with two columns would be satisfactory. The question as to whether the Journal should carry advertisements was also considered, and it was agreed that it should not. Dr. Allee indicated that the first edition was already in preparation. In the beginning the Journal will not be a periodical but will appear approximately every three months. Later on it might be made into a monthly publication, especially if the Journal is to carry abstracts from other publications.

COFFEE PESTS

Mr. Montealegre spoke at some length on the problem of coffee pests. About 1913, he said, the Broca was introduced into Brazil. It was not noticed until about 1934 when it was already too late to eradicate it. At the time, however, Brazil had a large coffee surplus and did not bother much about it. The first idea was to burn the plantations where the pest attacked. An entomologist was sent to East Africa to study the disease. Several biological controls were instituted, but in 1934 it was found that the Brazilians could not control this pest. Since then they have tried to control it with a wasp, but this has not been effective. Now, not even

insecticides can control it because the pest bores into the bean and lives there where it cannot be eradicated.

The next crop of coffee in Brazil will be under ten million bags, and the idea is to control the pest so that the crop will not fall very much below this figure. The problem is that the insect bores into the coffee bean and grain and is exported inside the bean into Cuba, Panama, Mexico, and Puerto Rico. The great danger is in importing the plague, and the only way to control it is to have a central control center with an entomologist in charge. There should be several of these stations in different countries with entomologists there to see that the Broca is controlled the moment it appears in any of these places.

Mr. Colom explained the interest of the Inter-American Economic and Social Councin in the production and marketing of coffee which has been manifested by the establishment of a Special Coffee Commission, an official organisation of the coffee producing countries. The Commission has taken over the duties of the Inter-American Coffee Board which ceased to exist in October 1948.

Mr. Elgueta then translated the following "Notes on a Plan for the Control of the Broca" which had been prepared in Spanish by Mr. Montealegre:

"A Commission, composed of members of the coffee associations of the Caribbean, should be sent to Brazil for the purpose of studying the problems created by this pest. The Commission should include at least three representatives of the several countries of the Central American and Mexican Federation, one Colombian, one Venezuelan, and a technician of the Inter-American Institute of Agricultural Sciences, and if possible, another technician from the Imperial College of Tropical Agriculture in Trinidad.

If the report of the Commission indicates that the threat is as dangerous as it seems to be, we should proceed to form an association to control the pest on the following bases or others that may be considered more effective:

"1. The establishment of a Technical Center to be directed by an entomologist with a thorough knowledge of the plague, the insect that produces it, and the methods of control in his country. This technician should be chosen from those of the Dutch East Indies, the Experimental Station of Lyamungu in Tanganyika, the I.N.E.A.C. of the Belgian Congo, or be an entomologist from any of the interested countries who, before beginning this work, might carry out some studies in these technical centers of the East.

"2. The establishment of substations in strategic places which the Technical Center would designate in the various coffee-producing countries.

"3. The collaboration of coffee associations and official coffee departments of all the interested countries as well as the coffee plantations and processing plants themselves in calling attention to any outbreak of the pest that may be noticed on the plantations, in the berries, or in the grains at the processing plants.

"4. The obtention of the cooperation of the Pan American Coffee Bureau in New York in order that it may watch the imports of coffee and obtain the cooperation of the roasters and buyers in the United States in advising the association of the arrival of any shipment, however, small, that may contain grains which have been bored by the Broca.

"5. The establishment of a fund to pay the expenses of the campaign and compensate the producers whose coffee trees may have to be destroyed, if such is the case, by means of a levy of one American cent ($0.01) per 60 kilogram sack that may be exported from each country. This levy would go

into a common fund and be applied to any of the countries that should be attacked by the pest.

"6. Absolute prohibition of importing from countries where the pest exists or may appear, or from markets importing products from places where it exists, used sacks or products of any kind in whose packing it might be possible to transport its germs, eggs, larvae, or the insects themselves.

"7. Prohibition of importing coffee seed of a y variety from places in which the pest is expected to exist and absolutely from Brazil or any country of the Eastern Hemisphere.

"8. Prohibition of importing green coffee or coffee for consumption from Brazil as well as the Eastern Hemisphere, to those coffee countries of America whose own production may not cover the total consumption, such as Cuba, Panama, etc.

"9. The formulation and carrying out of the necessary arrangements for preventing the importation of coffee for consumption from countries in which the plague exists to bordering places, especially the Antilles where it is not grown, but which have a great amount of trade with interested coffee countries, Curaçao, Aruba, etc.

"10. The initiation and maintenance in all the coffee countries of a press campaign with the object of making the coffee producers and the public in general aware of the danger and the necessity of cooperating in order to save the industry."

Supporting reports on the seriousness of the Broca plague, taken from editorials in the Tea and Coffee Trade Journal and a publication of the Central American and Mexican Coffee Federation, were also presented.

Dr. Allee stated that the United States Department of Agriculture would not allow the importation of diseased coffee into the United States

and that he understood that four entomologists were working on the problem in Brazil and were trying to control it with benzene hexachloride. Dr. Montealegre's feeling, however, was that the only way to stop the pest is to destroy a plantation when the trouble begins. Dr. Allee suggested that the Administrative Committee might consider the problem further as presented by Dr. Montealegre and that the problem be recognized as having four points: (1) the prevention of infection, (2) measures for controlling the pest if it attacks, (3) public education, and (4) research and training. While the Institute is interested in all these points, the function it might undertake would be research, training, and consultation. If the countries should wish to set up a control and it should be decided that a central program should be established in Turrialba, the Institute could train some of their people. But the quarantine measures would be a matter to be taken up by the Special Coffee Commission.

BUDGET DISCUSSION

An attempt was made to forecast the budgetary position of the Institute as of June 30, 1949. The Institute expected to receive in the fiscal year 1949-50 the same fixed income as it received during the fiscal year 1948-49. However, it was hoped that Mexico would pay its delinquent quotas, which would mean an additional sum of $22,000 in the budget. Some $50,000 might have to be borrowed from the Pan American Union, but the Mexican quota would be used to pay back a portion of it, and the remaining $28,000 would have to be paid from other quotas.

It was agreed that the narrative part of the budget to be submitted to the Board of Directors would be written in Turrialba and presented in April if possible. The 1950 budget should be presented in September 1949. For

1949-50 each Department is to plan on a budget ten percent less than this year in order to repay the Pan American Union loan. However, if delinquent quotas are paid, the Departments might increase their budgets, subject to release by the administration.

With regard to the request made to the International Bank for Reconstruction and Development for financial assistance, Mr. Colom stated that a report of over twenty pages was presented to the Bank, with special emphasis, at the Bank's request, on the use of agricultural machinery and the development of the Agricultural Engineering Department. However, the Bank itself cannot give money; it cannot make loans; but it can try to get the money elsewhere and hopes to obtain it from manufacturers of agricultural machinery or from some bank or corporation in New York. Dr. Buchanan's petition to the Ford Foundation for the development of the same work also remains to be acted upon by the Foundation.

Regarding President Truman's Point Four Program, it was hoped that funds might be obtained for (1) a locust control program, (2) a program for training in the use of farm machinery, (3) a grain storage program on a pilot basis, (4) a fiber production program, and (5) capital improvements, such as the construction of badly needed tropical buildings.

NEW MEMBERS FOR THE ADMINISTRATIVE COMMITTEE

The desirability of adding new members to the Committee and the necessity of replacing two members, whose terms would expire at the end of December 1949, was discussed briefly. The following men were suggested as possible candidates from the United States: J. A. Hannah from Michigan State College, Knowles Ryerson from the University of California, Norman Volk from Purdue University, Richard Bradfield from Cornell University, Paul C. Manglesdorf from Harvard University, and J. H. Miller from the

University of Florida. The matter was to be considered further in correspondence and at the next meeting of the Committee.

March 31, 1949

PROGRESS REPORT

1948-1949

PLANT INDUSTRY DEPARTMENT

Manuel Elgueta

PERSONNEL

The following changes were made in the personnel of the Department:

Dr. J. Harvey McLaughlin, Plant Pathologist, was appointed to work under Mr. George F. Bowman in the Cacao Center Program and has been working since November, 1948. Dr. L. R. Holdridge has assumed his work since February, 1949. Mr. Jorge León is working full time in the Department. Dr. H. C. Thompson, Head of the Department of Vegetable Crops at Cornell University, arrived in September to spend a sabbatical leave of six months with us. He has given us great help in organizing the vegetable program through his lectures, seminars and discussions. He will leave for the United States on March 30, 1949. Mr. Joseph L. Fennell resigned his position at the Institute on November 17, 1948. His resignation was effective only since the first of January, but he took advantage of vacation leave that was pending.

INTRODUCTIONS AND FORAGE PLANTS

Jorge León

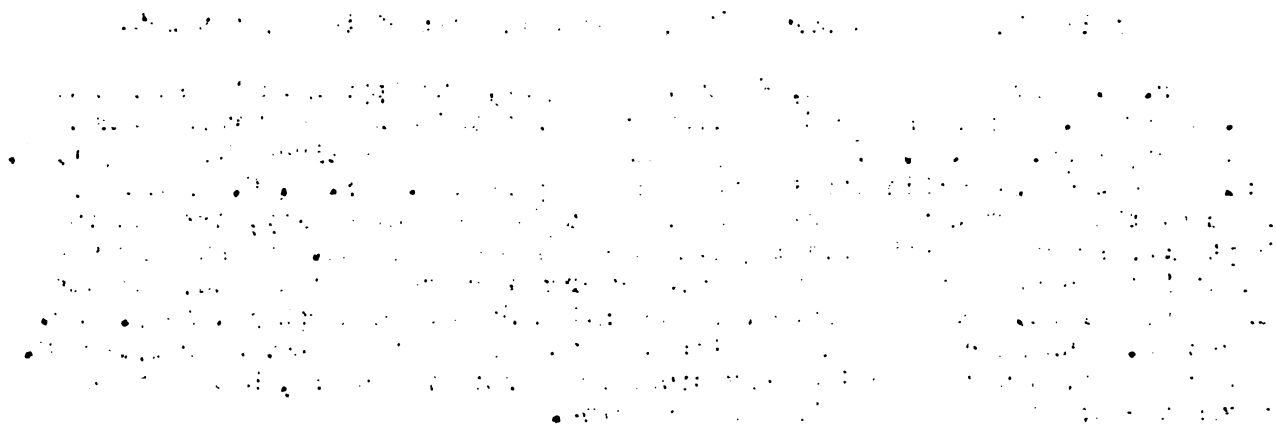
Introductions

During the last year, 302 plants from different agricultural institutions have been received, totaling 975 introductions. The most important groups of the last months are of the genus THEOBROMA, from Brazil and Colombia, and soybean, corn, and vegetables from the United States. There are also several bamboos from Puerto Rico and many legume forage plants from several countries, as well as a collection of shade trees from Brazil.

Collection of Grasses and Leguminous Forages

We have now 35 plots containing 22 species of gramineas belonging to the most important grasses of the tropics. There are also about 70 species of leguminous plants for cover crops and forage. Observations on growth and date of cutting are being taken. The transfer of the forage plant collection to the field in front of Mr. Casseres' house is almost complete. Additions to the collection amount to 15.

Work on the herbarium has already begun, and we have a collection of 300 specimens. It has not been possible to work on the mounting of this material yet, because of lack of personnel and pressure of work.



GENERAL HORTICULTURE

This section has been re-organized because of Mr. Fennell's regrettable departure last November.

The tomato breeding work has been given to Mr. Casseres who will report on it. A complete inventory of the material has been made, and all the strains of cowpeas, sorghums, and peanuts are already in the field in increasing plots to be evalued by observation this season and used for future variety trials during the next year. Also their observation will permit us to decide on future work with this material. Already we are aware of the value of some of the strains of sorghum and cowpeas and will give emphasis to the fixation of the best ones. Some of these seeds have been given to the Ministry of Agriculture in San José, and there are some reports of success with them in several localities.

SUGAR CANE

Manuel Elgueta and Jorge León

The loss of Mr. Murillo has left this program without a leader, with the result that we have not been able to cover all the aspects of the program. The harvesting time scheduled for the variety trial fell during the season in which the mills were not working, and if harvesting had been done at that time we would have had a loss of 300 tons of cane, which amounted to 9,000 colones.

Project No. 70

The sugar cane collection has been maintained with few additions. Increased plots of some outstanding varieties which deserve future trial are underway.

Project No. 83 Variety trial with and without fertilization

Date of sowing: August 29, 1947
First harvest: January 1949
Ten varieties--2 treatments, with and without fertilization, 12 replications in total

The original project contemplated three harvests: 12 months, 16 months, and weekly sampling. As it was not possible to do this, all replications were harvested together. Advantage was taken of this fact, however, to calculate the whole trial as two separate ones of six replications each and the total of the 12 replications also for teaching purposes.

Two germination counts were made: the first on October 14, 1947 and the second after the harvest of February 11, 1949. The results are given as follows:

TABLE No. 1 Germination: Number of Stalks per Plot

Varieties	October 14, 1947 With fertilizer	October 14, 1947 Without fertilizer	February 11, 1949 With fertilizer	February 11, 1949 Without fertilizer
POJ. 2714	141	133 '	275	237
POJ. 2878	106	111	186	174
MC. 666	96	103	67	70
CO. 281	287	265 xx ''	360	360
BH. 10/12	224	224 ''	163	156
Cristalina	76	64 x	119	90
Otaheite	112	98 xx	58	49
CO. 290	297	289	352	377
Ray. Criolla	247	242 ''	235	185
Hib. Argentina	271	226 xx ''	301	239

xx Differences between fertilized and unfertilized trials at 1% level of significance
x 5% difference
'' Difference in germination over POJ 2878 at the 1% level
' 5% difference
Year 1949. Significance calculation has not yet been made.

The analysis of variance was made only on the first count. There were three cases in which the fertilization gave a significant increase in germination. There were also big differences within varieties.

It is interesting to note that the count of this year follows almost exactly the pattern of last year. There are two varieties that are evidently losing germination after the harvest. They are Otaheite and MC. 666. Others, however, are gaining, for example, CO. 290, CO. 281, POJ. 2714 and 2878. This can be a good indication of vigor and sustained yield in the following harvests, which is of economic importance. The yields are given in the following table:

TABLE No. 2 Yields in Tons per Hectare

Varieties	12 Replications With fertilizer	Without fertilizer
POJ. 2714	125.94	105.60
POJ. 2878	135.02	126.36
MC. 666	119.89	111.76
CO. 281	143.48	125.09
BH. 10/12	117.18	104.01
Cristalina	82.00	63.93
Otaheite	107.41	83.78
CO. 290	186.93	169.76
Ray. Criolla	111.42	92.14
H. Argentina	158.91	143.22

Analysis of Variance

F. values

Replications	8.96 xx
Varieties	36.60 xx
Fertilizers	27.30 xx
Var. x Fert.	--

Least significant difference 4,24 tons per hec.

In this trial the best varieties were by order: CO. 290, H. Argentina, CO. 281, POJ. 2878 and POJ. 2714.

Fertilization produced a very significant effect. However, this trial did not show interaction, which means that there was no different fertilizer effect within the varieties.

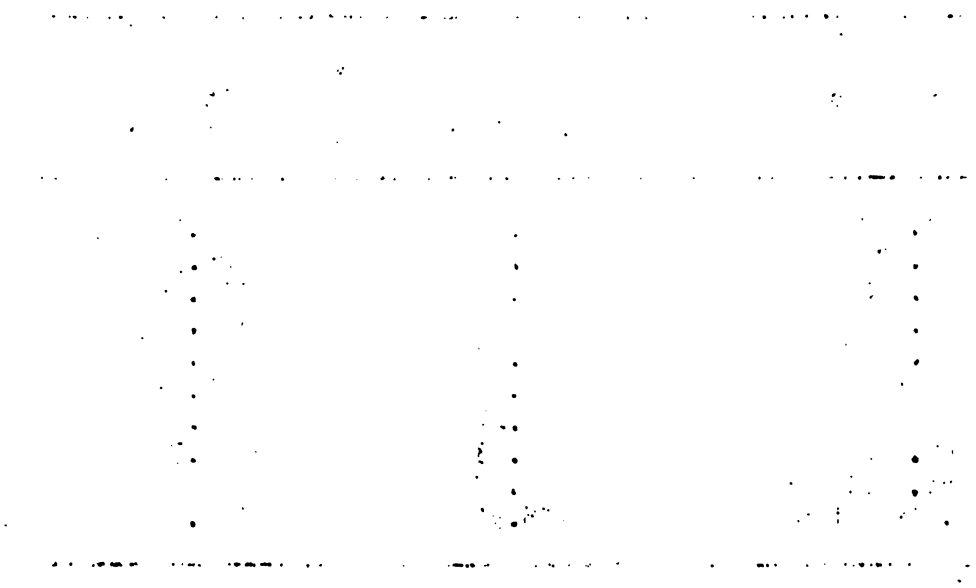
COFFEE

Manuel Elgueta and Guillermo Bonilla

Only work on breeding and agronomic trials is reported here. Plant pathology work will be reported by Dr. F. L. Wellman.

Breeding

There are already species and variety collections of 25 different types. The species were collected at the Finca Atirro from material introduced many years ago from Batavia, Java. Cuttings were brought and rooted at the Institute.



The variety collection has been increased recently through material which was brought to Dr. F. L. Wellman from Guatemala. We are not too sure about the species determination, but this will be done by some botanical institution.

The 70 clones selected from a segregated plantation at the finca of Sr. Franklin Fernández are already planted. There are also planted on the nursery 220 progenies from selected trees, as the first step of a breeding program.

Studies to ascertain the type of pollination of coffee have already been initiated. The first counts seem to indicate that self-fertilization can occur freely without any foreign intervention. However, this first trial, when completed, will give us only the knowledge just mentioned. We will have to make some other studies to ascertain the moment in which dehiscence is produced. If we can prove that it takes place before the flower opens we will be in a position to expect self pollination. Future studies of the progenies will confirm this assumption.

Actual counts indicate a similar behaviour in the enclosed branches and in the open ones, either in flower development or fruit formation. The fruits, however, are in their early development. For example, from 732 flowers in the enclosed branches, there are 261 fruits up to now. From 621 flowers in the open branches there are 193 fruits. If self pollination is proved, the actual planting of the 220 progenies will give us a good start in a line selection program.

There is also a nursery of about 40,000 plants from selected trees. It will be used for the program of agronomic trials that will be planted this next season.

Agronomic Trials

Project No. 99 Factorial fertilizer trial

This trial had its first harvest this year. There was a very pronounced effect of P and ca. and a detrimental effect of N. However, this significance of the result was not statistically satisfactory. This is due to the heterogeneity of the plant material and we expect to be able to get more significant results in future years.

Types of transplanting. The actual nursery is located near the Institute in a space that should be kept for the same purpose for several seasons. Transplanting with "adobe" takes all the top soil and is much more difficult than with naked roots.

A trial was made to see the influence of the different types of plants on transplanting. The treatments as well as results are given in the following table. Results are given in weight of plants.

Treatments	Weight of 5 Plants Kilograms
1. Adobe with leaves	2.069
2. Adobe with half leaves	1.796
3. Adobe without leaves	1.200
4. Naked roots with leaves	1.904
5. Naked roots with half leaves	1.322
6. Naked roots without leaves	0.739

Treatments of 1 and 4 were very similar and significant on the 1% level over 3, 5 and 6. Number 2 was not significantly different from 1 and 4.

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

This trial has not yet given significant results, though there are considerable differences among the various treatments.

The results are summarized as follows:

Cultural treatments		Fertilizers	
Shoveling	1099	N	723
Cultivator	963	P	689
Cover crops	1364	K	659
Weed chopping	1126	NP	638
		NK	472
		PK	443
		NPK	450
		Check	477

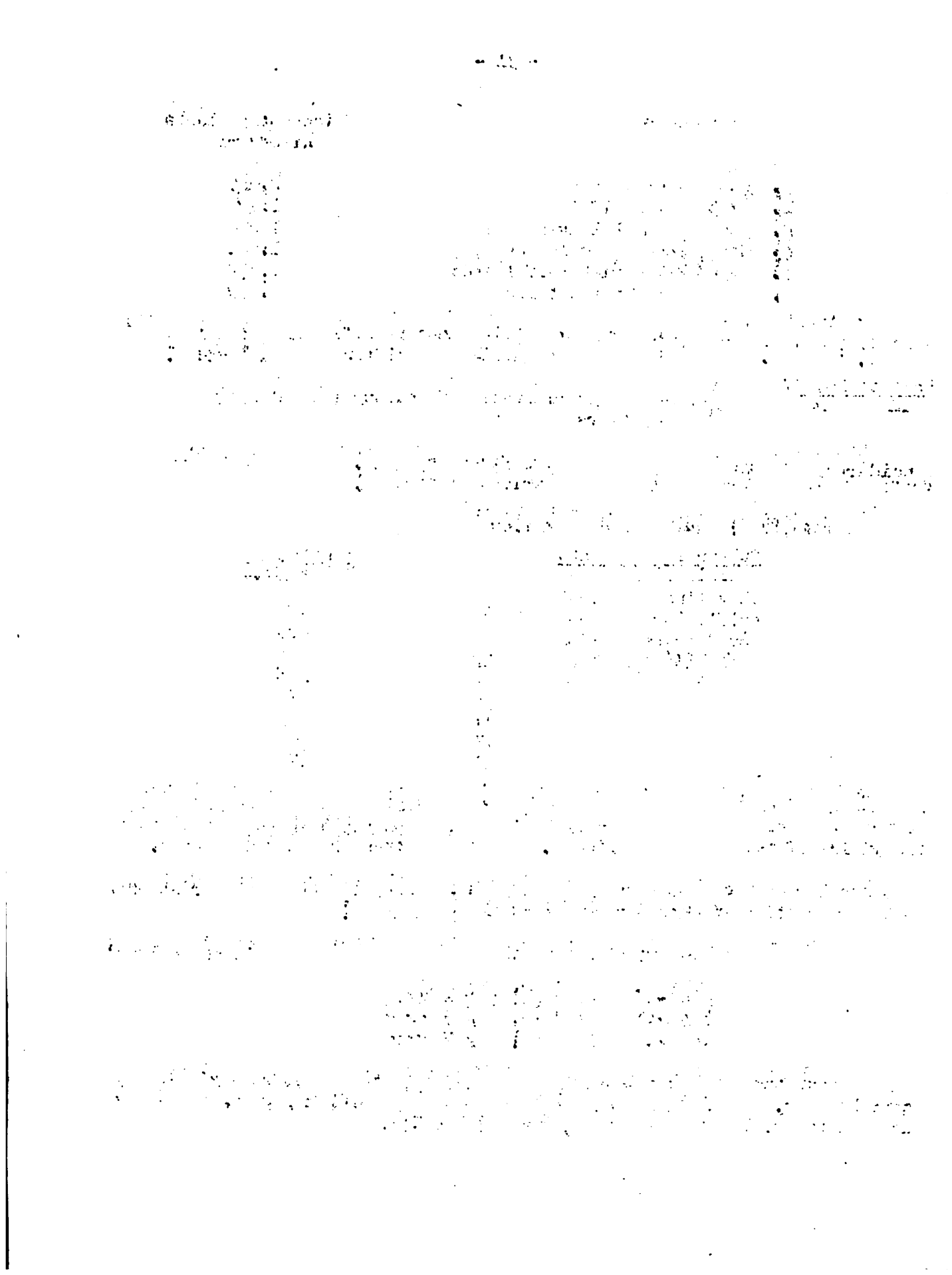
As last year, there is a tendency for the soil treatments that do not disturb the soil to give better yields. It is also noted in this trial that the yields of the treatments with N. were bigger than the ones without N.

Another fact that deserves consideration is the effect of the treatments on the renovation of this old and abandoned plantation.

The three-year summary of total yields for the whole area is as follows:

1946-47	2325 Kg. per Hectare
1947-48	1543 Kg. per Hectare
1948-49	2845 Kg. per Hectare

We must take into consideration the fact that this last year yields were poor; however, the yield of the whole area of the trial has recuperated and exceeded the yield of a good year, such as 1946-47.



Project No. 87. Shade effect on an old plantation

This is the first year of harvest of this trial. We are comparing here four types of shades as major treatments and pruning vs. non-pruning, and fertilization vs. non-fertilization as minor ones. The fertilized plots are subdivided in complete fertilization N, P, K, Ca. and only N, P, and K.

The results can be summarized as follows:

Shade treatments	(Kgs.)
No shade	107.1
Half shade	146.9
Normal shade	192.7
Free shade	172.7

Pruning vs. no pruning	
Pruning	244.5
No pruning	376.7

Fertilization	
N, P, K	236.2
N, P, K, Ca.	198.1
Check	186.7

Of these results only the pruning differences, showed statistical significance. However, when we compare this year's results with last year's, corresponding to the uniformity harvest, we expect to be able to reach some yield adjustments by regression which, possibly, will permit us to get also some significance on the shade treatments.

Other trials are also under way. The old project No. 86 reported last year is being repeated now adding new types of transplanting of young seedlings. The compost trial has not given results in coffee up to now. The collection of shade trees has 18 species which are already in production.

VEGETABLE CROPS INCLUDING POTATOES

Ernest H. Casseres

The presence of Dr. H. C. Thompson at the Institute during this six-month period was of significant help in developing the research program reported here. His work in revising projects, his advice on many problems, and his recommendations for further work are all gratefully acknowledged.

Project No. 39 Studies with Irish Potatoes

The original project has been revised in order to include more specifically the work under way and the phases of studies with potatoes that it may be

possible to develop in the foreseeable future. The subprojects mentioned in the previous report still make up the main portion of the study under way. The status of each one follows:

Subproject No. 1: Performance study and increase of new improved varieties

1. The greater part of our late blight resistant stocks is made up by the potatoes increased from the original 50-pound lots of nine varieties and lines from Cornell received in late 1947. Of these Harford and EVI-2 are the most promising.

2. Sixty pounds of new seed potatoes, including two new varieties, were received from Cornell in December and were planted in February.

3. An excellent assortment of 24 experimental lines and varieties were received from the United States Department of Agriculture in December and were planted in February.

4. The new materials mentioned under (2) and (3) were obtained by arrangements made by the writer with Drs. L. C. Peterson and F. J. Stevenson of Cornell at Ithaca, New York and Beltsville, Maryland respectively. Plans for further cooperation with the United States Department of Agriculture were also made by Mr. Elgueta and Dr. Stevenson.

5. With the visit of Dr. Karl Fernow for a few days in November, work was started selecting stocks free of leaf roll and tuber unit index work was initiated.

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

Small samples of four non-commercial varieties have been kept from season to season. Eight others listed in the March 1948 report have proven difficult to maintain. It is believed that maintenance of wild species and increase from lots small than five pounds should only be attempted when a full time employee and/or worker can attend the plantings all the time.

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

Due to a change in thesis project of former student José S. Aguirre, this work was reduced to a study of 10 clones. These have been grown once at Roberts and once at the Institute. A part of this material may be used to study the so-called "running out" of potatoes under warmer lowland conditions.

Subproject No. 5: Virus transmission

Progress Reports Nos. 7 and 8 recorded the harvest and subsequent plantings of potato stocks known to have leaf roll together with others known to be healthy. The insects noticed on the plants at Santa Cruz de Turrialba, where the original planting was made, were the flea beetle (Epitrix spp.) and the Diabrotica beetle. From 50 to 100 percent of the originally healthy plants were determined infected with leaf roll on March 23, 1949 at the Institute. It is tentatively stated that the above-named insects appear to have been the agents by which the virus of leaf roll was transmitted from infected to healthy stocks. This needs to be worked on further since it is considerably important in relation to potato studies at the Institute and in the highlands, especially with reference to production of disease free stocks.

Subproject No. 6: Effect of type of seed piece, spacing in the row and altitude on the production of seed size and commercial crop of potatoes

This new study was initiated during January 1949. Certified Katahdin potatoes from New York State were cut and cured in Turrialba and were planted at spacing of 6 and 12 inches apart in the row. The same spacing was given to comparable lots of whole potatoes. One experiment was planted at the Institute on March 3, and an identical one set out the next day at Hacienda Chicuá (Roberts) in Cartago at an altitude of 9,000 feet. Records and notes will be taken on this first experiment and the crop will be replanted several times in a continuation of the study. Further details will be presented as the work develops.

Publications

1. In its October 1948 issue LA HACIENDA carried a progress report report type of article summarizing the program and results to date. This was reprinted as Technical Publication No. 27--Las Papas - Importancia del Abono y Variedades Resistentes en su Producción--by the Institute's Washington office.

2. SUELO TICO, a new publication of the Costa Rican Ministry of Agriculture, presented an article in its November 1948 issue on the subject of bacterial wilt of potatoes currently causing losses in this country. It was reprinted as Extension Bulletin No. 1 by the Ministry for wide circulation. Ample credit was given to the Institute, and it is an example of the specific aid that Institute technicians can give participating Governments.

Student Assistants

Subproject No. 4. Storage losses of potatoes.

This subproject was completed as a thesis problem by José S. Aguirre under the direction of Dr. F. L. Wellman and the writer. Tuber unit indexing and improvement of the Estrella variety are being carried on with the assistance of Sr. Pedro Linares, a student from Venezuela, who has had some experience with the crop in his work with the Ministry of Agriculture in his country.

Project No. 40 Fertilizing vegetable crops

A three level N-P-K replicated fertilizer experiment with the Steins Early Flat Dutch variety of cabbage was harvested in November 1948.

A similar experiment with our own strain of the Master Marglobe variety of tomato was harvested during December 1948. The data and conclusions for the above will be presented in a complete report which is in preparation and which will include other previous experiments.

Project No. 62 Selection of superior local varieties

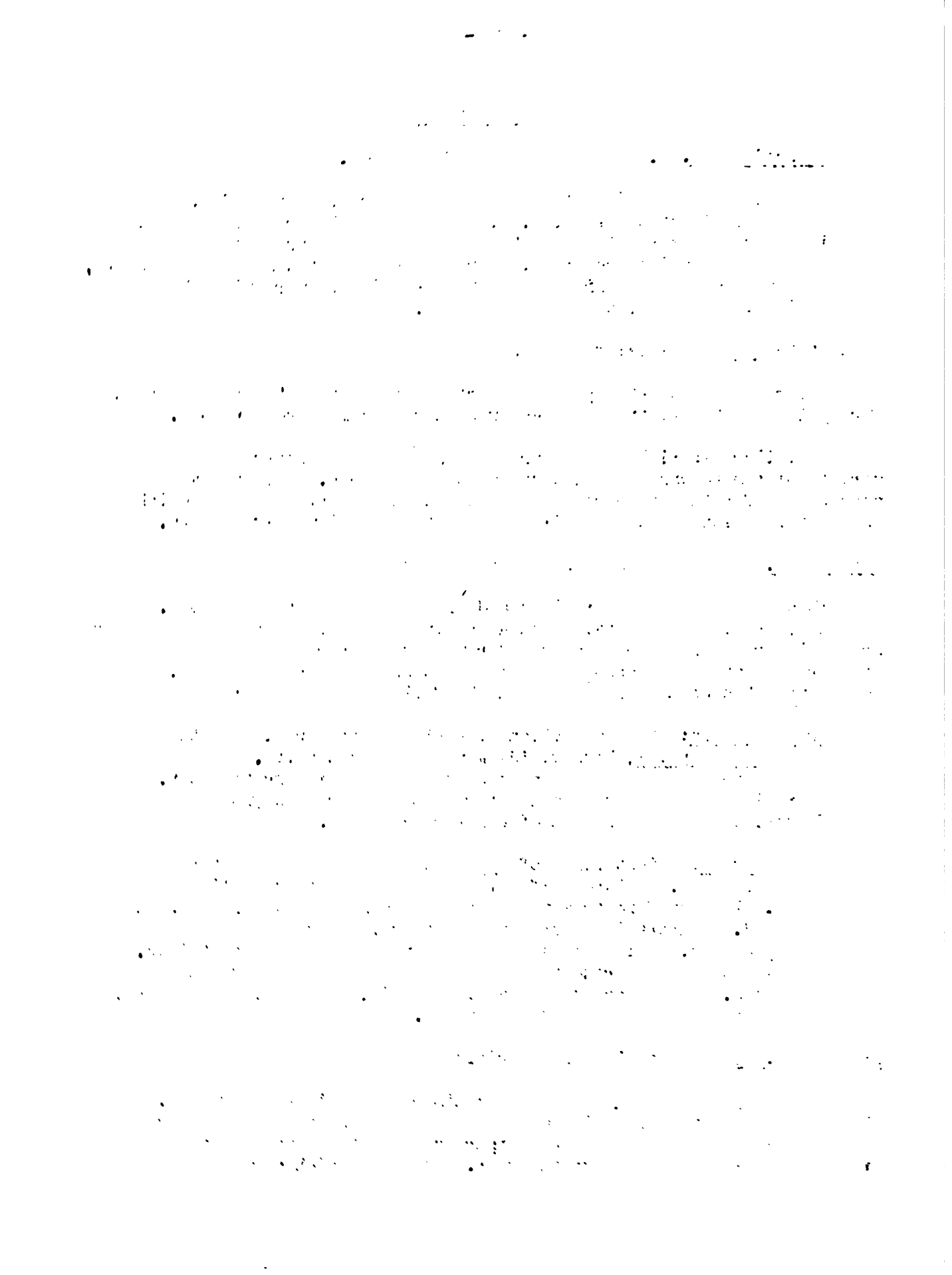
This project has been revised and mimeographed in the new form. The aim is to improve certain popular native vegetables that grow well here by simple breeding techniques in order to have better crops and more standardized materials upon which to base subsequent breeding work. Improvement has been carried on with the following two crops:

Sweet Peppers: Line selection of a pimento type resistant to Cercospora capsici, high yielding and of good quality. There are at present five lines under study, just beginning to fruit. There is also a newer planting for comparison with Keystone Wonder, an improved strain of California Wonder.

Native Ayote: Eight lines of ayote have now been selfed three and four times. Mature selfed fruit is now awaiting quality tests. Type uniformity with apparently no loss of vigor has been obtained. Comparative performance data will be secured in the next planting. Collections of certain vegetables are maintained, and listed in this project, but no formal study is being conducted with them. These include Cassava, plantain, chayotes, hot peppers, and miscellaneous herbs and vegetables.

Project No. 63 Vegetable variety trials

This project has been revised and mimeographed in the new form. The revision set up more uniform methods of planting and data taking which should make it possible to compare variety tests made at more frequent intervals throughout the year. Forms on which harvest data



can be annotated in the proper order were designed and included with each copy of the project.

Field observations of interest regarding varietal performance of several vegetables were published in the December 1948 issue of the Information Bulletin. Replicated yield trials of six varieties of snap beans showed superiority of Tendergreen, Sure Crop, and Florida Belle over Black Valentine, Pencil Pod, and Logan. A replicated comparison of the 76-16-6 line of the Turrialba tomato with our line of Master Marglobe showed approximately 10 to 20% higher yield for the latter in two tests. A complete report on the above will be made when the data is secured on the following trials now underway:

1. Peanuts: 8 varieties, including Florida Runner, Tennred Bonita and 5 experimental kinds from the Florida Agricultural Experiment Station.

   Note: This crop is included here at the suggestion of Dr. Thompson, since the study is similar to that with vegetable varieties.

2. Peas: Two native varieties--one large seeded and one small seeded. When picked at prime stage and used the same day these peas are of good quality; data regarding possible differences are being sought.

3. Onions: Six short day varieties secured through the co-operation of the Kilgore Seed Company of Plant City, Florida, are now growing in a replicated test. The varieties are Cristal Wax Bermuda, White Grano, Texas Grano, Yellow Bermuda No. 986, Large Yellow Sweet Spanish, and Louisiana Red Creole.

4. Watermelon: From the same source as the onions, including, Dude Creek, Dixie Queen, Blacklee, Garrison, No. 46-40 (new).

Tomato Improvement

Over the past six months, Sr. Pedro Linares, a student from Venezuela, has been carrying out an evaluation of the tomato materials left by Mr. Fennell, under the supervision of Messrs. Elgueta, Thompson and Casseres. One hundred lines are being studied at present. Out of these, fifteen or twenty may be selected. While there appears to be some resistance to Phytophthora infestans in some lines, fruit size and quality are poor. It is anticipated that several back crossings to Marglobe will have to be made in order to have something good enough to release.

CORN PROGRAM

Breeding Superior Corn Adapted to the Costa Rican Lowlands

Mario Gutiérrez G.

Introduction

Work on a comparison of the relative efficiency of five methods of breeding corn superior in yielding ability and agronomic performance was started in August 1948. Prior to the initiation of the actual breeding practices, an idea of the variability for plant and ear characters and their possible inter-relationship in the variety used for the study was desired. Consequently, individual plant measurements were taken for date of silking, plant height, ear height, root lodging, ear shank length, ear length, shelling percentage, ear shape index, and yield.

Frequency distributions were prepared from such measurements. Central tendencies, measures of dispersion and correlation coefficients--both simple and partial--to determine the possible association of the characters studied were also computed.

The present report deals primarily with the results obtained for plant characters, from the standpoint of variability and inter-relationship. Data for ear characters remain to be tabulated and statistically reduced and will be reported later. A discussion of the application of the results obtained to the breeding practices will necessarily have to be deferred until then.

Variability for Plant Characters

Four plant characters, namely plant height, ear height, date of silking, and root lodging were considered. They will be treated in the same order.

Date of Silking

Date of silking was expressed as the number of days which elapsed from the time of planting to the appearance of the first silks. Four thousand nine hundred eight individual plants were observed for this character at two-day intervals, and the frequency distribution presented in Table I was prepared. Results are also shown graphically in Figure I. The mean number of days from planting to silking in the variety was 72.15 and a range of 22 days (61-83) was observed. The distribution showed a marked positive skewness, the mode being at 69 days.

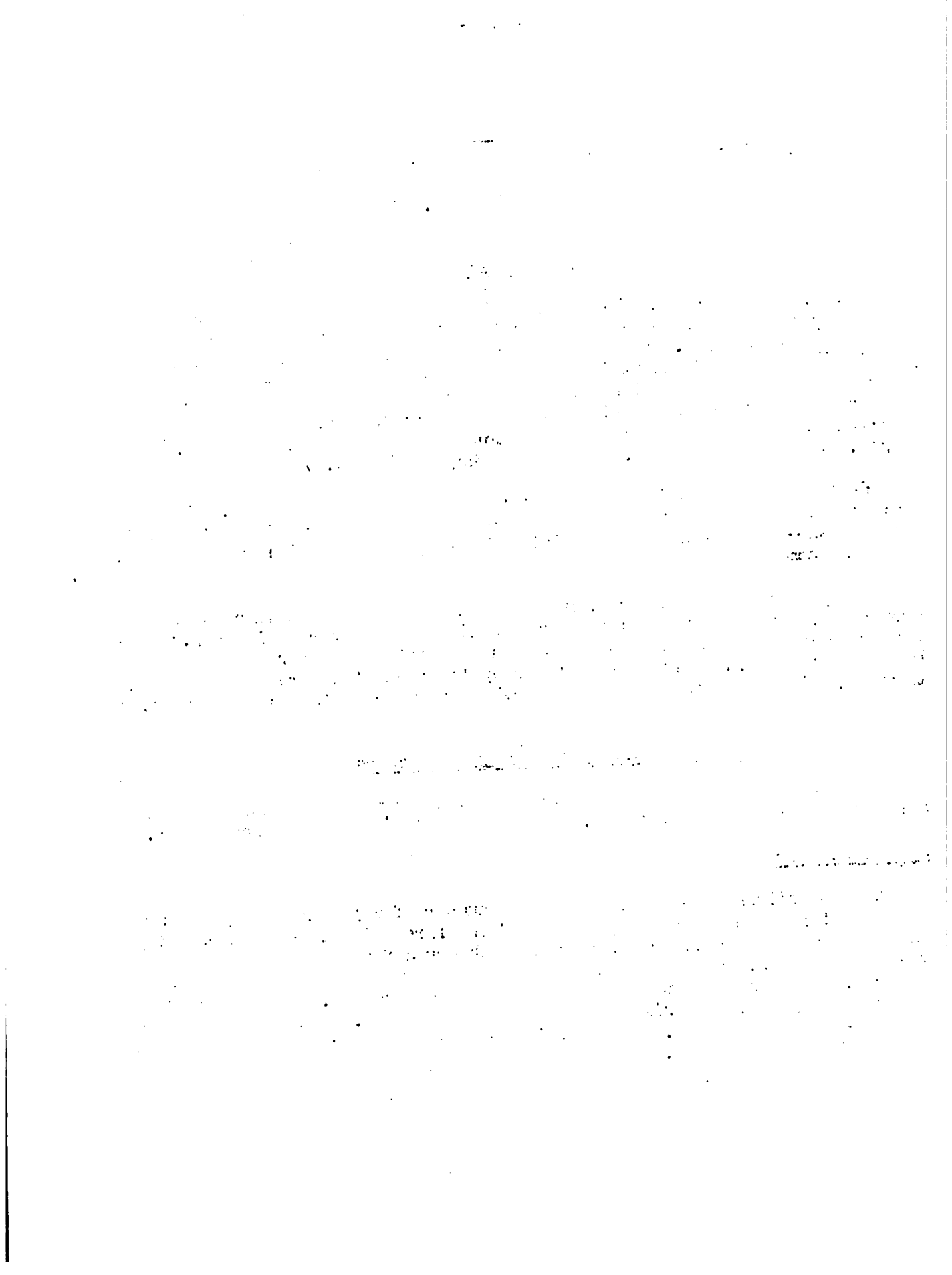


TABLE I. Frequency Distribution for Date of Silking in a Random Sample of the Variety of Corn I-452

Frequencies:	No. of days from planting to silking											Total	Range
	61	63	65	69	71	73	75	77	79	81	83		
No. of plants	34	234	889	1617	716	603	348	180	113	60	114	4908	22

A normally distributed, random sample comprising 2,048 plants was selected from the total of 4908 plants for which the date of silking had been taken. All subsequent measurements are based on such samples. Records for 61 of the latter were incomplete and had to be discarded, leaving a total of 1,987 plants on which measurements for plant height, ear height, and root lodging were available.

Plant Height

The frequency distribution for plant height is presented in Table 2 and shown graphically in Figure 2. Measurements were taken in meters from the ground surface to the tip of the tassel; classes were formed at .20 meter intervals. The mean fell in the mode class, indicating normality in the distribution. The tail in the low side of the abcissa is a result of having included, by random slection of the sample, some dwarf plants which, under ordinary conditions, would not be considered as normal individuals. The mean plant height was 2.81 meters with a range of 3.40 (0.58-3.97) meters.

Ear Height

Ear height was also measured in meters from the ground level to the node of attachment of the ear shank to the plant. Results are tabulated in Table 3 and shown graphically in Figure 3. The distribution was normal, the mean falling in the mode class. Mean ear height for the variety was 1.21 meters, a range of 2.66 meters (0.20-2.85) having been recorded.

Root Lodging

Five root lodging classes were recognized by means of visual scores. A value of 1 was assigned to plants completely erect, while plants completely prostrated were considered as having a value of 5. Intermediate values of 2, 3, and 4 were given to plants having inclinations of about 15, 30, and 50 degrees, respectively. Table 4 summarizes the results obtained for this character, which are also represented graphically in Figure 4. The distribution is markedly positively skewed and leptokurtic. By considering plants of classes 3, 4, and 5 as lodged, a value of 22.9 percent root lodging for the variety is obtained, which points out the necessity of selection for this character.

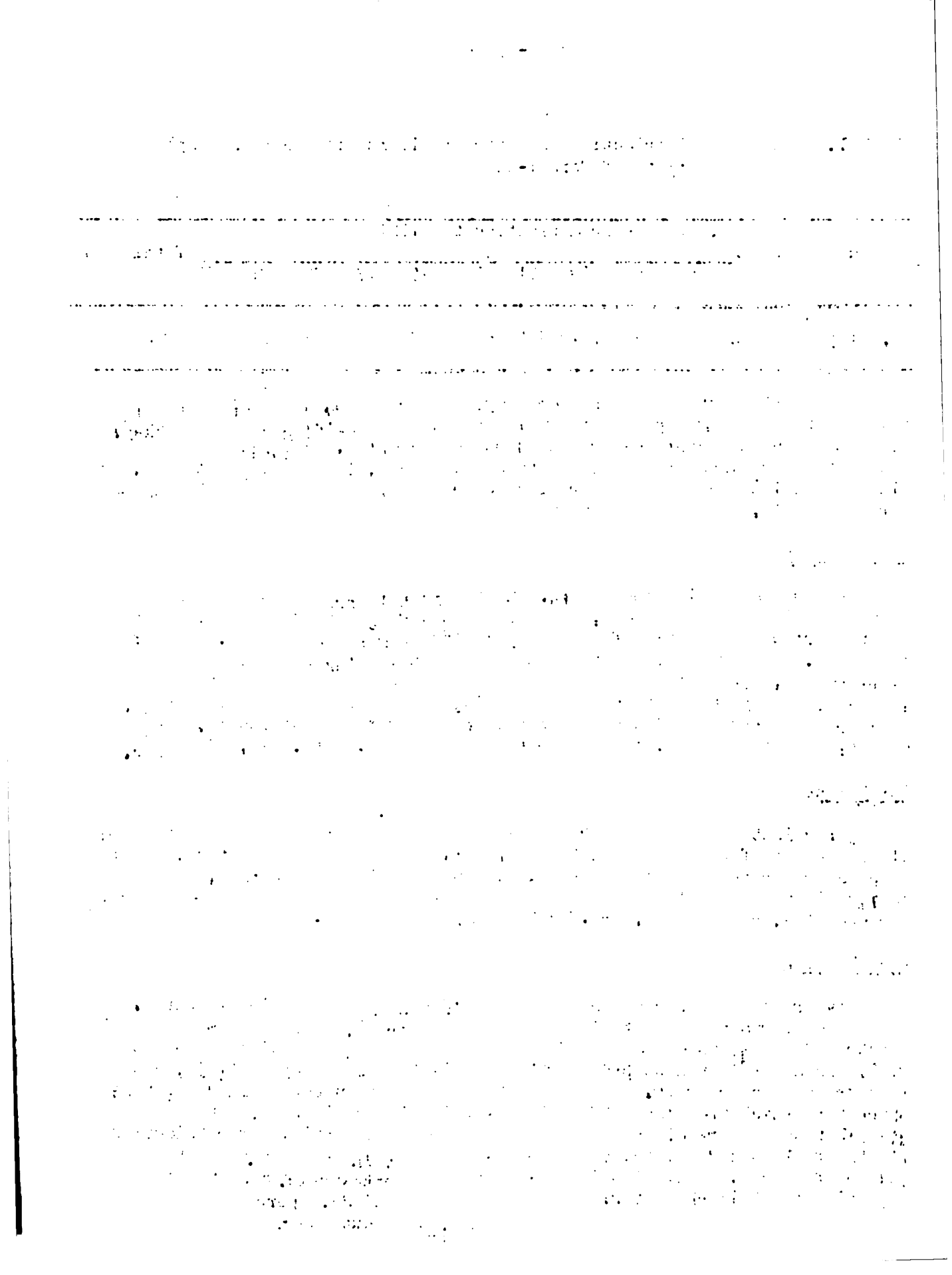


TABLE No. 2. Frequency Distribution for Plant Height in a Random Sample of the Variety of Corn I-452

Frequencies	Class Centers - Meters																Total	Range
	67	87	107	197	147	167	187	207	227	247	267	287	307	327	347	367	387	
No. of plants	5	16	6	4	15	23	33	63	120	201	317	383	367	277	125	25	7	1987	340

TABLE No. 3

Frequencies	Class Centers - Meters												Total	Range
	29	48	67	86	105	124	143	169	181	200	219	238		
No. of plants	13	24	83	195	436	506	432	197	60	8	1	1	1956 x	2.66

x Difference in this total and that for above is due to 31 barren stalks.

TABLE No. 4. Frequency Distribution for Root Lodging Index* in a Random Sample of the Variety of Corn I-452

	Root Lodging Index					Total	Mean Root Lodging Index	
	1	2	3	4	5			
No. of plants	1175	357	303	85	67	1987	1.76	.024

* 1, completely erect, 5 completely prostrated

The mean, standard error, standard deviation and coefficient of variation for the four plant characters studied have been tabulated and presented in Table 5.

TABLE No. 5. Mean, Standard, Error, Standard Deviation and Coefficient of Variation for Four Plant Characters in a Random Sample of the Variety of Corn I-452

Plant Characters	Mean	Standard error	Standard deviation	Coefficient of Variation
Date of silking, days	72.15	.070	3.11	4.31
Plant height, meters	2.81	.011	.48	17.08
Ear height, meters	1.21	.007	.32	26.44
Root lodging index	1.75	.024	1.07	61.14

Ample variability, as indicated by the ranges and coefficients of variation, were found for all characters measured; this condition will facilitate the breeding program.

Character Inter-relationship

The possible inter-relationship of the plant characters considered was explored by means of correlation analysis. The correlation coefficients obtained from this study are presented in Table 6.

TABLE No. 6. Correlation Coefficients Among Several Plant Characters in the Variety of Corn I-452

Characters correlation	r values
Plant height and ear height	.8242 xx
Plant height and date of silking	-.2284 xx
Plant height and root lodging	-.1379 xx
Ear height and date of silking	-.1584 xx
Ear height and root lodging	.0009

xx Exceeds the 1% level of significance

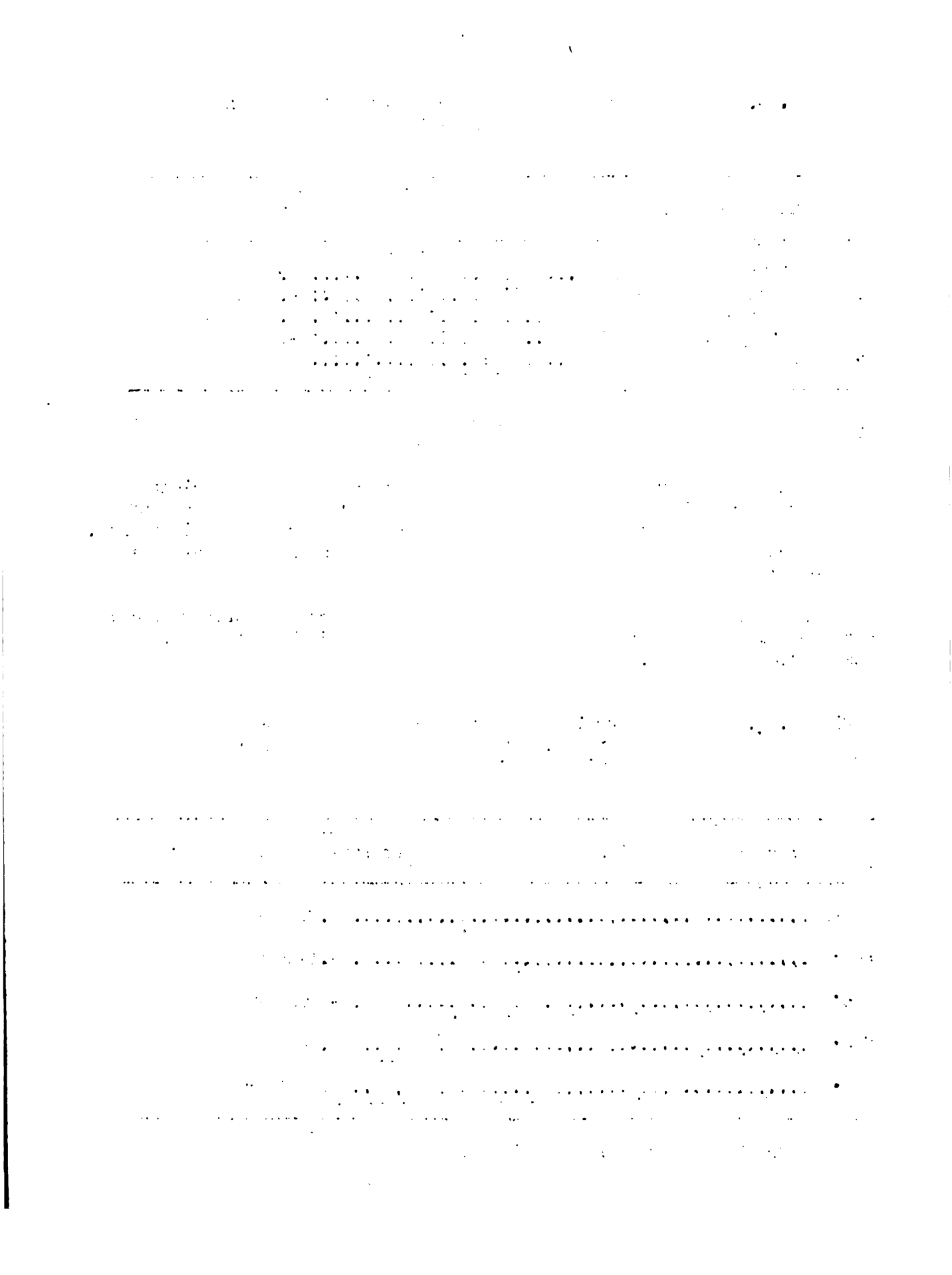
Although with but one exception all the correlation coefficients were highly significant, only the association between plant height and ear height was of a sufficiently large magnitude to warrant consideration. Since such correlation is positive, the breeding for the two characters will be greatly facilitated.

The inter-relationship of the various characters was further explored with the aid of partial correlation coefficients and the results are summarized in Table 7.

TABLE No. 7. Partial Correlation Coefficients Among Plant Height (P) Ear Height (E), Date of Silking (D) and Root Lodging (R) of the Variety of Corn I-452

Characters combinations	Correlation coefficients
$r_{PE \cdot D}$	.8197 xx
$r_{PD \cdot E}$	-.1749 xx
$r_{PD \cdot R}$	-.2008 xx
$r_{PR \cdot D}$	.0822 xx
$r_{ED \cdot P}$	.0541 xx

xx Exceeds the 1% level of significance



Only the correlation between plant height and root lodging and ear height and date of silking changed radically when date of silking and plant height were respectively kept constant. Such a condition indicated that the relation between plant height and root loding denoted by the simple correlation coefficient results from their association with date of silking; in the case of ear height and date of silking, the characters are correlated through plant height.

Material Developed

Three hundred seventy-two S_1's were selected from a total of over 1,200 self pollinations as deserving further consideration. They are being grown in a detasseling block to produce top-crossed seed with which to test their general combining ability next season and at the same time they are grown in the nursery for further inbreeding.

Composite seed from 100 ears was produced by the method of mass selection with bi-parental control described in the project. Part of this material is being grown in an area of one acre and will be used in a second cycle of selection for plant and ear characters with the use of the same method.

One hundred sixty-five ears were selected for the ear to row phase of the study and grown with an appropriate check in a 13 x 13 triple lattice design to compare them for yield and agronomic performance. This test may have to be repeated next season as the stand for two blocks in group X of the lattice was greatly reduced by insect damage.

By mass selection, 150 ears were selected and composited to produce seed with which to practice a second cycle of the same method. Remnant seed of all this material has been saved, dried, treated with Arasan and properly stored for ulterior use.

WORK IN THE LABORATORY AND ON COFFEE PATHOLOGY

March 1948 - March 1949

Frederick L. Wellman

An attempt has been made to carry on a reasonably wide range of activities, paying attention to the wishes of my office in the United States Department of Agriculture, and assistance to the Government of Costa Rica. Continuous effort was made to limit the lines of work to insure proper attention on a high plane. Conditions of work were excellent, although some equipment, a better supply of power and heat, and some further assistance are still needed.

The purpose of the work was twofold: First, consultation and training to stimulate both Latin American and United States students in the development of technicians for tropical plant science; and, Second, research on such problems as demonstrations, advancing knowledge in tropical plant pathology, and leading others into the habits of well-planned research activity.

Coffee Disease Work

The most important effort is still directed toward the American Leaf Spot of coffee, the worst disease of coffee in the occident. Its taxonomic position is in sore doubt. Dr. Rolf Singer, formerly of Harvard University and now in Argentina, has recently suggested change from Omphalia flavida to Mycena flavida. The limited agaric material on which he based his work was provided by me. There is still some question in my mind, and I believe this needs further clarification.

My work on the organism has been especially on pathology, physiology, and control. It has been demonstrated that it is completely dependent on liquid (rain) water for distribution; infecting bodies may anchor on leaves in as short a time as 15 to 20 minutes; laboratory tests indicate little difference in susceptibility of coffee varieties; it is not seed borne; the luminescent character is of enzymatic nature; and development of reproductive bodies is wholly dependent on thiamin in its substrate. It is still being studied in culture, and recently it has been found that infecting bodies are killed at 40 to 45 degrees C. It is both a severe parasite and a delicate but awkward organism.

The use of control measures by defoliating diseased trees takes advantage of weak points in the life history of the causal organism. Cooperative work on control is being carried on through the Institute and the Agricultural Extension Service (STICA) of the Government of Costa Rica. Agricultural Stations of Guatemala and El Salvador have also requested project plans to apply in their own countries. Refinements are being studied.

The Cercospora disease of coffee is serious in all coffee countries. The work of Sr. Quesada, assigned by the Costa Rican Government to study under me, has passed the preliminary stages. All pertinent literature has been covered, he has studied the morphology, has secured the fungus in culture, and started good work in its physiology and pathology. This work will have world-wide importance. He is likewise learning the basic principles of plant pathology, and getting an acquaintance with a wide range of diseases.

The Rosellinia root rot of coffee, which has wide distribution, is disturbingly present in many coffee areas. Mr. Ralph Segall has worked with the organism in culture. He profited by previous mistakes made by

me in my preliminary studies, and we now have experimental material ready for productive activity. The fungus is slow in growing and has never been adequately investigated anywhere.

A wholly new coffee disease (Penicillium) has caused very serious losses in the seed beds here at the Institute. Sr. Bonilla, Sr. Granados, Miss Hastings, and I have all been engaged in the study.

Seeds have been obtained of varieties and species of coffee that are being turned over to the Institute for both horticultural and pathological work. A program has also been instituted with the Ministry of Agriculture in which, by the end of this year, over 50 farmers will be selecting mother trees of high yielding character in Costa Rica. Soon, coupled with the work of Sr. Elgueta and Sr. León, a wide range of varieties and high yielding germ plasm will be available in the country for breeding for yield and resistance to diseases.

Coffee Physiology and Nursery Practice

We have long needed to know features of consequence about the physiology of the coffee seedling in relation to disease susceptibility. Sr. Granados has been applying his knowledge of chemistry and laboratory techniques to this problem. After studying growth reactions in several solutions, he has determined the simplest methods for growing coffee seedlings in solutions and the types of measurements that may be recorded. Currently, a series in Hoaglands Solution is being studied to determine N, P, and K relations. Granados has laid the basis for work, and has assisted other students in growing seedlings of both coffee and cacao in culture solutions for disease studies.

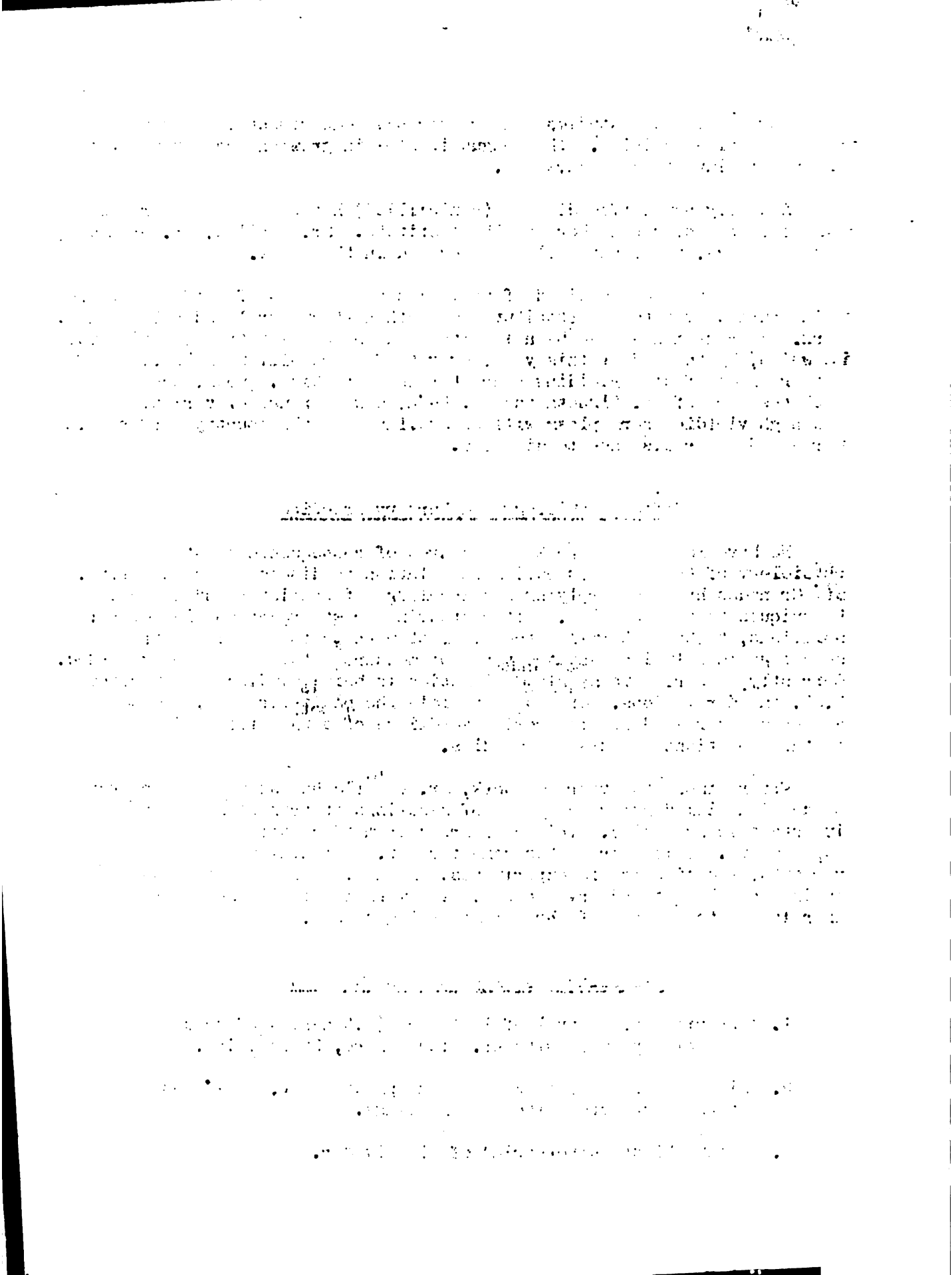
After almost two years of work, Sr. Bonilla has shown that an even shade of medium density and stage of seedlings at transplanting are important in nurseries. This he learned from adequately designed experiments. This year he has gone further, including additional variants, redesigning his experiments, and he is carrying the studies on in both the wet and dry seasons. The work is also being observed in relation to attacks of three leaf spot diseases.

Miscellaneous Plant Disease Studies

1. Spraying for control of leaf spot (Altenaria) of seed producing petunia with Mr. Claude Hope, La Dominica.

2. Disease survey of maize breeding plots of Sr. Gutiérrez at the Institute, with Miss Hastings.

3. Sesame blast (Alternaria) of El Salvador.



4. Plant disease collections within the confines of the Institute grounds, with John A. Stevenson of the Division of Mycology of the United States Department of Agriculture.

5. Miscellaneous disease determinations and advice on control for Costa Rican farmers and Governmental officials.

Consultations and Trips

1. Work with local farmers and Costa Rican Government Advisors (STICA).

2. Work with the Cacao Center in Costa Rica, and plans for work with OFAR cooperative station in Ecuador on cacao diseases.

3. Correspondence and visits from disease discouraged sesame growers of Nicaragua.

4. International meeting of plant pathologists in Guatemala, with a week's work-stop in El Salvador.

5. Plans for formation of a Tropical American Section of the Phytopathological Society; annual meetings (at the Institute?) with membership from Southern United States and Mexico to Peru.

Esso Fellowship Advisement

1. The fellow in Entomology (W. W. Neel from Florida) will leave possibly in June, but most likely in August. His main work has been on cattle tórsalo under Mr. Rhoad. Other work of his includes insecticidal control of Diabrotica injury to beans; control of leaf cutting ants; aphid control on cacao seedlings; and miscellaneous insect determinations and local assistance for coffee growers and many others.

2. The fellow in Pathology (Ralph Segall from California) who is to leave soon, has worked for the past year on fungicide problems in the tropics. Tests have been made using the following diseases and spraying for: Cercospora leaf spot of banana; Ojo de Gallo of coffee; Phytopthora blight of potato; Phytopthora seedling blight of cacao; chemical defoliant measures for control of coffee leaf diseases. He has worked on laboratory tests of fungicides, and as well on cultural studies with Omphalia flavida and Rosellinia.

3. The fellow in Herbicides (Joseph Orsenigo from New York) will be here until the latter part of the year. There

has been less screening work done with the herbicides this past year. His more important contribution has been on weed control in coffee, which is now in the practical demonstration stage here and will be used in several other countries; and he is studying weed control in maize grain sorghum in commercial proportions, herbicide applications to sugar cane; cooperative work with Costa Rican growers on rice weeding problems, and the persistence of 2,4-D in the soil.

4 and 5 Two fellows took Masters degrees under the Esso program during this year: Milton Gertsch, working with beans, now in graduate school in Louisiana, and José Nuñez, who studied corn and returned to Venezuela.

One of my efforts has been to spread the practical information obtained through these Esso subsidized studies to the cooperative stations of the Office of Foreign Agricultural Relations of the United States Department of Agriculture, United Fruit Company research workers, and the extension services set up by United States cooperation in several countries through the Institute of Inter-American Affairs. These countries include as a present minimum, all of Central America, Ecuador, Haiti, Paraguay, and Peru.

Assorted Research Advisement

One student (W. L. McFarlane) brought here by Dr. Ochse of the University of Miami, Miami, Florida, has been working partly in cacao and on plant performance of coffee determing growth as correlated with flowering, fruit development, and weather. The work has been extended beyond the first concept of the problem, and reasons for recently determined changes in growth rate are being investigated. He is also helping me in determining the best month to defoliate coffee trees in the control of Ojo de Gallo, and he is studying grafting problems in coffee.

For about two months a DuPont Fellow (Víctor Pérez of Colombia) has been working on the pathology of seeds and seedlings, and the application of chemical and other seed treatments for seedling disease control. He has been placed under the direct supervision of Miss Hastings, working on several crops. He is learning plant pathological methods in the laboratory, greenhouse, and field, ways of mycological study, the place of chemical methods of seedling disease control, and the scientific attitude.

I still have minor contacts with cacao fellowship students, but those are considerably less as these have been largely supplied by Dr. McLaughlin. Consultative relations have been actively carried on with men of agricultural stations in Guatemala, El Salvador, Ecuador, and Costa Rica. In these consultations I have drawn not only on my

own efforts, but where possible, I have as well employed assistance from technicians of the Institute.

Publications

1. Coffee tree selection project. In Suelo Tico (for purposes of extension).

2. Spraying of petunias to control leaf spot. In U.S. Plant Disease Reporter

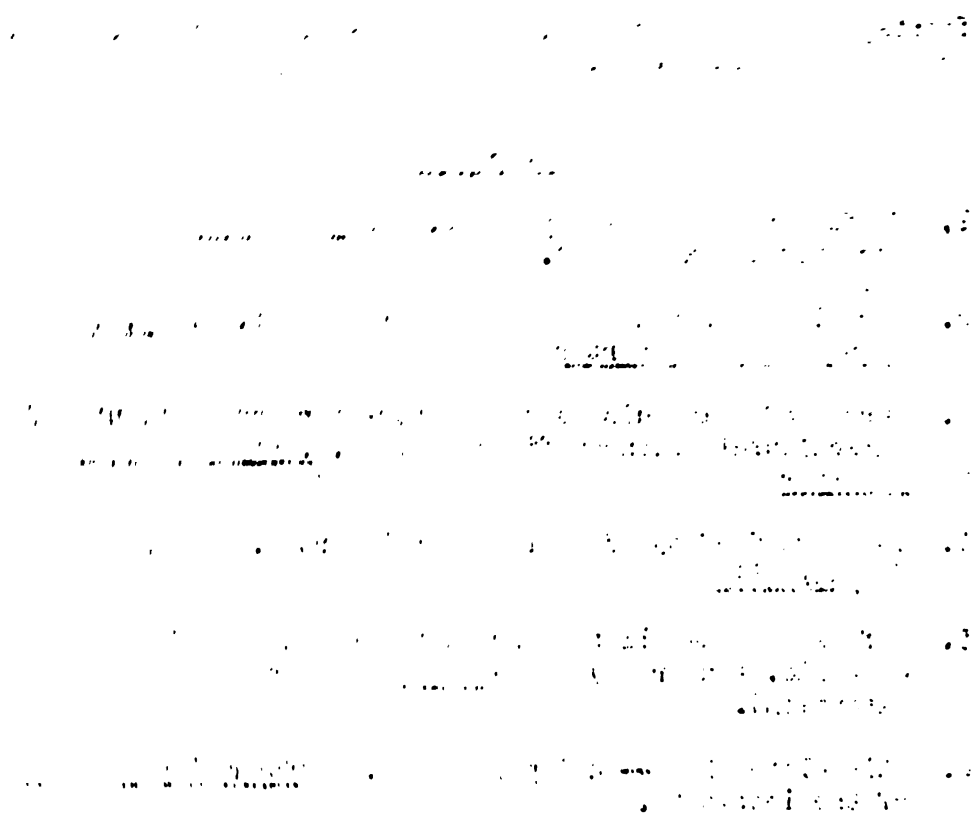
3. Survey of maize diseases in Inter-American Institute of Agricultural Sciences fields. In U.S. Plant Disease Reporter

4. The spread of ojo de gallo by rain drops. (In press) In Suelo Tico

5. Coffee tree defoliation project for control of ojo de gallo. (In press) In Suelo Tico (for purpose of extension).

6. Otis Alston Pope--An Appreciation. Information Bulletin of the Institute.

March 28, 1949



INTER-AMERICAN CACAO CENTER

George F. Bowman

Report on Operations for First Six Months

January-July, 1948

Student Training

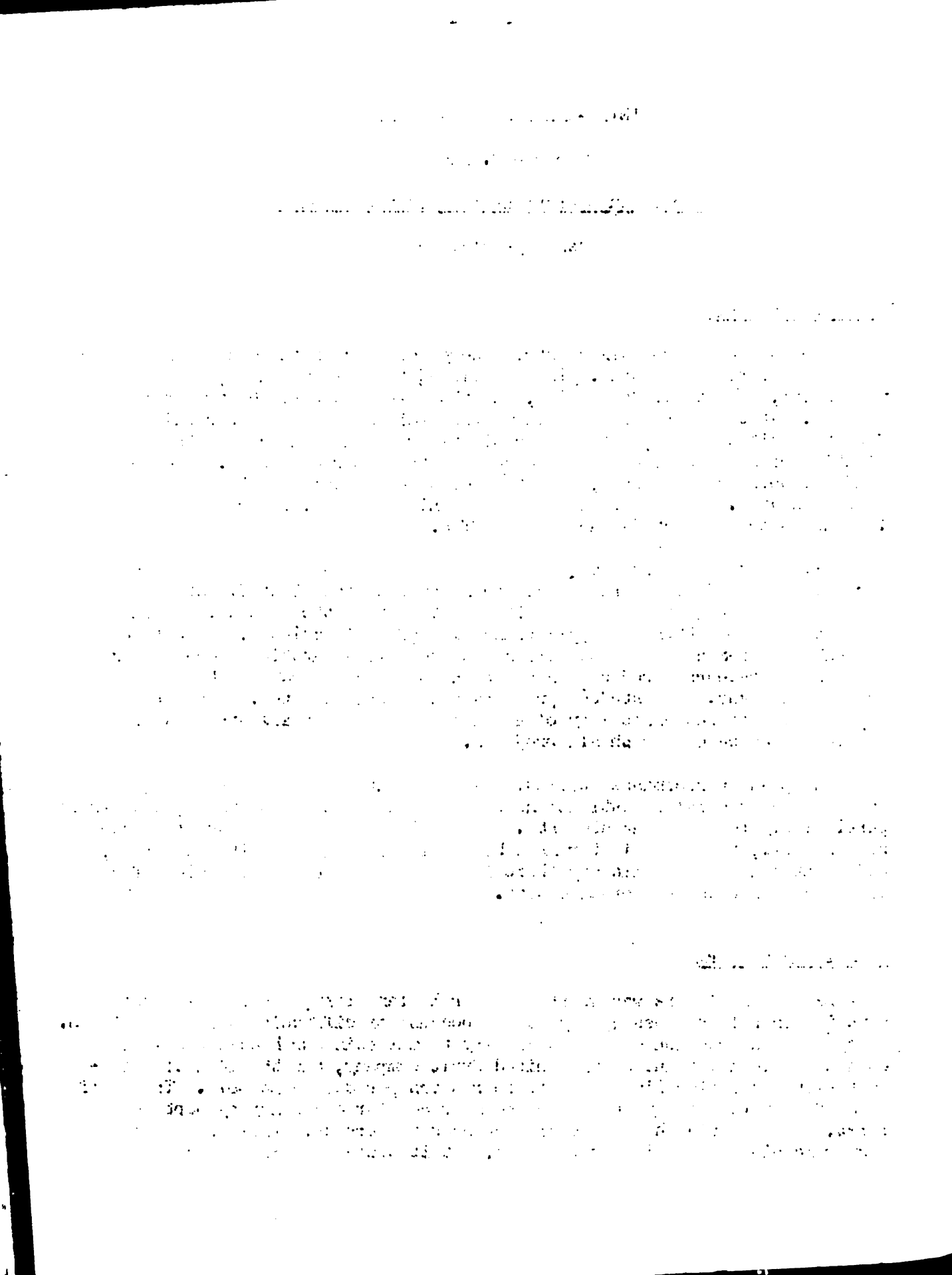
Nine students from six countries were enrolled in the Cacao Center during the first six months. These included three from Mexico, one each from Haiti, Nicaragua, Costa Rica, and the United States, and two from Ecuador. At the completion of six months training, Santiago Porcella III, from the United States, returned to Liberia where he will direct the planting of 200,000 acres of new cacao for the Liberia Company. One new student, Luis Allanic Taule, from the Dominican Republic, entered the Center in July. Lee McFarlane, from the United States, entered the Center in June in order to study cacao and coffee.

All of the students have shown great interest in the study of cacao and have advanced much more rapidly than had been anticipated. At the end of the first quarter it was quite doubtful that they would learn in one year any more than the basic principles of field culture, but before the end of six months they had all shown themselves capable of conducting independent research projects in addition to the combined work they are doing as a class. The student projects are described later. Each of these projects is the responsibility of a single student, but all students are completely acquainted with all projects.

The plant performance studies, described later, will be of great value in the general investigations of the Cacao Center, but they are designed particularly for training students. Before research work on any plant can be done well, the investigator must be completely familiar with the plant, and to attain this familiarity there is no surer way than the taking of a great mass of plant performance data.

La Lola Cacao Farm

Experimental work was started on our lowland farm, but rehabilitation work in general progressed very little because of difficulties of supervision. Delays in construction made it necessary to maintain our headquarters in La Joya house loaned to us by the United Fruit Company, and the lack of transportation facilities limited us to four hours per day on La Lola. The staff house and overseer's quarters were to be ready for occupancy by September first, and we could then start pruning work in earnest. The spray and duster machines were already on order, but it would be some months before



we could expect delivery on them. The propagators were started in August, as soon as money became available.

Investigations

The following departmental investigations, as differentiated from student projects, were under way:

A. Turrialba

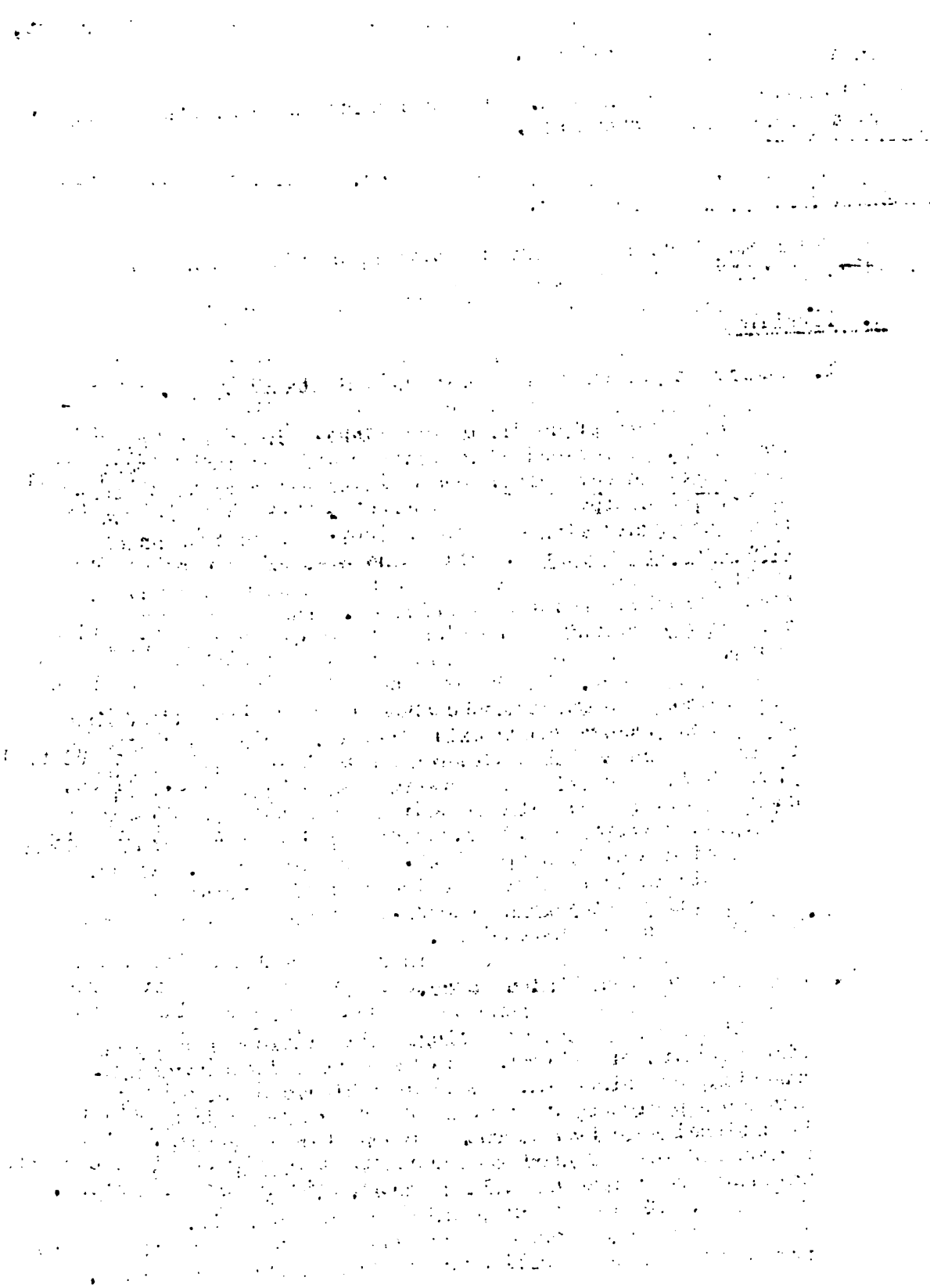
1. Fungicide screening and seedling resistance tests.

   A nursery of seedlings was planted in long beds, five rows wide. These beds were divided off in small blocks and the plants in each block sprayed with a fungicide or concentration of fungicide to be tested. The whole bed was 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 later be given field tests.

   In conjunction with the above tests we are attempting to find 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 per cent or more by means of spore suspensions.

2. 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.



3. Tests of climatic effects.

As fruit ripens on our clonal plants at Turrialba we plan to send samples to the United Fruit Company laboratory at Almirante for flavor tests for comparison with the same clone grown at sea level. Turrialba is at 2400 feet elevation. The first one, Clone 221, has been sent. While there was very little difference noted in favor of the Turrialba flavor, there was a considerable advantage in yield per pod. Turrialba 221 gave 15.1 percent dry beans per fresh weight of pod as compared to 9 percent for the lowland 221.

B. La Lola

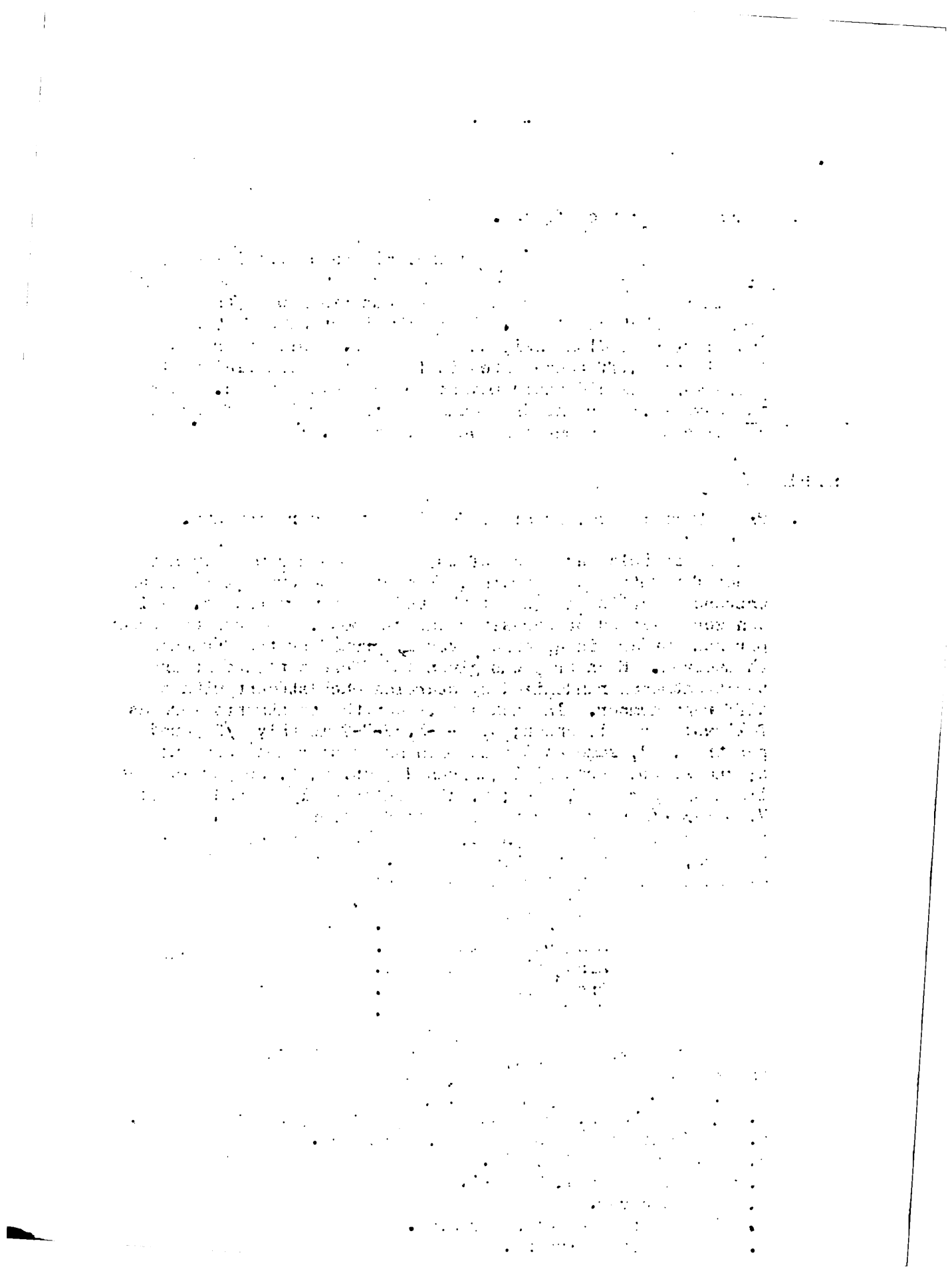
1. Plant performance, pruning, fertilizer, minor elements.

In La Lola farm each of the 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 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 sulfur 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 the following records on each tree:

a. Five sketches, one each from four sides, one from above.
b. Intensity of overhead shade, scale 1-5.
c. Soil type and drainage.
d. Vigor, on a scale of 1-5.
e. Ground cover.
f. Height of tree before pruning.
h. Height after pruning.

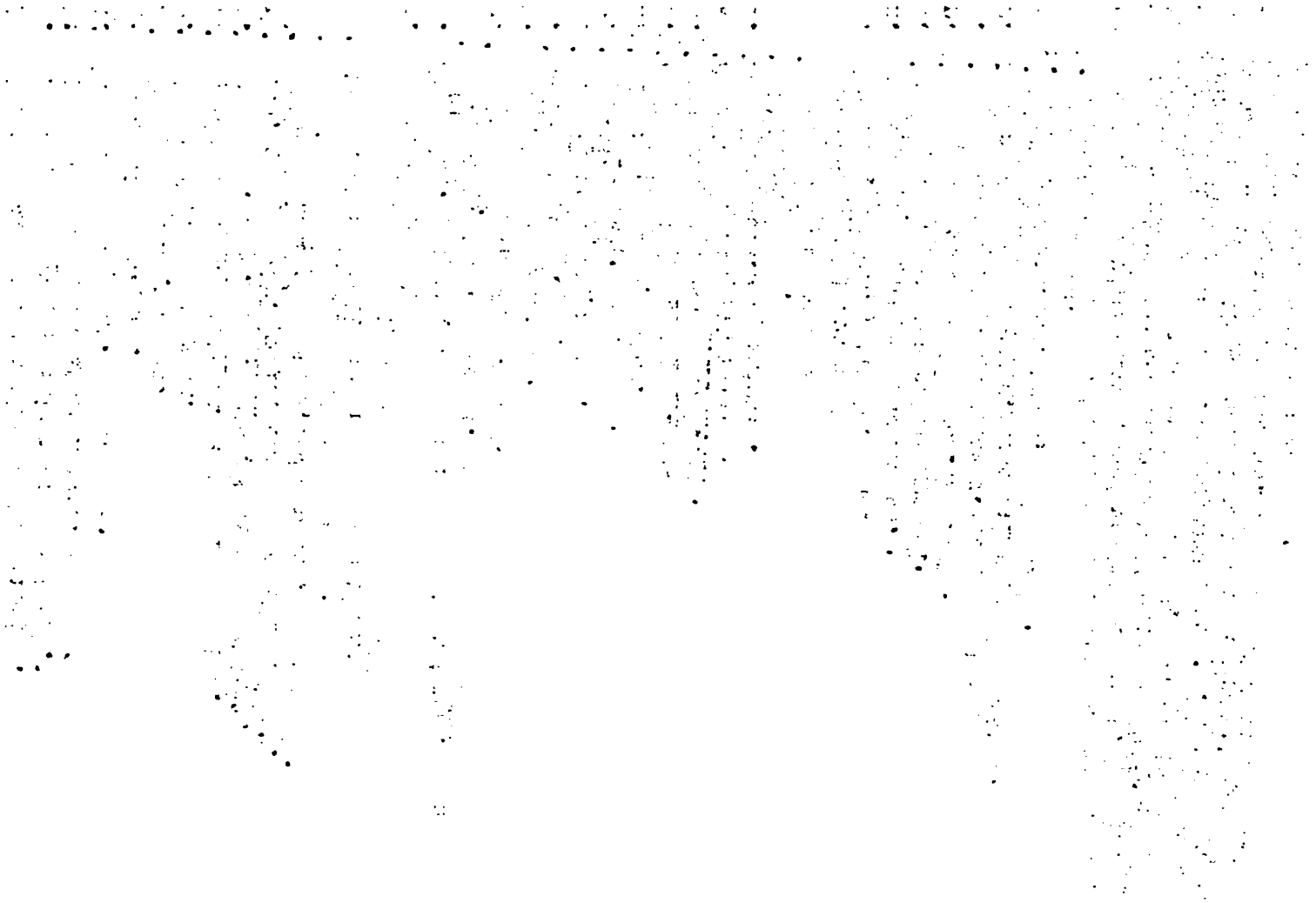


i. Diameter mzximum and minimum before pruning.
j. Diameter maximum and minimum after pruning.
k. Diameter of trunk at waist height.
l. Inclination of trunk.
m. Height of crown.
n. Number of main branches.
o. Number of mature chupons.
p. Incidence of Phytophthora cankers in branches.
q. Fruit pod, type, size, color, thickness of wall.
r. Bean, size, color, yield, in percent of fresh pod.
s. Number of pods per pound of dry beans.

Each week the following records are taken:

a. Rainfall for week.
b. Flowering. Approximate number per foot on trunk, main branches, small branches.
c. Fruit setting, number.
d. Total pods on tree.
e. Half-grown pods.
f. Three-fourths grown pods.
g. Full-size pods.
h. Number cherelles wilted.
i. Pods removed for Phytophthora.
j. Pods lost from other fungi.
k. Pods destroyed by animals.
l. Pods harvested.
   1) Trunk
   2) Principal branches
   3) Small branches
m. Flushing, abundant, little, none.
n. Average length of terminal growth.
o. Average diameter of terminal growth.
p. Average length of new leaves.
q. Average number of flushes still retaining leaves.
r. Number of chupons, trunk, major limbs.
s. Chupons wilted.

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 I consider of practical value, he is helped to plan his project and assemble the equipment necessary. He then submits a corrected program and starts work, or vice versa. 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.

1. Investigation of causes for variations in locally produced cacao.

A list of producers was 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 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, type 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 of treatments, if any, will improve the general quality of Costa Rican sun-dried cacao.

2. 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, and 8.5 and 16 seeds planted in each. So far the best growth appears to be at the neutral point or nearby. Later on 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.

3. Vegetative propagation.

This is a large project and grows larger 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, soil and wood mould, 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 cell-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 cheesecloth or cell-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 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.

4. Flowering and fruit setting.

Data are being collected on all the phenomena involved in flowering, pollenization, and self-incompatibility. The hour of opening, hour of pollen ripening, time of avscission, 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-pollenization are being tested, and value of different clones as pollen-parents 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.

5. 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, at each stage, the most vigorous growth. 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, I believe, what makes a seedling or chupon form a crown at high or low level.

6. 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.

7. 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:

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?

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

If air drying kills, how soon?

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

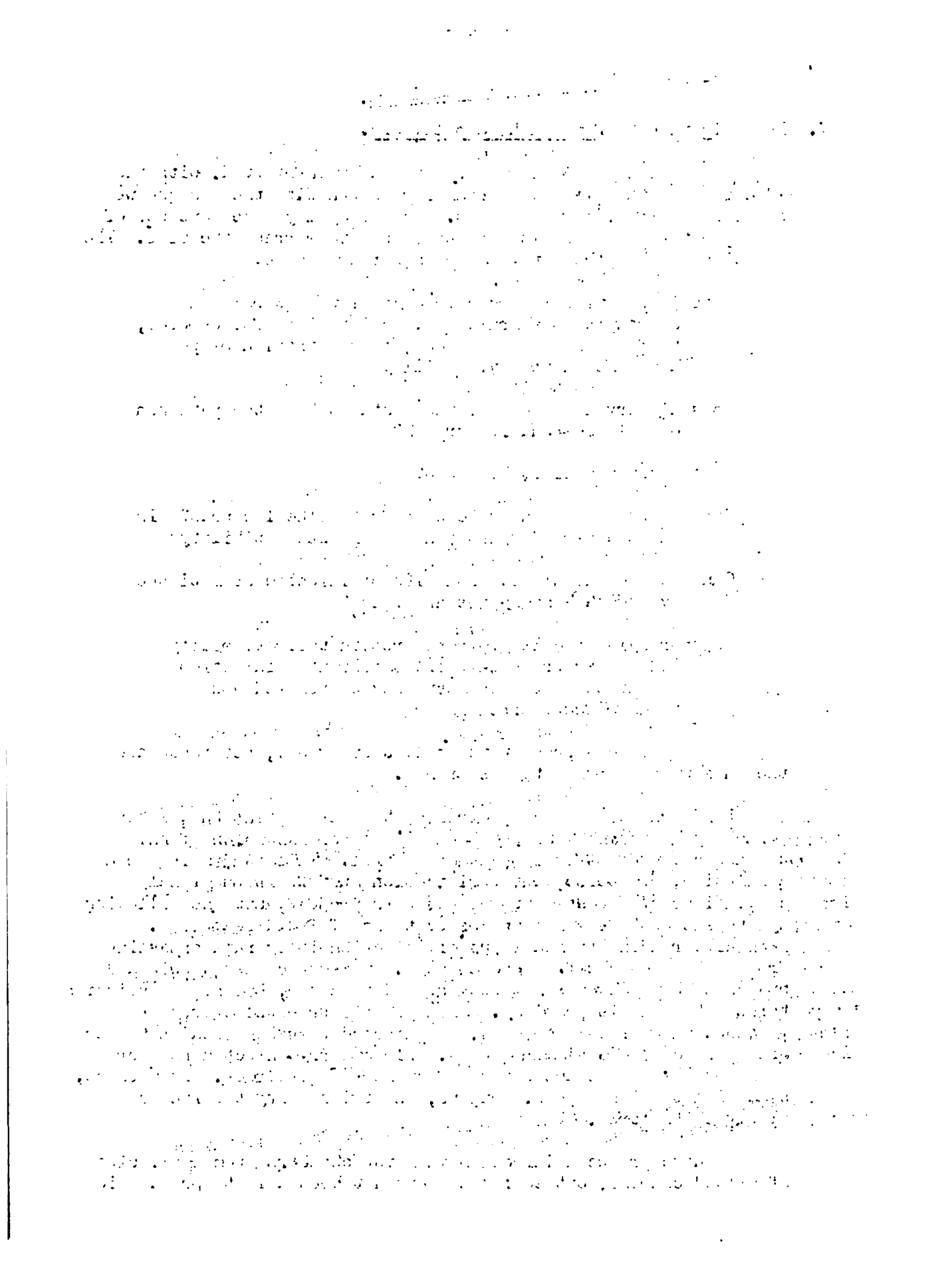
Can pods be inoculated from bits of infected stem tissue even though no spores are found?

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.

The work has already progressed to such a point that I have formed my own opinion as to the method of transmission of this disease and the possible means of control. This is jumping to a conclusion, of course, and verification must await the final conclusions of the student who has this project, but the following hypothesis best fits my own observations of field reactions. 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 carry 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. My advice, then, would be to prune heavily, then spray with a highly concentrated Bordeaux or other copper, possibly two or three times in a space of a week. After that we might be able to leave the farm unsprayed for a year or more until the inoculum could build up again.

Demonstration Farm

I have proposed that the Cacao Center be endowed with, or loaned, $350,000.00 for purchase of a farm. Within ten years this farm could be built up from its own income to such an extent that the Cacao Center would be a completely self-sustaining educational and research institution, with a built-in, automatic extension department. In my opinion a profit-making cacao enterprise would be the most effective possible agency for promotin the development of the cacao industry in this hemisphere.

August 23, 1948

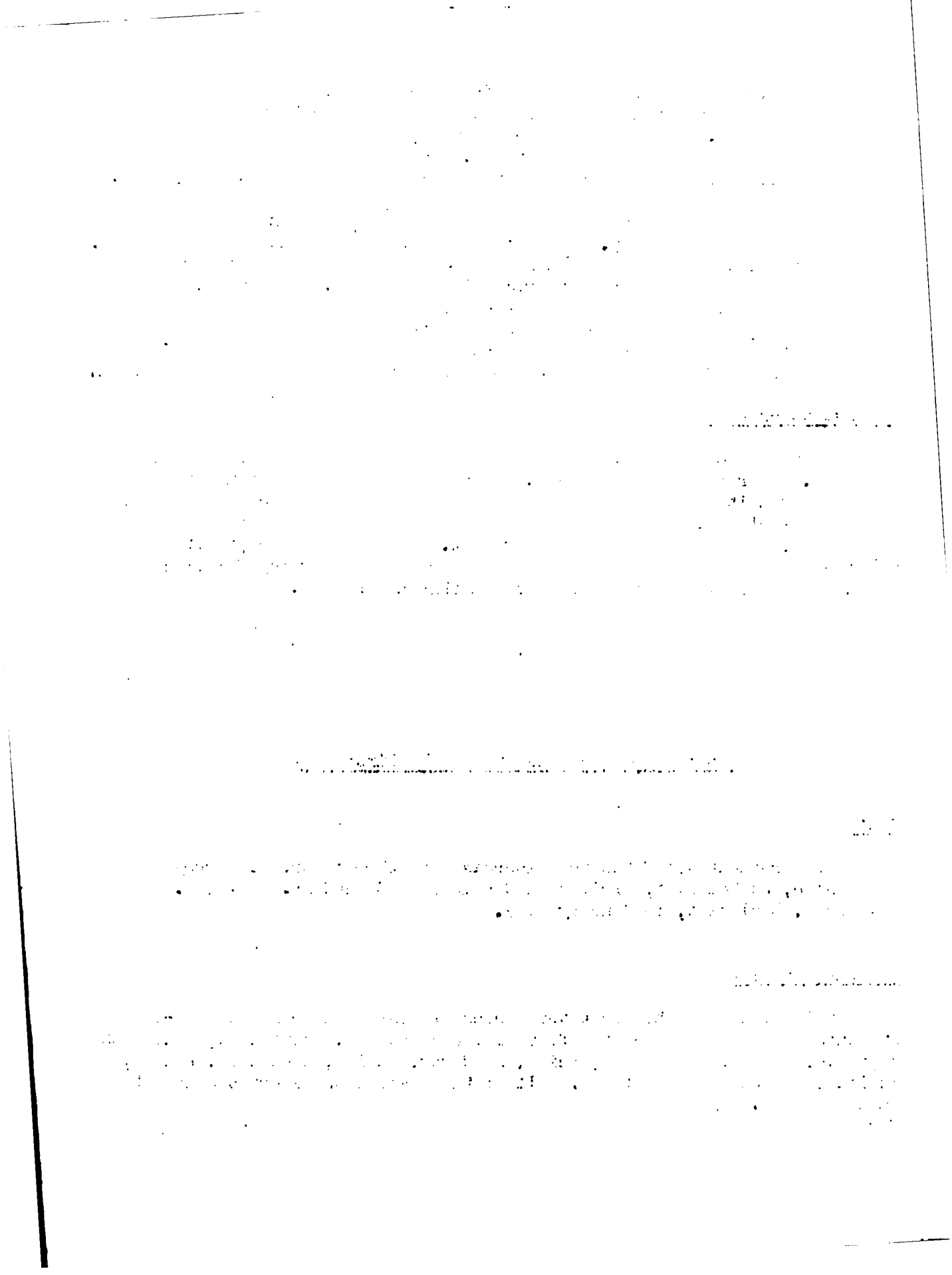
Report on Operations during the First Year

Staff

The permanent staff has been increased to three: Dr. J. Harvey McLaughlin, Pathologist, arrived in November 1948, and Dr. Leslie R. Holdridge, Ecologist, in January 1949.

Student Training

During 1948 and the first two months of 1949 we have had twenty-two students enrolled. These came from eleven countries, Costa Rica, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Surinam, and the United States. All of these students except two are still in attendance.



The students have shown marked interest in cacao culture and have applied themselves well. The presence of the older students has had a distinct leavening influence on the more recent arrivals, and we find that the latter learn the basic principles of field culture more rapidly than had been anticipated. Consequently, we now try to lead each new student into an independent research project in the second month of his course. In the attached list of projects it will be noted that all except the most recent arrivals are engaged in individual projects. This does not mean that any student is limited to the study of a single facet of cacao research, since all are required to continue in plant performance studies and to familiarize themselves completely with the projects of all the other students.

The plant performance studies as described in Cacao Information Bulletin, Vol. I, No. 11, are giving us information of considerable value but they are even more important as basic training for the students. Without a knowledge of the plant itself, it is difficult to investigate intelligently the reactions or aberrations of the plant.

Investigations

The staff investigations are being held to a minimum at present in order to place the greatest emphasis on student research. We feel that student projects, properly supervised, serve to train the students at the same time that they give us the information desired. We will initiate new line projects under the staff as rapidly as possible, but all or parts of each one will be given to students as soon as they show interest in them and ability to handle the work.

Student Projects

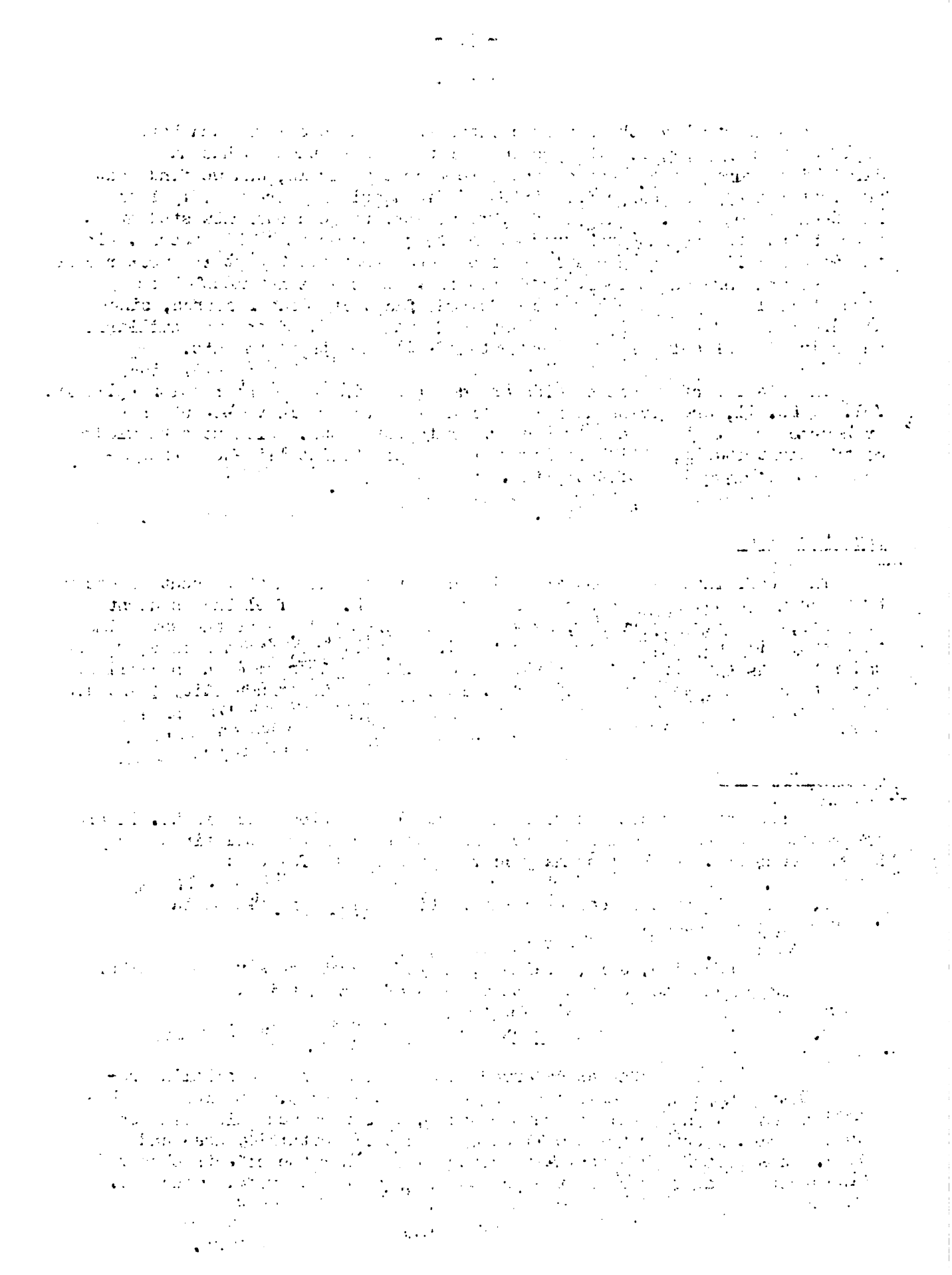
The student projects described in Cacao Information Bulletin No. 11 are progressing and the conclusions are being reported in the Bulletin as they become available. A brief summary of results to date follows:

1. Investigation of causes for variations in quality in Costa Rican cacao.

   Location, soil, drainage, and/or variety seem to be of little importance as compared with methods of fermentation.

2. Effect of pH on seedling growth

   Best growth was observed on soil of neutral to alkaline reaction; considerable stunting was noted at pH 5.0 and lower. This soil was naturally of pH 5.5 and changes were made with lime or acid. Further tests will be made on soils naturally acid and also naturally alkaline to determine whether the effects observed can be attributed to the pH itself or to the chemical amendment.



3. Vegetative propagation.

It has been found possible to root cuttings in the nursery bed by covering with a simple cold frame. Attention is necessary only twice a week and the system is feasible for the small producer.

Budding technique has been improved to the point that nearly 100% success is often attained; buds start growth within two weeks after budding.

4. Flowering and fruit setting.

It has become apparent that lack of pollination may be a contributing factor in low yields. Investigations on agents of pollination are being continued.

5. Effect of shade on seedling plants.

Most vigorous growth has been observed under 25% to 50% shade. An interesting observation is that the number of stomata per unit area of leaf surface is greater under heavier shade. Tests are planned to investigate the time required after change in shade conditions for trees of various ages to produce leaves of different stomatal concentration.

6. Transmission of Phytophthora palmivora.

Evidence indicates that we may be able to control this fungus by applying eradicant spray chemicals at rather long intervals. A cooperative test is planned with the United Fruit Company making use of their Tifo machine and other trials will be initiated in La Lola as soon as spray equipment is received.

New projects on root development, propagation by cuttings, seed treatment before planting to accelerate germination, etc. have been started and will be reported later.

Codification

An outline has been prepared to cover all experimental work on cacao. This will be discussed at this meeting of the technical committee and revised. Subsequently we expect to keep a record on it of work in progress both here and in the other experiment stations in the Americas, and use it to guide our lines of investigation away from unnecessary duplication.

Some Investigations Projected for 1949

Rehabilitation Demonstration

A 25-acre plot at La Lola will be rehabilitated by pruning, budding and/or supplying with budded seedlings. The trees are 30 to 35 years old and have been neglected in past years. A preliminary survey indicated that 35% of the original stand was gone. The overhead shade is fair--typical of old farms in Costa Rica.

Procedure

1. All trees will be pruned.

2. Three seeds will be planted in each blank space.

3. Clonal budwood will be budded onto basal chupons now present.

4. Trees without basal chupons will be partially ringed to promote production of basal chupons.

Six months later: New basal chupons will be budded with clonal budwood.

Twelve months later: Further clonal budding where possible.

Twenty-four months later: All trees pruned; trees with well developed clonal growth pruned heavily. All trees that have not produced a basal chupon will be cut out and seeds planted. Seedlings or chupons resulting therefrom will be budded later.

At intervals of six months thereafter, additional clonal budding will be done as necessary. All tree will be reduced gradually in size by pruning, leaving only clonal budded trees of high yield potentialities. Production and cost records will be kept.

Propagation Studies

1. Rootstocks.

We plan to use seed from clone U.F. 613 (a self-incompatible clone) pollinated by various other known U.F. clones in a study of the effect of rootstock in a budded-seedling program.

A row of each known cross will be planted to obtain rows of 100 seedlings each. This plot will be crossed with clonal budwood buddings. With eight known crosses and six clones for budding there will be a total of 800 trees of 48 kinds. There will be 16 or 17 trees of each kind, i.e., 16 trees of clone 221 budded onto 613 x 667, 16 trees of 221 on 613 x 221, etc.

An equal number (16 or 17) of rooted cuttings of each clone will be planted in the same plot.

2. Seedlings.

An equal number of seed of known parentage (as above) will be planted and left without budding to investigate their yield potential and for comparison with the budded seedlings.

Evaluation of Methods of Rehabilitation

The methods of rehabilitation will be: (1) Pruning, plus supplying with clonal cuttings, (2) Pruning and supplying plus elimination of uneconomic trees and the budding of resultant chupons, (3) Elimination of all old trees and replanting with rooted clonal cuttings. There will be three replications of each treatment; each plot will have a maximum of 81 trees possible (9 x 9 square). Data will be obtained from a central 7 x 7 square. The clonal cuttings supplied will be from seven known clones, planted one row each in each plot. Non-treated check plots will be included.

A duplicate of this entire experiment will be set up under a spray schedule of 5-5-50 Bordeaux on a 30-day cycle.

Each tree will be numbered and a record kept of the type, size, and color of pod; monthly production in number of pods, and losses of pods by disease and other factors. A record of pod yield and number of pods per pound of dry cacao will be made on outstanding producers. Cost records will be kept on the different methods of rehabilitation. This is proposed as a 10-year program.

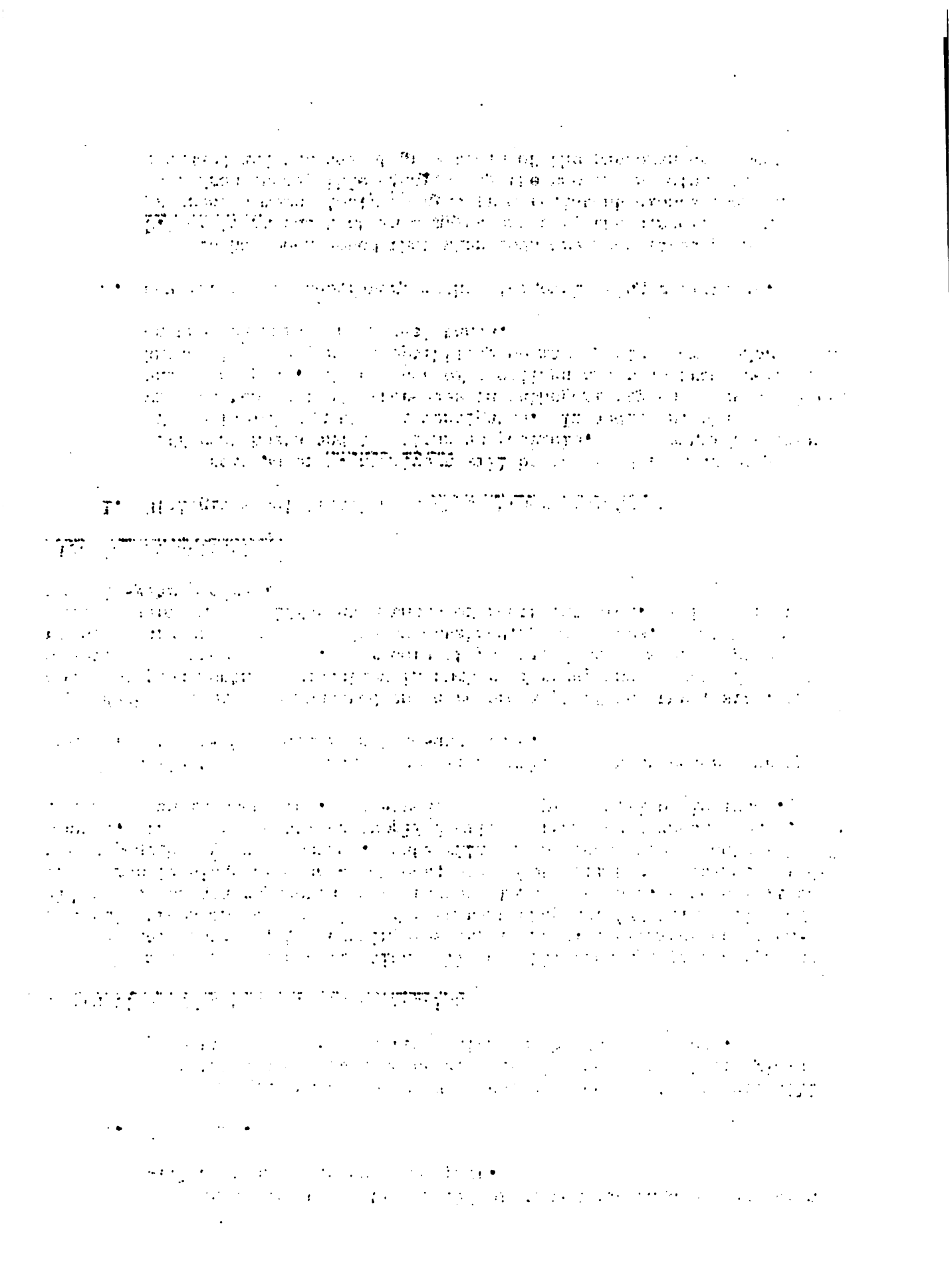
Disease Investigations

1. Biologic specialization in Phytophthora palmivora.

Isolates of P. palmivora will be obtained from as many different hosts and locations as possible. The sexual behavior of the isolates will be investigated. In addition, the isolates will be tested for differences in pathogenicity on young seedlings and cacao pods. By the use of seedlings and pods from trees of known tolerance or susceptibility we may acquire some information on the transmission of resistance.

2. Development of laboratory method for evaluating resistance.

It has been noted that when pods are inoculated with P. palmivora and kept in a moist chamber, the discoloration progresses more slowly on pods from resistant clones than on pods from susceptible clones. By the use of one clone as a standard and the use of one strain of the pathogen we hope to



be able to evaluate our selections for resistance without waiting for a natural outbreak of the disease.

3. Nature of resistance to P. palmivora.

By comparison of physiological, chemical, and physical components of tolerant and susceptible trees we hope to determine something of the nature of resistance.

4. Fungicide application methods.

Exploratory trials will be made with spray machines, mist blowers, and fog-drive machines (Tifa) to determine the advantages, costs, and efficacy of each method.

5. General disease observations.

We will continue a survey of plant pathogens affecting cacao and endeavor to determine their relative importance in cacao culture.

March 11, 1949

Program of Study

Fellowship Students

These students enter at the first of any term and remain for either six months or one year. At entrance, each student is given a bibliography of cacao and advised as to reading material to be covered during his course. During his second month he is advised on the choice of a research project, and when one has been selected he is directed to further reading material pertinent to his selected phase of the program.

All students spend three days of each week, Wednesday noon to Saturday noon, at La Lola farm. While there they take plant performance records on mature trees and on young trees when these are available. Plant performance records constitute one of the required courses and are continued throughout the student's entire year. In the remaining time at La Lola the students assist in preparation and recording of departmental experiments and conduct their individual research projects. We plan to inaugurate classes at La Lola in language, in design and layout of field experiments, and in preparation of oral and written reports.

During the time spent at Turrialba these students are required to continue the study of literature described above, to conduct laboratory work, either on their individual projects or general cacao investigation

under direction of the staff, and to attend seminars and such of the general Institute course work as should be considered necessary by their advisers. One seminar is given each week on some phase of cacao investigation or improvement. These seminars are led by students and staff. Each student is required to conduct at least one of these seminars before finishing his year's work.

Student research projects are chosen by the students themselves from a list prepared by the Center and must be approved by the staff members. The objective of the Cacao Center is to learn how to produce more cacao, of better quality, at a lower unit cost, and all projects must show promise of contributing, either directly or indirectly to the attainment of this objective.

The degree offered to fellowship students is "Especialista en Cacao". To earn this degree a student must complete one year's resident work, and such additional time as may be required, pass an oral examination given by two or more of the Cacao Center staff members, submit a full report of his year's work, including observations on all the projects of students and staff, and prepare an acceptable thesis on his own research project. Students who can remain for only six months are not given a research project but are required to stand the examination and submit the final report as described. They will be given a certificate of work completed.

Students who so desire may become candidates for the general degree of Master of Agriculture offered by the Institute. To do so they must meet the requirements for admission and complete the studies prescribed by the Institute as a whole. It is understood that these students must complete all the work outlined above for all cacao fellowship students and that this work will take precedence over their outside work toward the Master's degree.

Special students from other department or otherwise not on cacao fellowships, or who have already earned the degree of "Especialista en Cacao" and are on a second fellowship, may choose a research project on any phase of cacao improvement and will be advised and assisted by whichever member of the cacao staff they elect. These students may apply their studies toward a degree in the Institute or toward graduate requirements in other schools but cannot be candidates for the degree of "Especialista en Cacao" unless they complete all the work outlined for cacao fellowship students.

The general program for cacao students is as follows:

Monday

7:00 - 12:00 Greenhouse or laboratory - Turrialba
1:00 - 3:00 Language
3:00 - 4:00 Seminar
7:00 - ~~10:00~~ 9:00 Library

Tuesday

7:00 - 9:00 Cacao Seminar or lecture
9:00 - 12:00 Laboratory or field
1:00 - 2:00 Language
2:00 - 3:00 Seminar
3:00 - 4:00 Taxonomy or Methods of Science
7:00 - ~~10:00~~ 9:00 Library

Wednesday

7:00 - 10:00 Laboratory or field
10:00 - 1:00 Trip to La Lola
1:30 - 4:00 Field
4:00 - 5:00 Language-Elementary group
7:00 - 8:00 Language-Advanced group
8:00 - 10:00 Laboratory or study

Thursday

7:00 - 12:00 Field
1:00 - 3:00 Field or laboratory
3:00 - 4:30 Design and layout of field experiments
7:00 - 10:00 Laboratory or study

Friday

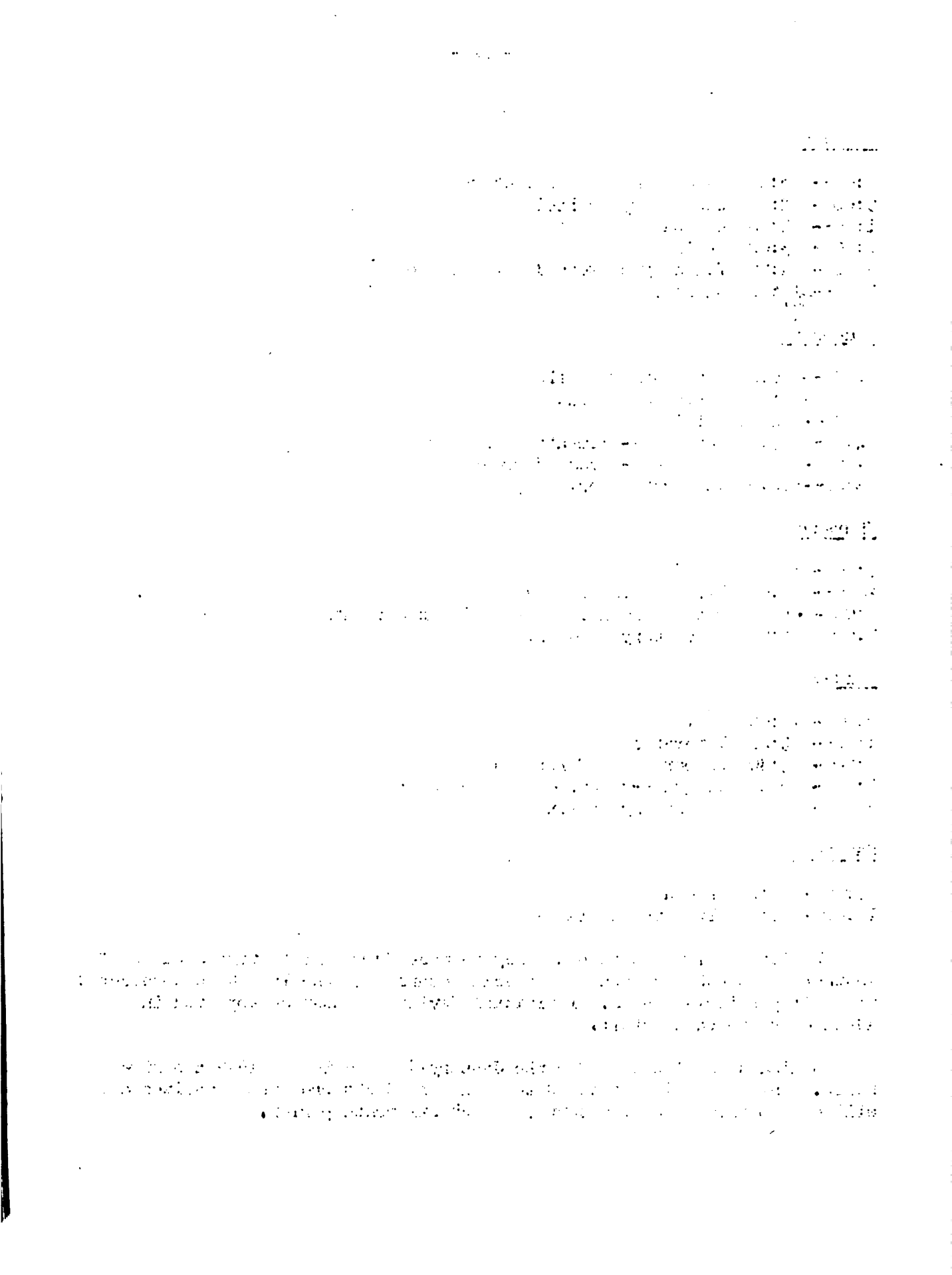
7:00 - 12:00 Field
1:00 - 3:00 Laboratory
3:00 - 4:30 Preparation of reports
7:00 - 8:00 Language-advanced and elementary
8:00 - 10:00 Laboratory or study

Saturday

7:00 - 10:00 Field
10:00 - 1:00 Trip to Turrialba

Variations in this schedule may be made from time to time because of weather or to take advantage of special courses in the Institute considered to be of particular value. Individual deviations must be approved in advance by the cacao staff.

Seminars and lectures for the January-June period of 1949 are given below. This list will be added to as new subjects present themselves and will be repeated to some extent for each six month period.

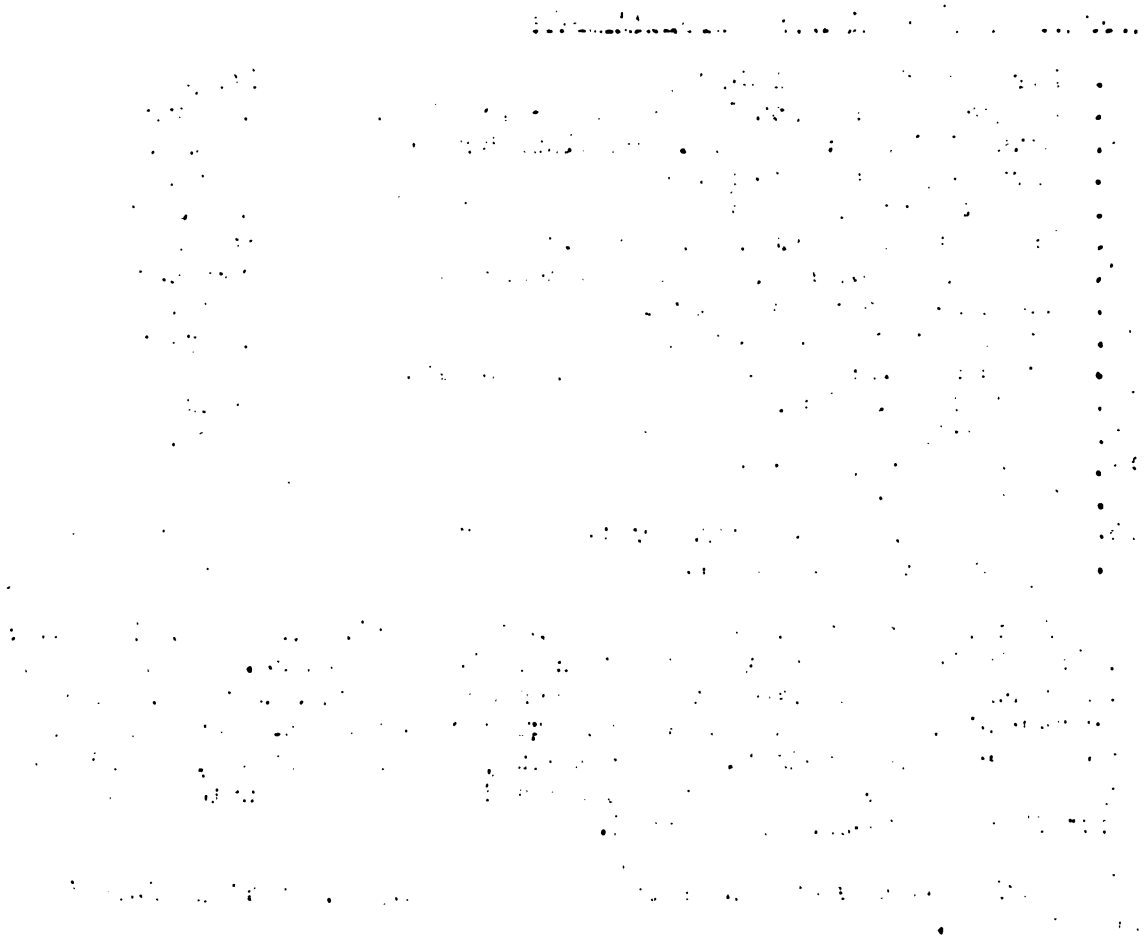


Schedule of Lectures to Cacao Students

1.	History of Cacao Industry	Barquero
2.	Geographic Distribution and Climatic Effect	Salazar
3.	Botany of Theobroma spp. and Distribution	Escamilla
4.	Physiology of Cacao Plant	Cabrera
5.	Soil Requirements for Cacao	Martinez
6.	Propagation and Planting Methods	Paredes
7.	Maintenance of Plantations and Renovation	von Buchwald
8.	Cacao Diseases and Control	Salazar
9.	Cacao Insects and Control	Barquero
10.	Breeding Cacao for Production and Quality	
11.	Harvesting Methods	Mejía
12.	Processing	Bowman
13.	Marketing and Prices	Oechsli
14.	Manufacturing	Bowman
15.	Preparation of Oral and Written Reports	McLaughlin
16.	Ecology of Cacao Regions	Holdridge

Each lecturer will be expected to prepare his discussion in writing and submit it for inspection and translation in advance. At the end of each month an examination will be given on the topics covered. Each lecturer will be expected to prepare questions and grade the answers on his particular subject. All students, both new and old, will be expected to attend the meetings and stand examinations unless special permission for absence is granted.

Cacao students may enter the course January 1, April 1, July 1, or October 1.



PROGRESS REPORT

ANIMAL INDUSTRY DEPARTMENT

Albert O. Rhoad

During the interval from the last Administrative Committee Meeting in November 1948 to this date considerable progress has been made in the Animal Industry Department. In particular, the construction program has progressed satisfactorily.

At this writing the horse barn, built with King Ranch grant funds, is about completed. There remain to be constructed a stone wall corral and some fencing around the horse pasture. Also under the King Ranch grant the construction of the animal climatological laboratory has progressed. However, this construction will be temporarily stopped awaiting equipment and special solarium construction materials. The corner-stone of this laboratory was laid at appropriate ceremonies on February 7. Completion of the creamery and abbatoir is now proceeding as most of the special equipment for these buildings has arrived from the States.

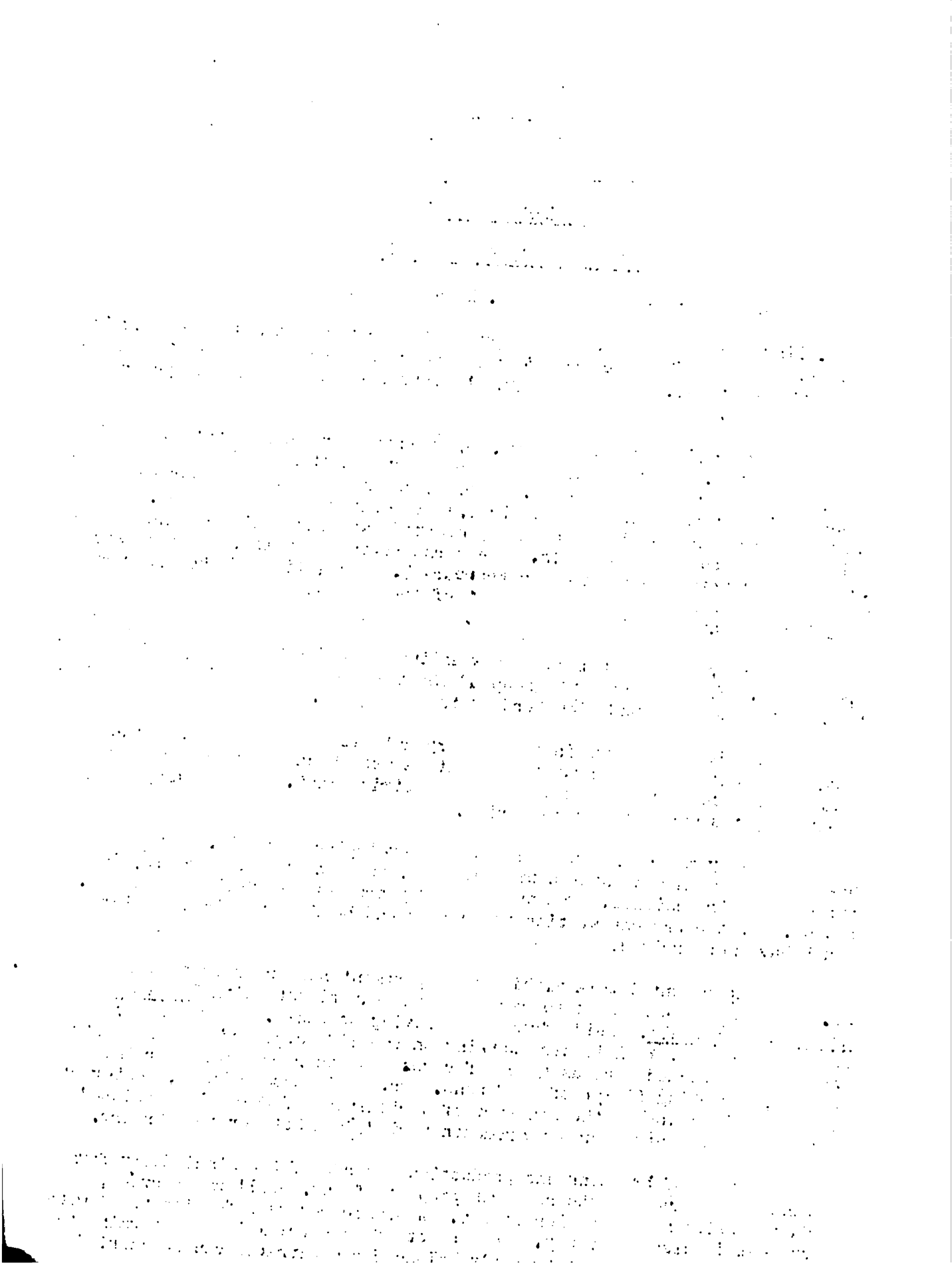
With the purchase of local type weanling pigs the swine unit has started operations. From the present group of thirty-four head, breeding stock will be selected as the foundation herd of the Institute.

The incubation of eggs in the poultry unit is progressing slowly as the large capacity electric incubator cannot be used because of the present very limited capacity of the Institute electric plant. Otherwise, the poultry unit is working satisfactorily.

The dairy and beef cattle herds are developing normally. Some difficulty, however, has been encountered with disease, especially anaplasmosis, in the pure-bred dairy animals. The average daily production of all cows is 10.3 pounds. At the present writing the horses and beef cattle from the King Ranch have not arrived.

The experimental work within the Department has progressed satisfactorily. Mr. William Neel continues to carry out the experiments with Dermatobia hominis, or tórsalo. Aside from the spraying schedule, using various insecticides, Mr. Neel is also working on the life cycle of this parasite and has constructed various types of cages and other equipment for this purpose, including fly-proof calf pens. Dr. Julio Mesa Salazar, Doctor of Veterinary Medicine of the Ministry of Agriculture of Colombia, assisted in these experiments over a four-month period from October to February.

The study of breeding and production records of the Mindi dairy farms in Panama continues as the research project of Ing. Guillermo Narváez, graduate assistant in the Department. A single reversal feeding trial with dairy cows is also under way. The object of this trial is to determine to what extent the feeding of properly balanced concentrates can be carried with the local type dairy animal.



The technical personnel of the Department has been increased with the addition to the staff of Sr. Hernán Sobrado, B.S., who has been placed in charge of the creamery operations. On the other hand, Sr. Daniel Castillo O. is no longer the flocks-master. Dr. Jorge de Alba of Mexico has accepted the invitation to join the Department staff as project leader in nutrition and assistant to the Head of the Department. Dr. de Alba is expected to report for duty on or about July 1, 1949.

The administration of the Department, insofar as it refers to the production of feed crops and other commercial aspects, has been improved through the placing of a manager on the Demonstration Farm. The Demonstration Farm manager also has considerable responsibilities outside this Department.

Consideration has been given to the possibility of placing a practicing veterinarian on the Department staff. This possibility is limited not by the work involved but by the budget. The increasing value of the Institute livestock, the number of prevalent diseases, and the calls for outside assistance in this field are sufficient to warrant the addition of a practicing veterinarian.

Regarding extension activities, the Head of the Department was called to Colombia in December to judge the "Segundo Exposición Nacional de Ganado Cebú". This exposition was held in Girodot from December 5 to 12. After the exposition, trips were made to several large cattle farms with the object of classifying Cebú cattle for registration purposes. Also a lecture was given at a call meeting of the Asociación de Ganaderos in Bogotá. On the return trip a short visit was made at the Facultad de Agronomía in Medellín.

The Head of the Department has been invited by the Rockefeller Foundation to head a special commission to study the animal husbandry and veterinary curricula and research projects of the various colleges in Central and South America. This invitation has been accepted and plans are now under way to start this survey in June and to terminate this circuit of the Americas by September 1. Dr. I. D. Wilson of the Virginia Polytechnic Institute will be the other member of this special commission.

March, 1949

PROGRESS REPORT

DEPARTMENT OF ECONOMICS AND RURAL LIFE

SUMMARY OF ACTIVITIES DURING 1947-48 AND OF PLANS FOR 1948-49

Julio O. Morales

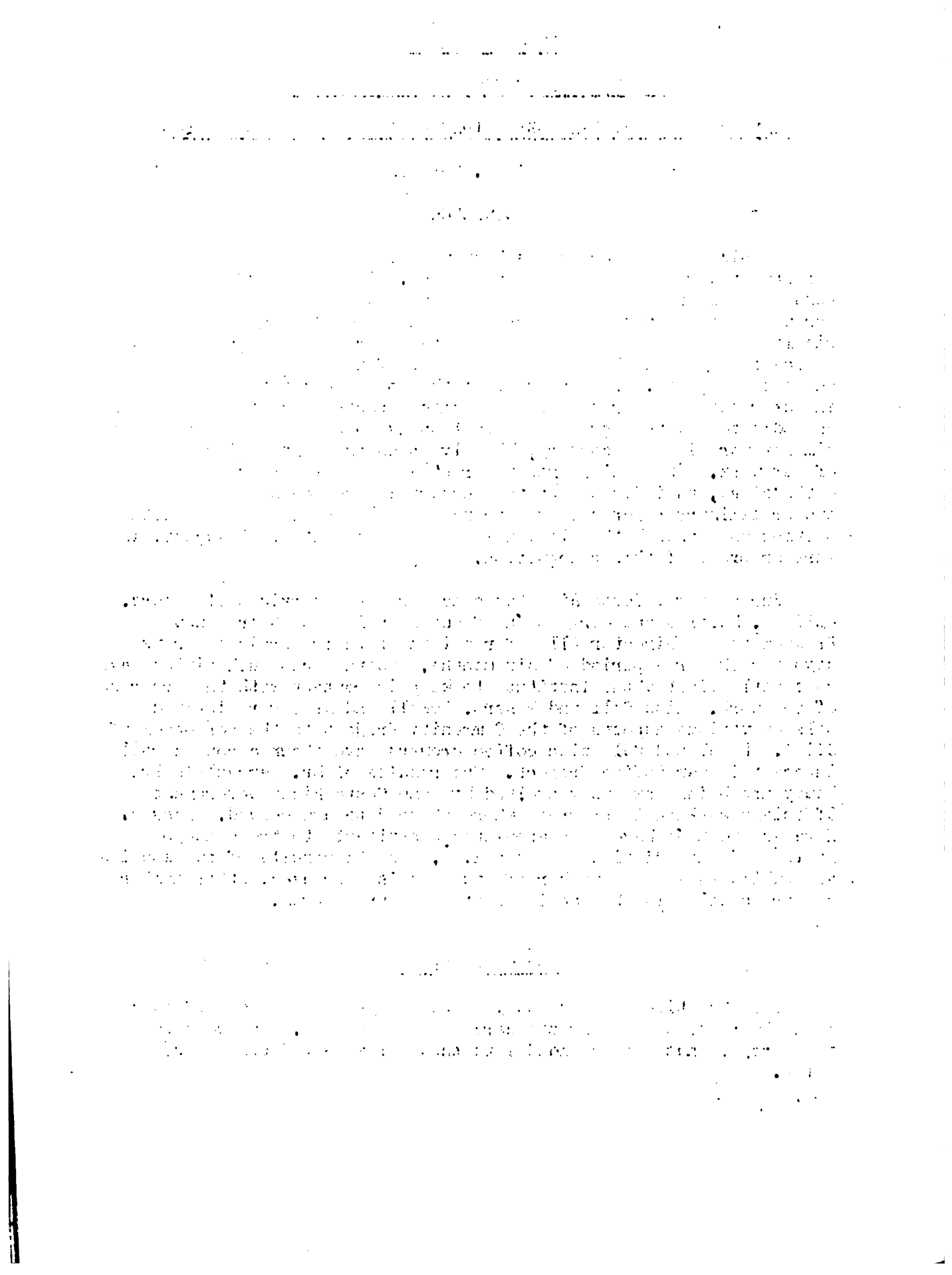
RESEARCH

Considerable progress has been made in the research program of the Department during the past twelve months. The work performed is receiving constantly increasing attention from institutions doing similar work throughout the hemisphere. Our research methods are beginning to be widely discussed in national as well as international circles, in spite of the fact that we have had only a year of intense work experience on these projects. The interest of the Coffee Federation of Colombia in our research program on the economic aspects of coffee production, as indicated by the agreement establishing cooperative ties to start similar work in that country, clearly shows the degree of recognition of our work. The hemispheric interest aroused by our trial census methodology, as indicated by the encouraging comments received on the two preliminary reports issued to date and on the Central American Meeting on Census Methodology held at the Institute last August, is further proof of this recognition.

Furthermore, Costa Rica has considered the services of Messrs. Julio O. Morales and Jorge León of enough value to their Census Program to ask Director Allee for a loan of their services for two days a week for a period of six months. Costa Rican authorities have constantly visited the Institute to keep in contact with the progress of the work. Miss Coll and Messrs. Powell and Arce were invited to talk on various aspects of the Community Project to the personnel of STICA. Local and Colombian coffee growers have shown a considerable interest in our Coffee Project. The results of Mr. Perrault's Price Study are being anxiously awaited by some Costa Rican Government Officials working in programs where these data are needed. Messrs. Morales and León have been appointed Consultants to the Consejo Nacional de Estadística of Costa Rica. As the results of our studies are published and the number of students is increased, other member countries will also become interested in our program.

Community Project

The objective of this study is to ascertain the most effective means to raise the living standards of a community. The work in this project has been divided into the four sub-projects described below.



1. Sociology and Anthropology Sub-Project

A good share of the Department's resources were devoted during the last year to this Sub-Project, which, supplemented by the contributions of Mr. Reed Powell (a Graduate Assistant sent by Dr. Charles Loomis under our Cooperative Agreement with Michigan State College) and consultations with Dr. Loomis and other members of the personnel of his Department at Michigan, made possible the enumeration of 655 schedules covering the following aspects.

a. Community delineation
b. Association patterns in the informal congeniality groupings
c. Association patterns in the informal prestige groupings
d. Class structure of the community

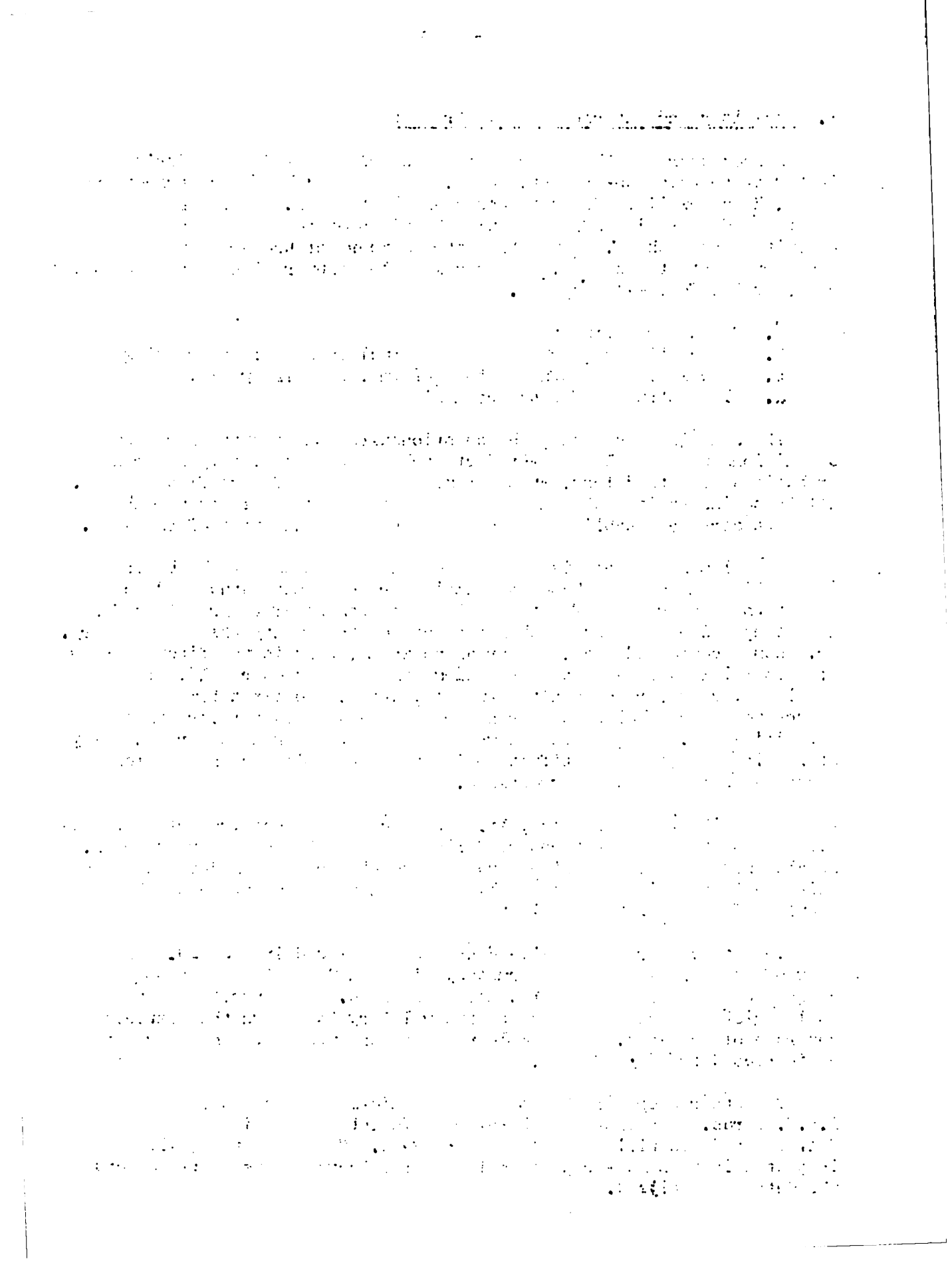
The sampling technique, the questionnaire, the instructions and definitions used in this Sub-Project include some completely new contributions to methodology, which promise to become of significant value. All these innovations were made by the Institute staff in an attempt to adapt already established methodology to the conditions of the area.

A preliminary analysis was made of these data to get the basic information on which to base the sample for the Health Study and to select the leaders of informal prestige and congeniality groupings for a meeting which was held at the Institute on the twenty-third of January. Dr. Loomis commented that, as far as he knows, this is the first meeting of informal leaders selected by sociometric methods ever held. The sample selected for the Health Study is, again, the first time that the structure of informal groupings has been used as a factor for sample stratification. Our sample design provides for checking the reliability of results against a stratified design not taking into consideration prestige and congeniality groupings.

In addition to the above, Mr. Powell collected considerable information on the town institutions rendering services to the outlying areas. He also made a very intensive study of the Atirro and San Juan Sur areas, which he is planning to use for his Ph.D. thesis to be presented to the Faculty of Michigan State College.

The study started in 1947-48 will be continued in 1948-49. The bulk of the work will be performed by Michigan State College students coming to the Institute as Graduate Assistants. The Institute Rural Sociologist will give them advice and will try to finish the complete coverage of the area. The sample ratio of the urban area may have to be increased from 1/8 to 1/4.

The other step will be to code the information and pass it to I.B.M. cards. The Institute Rural Sociologist and Michigan State College students will be analyzing the data. No major study will be initiated in this Sub-Project until the full coverage is completed and the data are analyzed.



2. Census Sub-Project

A population and Agricultural Census of District No. 1 of Turrialba was taken from August 26 to September 4. While the enumeration was carried out during these few days, months of pre-censal work had to be done in order to ensure the success of this operation. This pre-censal stage could be broken down into the following phases: (a) cartographic work, (b) selection and instruction of personnel, (c) propaganda, and (d) development of questionnaires, instructions and definitions. The magnitude of these operations can be appreciated by the fact that we trained about 120 enumerators, held meetings in practically all the neighborhoods of the District and in town, and had to raise maps for the whole area and break them down into the individual enumeration segments, with all houses properly located relative to roads, rivers and other points of reference. The sketch of each enumeration segment was basic for a complete enumeration, and guided enumerators in the areas assigned to them.

The schedule used called for a very simple coverage of demographic and agricultural information relating to a family. The combination of the two censuses in one operation, as well as the use, in the same schedule, of an agricultural supplement to take information on non-farm agricultural production constituted the principal tests made at Turrialba from the standpoint of census methodology. The results of these methods have aroused considerable interest throughout the Americas, because they offer many possibilities for a more efficient and correct enumeration of the two censuses and fit better with the new concepts relative to the place of sampling in the gathering of statistical data.

Table 1. Number of Families Reporting on Each of the Three Sections of the Schedule

Zone	Demographic section	Agricultural supplement (non-farm)	Agricultural section (farm)
Urban	1142	537	17
Rural	1369	771	413
Total	2511	1308	430

A total of 2,511 families were enumerated, of which 1,738 or over 2/3 have some agricultural production. Of the rural families, one in every three reported farm production and practially all the rest

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[illegible]

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[illegible]	[illegible]	[illegible]	[illegible]
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reported non-farm agricultural production. These figures are highly significant in guiding census methodology for highly agricultural countries.

The farm section of the schedule followed very closely the recommendations of the Commission of the Census of the Americas for 1950 and of the Food and Agriculture Organization of the United Nations. Yet, our Turrialba experience has led us to revise it drastically. Our revised questionnaires, with the accompanying instructions and definitions, represent an important contribution to the program for the 1950 Census of the Americas.

The editing and coding of the data is practically finished. We feel we have succeeded in carrying the integration of both censuses, starting in the pre-censal stage, through the editing and coding operations. We have devised a central card, combining basic information from both censuses and subsidiary cards for other more detailed information. This integration insures the combination of both censuses all the way from the preparatory work to the final publishing of the data. The fact that the family is used as the controlling unit may open new avenues for the application of sampling.

Two preliminary mimeographed reports on this trial have been prepared and a final report will be printed during the next few months. The first preliminary mimeographed report was sent to about 150 census technicians in the Americas; the second was prepared specially for the meeting of the Commissions of the 1950 Census of the Americas held in Rio de Janeiro last February. The International Business Machine Company may pay for the publication of the final report.

Dr. J. A. Becker, Chief of the International Commodities Branch of the Office of Foreign Agricultural Relations, wrote the following comments on the second preliminary report. "From the standpoint of a factual and objective account of the problems and procedures, the report is admirably presented....the section dealing with changes in the arrangement and wording of the schedule suggested by experience in the actual enumeration was very revealing. The outline of a course of instructions for supervisors and enumerators was well planned. The discussion of the enumeration plans and comment on its functioning should help others in setting up the machinery for taking a full census. The frank discussion, including the admission of faults (and these were minor, apparently), should appeal to census officials with little or no former experience in the actual planning and operation of the census.

"I hope that arrangements will be made to circulate this very frank report among workers in this field, as it should be extremely helpful in guiding census officials in planning, conducting and interpreting the census."

3. Economics Sub-Project

Dr. Paul C. Morrison and Jorge León have finished the historical account of the Land Use Evolution of the Area. They have also finished three basic maps on the topography, present land use and property distribution of the area. Dr. Morrison and Mr. León will publish an article on this study in the near future.

This study will be carried further by using census data. We hope that a soils map can be made in the near future, to enable us to explain more fully the present land use patterns.

Price data are being collected weekly for more than 80 food products at the town of Turrialba. These data will help to explain and guide consumption of food by the families studied.

4. Home Economics Sub-Project - Health Study

A questionnaire was administered to a stratified random sample of 99 rural families selected from the 420 cases visited in the Sociology and Anthropology Sub-Project. The schedule was also administered to a purposive sample of 41 clique and prestige leaders. This schedule was designed to obtain the following basic information:

a. Sanitary conditions of the house and its surroundings
b. Medical needs and medical facilities available
c. Health and hygiene habits
d. Dental care and conditions of teeth and gums
e. Care of the mother during pregnancy, and during and after labor.
f. Feeding and care of children during the first year of life.

Information was also obtained of the attitudes of the people in relation to:

a. Sanitary conditions of the house and its surroundings
b. Medical facilities available
c. Dental care
d. Problems in relation to mother and children

The analysis of these data is underway.

Miss Coll has studied carefully two cases of malnourished children and their reaction to an adequate diet and proper care. These case studies will be extremely useful as educational tools later on. They will serve to convince the families that adequate diet and proper care of children are within their economic reach.

In connection with this Sub-Project, the following plans have been made for next year:

a. Health Study

(1) Complete coverage of the area in relation to the administration of the health schedules.
(2) Obtain information about the physical status of a selected sample from the families interviewed in the Health Study, on the basis of complete medical examinations and laboratory tests. This information will supplement the data obtained in the Health Survey.
(3) Complete the analysis of the data and write the final report.
(4) Develop and test the effectiveness of various educational devices to be used in improving health conditions in the area.

b. Other Studies

(1) Plan and carry out the Dietary Study
(2) Plan and start the Housing and Furnishing Study

Coffee Project to Develop Methods for Studying Costs and Returns of Coffee Farm Businesses

The objectives of this study are as follows:

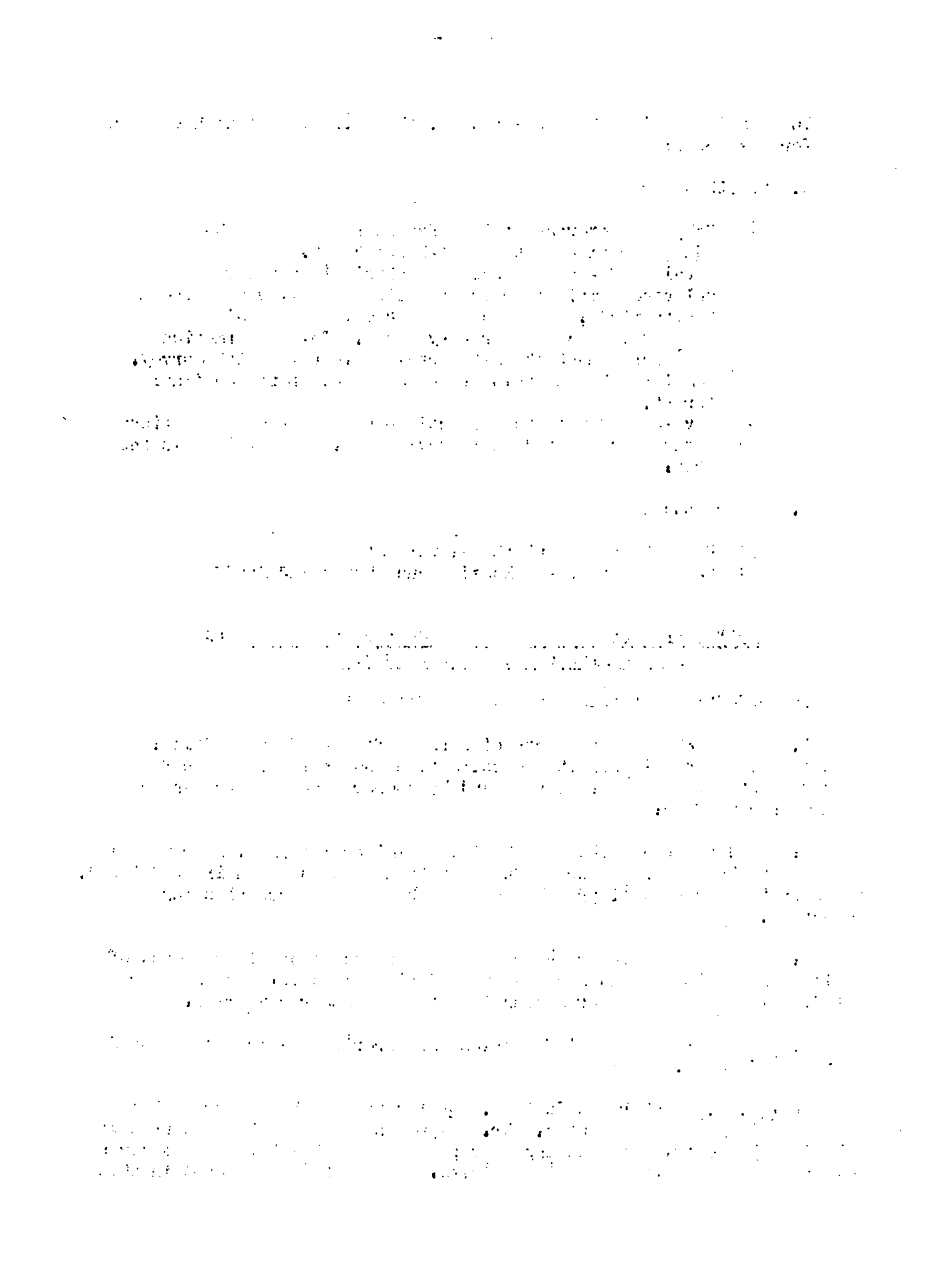
1. To develop for operators of large coffee farms a practical system of accounts which will permit the collection and analysis of accurate input-output data by the Institute and by cooperating research agencies in member countries.

2. To develop a method of obtaining similar information from small coffee farm operators who do not keep written records of their operations. The survey approach will probably have to be used in accomplishing this objective.

3. To stimulate interest on the part of individual farmers and of agricultural research and service organizations in developing greater efficiency in the coffee producing industry of member countries.

4. To obtain factual information and experience which may be used as teaching tools.

Drs. W. E. Keepper and Julio O. Morales have been working on this project for about eight months. Dr. Keepper has devoted to this project practically his full time during this period while Dr. Morales has given only a part of his time to this activity. The methods developed in this



project and in the Census Sub-Project already mentioned, form the Institute's initial contribution to the Cooperative Agreement with the Coffee Federation of Colombia.

During this eight month period, the following steps have been completed:

1. A survey of the literature available in our library relating to the aspects covered by the project has been completed.

2. About fifteen Costa Rican and two Colombian coffee farms were visited for the purpose of discussing the proposed project with the operators and of observing their operations and the types of accounting now in use.

3. As a result of observations obtained by the above visits and of experiences observed in similar endeavors in other countries, a preliminary schedule was developed for summarizing and analyzing the input-output data on coffee farms, with specific emphasis on the coffee enterprise.

4. The information covered by this schedule was obtained on six Costa Rican and two Colombian coffee farms in order:

a. To determine the workability of the proposed schedule and of the analytical procedure.
b. To determine how the accounts now kept by these operators may be adapted to meet research needs.
c. To obtain from these operators a summary of the previous crop-years operations.
d. To stimulate interest in the work and to obtain cooperation in keeping records on next crop-year's operations.

5. As a result of the previous step, a set of accounting forms has been developed to be used by farmers wishing to cooperate in the study. Visits to two of the six Costa Rican farmers cooperating in step No. 3 have been made in order to assist them in making the necessary changes in their existing accounting procedure and in opening the books for the ensuing crop year.

6. Dr. Morales visited the Colombian Coffee Federation, formalizing an agreement with this important institution whereby the Institute and the Federation will cooperate in establishing a similar project in Colombia. Messrs. Mejía Franco and Posada were sent to the Institute by the Colombian Coffee Federation to discuss in more detail the methods to be followed in the Colombian Study. We hope that similar agreements can be made in other member countries.

In connection with this study, the following plans have been made for next year:

Colombia - Mr. Francisco Gómez, the Colombian Graduate Student we sent to Michigan State College about a year ago, will return to the Institute

at the end of March. Drs. Keepper and Morales will acquaint him with the project while at Turrialba. During the second week of April Dr. Keepper will leave with him for Colombia. Mr. Posada will join them, upon their arrival in Colombia, in setting up the project. Dr. Keepper will stay in Colombia until he deems that Mr. Gómez can be left on his own, under the supervision of Mr. Posada. Mr. Gómez will use this Colombian Study for his thesis topic to fill this requisite for the Institute M.A. degree.

Costa Rica - Mr. Hugo Castro, a Costa Rican Graduate Student we sent to Montana State College, will return to the Institute early in July. He will be charged, under Dr. Morales' supervision and with the help of the Assistant Economist, with starting work on this project on about twenty Costa Rican coffee farms. He will use the experience in setting up the records on these farms and the data on previous years operations for his thesis.

Other students will be receiving training in colleges in the United States in order to take over the work from these students when Mr. Gómez and Mr. Castro graduate.

The methods developed in this project can be adapted to the study of other types of farm businesses, such as cacao, rubber, cane and similar businesses. The project leaders believe that this is a necessary and essential step in the more rapid development of the Farm Management field in member countries.

Agricultural Price Movement Project

Price is the most important single factor affecting farmers' profits. It also affects to a considerable degree the efficiency of farming operations. Therefore, a better understanding of price fluctuations and their effects on agriculture should be a major field of research in the Department.

The objectives of this study are as follows:

1. To determine the seasonal movements of prices of agricultural products and the factors which affect these movements.

2. To determine geographical variations of agricultural prices and the forces bringing about these variations.

3. To determine long-term movements of agricultural prices and the influence of various factors on these movements.

4. To determine the differences and flexibilities of agricultural prices at various levels of the marketing system.

5. To compare the agricultural price structure of member countries in order to gain insight into the factors which affect the observed differences.

Mr. Roger Perreault, a Graduate Student of the Department, working under Dr. Julio O. Morales, is using Costa Rican price movements as the subject for his thesis. This Costa Rican experience will be followed by similar studies on other countries. Mr. Perreault has done the following:

1. Secured information from the National Bank of Costa Rica on some thirty retail and twenty-five wholesale weekly food commodity prices from 1936 to 1947. With this basic information, the seasonal and long-term movements of retail and wholesale prices were reduced to index form, so as to enable comparison between individual commodities. A graphical presentation of each type of price movement on each commodity was made. This work has been done on the following prices:

a. San José Market (Costa Rican National Bank)

(1) Retail prices: rice, beans, corn, potatoes, plantains, chayote, pumpkins, tomatoes, yuca, sweet potatoes, cabbage, onions, garlic, lard, meat, bread, flour, vermicilli, raw sugar, salt, edible oil, milk, butter, cheese, eggs, fish, coffee, and refined sugar.
(2) Wholesale prices: coffee, bananas, cocoa, rice, beans, potatoes, corn, onions, garlic, yuca, hogs, lard, butter, cheese, refined sugar and raw sugar

b. Turracres Market (Costa Rican National Bank)

(1) Wholesale prices: beans, corn and raw sugar

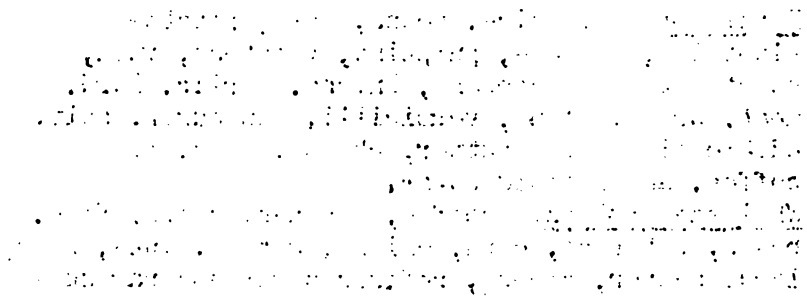
2. Secured books from a Turrialba wholesaler covering the 1925-47 period. The transactions on beans, corn, and raw sugar were abstracted from this source.

3. Obtained the prices of products sold at the auction market of Grecia, Heredia and Alajuela.

Mr. Perreault will return to the Institute from Chile in March 1950. He will gather additional information from wholesalers in other markets of the country, get additional data on the auction markets and complete the various phases of the Study on Costa Rican Price Movements.

Intercropping Project

A Spanish publication on the results of this study is in the press. It will be available for distribution in the very near future.



Exploratory Projects

1. Study of Costa Rican Coffee Processing Plants (Beneficios)

The available information of the 1936 Census has been related to the yearly data on coffee processed by the various plants. The plants have been located on a map and have been classified as to whether they are active or inactive. A preliminary study of variations in volume of business has been made. It has led to a preliminary analysis of biennial fluctuations in coffee production. Striking differences were observed in the extent and consistency of these biennial fluctuations.

2. Time and Travel Study of Coffee Harvesting Operations

The study on coffee farms described above indicates that harvesting constitutes 30 to 60 percent of total costs on the coffee enterprise. Labor accounts for more than 60 percent of harvesting costs. It seems evident that increasing the labor productivity in such an important operation will benefit considerably both laborers and farmers.

Detailed observations were made of two capable pickers, covering distance travelled, hand and body motions, time elapsed in each major movement, shape of tree, pattern of travel, etc. The following preliminary observations seem to be justified, although definite conclusions should wait until a thorough study is made.

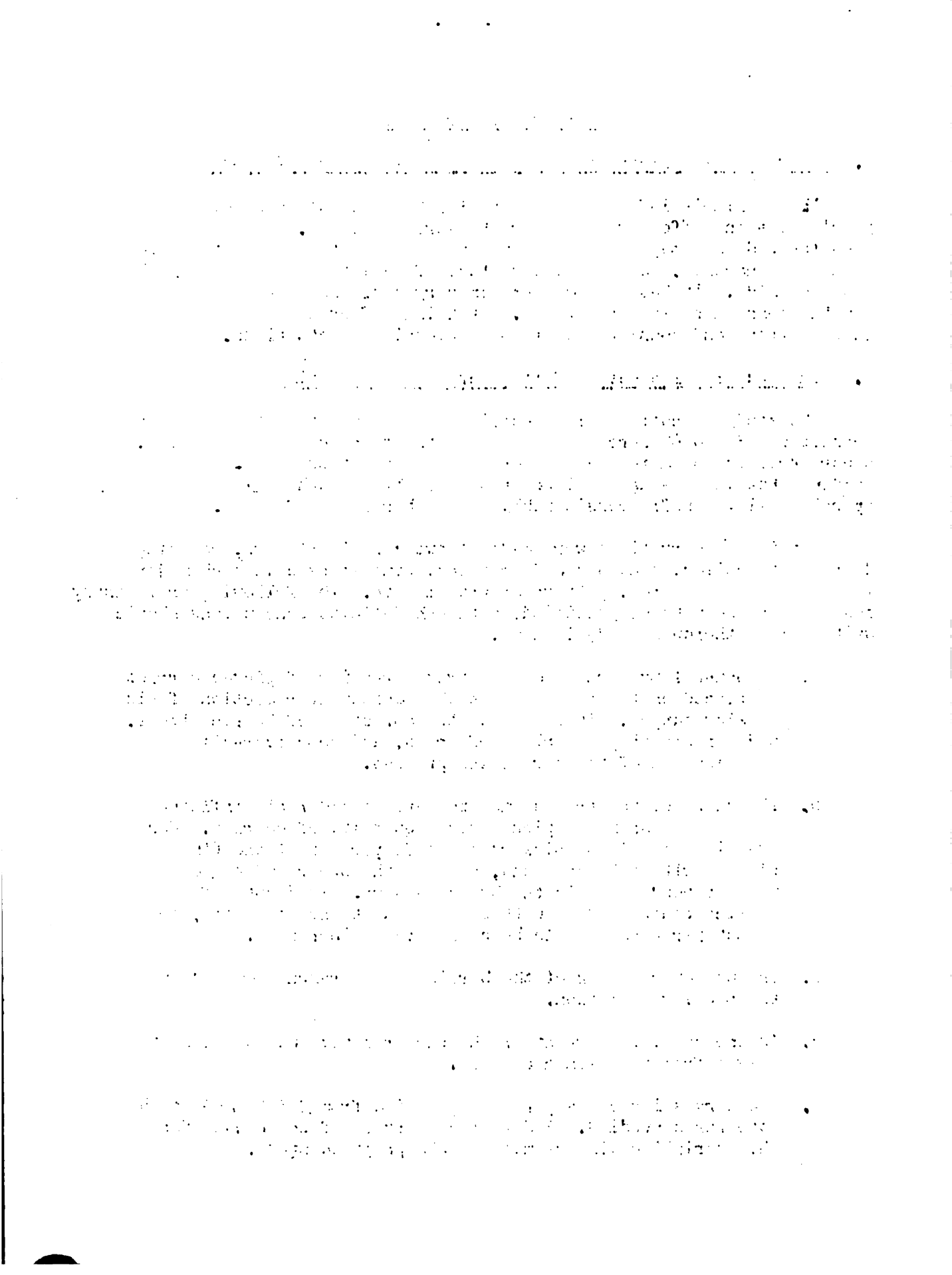
a. An unusual proportion of the transportation of picked berries is placed on the picker, with the consequent reduction of his picking output. This was due to poor stand of bearing trees, undesirable shape of block of trees, and poor over-all organization of the harvesting process.

b. The shape of the tree seemed to have considerable influence on the time spent to pick a given quantity of berries. For example, one of the pickers spent 75 percent of the time picking with only one hand, because the other had to be used to bend and hold the branches down. No doubt, if picking could be done with both hands at the same time, the output per picker would be considerably increased.

c. The uneven ripening of the berries on a branch slowed down the picking operation.

d. In one case, 10 percent of the picker's time was spent sorting leaves from the picked berries.

e. The harvesting costs per fanega varied from ₡25 to ₡60 on the five farms studied. A detailed analysis of the causes for this variation will be made in the proposed study.



Inactive Projects

The Department has to hold a certain number of projects inactive until graduate students arrive, who are interested in taking one or more of these projects as topics for their theses. Two projects are still under this category:

1. Study of Sugar Cane Small Processing Plant (Trapiches) - A study similar to the one on coffee processing plants.

2. Economic Problems of Cacao Production - A project similar to the one on coffee farms will be initiated during the next few months under the direct leadership of Mr. Paul Oechsli, a Cacao Fellow.

Formal Training

The Department has contributed to the formal teaching at the Institute in the following ways:

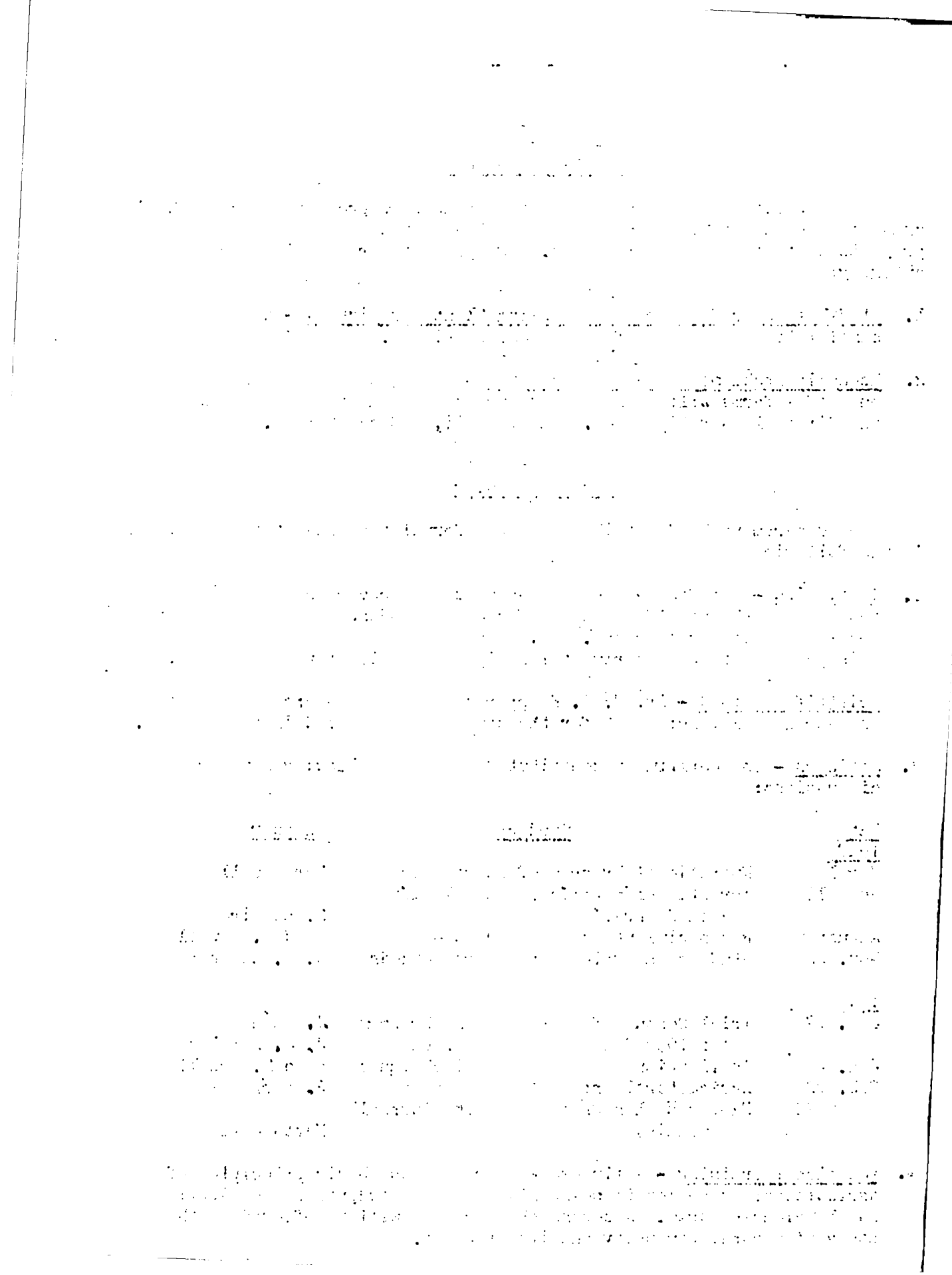
1. Statistics - A fifteen-week three-hour course covering the statistical tools, from the use of measures of central tendency to the Chi square and T tests of significance. Mr. Elgueta takes over the course at this point to teach experimental design, analysis of variance, etc.

2. Scientific Method - Dr. W. E. Keepper discussed "Research Methods in the Rural Social Sciences" for the students registered in this course.

3. Seminars - The Department contributed with the following seminar discussions:

Date	Subject	Leader
1948		
May 10	Nutritional Program of Puerto Rico	Marta Coll
June 13	Investigación Agrícola en Relación a la Geografía	M. Lemaire
August 9	Reconocimiento de la Comunidad	Reed M. Powell
Nov. 22	Studies in Agricultural Work Methods	W. E. Keepper
1949		
Jan. 17	Trial Census of Turrialba and Program for 1950 Census of the Americas	J. León J. O. Morales
Jan. 25	Application of Sociometric Techniques	Reed M. Powell
Feb. 22	Agricultural Prices in Costa Rica	R. Perreault
March 28	Family Health Problems in the Turrialba Community	Marta Coll

4. Vocational Training - A five-week course on the basic principles of agricultural economics is being given to the students in the Applied Rural Science course. A second short course will be offered on the study of a rural community and its problems.



Informal Training

The Department has experimented in the informal training of two types of students:

1. Students fully prepared to start directly in the study of a specific research problem:

   a. Reed M. Powell (Michigan State College Ph.D. candidate)
   b. Roger Perreault (Institute M.A. candidate)

2. Students requiring further course-work before they can start the study of a specific problem:

   These students usually come to the Institute for an orientation course of four to five months, are parcelled out later to other universities for a nine to twelve month period of course work, returning to the Institute to do a piece of research.

   a. Francisco Gómez will return from Michigan State College in a few days. Gómez will go with Dr. Keepper to Colombia in the near future to set up his research project. Mr. Antonio Posada of the Colombian Coffee Federation will supervise his work after Dr. Keepper returns to the Institute. This way Mr. Gómez will be working on his thesis in his native country.

   b. Hugo Castro Steinvorth will return from Montana State College in August. He will be working on his thesis in his native country, Costa Rica.

Plans for Next Year

The following students are expected to be registered in the Department next year:

1. Hugo Castro - working on his M.A. thesis in Costa Rica
2. Francisco Gómez - working on his M.A. thesis in Colombia
3. Roger Perreault - working on his M.A. thesis in Costa Rica
4. Paul Oechsli - working on preliminary survey for his Ph.D. thesis problem in Costa Rica.
5. Sakari Sariola - working on his Ph.D. thesis in Costa Rica
6. Anaclete G. Apodaca - working on his Ph.D. thesis in Costa Rica under the supervision of Drs. Hatch and Morales.

7. Another Michigan State College Student - working on his Ph.D. thesis in Costa Rica.

8,9. Two Colombian Students - For orientation course and parcelling out to Michigan, Pennsylvania or Montana State College.

10. Pánfilo Rodríguez - A student from Mexico to be handled together with the Colombians.

11. A Costa Rican Student - Same as the Colombians.

During the year we have succeeded in strengthening our ties with Michigan, Pennsylvania, and Montana State Colleges. These colleges will have available assistantships or scholarships for our students. A solution has also been found to the problem of financing their travel.

Our flexible training plan has been working very well to date. It is meeting with the enthusiastic approval of students, colleges in the United States, and authorities connected with the field of graduate training.

Dr. M. M. Kelso from Montana State College writes: "We have been extremely well pleased with Hugo's work, and shall be very pleased if we can obtain another student from your Institute of equal scholastic ability and personality...."

OTHER ACTIVITIES

Help to Costa Rican Census Program

Two members of the Department have been helping the Costa Rican Census Office in drafting the plans for the 1950 national census. They have also served as consultants to the Consejo Nacional de Estadística.

Census Meeting

A meeting of Census technicians from the Central American countries and Panamá was held at the Institute from August 26 to September 4. The delegates to this meeting witnessed the enumeration and were deeply impressed by the organization of this important phase of the census work. Detailed discussions followed the practical field observations. The general impression revealed in the delegates' personal and official correspondence indicates that the meeting was very profitable.

Cooperation with Agricultural Colleges

Special effort has been made to develop closer relations with the Colombian agricultural colleges at Cali and Medellín. Messrs. Carlos Madrid, Guillermo Ramirez and Gregorio Beltrán are deeply interested in

strengthening the Social Sciences field within their colleges. The Department is experimenting on the ways by which the Institute can help them to achieve this goal. Three ways are going to be tried during the next year: (a)strengthening the Social Science Section of their libraries; (b) training outstanding graduates from these colleges in the Social Sciences field, so that more able, well-trained men are available to strengthen the Social Sciences Section of their Faculties; (c) initiating a practice of mutual visits and lectures. Mr. Beltrán is going to help Mr. Posada in the Cooperative Coffee Project between the Institute and the Colombian Coffee Federation. The Department was instrumental in getting for the College of Cali a set of the Journal of Farm Economics which Professor M. E. Bond from Cornell wanted to offer as a gift to a college.

Colombian Coffee Federation Agreement

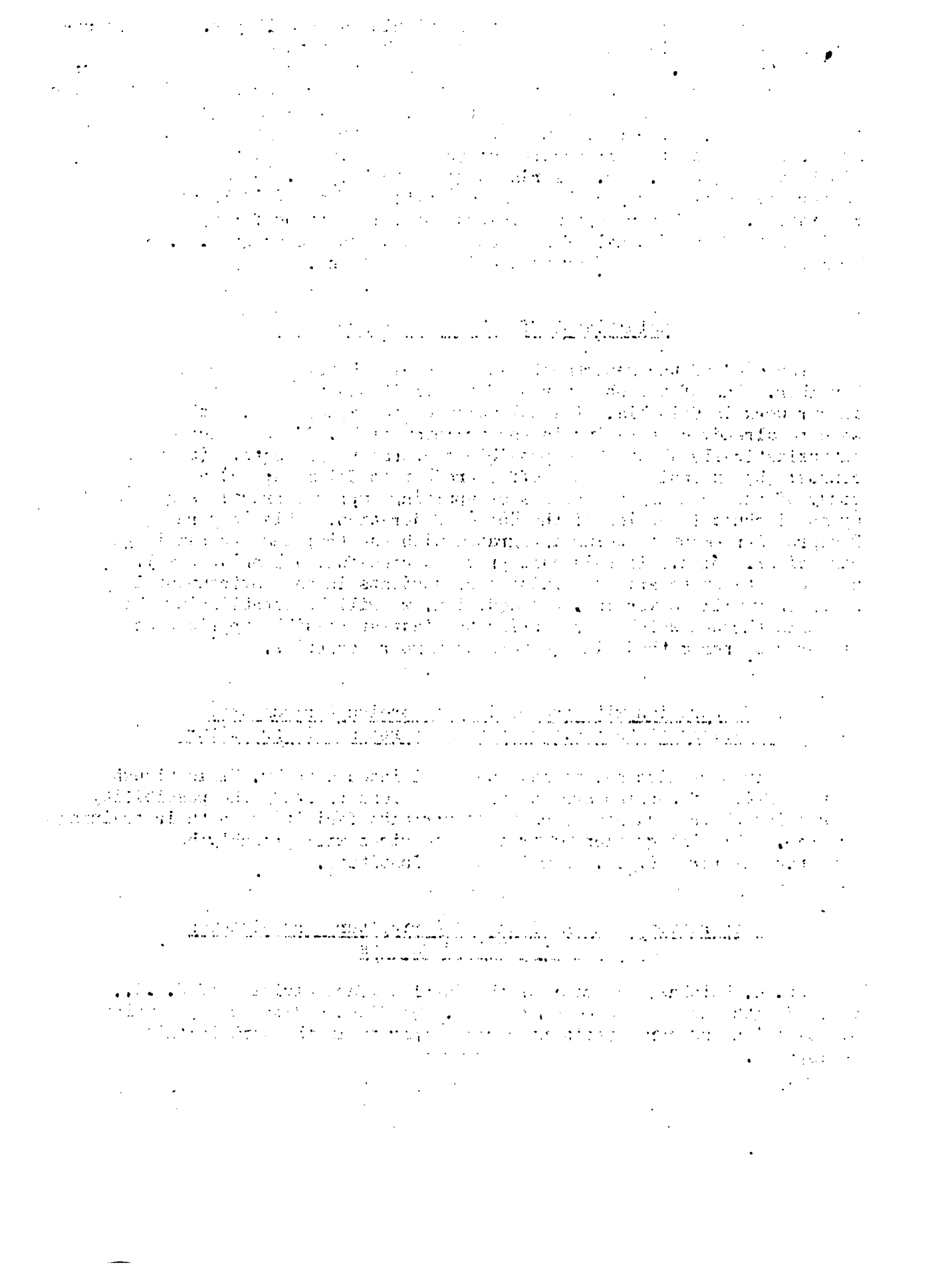
The Head of the Department made a one-month trip to Colombia in November. One of the objectives of the visit was to stimulate interest in our work in Colombia. The Colombian Coffee Federation, with which we were already cooperating in the training of Mr. Gómez, reacted very enthusiastically about three possible cooperative projects: (a) a trial census; (b) extension of our Coffee Project to Colombia; (c) a detailed study of the economic advantages of applying improved practices developed by the Technical Section of the Coffee Federation. This Cooperative Research Agreement is being integrated with the training program in the case of Mr. Gómez. If this case proves successful, a long step will have been taken toward the training of students in the environment in which they will be working. In addition, we will be establishing the channels through which we can bring the fastest possible application of our research methods in the various member countries.

Cooperation with the Office of Foreign Agricultural Relations of the United States Department of Agriculture

Preliminary discussions have been initiated with Dr. Ellis Clough of the Office of Foreign Agricultural Relations to study the possibility of getting their students to use our Turrialba facilities in their training program. This integration of training services will probably be advantageous for O.F.A.R. as well as the Institute.

Cooperation with the Food and Agriculture Organization of the United Nations

Dr. H. Belshaw, Director of the Rural Welfare Division of F.A.O., visited with the Institute a month ago. We discussed the ways in which his Division and our Department could cooperate in the work in this hemisphere.



Contribution to the 1949 Inter-American Cacao Conference

A paper was specially prepared for the Cacao Conference. This paper was well received and raised considerable discussion from the delegates. It influenced the drafting of two resolutions urging the need for research work in the economic and social aspects of cacao production and marketing. This paper will be published in various scientific and popular publications.

Translation of Dr. John A. Hopkins' Farm Management Text

Dr. John Hopkins came to the Institute in October to discuss with the Department Staff the translation of terms used in his book and the possible ways of adapting it to the conditions of Central and South America. We went carefully over every chapter, trying to eliminate the parts that were not adapted and making lists of data from this area, which could be substituted for the one in the English version. It was decided at that time that Dr. Morales would try to develop a monograph on suggestions for teachers who wanted to use the translation as a text. This monograph will include explanations, suggested exercises, etc. A future Farm Management text will probably evolve from this monograph, as suggestions from teachers and college professors accumulate through time. Some work has been done in drafting this monograph.

Meeting of Informal Community Leaders

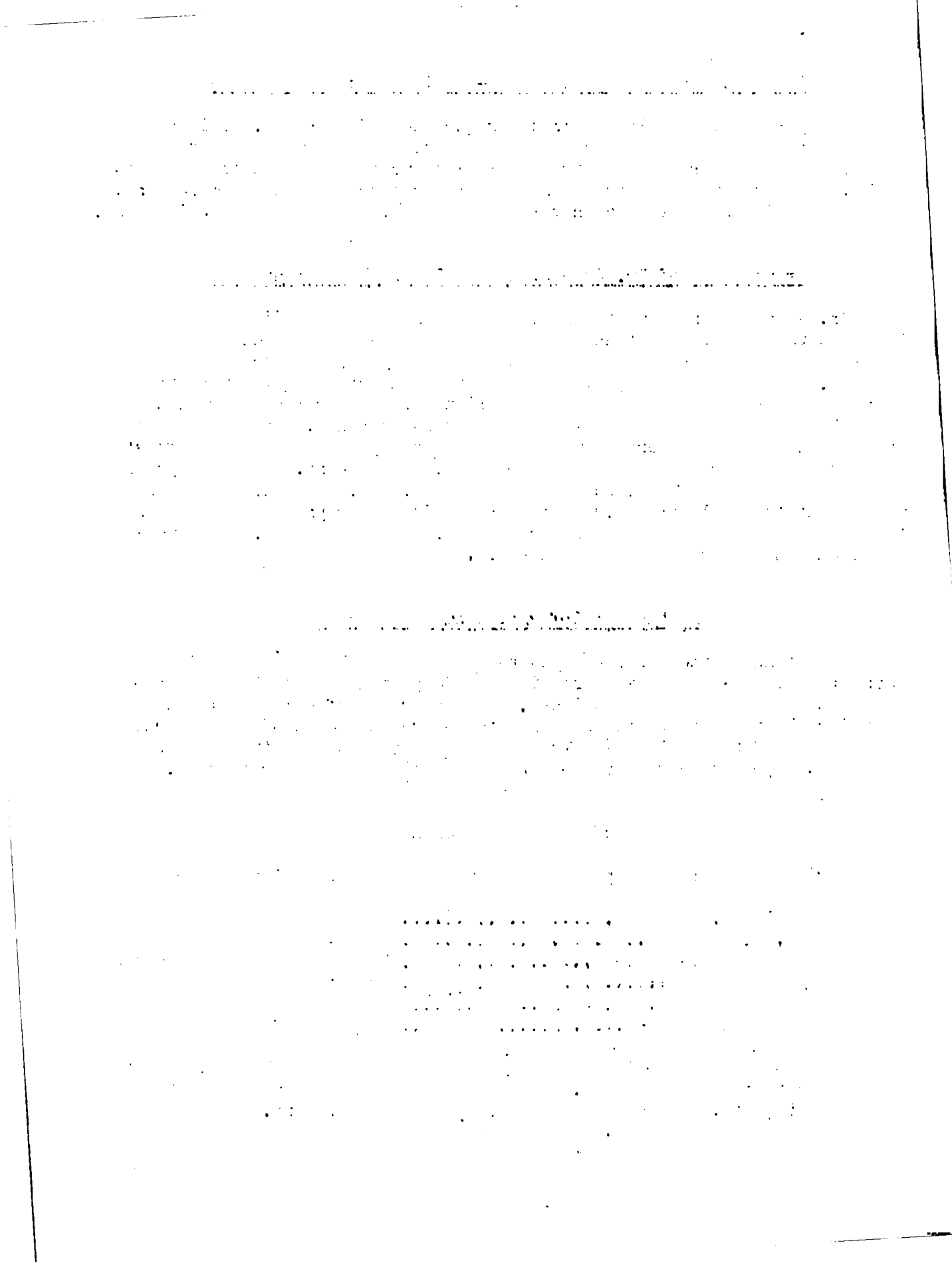
A meeting of the informal leaders selected in the Sociology and Anthropology Sub-Project was organized in cooperation with other departments and services of the Institute. The objective of this meeting was to bring about a better understanding to the rural people of the community of the work of the Institute. The meeting was very successful and has brought whole-hearted cooperation from the families of the community.

BUDGET AND PERSONNEL

During the year the Department has made use of the following personnel:

Julio O. Morales	Chief
W. E. Keepper	Visiting Scientist
Marta Coll-Camález	Home Economists (10 months)
Jorge León	Assistant (4 months)
Antonio Arce	Assistant (11 months)
Juvenal Valerio	Assistant (9 months)

Drs. Loomis and Morrison have served as consultants. Miss M. Lemaire spent a month at the Institute. Messrs. Powell and Perreault, Institute Graduate Students, worked on the research of the Department.



The total estimated expenditures of the Department for the 1948-49 year will be around $12,000. This very low expenditure, in relation to the volume of work done, has been achieved because of:

1. The Costa Rican Government financed the trial census work up to the amount of ₡12,000 (over $2,000).

2. Dr. W. E. Keepper has spent a whole year with us at very little or no cost to the Institute.

3. Graduate students have succeeded in taking over a share of research work.

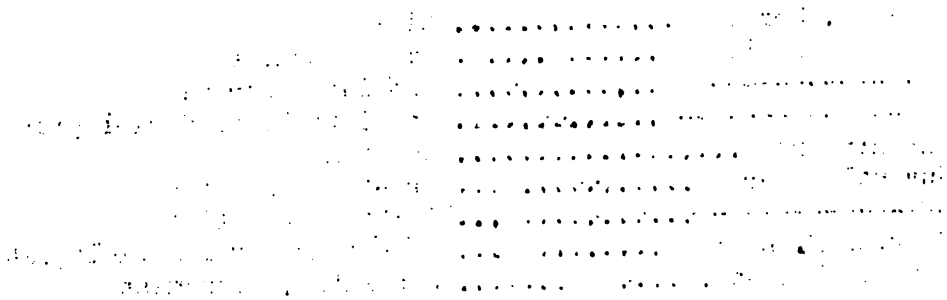
4. Our research does not require heavy permanent investment.

Plans for Next Year

It appears that we will not be able to have another Visiting Scientist this coming year. We have not been able to find a satisfactory replacement for Mr. Jorge León. Miss Coll's place will be taken by Miss Ana Teresa Blanco. It is evident that unless the Department is strengthened with an Associate Economist and an Associate Rural Sociologist, the load placed on the Chief of the Department will be impossible. To provide a smooth running organization the following personnel will be needed:

Julio O. Morales .....Chief
Ana Teresa Blanco .....Home Economist
---------- .....Associate Economist
---------- .....Associate Rural Sociologist
Antonio Arce .....Assistant
Juvenal Valerio .....Part-time Assistant
---------- .....Visiting Scientist
Charles P. Loomis .....Consulting Rural Sociologist
Antonio Posada .....Cooperator, Economist

March 25, 1949



PROGRESS REPORT

AGRICULTURAL ENGINEERING DEPARTMENT

March, 1949

Norton.C. Ives

PERSONNEL

During the past year the personnel devoted to departmental activities has been comprised of the head, two assistants and four field laborers.

TEACHING

No students have been in attendance in this Department during the past year. Course and laboratory work have been conducted in certain phases of agricultural engineering for the vocational students at the Demonstration Farm. The Head of the Department has been responsible for the weekly series of staff-student seminars, the schedule of which is prepared quarterly. With few exceptions all papers presented are mimeographed for distribution and filing.

RESEARCH

The four projects reported on a year ago are still in progress, although intensive work has been done on the Grain Drying and Storage Project only. Performance data of the erosion runoff plots and the Tile Drainage Project have been systematically taken. However, there have been no rainstorms of equal intensity as those of January and March of last year, for which results were presented in last year's report.

PROGRESS IN GRAIN DRYING AND STORAGE RESEARCH

Since around the first of August, the writer has devoted the major portion of his time to this important and timely work. Following is a brief summary of activities between August and the present time.

Design Work--Basic Considerations

Drying is of necessity a major step or operation in the production of nearly all tropical agricultural crops. At present it is being accomplished largely through the use of sun driers and large industrial processing type artifical driers such as the common types of drum or cylinder driers used for coffee and sugar. The former method has served almost entirely for the one- or two-acre farmer, and both are used by the large producers .

and processors such as the coffee ingenios and sugar beneficios. Both have certain outstanding disadvantages for what might be described as the middle-sized farmer who now employs or desires to employ modern machinery in his farming operations.

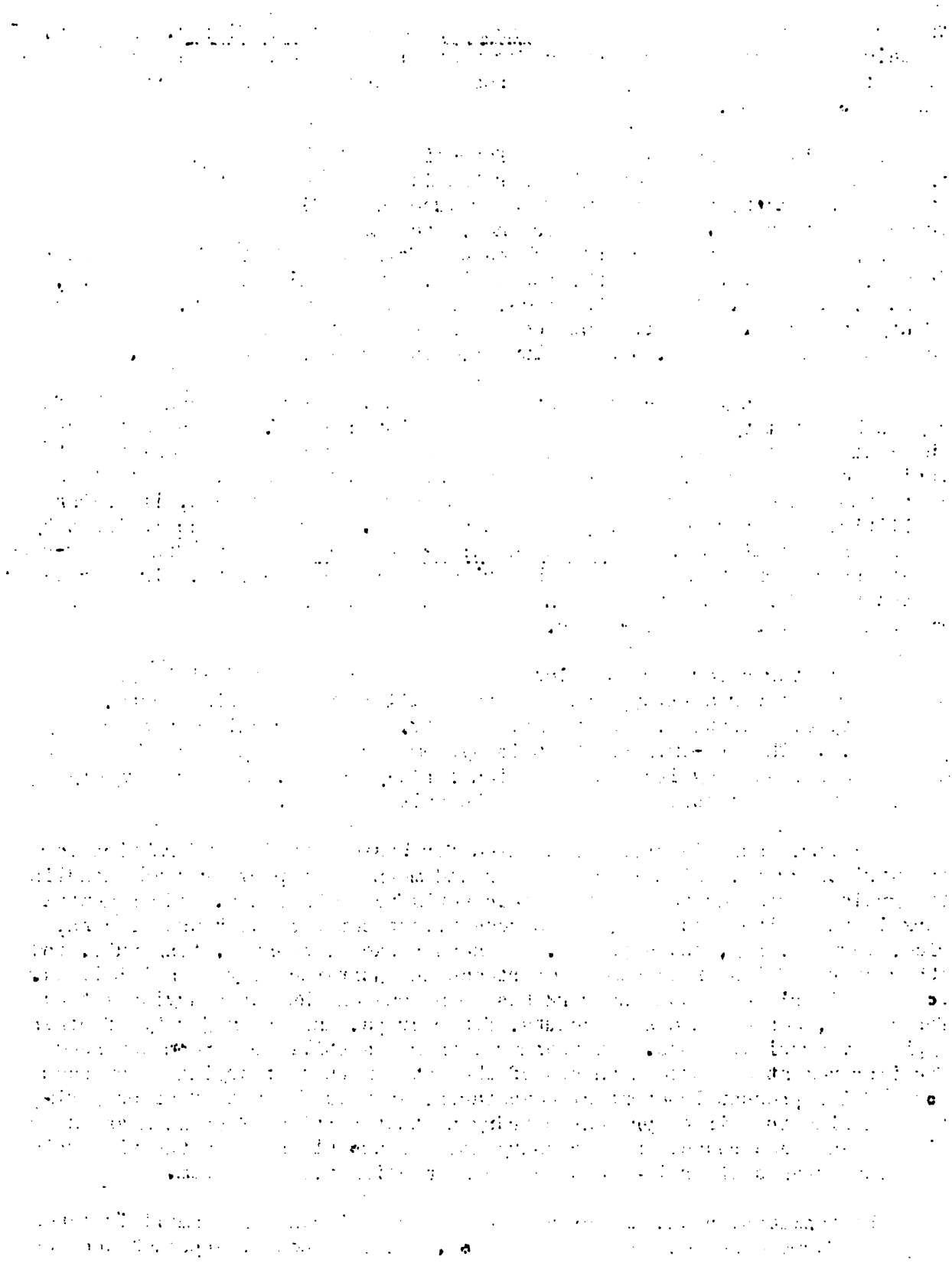
There is a definite need for a farm-size or small community size drier that could be used satisfactorily for the large variety of tropical agricultural products that could well be produced in a diversified tropical agricultural system. Such a drier should accommodate with a good degree of performance a variety of crops such as the following: hay (partially sun dried), ear corn, shelled corn, rough rice, sorghum heads, sorghum grain, peanuts, bean hay, beans in the pods, threshed beans; in short, all forms of hay and grain. Also it would be advantageous if such a drier could be used for other products, such as lumber, fiber crops, tobacco, etc.

Basically the batch-type system is the only system that can successfully dry such a variety of forms or products as listed above. In the batch system the grain or hay is placed to the proper depth or column thickness in the vehicle or storage unit, where it stays unmoved until dried, and in cases where subsequent storage is desired it further remains unmoved, if drying facilities are provided in the storage building. Drying is accomplished by the passage of air properly heated or dried and forced through the inter-seed or air spaces of the material to be dried. This forced-heated air carries in the heat for evaporation of the water and then carries out the evaporated water in the form of water-vapor.

The features more or less inherent in this system of drying are its high degree of versatility, low relative initial and operating costs, simplicity of operation, and its moveability.(The drier unit may be highly portable.). The pre-eminence of this system for general purpose farm type drying is attested by its wide adoption for hay, grain, and ear corn drying throughout the agricultural areas in the United States.

However, there is still great need for basic data and information for the various crops, climatic conditions and methods of providing and handling the grain column and the air to obtain satisfactory results. Experimental work in the United States has been done almost entirely with wheat, corn, rice, legumes, hay, and soybeans. Work on tobacco, peanuts, tung nuts, and other crops of lesser economic importance has just recently been initiated. To the writer's knowledge no work has been done on the batch drying method for coffee, sorghum heads, coconuts, fiber crops, and the majority of other typically tropical crops. Furthermore, there is still much room and need for improvement of certain phases of the batch method of drying to overcome some of its present inherent disadvantages, such as the method of preparing and handling the air to prevent overdrying that portion of grain near the air entrance and reduce the necessary loss of useable heat in the air during the final stages of drying in a one-pass one-directional system.

The application and use of absorbents or desiccants for small isolated tropical farms deserves special attention. This method of approach appears



highly feasible and desirable for the storage of small quantities of seed grains, in that drying can be done under most favorable conditions for maintenance of seed quality and grain moistures can be held at almost any level down to eight percent and for any length of storage period, given nominal attention.

Methods for holding the product while drying in the batch method may, for convenience, be classified into three general approaches: (1) Drying the product in its original sack; (2) drying the product in the bin or room in which it is to be stored by the use of properly located distribution air ducts, or by use of a perforated false floor under the entire mass of material; and (3) placing the material in a relatively thin column, about one foot thick, removing it immediately as soon as it is dried. By placing this column support on wheels and thus having it serve also as the hauling container, two complete handlings of the grain can be eliminated.

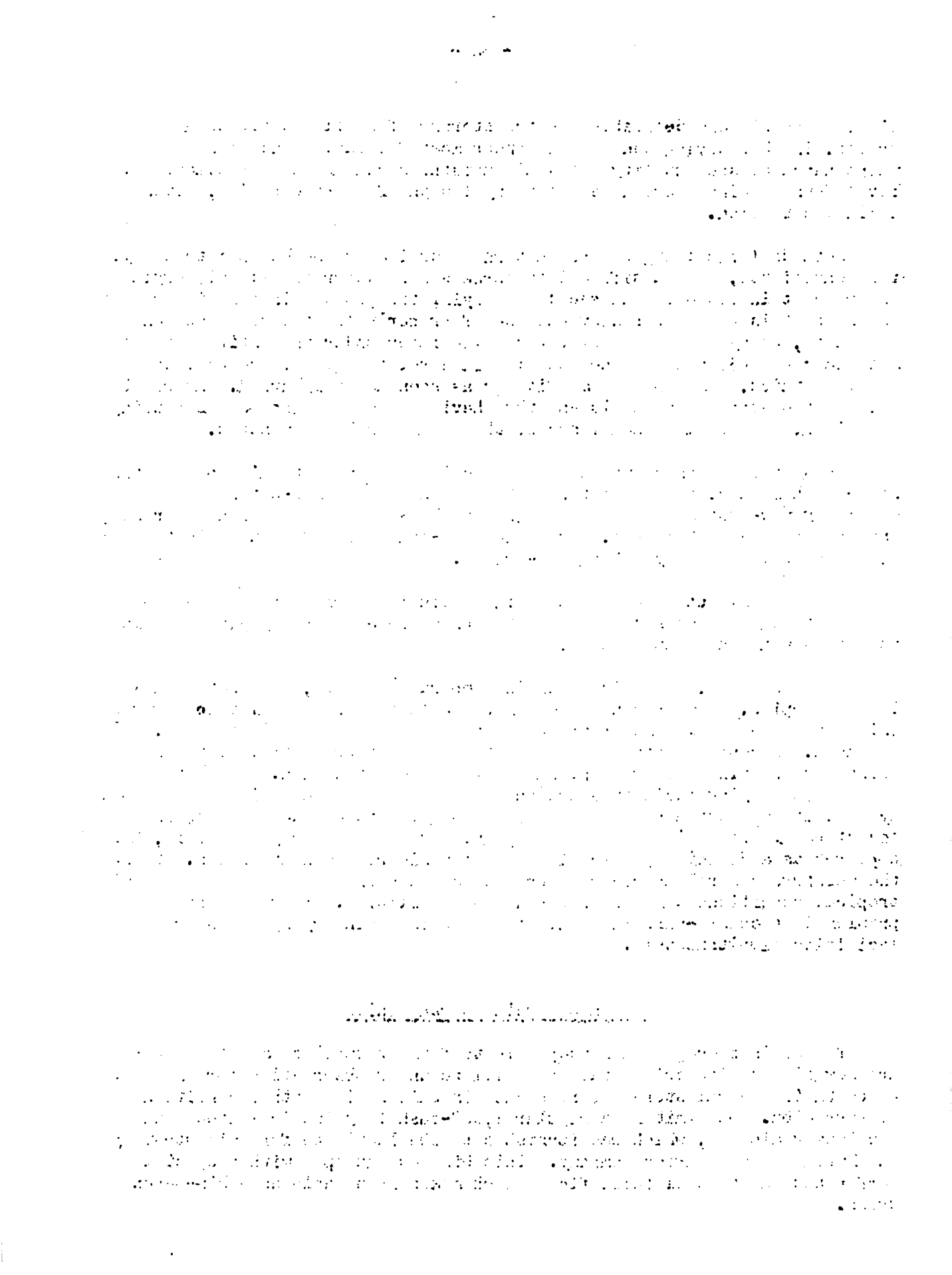
These three methods may best be described in short terminology as the sack-batch method, the bin-batch or bulk method (the mow-batch method or simply mow-system in the case of hay to be left for subsequent storage), and the column-batch method. When the last-named method is used in trailers, it may be called simply a "trailer-drier".

The predominant method of handling grain in tropical regions at the present time is in sacks; thus a system that would dry the grain right in the sacks would have much merit.

Grain storage, as it is known in temperate regions, does not yet exist in the tropics. Just recently some large bulk or terminal elevator storage units have been built and/or are to be built in Venezuela, Costa Rica, and Colombia. Recent reports indicate that several other Central American countries are also seriously planning similar construction. While terminal storage and drying facilities are an essential part of a nationally planned system, it does not appear that they will solve the need of farm drying and storage. Economical methods of providing farm storage, therefore, has appeared as a definite problem in need of basic research attention. Using the moisture control approach to provide grain safe for storage under humid tropical conditions demands proper drying facilities. Thus the whole problem is a double-barrelled one of developing both drying and storage facilities simultaneously.

Design of Grain Storage Units

Two grain storage units adaptable to farm or small community center use are now filled with dried grain and will be under observation for one year as to their general storage performance in this humid weather condition of Turrialba. One unit is a regular 1,000-bushel cylindrical steel and aluminum grain bin, which was furnished to the Institute for this study by the Butler Manufacturing Company. This bin was equipped with a special perforated sheet steel false floor which makes it useable as a bin-batch drier.



The other unit was designed and constructed here at the Institute using ordinary rough sawed lumber and asphalt roll roofing for weather proofing the building, as well as rendering it tight against the entrance of rodents and insects. It was equipped with a special system of inverted-V flues for the drying air distribution, and was also experimented with as a bin-batch type drier. It is now filled with 400 bushels of rice and 400 bushels of corn, which comprise part of the grain under observation at the present time.

Sack Drier Design and Experiment

An A-frame type sack-batch drier was designed and set up in the then just completed Quonset hut. Two batches of 32 sacks each of freshly combined Rexoro rice were trucked to the Institute from a finca in the San Carlos Valley, through the wholehearted cooperation of the Rojas brothers. A seminar paper presents the significant results of these initial runs.

Corn Drying Experiments

In late December special arrangements were made in cooperation with the Consejo Nacional de Producción and STICA whereby 1,200 bushels of freshly harvested ear corn between 35 and 40 percent moisture were shipped in sacks to the Institute from the Old Line region of the Atlantic coastal plain area. This corn was dried on the ear down to 18 to 25 percent moisture, after which it was shelled and then placed in the steel and wood bins, being dried to 11 percent and less after being placed in the bins.

The drier used in all these experiments was a commercial unit purchased from the American Crop Drying Equipment Company. It is a small portable unit equipped with a three horsepower electric motor, a 24-inch propeller type fan, a 2- to 5-gallon-per-hour pressure atomizing spray type oil burner, and controls. Heat use efficiencies for drying ran from a low of three gallons of water evaporated per gallon of fuel to 6-1/2 gallons per gallon or up to approximately 50 percent heat use efficiency, which is a good over-all heat use efficiency.

Fumigation

Both Institute drying bins have been fumigated with methyl bromide. Considerable difficulty was experienced in getting a complete kill with this gas due to its rapid filtration through the cracks around the doors, etc. As a result of special efforts to seal both bins and through increasing the dosage over that recommended, or two pounds per bin, a complete kill was effected in the steel bin, but not yet in the wooden bin. Further experiments are to be made with methyl bromide in the wooden bin, but a less volatile liquid type of fumigant may have to be used.

Special Reports

A special study was made on the general performance of the ear corn drier located at Guacimo, and a special report was prepared which included recommendations as to slight modifications of the present drier and suggestions as to a completely new unit for drying ear corn. Five seminars have been prepared on the general subject of grain drying and storage during the past year.

Grain Storage and Preservation Conference at Palmira

The Head of the Department had the opportunity of representing the Organization of American States and the Institute at the Food and Agriculture Organization Conference on the Storage and Preservation of Grains and Other Food Products which was held in Palmira, Colombia from February 13, 1949 to February 20, 1949. A special paper was prepared and presented at this conference on the work done to date.

Future Plans

The immediate future plans comprise the construction of an already designed system of oxcart or trailer drying which incorporates air reversal and re-circulation. A stationary wood burning furnace, now partially designed, is to be built and a centrifugal type fan, already on hand is to be installed. The design and construction of a portable wood burning furnace is contemplated in cooperation with some of the larger rice growers in the Pacific region of Costa Rica.

A small batch drying and storage unit suitable for the one- or two-acre finquero and also for an experiment station worker desiring to dry and store small quantities of seed is in the process of design. This unit will employ the use of an absorbent or desiccant material, probably activated alumina with a small portion of indicating silica gel. Special drying ovens will be developed for regenerating the desiccant.

Considerable theoretical work has been done and special additional effort will be given to the use of a heat pump for agricultural drying. Cylindrical silo-type granaries built of brick and mortar are to be given special consideration in cooperation with some prospective builders. It is hoped that some cooperation can be extended in obtaining some performance data on the new set of Grain Silo in San José. Some preliminary studies on coffee drying are also anticipated.

SERVICE WORK AND OTHER ACTIVITIES

Five house plans have been designed and drawn up with various degrees of details. Design calculations were made for a dehumidification system for the Institute Library. Some special plans and calculations were made for the

Animal Climatological Laboratory, and considerable survey work has been done, including building locations and layouts. Some maps of the Institute have been made by Ing. Luis Balma, assistant in charge of surveying and field laboratory work.

Gregorio Alfaro, full time assistant, has performed most of the lumber laboratory tests made so far and prepared a seminar on the work done to date on preservative treatment characteristics of the various woods tested. In addition to his many other duties Sr. Alfaro is developing and organizing an exchange system of weather data summary reports for the Central American countries, and he is in chargo of the Institute Weather Station.

DEPARTMENTAL DEVELOPMENT PLANS

A special request, largely through the efforts of Dean Buchanan, has been made for a grant-in-aid from the Ford Foundation for development of the Agricultural Engineering Department. This was an unsolicited request, and there has been no action reported on it to date.

Recently a similar request has been made to the International Bank for Reconstruction and Development in order that training facilities may be established in Central America for tractor and machinery operators and servicemen. Future activities and plans of the Department will depend greatly on the procurement of such outside funds.

March 28, 1949

PROGRESS REPORT

EXTENSION SERVICES AND APPLIED RURAL SCIENCE TRAINING

D. Spencer Hatch

FIRST YEAR DEVELOPMENTS

Since the Administrative Committee Meeting here a year ago, developments have taken place in:

1. Organization of the Applied Rural Science Training Course.
2. Training of Students in Applied Rural Science.
3. The Institute's Demonstration Farm.
4. Early Steps in the Noche Buena Rural Center.
5. Extension Services (beginnings in the Turrialba area, some studies further afield in Costa Rica, and some contacts with other countries).

ORGANIZATION OF THE APPLIED RURAL SCIENCE TRAINING COURSE

Mr. Claude R. Kellogg had pushed the plans forward as he explained to the Administrative Committee last March. I returned to take charge on the fourth of May and continued to have Mr. Kellogg's valuable help for six weeks longer, until he returned to his work in Mexico. Before going Mr. Kellogg completed and put out in mimeographed form our first extension bulletin APICULTURA PARA EL NOVICIO which is illustrated with line drawings. Several hundred appropriate books had been designated and set aside as the Extension Education Section of the library. Mr. Kellogg and I completed the series of lectures to the regular students of the Institute as a part of the Basic Science Course.

A prospectus was prepared in advance of the arrival of twenty-eight students in September and early October. The name "Applied Rural Science" ("Ciencia Rural Aplicada" in Spanish) was chosen for the new training. It expresses exactly the aim of our training, i.e., to prepare students to apply the useful findings of scientific experimentation, in this Institute or elsewhere, to farming and rural life. Also it would prepare them for rural leadership, making them able to teach farmers and farm families how to apply these values of science for general improvement. We would help to bridge the regrettable gap which exists between scientific research and actual farming and rural life. By linking teaching and application to excellent research this Institute can really serve the member countries.

We lack in teaching help. The "Assistant Educationist with M. Sc. degree and some years experience in Vocational Education" as specifically called for in the plans, has not yet been found. Rather in desperation, when the students were arriving, a local inspector of school was induced to help supervise students in the field work, at first part time, and later full time. It is the definite intention that members of the staff of the different departments of the Institute will assist in the teaching. Gradually, we have secured some very excellent teaching from a number of staff members. The School Inspector resigned, and Mr. Otón Páez, formerly with the Costa Rican Department of Agriculture, has been engaged to supervise the field work of students.

TRAINING OF APPLIED RURAL SCIENCE STUDENTS

Twenty-eight students have come--twenty-two from Venezuela, selected by the American International Association; five directors or teachers of rural schools sent by the Department of Education of Costa Rica; and one special student from Turrialba. Because of lack of accommodations and the undesirability of working with large numbers in practical courses, other applicants have had to wait. The five Costa Rican teachers, all excellent students and good workers, have gone back to their schools, although they petitioned the Government Department of Education to arrange for longer study. Four of the Venezuelan students have eliminated themselves and returned home.

The basic course is definitely fixed for one year (11 months actually), September 15 to August 15. During this year we come to know each student very well, and it is possible to select certain ones who would profit by further study here toward becoming valuable rural leaders. It is probable that six of the best from the first year's group from Venezuela will be chosen to continue a second year. Since it is not possible to accommodate more than twenty students from Venezuela, this means that fourteen new ones can be selected, from the very large number of applicants, to enter on next September 15. It is the intention of the Institute to receive students for training in Applied Rural Science leadership from other member countries when arrangements can be made.

All are now agreed that the basic course should give all-round experience in general agriculture and some contacts with actual rural life. The students work during six forenoons a week in groups in the different departments, changing every two weeks, or, in some cases, every month. The plan of paying the students by the hour for their productive field work is working very well. They earn this way approximately $15 per month each, and do not receive any stipend as other students do.

Students have five full afternoons of class and laboratory work, part of these also in the field. We have to have adequate teaching help. This type of mature students demands real teaching, not pretence of teaching or evidence of trying to teach without thought or preparation; nothing but

good farming, good gardening, good poultry keeping, and good animal husbandry will suffice. The students come with varying backgrounds and degrees of preparation, so that every one requires much individual, personal guidance and consultation.

Without adequate staff or equipment this first year is difficult. The instruction is improving steadily, and we are confident that with full use of the facilities of all the departments of the Institute, with the cooperation of Department staff members, with the Demonstration Farm, Rural Center, and the active extension program, we can give training here for Rural Leadership such as is not quite possible in any other institution or anywhere else.

THE DEMONSTRATION FARM

The Demonstration Farm was created to increase facilities for basic training in agriculture and, therefore, has the closest relationship to the Applied Science Course. It is operated as a commercial farm on 1,135 acres set apart for different types of crops and animals. Simultaneously with the organization of training for students, development went ahead in the animal husbandry section, in some planting of field crops, and in increasing the area and production of the commercial vegetable gardens. Ten acres of bananas and plantains were put in to be interplanted with cacao as soon as the bananas are high enough to give shade.

Until the beginning of this year we got along without the much-needed farm manager, but in January Mr. Walter Dennelley was secured to fill the position. We expect notable progress in all operations, animals, and crops, so that the farm will give facilities for the training of students, as well as producing income for the Institute.

SOME DEVELOPMENTS OF THE RURAL CENTER

The Noche Buena Rural Center is the headquarters for training and teaching for Rural Leadership. As planned, it will be the base for trying out and illustrating all sorts of helpful practices for the rural families of this part of Costa Rica (22,000 people live in this area); it will be the base for teaching Applied Rural Science students the different techniques for extension and the improvement of rural life; it will be a center for illustrating and showing various useful extension techniques for the member countries.

Very unfortunately, the funds for this Center have not been found as easily or as soon as anticipated. We are looking for $58,000 to establish the Center and to maintain its activities for three years. However, because its importance and urgency are so great we have gone ahead with some preliminary steps, on the excellent site of 51.9 acres.

Some roads have been made and building sites leveled. With the help of the students, two of the garden areas have been surveyed, fenced, plowed, and put into vegetables. Every student has his own parcel of land, on which he plans, plants, and raises vegetables commercially. He carries on through the marketing of his own produce. The students have surveyed and made a simple irrigation system by which they can lead water from one of the Noche Buena brooks onto all of their plots. They have made composts for fertilizing and have controlled pests on their vegetables.

A site has been leveled and foundations started for a small, attractive, model house to be built with the assistance of the students for occupancy by a local family. Mostly local materials will be used. It will be cheap and can be copied by small farmers.

Near the brook supplying water at the back of the Center, brick making has been started with simple sheds, a mixing pit, and oven. We expect this beginning will lead on to roof and floor tiles, drain tiles, flower pots, and dishes from a variety of clays available on the Institute, and nearby. There was no making of bricks or tiles or finer grades of ceramics in the Turrialba area. This simple set-up can be copied by any rural community.

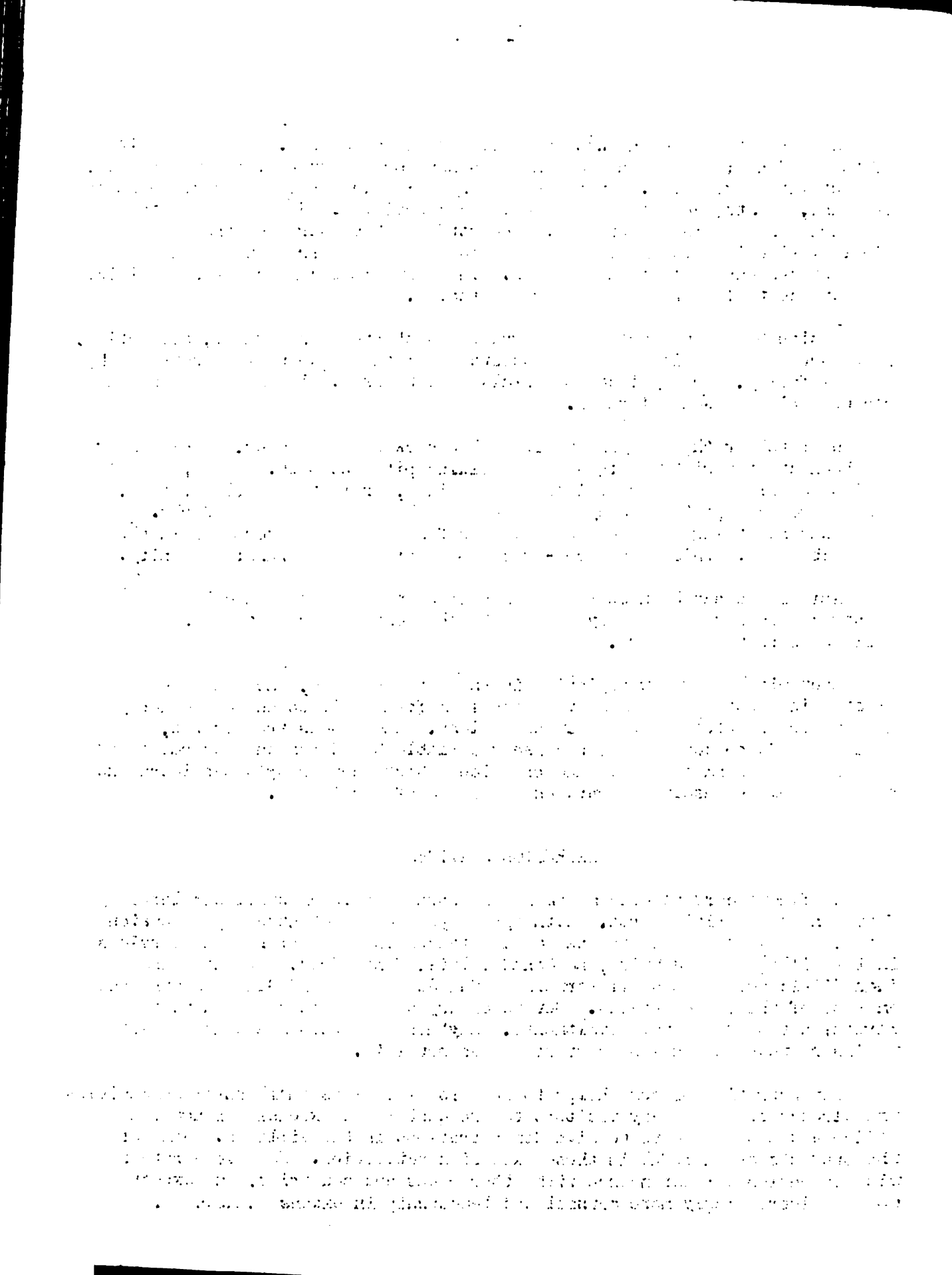
Apiculture has been started; honey is being extracted, and bees in twenty modern hives are ready to move to the Center as soon as there is resident supervision there.

Even with these few beginnings in the total program, the Center has created interest and has many visitors from farm families who are eagerly looking for helpful ideas and illustrations. When funds are secured, we shall proceed to develop the necessary copiable buildings and equipment and the active program of skills and practices which rural people can learn and adopt to help themselves upward on all sides of rural life.

EXTENSION SERVICES

We find a cordial welcome among the rural people on small and large farms in the Turrialba area. Although as yet we do not have any extension staff, we have been able to make acquaintances and to perform some services in the villages of La Suiza, La Canadá, Tuis, Santa Cruz, Cervantes and Juan Viñas; among the small farmers of San Juan Norte and San Juan Sur; and on some of the large estates. Devoid of any staff or budget we have to be careful not to make many commitments. Anything we start means more visits to insure that what has been started does not fail.

Demonstration of some helps to leaders of various small rural communities are already bringing many visitors to the Center and Extension Education office and many requests to give demonstrations in the villages. Some of the students are helpful in these extension activities. We have a rather wide extension correspondence with other areas and countries, and expect to give increasingly more counsel and leadership in extension methods.



PERSONNEL

We are budgeting (1949-50) for the following much-needed help: Associate Educationist; part time (2/3) technician, teacher and superintendent of students in their afternoon classes and laboratory periods; one graduate student assistant. They would all help some with the Rural Center and Extension. If an Associate Educationist is not found, then we must have an extension agent to be paid from savings.

PROGRESS REPORT

ORTON MEMORIAL LIBRARY

Angelina Martínez

The most significant event since my last report is Dr. Shaws's survey of the library resources of Mexico, Central America, Panama and Colombia. This study was undertaken under the sponsorship of the Rockefeller Foundation and at the request of the Institute. A formal request has been presented to the Rockefeller Foundation asking for the necessary funds to carry out the program outlined as a result of this study.

All the library routines have proceded as usual. We have ordered the following books and pamphlets since July 1948:

339 new books
220 pamphlets
142 sets of Library of Congress cards

About 150 of the books ordered have been received. Eight hundred seventy-nine bound and hundreds of unbound pamphlets have just arrived from the Pan American Union. These were discarded by the Library of the United States Department of Agriculture in Washington, D. C. Sixty-one volumes have been sent to San José to be bound.

Having just completed an inventory of our journal collection we can report that the Library receives 262 current subscriptions from all over the world. Of these only 82 are paid subscriptions. The other 180 are received as complimentary subscriptions, exchanges, etc.

Two thousand one hundred twenty-seven volumes were charged out of the Library for the period July 1948-February 1949.

In view of the possibility that the Library may be moved to the first floor of the building, we have decided not to acquire any additional furniture for the time being. Only eight shelves have been made at the carpentry shop so far.

A Guatemalan student is due to arrive here on the first of April for in-service training in library techniques and routines.

Very shortly the Librarian will start compiling a list of the 500 periodicals most frequently used in agriculture, using one of the standard reference-frequency counts. The Librarian proposes to issue a monthly Library News Letter to keep staff members informed as to the latest books and periodicals received in the Library.

REPORT ON STUDENTS

Ernest H. Casseres, Registrar

Enrollment reached its peak in January, 1949, with 56 students (54 in residence); 49 students (47 in residence) are now enrolled.

TEACHING PROGRAM

Period: October 1948 - March 1949

Course Title	For	Professor
Statistics	Graduate Students	J. O. Morales
Methods of Science	Graduate Students	Manuel Elgueta
Special Topics in Applied Plant Physiology	Graduate Students	H. C. Thompson
Taxonomy	Graduate Students	Jorge León
Cacao Seminars	Cacao Students	George F. Bowman (Chairman)
Seminars (Staff & Student Series)	Graduate Students & Vocational Students	N. C. Ives (Chairman)
Language (English & Spanish) - no credit	Graduate Students & Vocational Students	A. Martínez (Chairman)
Rural Administration	Vocational Students	J. O. Morales
Animal Industry	Vocational Students	G. Narváez
Production of Vegetable Crops	Vocational Students	E. H. Casseres
Soils and Fertilizers	Vocational Students	G. Bonilla
Agricultural Engineering	Vocational Students	L. Balma
Agriculture and Poultry Keeping	Vocational Students	C. L. Valle

MASTER'S DEGREES CONFERRED TO DATE

1.	Pedro Trujillo	Mexico
2.	Dale Madden	U.S.A.
3.	Milton Gertsch	U.S.A.
4.	José S. Aguirre	Mexico
5.	José Nuñez	Venezuela
6.	José Manuel Muñoz	Mexico

STUDENT ENROLLMENT

Second Semester 1948-1949

	NAME	COUNTRY	DEPARTMENT
1.	Alvarado A., Jorge	Costa Rica	Plant Industry - Cacao (Special)
2.	Arauz, Ramiro	Costa Rica	Applied Rural Science
3.	Barquero, Humberto	Costa Rica	Plant Industry - Cacao I
4.	Bereciartu, Pedro	Venezuela	Applied Rural Science
5.	Brooks, Erwin	E. E. U. U.	Plant Industry - Cacao I
6.	Bruzual S., Alberto	Venezuela	Applied Rural Science
7.	Cabrera, Leonardo	Mexico	Plant Industry - Cacao II
8.	Castro, Hugo	Costa Rica	Economics and Rural Life[x]
9.	Chacón, José	Costa Rica	Applied Rural Science
10.	Dadaille, Bertin	Haiti	Plant Industry - Cacao II
11.	Dejean, Monod	Haiti	Plant Industry - Cacao II
12.	Dodero, Rodolfo	Costa Rica	Applied Rural Science
13.	Escamilla, Guadalupe	Mexico	Plant Industry - Cacao II
14.	García, Gustavo	Venezuela	Applied Rural Science
15.	García, Omar	Venezuela	Applied Rural Science
16.	Giménez L., Oscar	Venezuela	Applied Rural Science
17.	Gómez, Francisco	Colombia	Economics and Rural Life[x]
18.	Hernández S., Alberto	Venezuela	Plant Industry - Cacao II
19.	Hurtado C., Luis	Venezuela	Applied Rural Science
20.	Linares, Pedro J.	Venezuela	Applied Rural Science
21.	Lucas, Allan D.	Panama	Plant Industry - Cacao III

[x]Graduate Student Assistant

22.	Marquez, Luis	Venezuela	Applied Rural Science
23.	Martínez, Vicente	Mexico	Plant Industry - Cacao II
24.	McFarlane, W. Lee	E. E. U. U.	Plant Industry - Cacao[X]
25.	Medina, Adolfo	Venezuela	Applied Rural Science
26.	Mejía, Ulises	Honduras	Plant Industry - Cacao III
27.	Mora R., O. Alí	Venezuela	Applied Rural Science
28.	Murga, Lionel	Guatemala	Plant Industry - Cacao III
29.	Narváez, Guillermo	Mexico	Animal Industry[X]
30.	Neel, William W.	E. E. U. U.	Animal Industry - Esso
31.	Núñez, José I.	Venezuela	Plant Industry - Esso
32.	Oechsli, L. Paul	E. E. U. U.	Plant Industry - Cacao I
33.	Orellana, Melisio	Venezuela	Applied Rural Science
34.	Orsenigo, Joseph R.	E. E. U. U.	Plant Industry - Esso
35.	Osal, Victorino	Venezuela	Applied Rural Science
36.	Paredes, Luis A.	Ecuador	Plant Industry - Cacao III
37.	Pérez S., Ildegar	Venezuela	Applied Rural Science (Special)
38.	Pérez, Víctor	Colombia	Plant Industry - duPont
39.	Perreault, Roger	Canada	Economics and Rural Life[X]
40.	Pinto S., Enrique	Venezuela	Applied Rural Science
41.	Piñero, Antonio	Venezuela	Applied Rural Science
42.	Powell, Reed M.	E. E. U. U.	Economics and Rural Life[X]
43.	Quesada, Tomás	Costa Rica	Plant Industry (Special)
44.	Romero G., Froilán	Venezuela	Applied Rural Science
45.	Salazar, Manuel	Nicaragua	Plant Industry - Cacao II
46.	Santos, Víctor	Venezuela	Applied Rural Science

47.	Segall, Raphael	E. E. U. U.	Plant Industry - Esso
48.	Siller, F., Luis Rey	Mexico	Plant Industry - Cacao III
49.	Smit, Anton G.	Surinam	Plant Industry - Cacao II
50.	Tovar G., Evelio	Venezuela	Applied Rural Science
51.	Vázquez M., José	Mexico	Plant Industry - Cacao III
52.	Velasco, Néstor	Venezuela	Applied Rural Science
53.	Velásquez B., Rosendo	Guatemala	Plant Industry - Cacao II
54.	Vivero, José E.	Ecuador	Plant Industry - Cacao III
55.	von Buchwald, Angel	Ecuador	Plant Industry - Cacao III

Summary		Number
Graduate Student Assistants		22
Technicians in Cacao		8
Students of Applied Rural Science		20
Countries represented:	Canada	0
	Colombia	2
	Costa Rica	5
	Ecuador	3
	E.E.U.U.	6
	Guatemala	2
	Haiti	2
	Honduras	1
	Mexico	6
	Nicaragua	1
	Panama	1
	Surinam	1
	Venezuela	20

Summary to March 31, 1949