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TECHNICAL ASSISTANCE TO THE
AGRICULTURAL SCIENCE AND TECHNOLOGY INSTITUTE

(I C T A)

OF
GUATEMALA

FINAL REPORT

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INTRODUCTION

This is the final report on the technical assistance provided by Servicios Técnicos del Caribe to the Agricultural Science and Technology Institute (ICTA) of Guatemala, during the period covered from July 1974 to December 1979, under USAID financed Contract PIO/T-520-197 - 1-3-40006 Pro. ag. 74 -2, as amended. Agronomist Carlos E. Crisóstomo Vergara performed as the resident Adviser under the Contract.

The technical services were originally contracted for a twelve month period. However, based on results obtained and agreement among the parties, said period was extended several times reaching a total of 66 months, as shown below, together with the main function assigned to the technician in each extension of the contract.

<u>Period</u>	<u>No. of Months</u>	<u>Title</u>
July 1/74 - June 30/1975	12	Coordinator La Máquina Pilot Project
July 1/75 - Dec. 31/1975	6	Coordinator La Máquina Pilot Project
Jan 1/76 - Dec. 31/1976	12	Head ICTA's Activities Region IV
Jan. 1/77 - Feb. 28/1977	2	Head ICTA's Technical Division
March 1/77 - April 30/1978	14	" " " "
May 1 /78 - April 30/1979	12	" " " "
May 1 /79 - Dec. 31/1979	8	Advisor, Head Technical Division
Total	66	

As noted above, the level of responsibility assigned to the technician increased progressively during the life of the contract. The main functions assigned for each one of the principal periods are summarized below:

Coordinator La Máquina Pilot Project

1) Provide professional guidance and orientation to the ICTA's research teams on crop production in La Máquina, geared to develop strategies to identify needs of small farmers and to coordinate research and experimentation activities for developing solutions to the problems confronted by these producers and ways of transferring the technologies developed.

2) Provide in-service training to the technicians participating in the Pilot Project.

Head ICTA's Activities Region IV

1) Assist ICTA in increasing its capacity to conduct research and experimentation on crops required under "Plan Nacional de Desarrollo Rural," heading the technical and administrative functions of ICTA in Region IV (La Máquina y Nueva Concepción), oriented towards the development of technology to increase productivity and social well being of small and medium size farmers.

2) Provide technical guidance, orientation and in-service training to technicians operating in the region.

Chief, Technical Division of ICTA

Collaborate to strengthen ICTA'S research program to increase food production, heading the Technical Division of ICTA at the national level.

Advisor to the Technical Division of ICTA

Collaborate with ICTA in consolidating the activities of the Technical Division, providing guidance and orientation to the newly appointed Chief of the Technical Division so as to assure continuity of its operations at the termination of the technical assistance. It is important to mention that the New Director of the Technical Division was the first Guatemalan to hold this position, occupied until then by expatriates. Thus, one of the fundamental tenets of technical assistance was complied with.

DEVELOPMENT OF THE PROJECT

Coordination of "La Máquina"
Pilot Project"

Background

At the time services under this contract were initiated, ICTA had already selected three pilot areas where first efforts were being made in conjunction with farmers to assess the validity of results obtained in ICTA'S Production Centers (Experiment Stations) under the conditions prevalent in rural areas, before making definitive recommendations. The three pilot areas were limited to the Quezaltenango Valley, seven-

ral municipalities of Juticapa Department and La Maquina Settlement Project.

Early in 1974 an agreement was signed between ICTA and DIGESA (Dirección General de Servicios Agrícolas) making possible for DIGESA promoters, working in the pilot areas, to be transferred, on a temporary assignment, to ICTA and charged with functions related to carrying out field trials on a number of farms located in those areas where technology developed by ICTA would be tested under local conditions. Overall objective was to integrate both research and extension under one single institution which would be ICTA - thus assuring a continuous flow of improved technology from its very source to the ultimate user: the farmer.

The technician working under the Contract was assigned the responsibility of carrying out and coordinate activities in the La Maquina Pilot Project, located in the municipalities of Cuyotenango and San Andrés Villa Seca of Suchitepéquez and Retalhuleu, respectively, covering an area of 34,478 hectares - mainly farms 20 hectares in size - where DIGESA promoters, under the leadership of a technician from ICTA, were carrying out the following activities:

- Forty (40) corn field trials where ICTA Tropical 101 intervariety hybrid was being compared with "Criollo" corn.
- Seven (7) rice field trials where IR-22 and CICA-4 varieties were being compared with local material utilized by the small farmers.
- Forty four (44) soybean field trials to determine how this crop - new to the area - would perform under local conditions.

These were additional responsibilities to the normal functions of the agricultural promoters (Extension Agents).

Diagnosis and Formulation of Strategies

During the first six months of the contract, basic information on the zone was developed to guide the activities to be carried out in the area. Beside reviewing written material available, assistance was given to the Systems Team of the International Center of Tropical Agriculture (CIAT) in conducting a sample survey in the area.

One hundred farmers in the Pilot Project were interviewed. Results, however, were made available too late when the program was already underway. However, having participated as an interviewer and in frequent meetings with CIAT personnel provided a good insight into the production systems being followed in the area and the problems being encountered, which together with other relevant information permitted to describe the following situation:

La Máquina settlement is located 14°23" latitude north and 91°35" longitude west, with an elevation that varies from 6 to 150 meters above sea level. Ecologically it is classified mainly as a Dry Sub-tropical Zone (Holdridge 1974) having a median temperature of 27°C, a maximum median of 35°C and a minimum median of 20°C. Median annual rainfall is of 1860 mm received mainly from May to October.

Predominant soil series is, according to Simons, Istán clay with Istán "franco limoso" in a minor scale; although soils of the Chaparrico series are found in association with the above mentioned series. Topography is undulated with a smooth slope toward the coast.

Principal crops are corn, ajonjolif, and rice, accupying 74; 44 and 2 percent, respectively, of agricultural land in two seasons: May and August. Two crops are produced annually based on a rotation of corn - ajenjolif, mainly.

Corn utilizes around 17,500 hectares with an annual average production of 28,500 metric tons and a median yield of 1.6 tons per hectare; which is the result of: only 3 percent of area in corn being planted to improved varieties, potential yields of "Criollo" varieties are low, high incidence of mulching due to height to plants and strong winds, high incidence of pests not properly controlled, plants have to compete with weeds; low use of fertilizers, shortage of labor, limited financial resources, adverse weather conditions. Corn is planted when the rainy season starts (end of April and beginning of May) and on rare occasions a second crop is planted in September intercropped with the first planting made in April - May.

Sesame, second in importance, occupies approximately 10,000 hectares planted at the end of July and beginning of August intercropped with corn when plants have reached physiological maturity. Annual production averages 4,000 metric tons with yield of 0.4 tons/hectar. Varieties more commonly used were introduced to the area years ago and farmers have been selecting and keeping their own seed which they now name Blanquina and Chicote. Principal problems include high incidence of fungal diseases, low yield potential and no utilization of fertilizers.

Rice constitutes the third traditional crop in importance in the area with an area of approximately 500 hectares, average annual production of 1,000 metric tons and yields of 2 tons/hectare. It is produced on impermeable soils of the Champerico series found in small lots all throughout the entire parcelation project. Factors accounting for low productivity are varieties with low yield potential and susceptible to bending, poor distribution of plants in a particular plot due to inadequate planting techniques, high weed competition with plants due to inadequate controls, inadequate pests control, very limited use of fertilizers.

Other crops of some importance are beans, cassava, "achiote", water melon, tomatoes, peanuts and a squash variety whose seed is utilized as an spice. Some fruit trees like mango, citrus, papaya, cashew (marabón) and guava, among others, are also grown in the area.

Around 20 percent of the area is pastureland and forage utilized mainly for beef cattle.

Absence of technical assistance is notorious, Promoters visiting farmers one or two times annually, on the average; the rest of the time utilized on paper work and carrying out credit activities.

Another point of reference to define activities to be conducted in the area were the field trials being carried out by the Promoters. Results obtained on these trials are summarized below:

- Corn yields of the ICTA Tropical 101 hybrid were, on the average, 3.5 tons/hectare compared with 1.6 tons/hectare of the "Criollo" materials.
- Rice variety CICA-4 yield were 4.4 tons/ hectare, IR-22 averaged 5 tons/hectare, compared with an average of 2.2 tons/ hectare obtained on Blue Bonnet-50 seed kept by farmers.
- An eruption of the Fuego Volcano made it impossible to obtain dependable results on the soybean trials.

Although ICTA had defined policy to solve problems confronted by small and medium size farmers making them a party to the process of developing and transferring technology, it was necessary to hold a series of meetings with ICTA officials (General Manager, Deputy Manager, Associate Director, Technical Director) and on occasions with members of the Technical Division with the purpose of consolidating the methodology to be utilized. Both groups, particularly the latter, showed enough flexibility to adjust methodology to the cropping systems and type of farmers found in the various zones.

In the specific case of La Maquina Project a series of activities were defined to be carried out in plots provided by farmers. These are described below:

Farmer's Tests (Parcelas de Prueba)

Work done in conjunction with the farmer, utilizing plots of one "cuerda" of land (1,166 sq. m.) for each treatment, with no repetition, where the farmer provides the land and labor needed, and ICTA provides technical assistance and additional inputs needed, the latter to be repaid by the farmer at the time of harvest. The purpose is to evaluate farmers use and management of improved technology as compared with his traditional operations.

Farm Trials (Ensayos de Finca)

These are applied research activities carried out directly by ICTA. The farmer provides the land only. The idea is to adapt research findings to actual field operations and feedback researchers with real operations results.

Research

Work was carried out on fertilizers, control of plant insects and diseases, weed control, etc. ICTA provided inputs, the farmer provided the land. The idea is to develop new technology adapted to meet the pressing needs of the farmers in the region.

Field Day

Meetings of farmers (10-20) to observe and discuss farm trials and research carried out on the farms were sponsored. This is an effective method of promoting improved farm practices.

Production "Clinics"

Meetings of all collaborating farmers for each crop were held. The purpose of these "Clinics" was to exchange ideas with the farmers on the results of work in progress. Farmers are valuable in assisting in the orientation of research to meet felt needs.

It should be mentioned that the ICTA/DIGESA contract was cancelled since DIGESA Promoters, because of their credit activities, did not have the time to provide the assistance needed by ICTA. Furthermore, they requested certain conditions to be satisfied before their transfer to ICTA which could not be met.

ICTA decided that the Production Coordinators in pilot areas would also supervise other ICTA activities in their areas. In the case of La Máquina Project there were two Production Centers in one of which administrative personnel and the corn-sesame program were concentrated. The technicians from the Republic of China were assigned to the second Production Center. These technicians were originally assigned to the Instituto de Transformación Agraria (INTA).

THE RESULTS

Tests and Transfer of Technology

Members of the Team:

Eight (8) Agricultural Engineers

Two (2) Agronomists

Two (2) Students from the Faculty of Agronomy of Universidad San Carlos who were complying with their farm practice

Four (4) Peace Corps Volunteers

Projects were so located in participating farmers plots that each one could be observed by a minimum of 12 farmers, at the same time that the projects were a representative sample. The results were as follows:

Corn

It was shown that improved seeds tried were superior to the "Criollo" both in yield and in growth. The use of improved seeds and adequate cultivation practices increased productivity in corn

by 108% and profitability was increased by 66% with an increase of 43% in investment compared to traditional practices. The use of fertilizers did not increase yields significantly but they increased production costs by 38% and reduced profitability by 29%. The traditional practice of planting corn at the beginning of the rainy season intercropped with sesame planted during late July or early August proved to be the most effective system. The use of herbicides proved to be advantageous over hand weeding but care should be taken with the use of fertilizers having high residual effect; it affected sesame yields. Breeding stock (corn) produced in Guatemala needs improvement. Though production is higher than the "Criollo" there is a high incidence of rot (grain). As an alternative a number of imported varieties were selected. The use of granulated insecticides to control leaf diseases proved to be a sound and economic practice. There are doubts as to the need of controlling soil plagues.

Rice

The improved variety CIGA-4 proved to produce higher yields than the varieties commonly used by the farmers. The use of nitrogen increased yields of CIGA-4 but its high price in 1975 cancelled any increase in income.

Drought spells brought about substantial losses in certain areas. It is risky to plant rice near the coast. The best areas are "Sector A" and part of "Sector B" of La Maquina. In the

"Farmer's Tests" there were weed problems but in evaluating herbicides it was found that there are some products or combination of products that proved to be effective. In comparison with traditional practices, yields increased by 76% when using the recommended technology excluding fertilizers. Yields increased by 122% when using fertilizers while income increased by 42% and 39% respectively against 29% for the traditional system.

Ajonjolí

The results in this crop were not above those currently obtained by farmers. Yields were very low, about 0.5 tons per hectare. There was no response to the use of fertilizers. Fungous diseases attacked severely. Because of this reason it was decided to start a specific program for this crop to produce disease resistant stock and of a higher yield potential. "Ajonjolí" is an export crop which increases farmers income. It is also a good alternative as a second crop in La Máquina. Emphasis should be placed in developing improved and adequate technology for this crop.

Soybeans

Growing soybeans does not represent a good alternative for La Máquina settlement. Yields, when intercropped with corn were low and there is not a promising local market.

Beans

The experience on beans was erratic. In some areas yields were satisfactory, in others the crop was lost because of excess

rain at harvest time. Production costs were found to be low. There was no response to the use of fertilizers. Some trials on planting season should be carried out in the future. It seems that production for home use is the most that can be expected because of climate.

"Frijol de Costa" or Cowpea

This crop was planted at the beginning of the rainy season as an alternative for intercropping with corn. The results were not satisfactory. Yields were low. Though some families found cowpeas acceptable, this grain will have difficulties as a substitute for beans.

Transfer of Technology

Though the idea was that the project would carry on its activities to the point of transfer of improved technology produced, there were difficulties in carrying this action to an end, mainly because this function in the public sector belongs to DIGESA, thus facing an interinstitutional conflict of duplication of efforts. However, satisfactory results were achieved in the transfer of technology since all activities were carried out in the farm and in close collaboration with the farmers; field days were organized, seminars "clínicas de producción", meetings with DIGESA personnel were successfully organized.

The publication of bulletins with recommendations on the most important crops also helped in promoting the use of improved technology.

The Corn- "Ajonjolí" Program

This program was handled by two Agronomists detailed in La Máquina. There was a support activity on the genetic improvement of corn in the "Zona Baja". The main activity was carried out from the Centro de Producción Cuyuta.

Increasing plant population, lowering the height of the plant and increasing yields were the main objectives. The following varieties were used: ICTA -B-1; Queztzal Oro Blanco (Opaco) and Sintetico Amarillo. Some germ material originating in CIMMYT was also evaluated. Out of this effort some varieties were selected for farm trial.

Republic of China Technical Mission

Five technicians from Tiwan carried out their activities in a 20 has. plot transferred ^{to} / ICTA by the Ministry of Agriculture. The objective was to look for a better land use on the basis of an integrated farm plan oriented towards home consumption needs and regular sales instead of one seasonal sale. To that end the following crops were planted: corn, rice, soybeans, cowpeas, "camote", cassava, peanuts and vegetables. Swine were raised and fish ponds were made to grow Tilapia and Carpa from Israel. Production was satisfactory. Field days were organized and farmers became interested in the project though not necessarily as an integrated project. The project has some inherent limitations such as the need for irrigation and abundant water for vegetable growing and for the fish sub-project.

Socio-Economic

The socio-economic component was in charge of one Agricultural Engineer and one Agronomist. They contributed to the evaluation of the different planting systems prevailing in La Maquina conducting farm income studies, and assisting in promoting the use of simple farm records.

Twenty five farmers were selected at random for the project. They were trained to keep a daily record of activities including farm records such as labor, inputs, value of the crop, income and expenses, etc. The information was collected for each crop and later on analyzed.

These farm records, in addition to their importance to the research workers, served to stimulate the farmers to keep records. Through special meetings held with this purpose, other farmers started to keep farm records and accounts.

The results of this activity were similar, to a large extent, to those obtained at the "Parcelas de Prueba". This activity should be continued. It will help to evaluate the use of improvements in technology.

In-Service Training

Regular meetings were held with the personnel of the project to plan and discuss the activities to be undertaken and to examine the problems arising in daily operations. Field days for technicians were organized. The exchange of ideas between technicians and farmers was an important part of the in-service training. Specialists from ICTA participated in a number of meetings. Two Agricultural

Engineers were sent to CIAT for a period of 6 months for training on crop production.

Administrative Activities

Administrative activities were coordinated so as to provide adequate support to technical activities. Though this activity required considerable time, it made possible for the Advisor to be in a position of authority to provide necessary logistic support to all the technicians. In the past, the main problems originated in the centralized system of operations. The Advisor was assigned a Chief of Field Operations, an Assistant pay master and adequate secretarial and office support.

OTHER ACTIVITIES

Seed Production

The team under the leadership of the Advisor had the responsibility for increasing the production of improved seeds of some crops using the facilities at Centro de Producción Cuyuta where irrigation is available. This activity was carried out with the collaboration of ICTA'S technicians who are in charge of specific programs.

In collaboration with Dr. Plant and Eng. Manlio Castillo, Production Coordinators at Jutiapa and Parasitology Program, respectively, a seed production program was prepared. The project was presented to the Interamerican Development Bank and the amount of \$616,000 was assigned for this purpose (Grant 66% and 44% national funds).

In collaboration with Dr. Plan a program for production and marketing of improved seeds was designed before the BID project was in operation. Seeds were to be sold through the "Production Centers" of the teams responsible for trials and transferring of technology. In this way La Maquina Project received 200 qqs. of improved corn seed; 310 qqs. of improved rice seed and some beans and "ajonjolí" seeds.

CONCLUSIONS AND RECOMMENDATIONS

The institutional strategy of carrying on applied research in the farms themselves proved to be effective. It makes possible for research workers to operate on the basis of the real problems and needs which in turn facilitates the search for practical and reliable solutions to existing problems. This practice should be continued.

The validation of technology through farmer's tests makes it possible for the farmer to participate directly in technology development program. On the basis of his observations he makes his own conclusions. The system makes it possible for the researcher to know immediately if the results meet the needs of the farmers or if additional work or revisions should be made. This system is valid and should be continued.

The continuous relationships between the researcher and the farmer makes possible the exchange of experience which help both.

Though the methodology used was successful in the transfer of technology there is ground for improvement. A government policy decision is urgent as to the integration of efforts of all sector institutions in the area of transfer of technology.

Administrative mechanisms should be examined to reduce bureaucratic procedures that often have negative effects on scheduled field operations.

It is convenient to start thinking about decentralization of certain operations. La Maquina experience deserves careful evaluation.

HEAD OF ICTA'S ACTIVITIES IN REGION IV

Background

ICTA'S strategy for national coverage was designed on the basis of three Pilot Projects. New areas were to be added on the basis of the existing regionalization scheme of the agricultural sector. It was anticipated that "La Maquina Project" would be extended to the East and to the West, thus covering a large part of southern Guatemala. In this area there are a number of settlements producing cotton, sugar cane and livestock, mostly for export. This area covers the Departments of Escuintla, Suchitepéquez, Retalhuleu and part of San Marcos and Quezaltenango. It is within Region IV of the agricultural sector.

On the basis of the above mentioned program the duties of the Coordinators of the three projects were extended in 1976 to the Region as Regional Coordinators. The Advisor was appointed Director of Region IV. His activities covered the settlement of Nueva Concepción in the Departamento de Escuintla with an area of 34,909 has., subdivided in 20 has. farms.

In addition to supervising regional activities the Regional Directors represented ICTA in the "Regional Agricultural Committees" which were organized by the Ministry of Agriculture as an advisory body to the "Agricultural Public Sector Coordinating Committee" (COSPECO).

The Regional Chiefs or the Regional Directors of the different sector institutions were the members of the Agricultural Regional Committees. They would operate under the leadership of DIGESA'S Regional Chiefs and were entrusted the responsibility for interinstitutional coordination of agricultural development efforts.

Diagnosis and Strategy

During early 1976 the "Parcelamiento de Nueva Concepción" was visited with technicians from the Technology Transfer Team of La Maquina. The purpose was to take general cognizance of the situation and to hold informal interviews with farmers.

The different sector institutions operating in the area were visited. The following description is based on information collected and publications available.

The Parcelamiento de Nueva Concepción is located at 14°15' north latitude and 91°13' west longitudes. Altitude 10 - 75 meters above sea level. It is classified within the Húmedo - Seco Zone. Median annual temperature 28° C., maximum monthly temperature (April, May and June) 35° C. Minimum monthly temperature (January) 19 C. In general there are no sudden temperature changes.

Rainfall: 1600 to 2300 mm. per year mostly during May to October. Highest rainfall: August - October.

Soils: sandy-loam or sandy-clay with abundant organic matter in the northern part of the project. Sandy soils prevail in the southern part of the project. It is mostly an area of plain land. Soils types I and II prevail.

In this Project there are three planting seasons:

- 1) "De humedad" - March
- 2) "De Fuego" - May - at the start of the rainy season.
- 3) "De Segunda" - August

The most important crops are: corn, rice, "ajonjolí", plantains, pasture and kenaf. There is also some double purpose cattle. (Beef and dairy).

On the basis of the results of activities in La Máquina the teams on "Pruebas de Tecnología" emphasized farm tests (ensayos de finca). The number of "Parcelas de Prueba" was reduced.

Taking advantage of the organization of the "Comité Regional de Desarrollo Agrícola" it was agreed to emphasize the transfer of technology through DIGESA Promoters and through the technicians of other Sector institutions.

THE RESULTS

Technology Tests in La Máquina

Staff: Seven Agricultural Engineers

One Agronomist

One Student from the Faculty
of Agronomy of the University
of San Carlos

Two Agricultural Engineers resigned to accept positions in the private sector. Substitutes were appointed.

All activities were developed on the farms themselves. Crops covered: corn, "ajonjolí" and rice.

Corn

It was confirmed that the use of improved seed is the most important factor in increasing yields. Unless improved seed is used it is not advisable to modify the traditional system component. The chemical control of weeds, increasing plant population, control of leaf diseases increase yields when used on improved varieties.

Preventive soil treatment as well as the use of fertilizers do not increase yields significantly while they reduce profitability significantly.

Seed produced by the Corn Program, namely, ICTA Tropical 101, ICTA 5-1 and La Máquina showed good yields, good agriculture characteristics and good tasseling and solid ears of corn.

It has been confirmed that recommended plant population is correct. Fertilizing and the use of micro-nutrients didn't have a significant effect on yields.

A number of herbicides and combination of herbicides proved to be effective in the control of weeds and had no residual effects on "ajonjolí".

In the case of "alcabras de segunda" a favorable response to nitrogen application was noticed. However yields were not very high because of lack of rain and plant diseases. This confirm why farmers prefer to make small "alcabras de segunda".

Rice

Variety CICA-4 was discarded because of its susceptibility to Prionothra orizae in northern Guatemala. Prices were lower than

for other varieties. ICTA'S rice program is using Variedad ICTA-6 which has shown good yields in La Máquina. A favorable response to the use of nitrogen was observed. Herbicides selected last year proved to be effective in weed control in "parcelas de prueba". Using ICTA'S recommended technology yields of 4 tons per ha. were obtained. The profitability was 93%.

Ajonjolí

Material selected by the "Ajonjolí" Program was tried. The varieties Maporal and Aceitera, both from Venezuela showed tolerance to fungous diseases. Their yields are higher than traditional varieties. Efforts are underway to produce enough seed for next year's plantings. It has been found that the 2nd. week of July is the best planting season. Plantings should not be made after August 15th. Higher yields are obtained in double row planting between rows of corn. Studies on plant population are contemplated.

Transfer of Technology

With the organization of the "Comité Regional de Desarrollo Agrícola" the mechanism for interinstitutional communications in the field of the transfer of technology started to take shape. On the basis of ICTA'S findings the farmers of La Máquina were no longer required by BANDESA to buy and apply fertilizer which was unnecessary. As a result of ICTA'S findings the amount of the loan per hectare was reduced. Farmers were receiving Q.250 while the real need was only Q160. In this way a better use of credit was promoted for the benefit of both the farmer and the Bank. The relations

between field personnel of different institutions was strengthened DIGESA promoters participated actively in the "Field Days" sponsored by ICTA. The design of demonstration plots used by the Extension Agent was revised and ICTA'S system for "Parcelas de Prueba" was adopted. Technology developed by ICTA was used also by Extension Agents.

Field Days, Seminars, "Clínicas de Producción" and the publication of bulletins with recommendations on improved technology, were continued.

The Corn Program

An Agronomist was detailed in the Corn Program. Two other Agronomists who ^{had} been originally assigned to this program were transferred to the "Ajonjolí" Program and to Chimaltenango. However the program was strengthened through the contract signed between ICTA and CIMMYT, using USAID funds. Coordination between this program and the "Pruebas de Tecnología" activities was strengthened also. Joint trials for evaluating research material were carried out at the farm level. Basic material for the future development of new varieties and hybrids was selected. Plant population studies were continued. Emphasis was placed on the improvement of the corn ears. The evaluation of genetic stock from CIMMYT was continued. Out of all this work some varieties were selected for evaluation at the farm level.

The Ajonjolí Program

One Agronomist participated in this program. He worked for 6 months with irrigation facilities and for 6 months without such facilities.

Activities were concentrated in the selection of "genetic lines" departing from existing material, in search of resistance to diseases. The evaluation of material imported from Mexico, Venezuela and Nicaragua was carried out. The amount of seed for field trial of pre-selected material, was increased. The phase "Pruebas de Tecnología" was emphasized.

The Republic of China Technical Mission

This activity was continued in the 20 hectares provided to the Mission. Yields were satisfactory. The number of pigs was increased over last year. Small farm machinery was imported from Taiwan, including a small rice processing plant with which they provided husking service to small farmers. They also worked with farmers by planting demonstration plots for different crops. Some field days were organized and carried out in this project for technicians and farmers from the public sector.

Socio-Economic

This support activity continued with the same personnel of the previous year. The number of farmers collaborating increased by 50%. An evaluation of the acceptance of new technology was carried out. Through this evaluation the impact of the transfer of technology sponsored by ICTA was measured. The percentage of farmers using the new technology on their own initiative was determined. In the case of corn the evaluation showed an increase in the use of improved seed (41%) and in the control of diseases (53%). None of the farmers in the sample used fertilizer which

is consistent with ICTA'S recommendation. In relation to plant population and the preventive control of soil diseases the index showed 13% and 0% respectively. The effect of the transfer of technology was also measured through the farm records. A sample of 49 farmers who planted corn showed that 60% used improved seed; 74% controlled leaf diseases and only 5% used fertilizer.

Technology Trials in Nueva Concepción

This activity was not carried out as contemplated since the technical personnel and logistic support were not provided. However, in an effort to obtain some preliminary information based on farm trials, an agronomist from La Máquina and two students participated. Four Peace Corps volunteers also participated. Corn and rice were covered with the fertilizers as follows:

Corn

The following aspects were covered: evaluation of commercial and research material; plant population, and response to nitrogen. It was found that the plantings made in March (Siembras de Humedad) showed the highest yields - up to 5.5 tons per ha. In the plantings made in May when the rainy season started (Siembras de Fuego) yield was substantially lower - not more than 3.5 tons per ha. The varieties produced by ICTA had the same performance as commercial hybrids. Some of the research varieties surpassed the yield of all material used. The "Criollos" were the lowest producers. No response was found in relation to the use of nitrogen. Only the "Siembras de Humedad" showed difference in plant population.

The best results were obtained with 40 and 50,000 plants per hectare.

Rice

Both research and commercial material were studied. The varieties produced by ICTA and the new "lines" distributed by the Rice Program are producing 8 to 10 tons/ha. as compared to 4 to 5.5 tons/ha. produced by the commercial varieties commonly used by farmers.

Transfers of Technology

Field Days were organized for both farmers and DIGESA technicians. Farmers indicated their interest in the presence of ICTA in their project and offered to collaborate next year by providing land for ICTA'S activities. Field Days are a good technique to promote improved technology.

In-Service Training

Regular meetings of the technical personnel assigned to the project were held to discuss the methodology and execution of the different activities. Field Days and seminars were organized as part of the in-service training program. ICTA'S specialists participated in these activities.

One Agricultural Engineer was sent to CIMMYT for six months to participate in a course on corn production.

Two Agricultural Engineers received in-service training offered by ICTA in Jutiapa (10 months).

One Agricultural Engineer was sent to the Colegio de Post-graduados de Chapingo, México, to work towards a Master's Degree in Soils.

Administrative Activities

The Adviser in his position of Regional Director had more authority in the coordination of administrative services. However the centralized nature of administrative services continues to be a problem.

Other Activities

"Comité Regional de Desarrollo Agrícola"

As a Member of this Committee the Adviser participated in a number of meetings with the Chiefs and Regional Directors of the other agricultural institutions of the Public Sector. Important aspects of the agricultural development program for the region were discussed. The prices for basic grains suggested by the Committee were taken into consideration by the Instituto Nacional de Comercialización Agrícola (INDECA) to fix buying and selling prices policy. Suggestions were made to reduce delinquency of loans granted by the Banco Nacional de Desarrollo Agrícola (BANDESA). As a result of these coordinated efforts delinquency has been reduced.

A seminar of all the technical personnel from DIGESA was held and all sector agencies had the opportunity of explaining their programs objectives and achievements.

ICTA received backing to extend its activities to Nueva Concepción and La Blanca settlement. Some problems faced by the different institutions were solved.

International Meetings

The Advisor participated in the XXII Annual Meeting of PCCMCA where a round table was organized to present the development of activities in La Máquina Project. The participants showed great interest in this project and its approach to the development and promotion of technology.

The Advisor participated in a meeting organized by CIMMYT in México where applied research and the transfer of technology were discussed extensively. Technicians from Central America and the Caribbean participated in this meeting.

CONCLUSIONS AND RECOMMENDATIONS

ICTA'S institutional strategy to generate adequate technology has shown to be effective. Farmers are accepting the new technology.

In Region IV, as a result of the organization of the Comité Regional de Desarrollo, there is a better coordination of the activities and programs of the different institutions of the agricultural sector. The program for the transfer of technology has multiplied its effectiveness. Of course there is a pressing need for the continued improvement of this situation.

DIGESA Promoters spend most of their time in credit activities. A policy decision is required on this matter since Promoters are counted upon to promote new technology.

The need for expanding activities to increase its coverage made it necessary to extend activities to Nueva Concepción Settlement before the technical resources necessary were available. Fortunately some positive results were achieved. Additional national backing is needed by ICTA.

The continuity of the programs depends, to a large extent, on the stability of the personnel trained. Some technicians resigned because of salary problems. The situation may turn critical if adequate measures are not taken by the Central Government.

DIRECTOR OF THE TECHNICAL PRODUCTION
UNIT OF ICTA

ICTA, Its Organization, Objectives and Operations

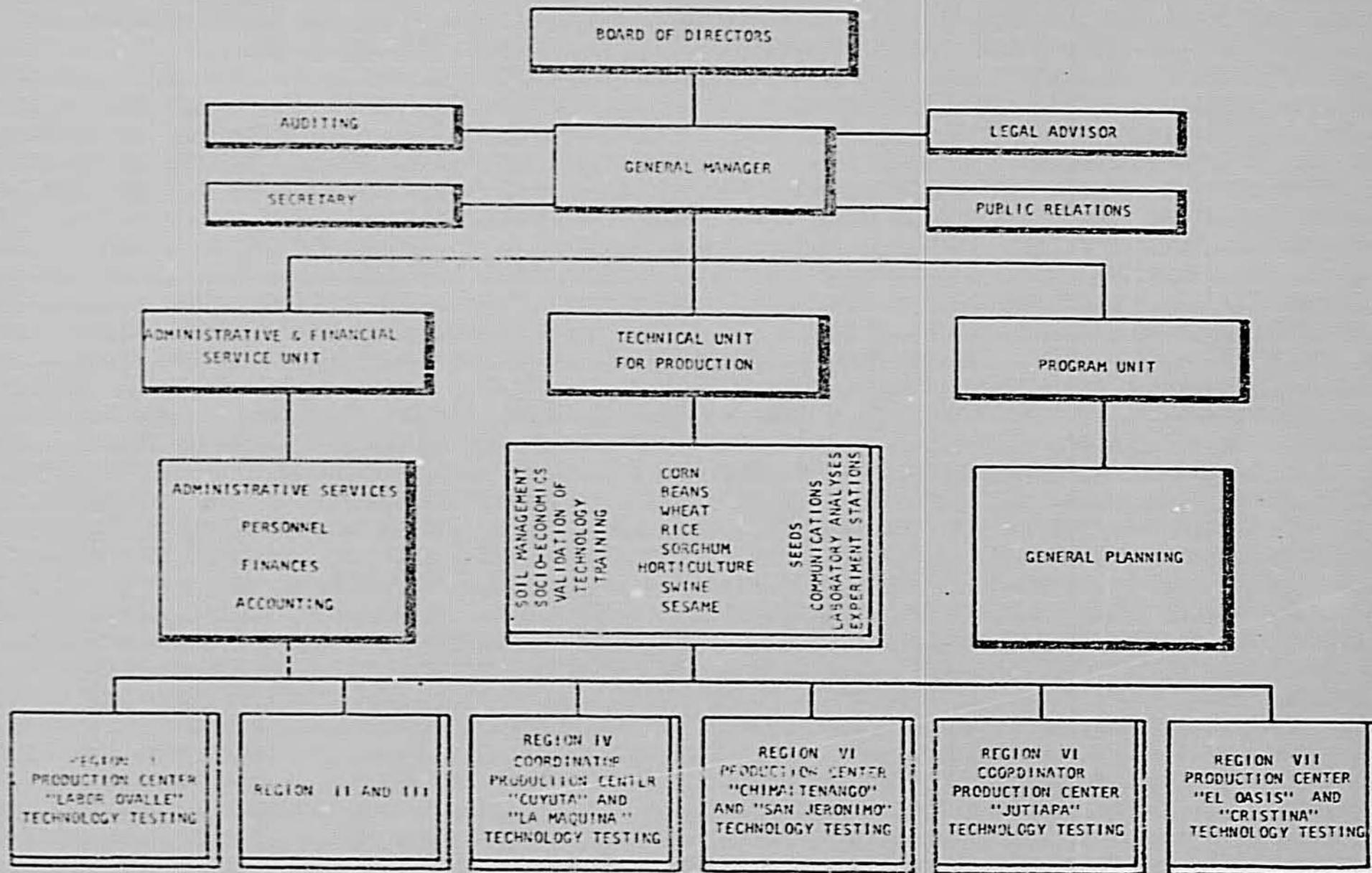
The "Instituto de Ciencia y Tecnología Agrícola" (ICTA) started operations on May 10, 1973. It is a decentralized institution of the Public Agricultural Sector of the Government of Guatemala. It has the responsibility of generating and promoting the use of science and technology.

ICTA is organized under a Board of Directors presided by the Ministry of Agriculture, who is at the same time Chief of the Sector. The other ex-officio members of the Board are the Ministers of Economy, Public Finance, the Secretary General of the Consejo Nacional de Planificación Económica, the Dean of the Faculty of Agriculture of the University of San Carlos and a representative of the private sector appointed by the other members of the Board.

The Advisors to the Board are: The General Manager of ICTA, the Director General of DIGESA, the General Manager of BANDESA, the General Director of INDECA and the President of the Instituto Nacional de Transformación Agraria (INTA).

The administration and operations of ICTA are under a General Manager and an Assistant General Manager. To carry on its activities ICTA has three units: The Technical Unit for Production; the Administrative and Finance Unit and the Planning and Programming Unit.

The Organization Chart of ICTA follows:



 CENTRALIZED ACTIVITIES
 REGIONAL EXECUTION OF PROGRAMS

The Technical Unit for Production

This unit is responsible for the applied research activities. All research is oriented towards the solution of agricultural problems which in some way affect rural welfare. It should develop methods to increase agricultural productivity, promote the use of technology by the farmers and promote regional development. Its activities are to follow the determination of the Public Sector.

The Technical Unit is structured along the lines of Production Programs on specific crops, namely, corns, beans, rice, wheat, sorghum, "ajonjolí", vegetables and livestock. These in turn are supported by: Prueba de Tecnología (Technology Trials); Socio-economics; Soils and Water Management; Seed Production and Training. There are also technical services namely: Production Centers; Seed Processing Plant; Soils Laboratory and the Germ Plasma Bank.

There is a Technical Director who is responsible for the operations of the Unit, to the General Manager. There are Program Leaders and support activities (socio-economic) that constitute the technical coordination team that serves as an advisory body to the Director of the Unit. There is also a body of scientists and technicians responsible for field work activities.

The methodology used contemplates an integrated operation - Production Programs and Supporting Activities - functioning as a multidisciplinary team at the regional level. This gave origin

to what has been designated as the Agricultural Technology System for Production which is illustrated diagrammatically on page 36.

The following are the different phases of the system:

Diagnosis of Action Areas

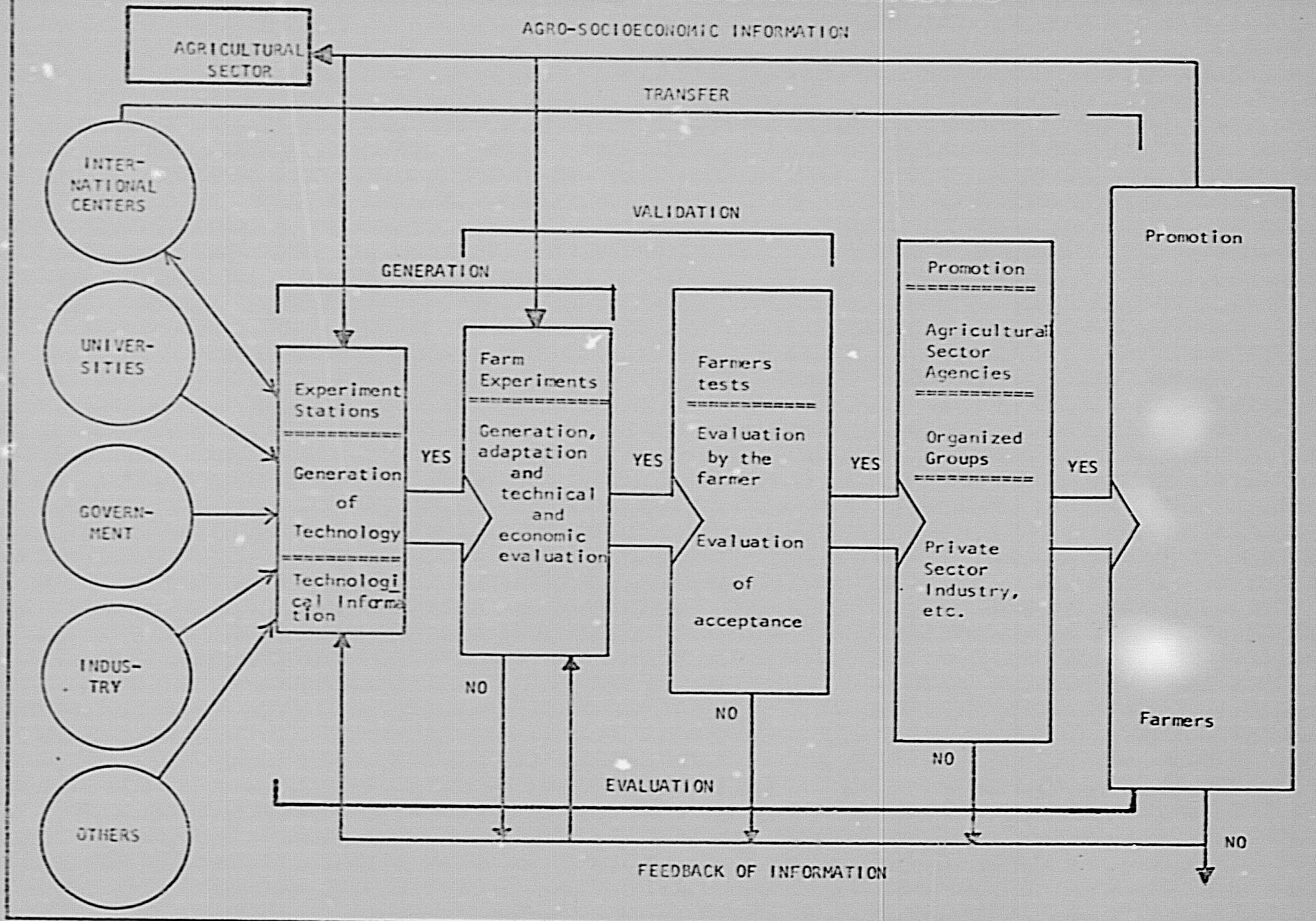
Before the research program is designed the problems and characteristics of the target group are identified. For that purpose socio-economic information is compiled on the selected areas.

Originally ICTA carried out surveys to collect necessary information to design its regional research program. This method proved to be ineffective because of the following reasons:

- 1) The survey is time consuming. Analyzing the survey and writing the report and conclusions takes much time. As a result the findings are delayed and not available when needed to plan the research activities.
- 2) The cost of the survey and the analysis of the information is expensive for an agency having a very limited budget.
- 3) The findings of the surveys are claimed not to be very reliable since the farmer is not likely to provide the correct information when interviewed in the formal way required by an extensive written questionnaire.

TECHNOLOGICAL SYSTEM FOR AGRICULTURE

AGRO-SOCIOECONOMIC INFORMATION



- 4) The farmer resents being subjected to continuous surveys;- population, anthropological, sociological.

At present ICTA uses a combined approach: available information, soils surveys, population studies, production surveys, etc.) recognizance trips made by the regional technical team to sounds and explores the community. The technical team is composed of agronomists and the socio-economic technicians thus providing a multidisciplinary approach with greater capacity to sense the farmers needs and the farm problems.

The agricultural and socio-economic exploration - not to call it a survey - is carried out in a short period - one or two weeks. During this period a team of one agronomist and one member of the socio-economic group visits the region and interview the largest number farmers possible. They observe and take notes on the physical condition of the soils, climate, management of crops and many other conditions or situations that, in one way or another, affect the farm and the farm family. Every day the group holds a meeting to discuss their findings and when this stage is completed there is a final meeting in which the group discusses its findings and prepares a written report on its conclusions.

It has been found that this kind of approach has the following advantages:

- a) It can be completed in a short period.
- b) The costs is very low compared with the usual socio-economic surveys.
- c) The informal approach to the farmer brings better and more reliable information.
- d) The farmer is happy to provide the information since the interviews are short compared to the survey.
- e) The agronomists who will work in the area get a first hand feeling of the existing conditions.

Existing farm records are another good source of information for planning research. These contain a daily record of the activities carried out in each crop. A simple record includes inputs used, labor employed-family and hired labor - use of machinery. All items include cost and the area where used. Records are kept by the farmer with the assistance of the technicians from "Prueba de Tecnología" and the Rural Socio-Economic Team; provide a good base to determine profit or loss. Of course, this information is of great importance both for the farmer and for ICTA.

Collection of Information and Materials Available

Once the diagnosis is completed, available information is examined to identify technological alternatives generated by Inter-

national Research Centers, Universities, Governments and other national programs such as industrial sector, foundations, regional organizations, the Institute itself and others.

Planning and Programming of Activities

With this background, and on the basis of the requirements of the "Plan Nacional de Desarrollo" the planning and programming of activities is started. This work is carried out at the regional level with the participation of the supporting personnel assigned to the area. The group includes personnel from DIGESA, the other chief of programs or Regional Directors of the Agricultural Sector. Under the leadership of ICTA'S Regional Director - in coordination with the Technical Director - a Regional Operations Plan is prepared on the basis of needs and resources available. This exercise is generally carried out at the beginning of the year and takes about one week of intensive work in each region.

Executing the Activities

For the execution of the operating plan, the following phases are anticipated. Research to take place in the "Centros de Producción" of ICTA. Various aspects are taken up at this stage such as evaluation of germ plasm, creation of new varieties, study of the physiology of yields, resistance or susceptibility to plant diseases and insects.

Field Trials (Ensayos de Finca) properly located in the area under study in plots provided by farmers make possible evaluating

technical and economic results of experiments carried out in different ecological conditions; and generating, adapting and evaluating, technically and economically alternatives to solve farm problems.

This research activity, controlled by the researcher, counts on the participation of the farmer who contributes land and its preparation. ICTA finances the inputs and the labor necessary. It is at this time that the feed back farmer-researcher - farmer takes place. Is a process of paramount value in improving technology produced.

Farmer's Tests (Parcelas de Prueba)

Technologies considered to have adequate economic and technical possibilities are then given to farmers for their own evaluation under the collaboration and assistance of the technicians. The unit is the same used by farmers (manzana, tarea, cuerda) so that the farmer himself can compare his technology in relation to the new such as a new improved variety, quantities of fertilizers to be used, methods and time of planting. In this process ICTA provides inputs required and the farmer repaid at harvest time. All other costs are borne by the farmers.

Evaluation of Acceptability

With the purpose of assuring the success of alternatives developed, the degree of acceptance is measured on the basis of the utilization of new technology by those farmers that participated the previous year in farmer's tests. The idea is to find what are they making of the practices they learned to manage under the

supervisor. An index of acceptability is developed based on the percentage of farmers that adopted the new technology on their own initiative, and the area on which it was applied.

Transfer of Technology

First and most important clients of ICTA are the "Change Agents" (Credit and Technical Assistance Promoters) of the "Dirección General de Servicios (DIGESA)". Communications between these two institutions have progressed. In 1978 the Regional Committee (formed by representatives of the various institutions) in Region IV approved and a seminar was conducted by ICTA for DECESA'S Promoters to acquaint them on ICTA'S recommended technologies and transfer methodologies to be utilized.

This in-service training was extended in 1979 to include also Region VI personnel ^{and} is expected to cover all the Regions eventually. Promoters, in addition to their regular work, are dedicating half a day per week to participate in seminars, institutes, surveys, fields days. They also participate in farm trials and farmer's tests.

The success of the Production Technology System rests on the fact that 80% of the activity is carried out on the farms themselves which, in turn makes it necessary for the technicians to live in the area under prevailing conditions. There is a continued exchange of ideas and experiences which in turn helps to better orient research work to tackle actual and pressing needs.

Activities Carried Out

Since the very beginning ICTA'S Technical Production Unit had been headed by a Consultant, financed by the Rockefeller Foundation under an agreement with the Government of Guatemala. This Agreement was implemented by ICTA and the "Centro Internacional de Agricultura Tropical - CIAT". The Consultant resigned because of personal reasons in 1976.

ICTA'S management made an analysis of the personnel situation and decided to designate the Servicios Técnicos del Caribe Advisor as Director of the Technical Unit. AID concurred.

A new Regional Director was appointed for Region IV. The technician selected was one of the Agronomists in the "Prueba de Tecnología" Project at La Máquina.

The appointment of the Advisor to the new position coincided with the presentation of results and operating plans for the various areas of activities of the Technical Division providing a good opportunity to analyze the activities to be carried out. Due to budget limitations ICTA'S activities had been spread too thinly.

A plan was proposed to the General Manager to concentrate on ongoing activities halting new activities to an absolute minimum. This plan was approved including the utilization of Agricultural Engineers that were completing the course offered by ICTA in Jutiapapa to reenter key activities. The personnel, the machinery, the equipment and the vehicles were redistributed.

The centralized administrative structure and of the Unit itself made it necessary for the Program Coordinators and support activities to spend much of their time on administrative matters, thus affecting their principal function in supervising and assisting in needed field activities. The Director of the Unit had to take over a large part of the administrative activities of the Coordinators and to rely on the Regional Directors for assistance. This resulted in greater efficiency of the Coordinators.

Later on a reorganization project for the Technical Unit was developed with the participation of Coordinators, Regional Directors and other units of ICTA. It was discussed and approved by the General Manager. Interdisciplinary technical teams have been organized under the leadership of the Regional Directors. The Coordinators are discharging their important duties effectively.

The presentation of research results was regionalized. A week was dedicated to each region and all personnel assigned to the Regional Team participated. Since 1978 the following groups have been added:

**Regional Agricultural Committee and DIGESA'S
Agricultural Promoters**

Previously, these presentations were made before the Coordinators and Regional Directors and it was more of a report to the General Manager without a technical discussion of the results.

The new approach provides an opportunity for field workers to present and discuss their reports. At the same time operating plans for the next crop cycle were drafted. These plans were better oriented towards the solution of problems usually on a priority basis. The participation of the other sector institutions improved communications with ICTA and contributed to enhance the credibility of its achievements.

The drafting of the Budget Project done by Coordinators was now assigned to the region thus better reflecting field needs.

The Advisor recommended to the General Manager organizing consultation groups to advise on institutional policies and make recommendations to the General Management. As a result two Commissions were created, Seed Committee and Statistical Committee.

Through the Seed Committee some strategies were reexamined and defined. They have had considerable impact in the production and distribution of seeds at the national level.

Up to 1976 basic grains seed production was carried out by the Research Centers of ICTA or under contract between the Public Sector and private farmers. The promotion policy was based on high prices for seed producers and low prices for the farmers buying it so that they be motivated to plant the new improved seed. Processing and marketing costs were not considered. Sales moved very slowly. There were losses in storage and surpluses were accumulated all resulting in an economic loss for the public sector.

The Seed Committee assisted in changing this situation. ICTA would dedicate itself from now on to the following activities:

- 1) Produce the basic genetic stock
- 2) Processing and storage of seeds
- 3) Price incentives for producers and distributors of seeds

Private seed production jumped. With the support of the Public Sector both the availability and the demand of seed have increased.

With the assistance of the Statistical Committee uniformity in methodology used by the different teams has been achieved.

A seminar was organized for all technical personnel to discuss basic concepts in relation to the design and interpretation of results. The seminar was carried out simultaneously in the different regions.

The transfer of technology to guarantee that new developments are used by the farmers has been a cause of permanent concern of the General Manager and the Technical Unit.

The Advisor participated in the work of the Commission that prepared a proposal for the Inter-American Development Bank. The Proposal contemplated expansion and consolidation of the activities of ICTA and support for the seed production program. A model for the transfer of technology was designed based on the Guatemalan experience and on the ideas and concepts developed through discussion and self-evaluation in ICTA.

The model contemplates following ICTA'S production technology system to reach the farmer directly. For this purpose it has been proposed that DIGESA Promoters be stationed in ICTA and assigned to the regional teams. The regional teams would operate in "modules". These modules would be integrated by 4 to 6 agronomists in the phases of generating and testing of technology.

There would be three Agricultural Promoters for each Agricultural Engineer in the transfer of technology phase.

There would be ten community leaders for each agricultural promoter in the phase of promoting or escalating the use of technology. These voluntary leaders would not receive a salary but would be compensated indirectly.

The strategy discussed proposed that present credit functions of the agricultural promoters be transferred to BANDESA personnel. It also contemplated some overlapping of activities between the researchers and agricultural promoters and between the promoters and community leaders to assure a continuous flow of information. It was estimated that 25 "modules" would be needed to cover the whole country of which 19 modules were contemplated for the project. The rest would be implemented gradually during a four-year period.

Visits were made to international and regional Research Centers such as CIMMYT in Mexico, CIAT in Colombia; CATIE in Costa Rica and EMBRAPA and EMBRAPER in Brazil. These visits offered the Technical Director the opportunity of exchanging ideas with

scientists and technicians on common problems. It offer also the opportunity to identify materials and information of interest to ICTA.

The Advisor participated in national and international seminars in which he had the opportunity of presenting some of ICTA'S accomplishments and gathered useful information for the use of the Technical Unit.

The field supervisión entrusted to the Technical Director could not be carried out fully because of his demanding administrative responsibilities. This situation should be corrected in the future. Adjustments will have to be made in administrative set-up so that the Director can properly discharge his supervisory duties.

In view of the fact that the external technical assistance program would come to an end within a year, the Advisor recommended the appointment of a national to the position of Director of ICTA'S Technical Division, with a period of overlapping. This recommendation was approved by the General Manager and in November 1978 Agricultural Engineer Pello Ramiro Ortiz was appointed Director. Eng. Ortiz has been working for ICTA since its early years. First, he worked in plant nutrition in the Zaltiplano. Later on he was sent to Chapingo, México to get his M.S. Degree in Soils. Upon his return he was appointed Leader of the "Equipo de Pruebas de Tecnología" and later on Regional Director. He meets fully the requirements for the new post to which he has been appointed.

R E C O M M E N D A T I O N S

1. ICTA needs to demonstrate that it has found an effective strategy to develop and transfer adequate technology to the small farmer. This is necessary to obtain needed National Government support to continue expanding and diversifying its activities.
2. The expansion and diversification of activities should be carried out gradually. It should be started in those areas where there is population pressure on the rural resources and where there are resources susceptible to improvement in their use.
3. It is not advisable to spread its programs too thin trying to cover all crops. It would be better to concentrate efforts on present programs and on new promising programs which clearly have a potential for improving the economy and the welfare of the farmer and his family.
4. It is recommended that action be taken to accelerate the processing of the Loan Project prepared for the "Banco Interamericano de Desarrollo (BID)". These funds are necessary for the above mentioned expansion and diversification of activities.

5. It is necessary to further define the responsibility of the transfer of technology and technical assistance. It can not stand on no man's land.

It has been recommended that both functions be assigned to ICTA. The important decision is to see to it that some one is held responsible for the transfer of technology generated by ICTA. The important thing is not who does it but that it be done effectively and efficiently and that some one is accountable for it.

6. ICTA should take the initiative regarding the "Proyecto de Diversificación de Cultivos en el Altiplano" now under consideration of USAID. It is proposed that the project follows ICTA'S basic strategy.
7. The support ICTA has received through technical and scientific assistance from international institutions has been an important factor on the development of its progress. It is strongly recommended that these valuable relationships be strengthened, at the same time that new sources of support are looked for. Because of the dynamic nature of applied research it needs continuity and a permanent evaluation of its strategies.
8. Some improvement in compensation of personnel is necessary. These efforts already started should be continued. The stability of present technical personnel is important and an increase in salaries will help to keep this personnel in ICTA.

9. The training of personnel should continue to be of concern to ICTA. Efforts should be increased in the in-service and formal training programs.
10. The General Manager is fully loaded with administrative and interinstitutional coordinating functions. Those activities are, of course, fundamental to ICTA. It is recommended that the duties and responsibilities of the Deputy General Manager be reexamined. Without losing the necessary controls and without delegating responsibilities that belong to the General Manager, the Deputy could be entrusted additional coordinating responsibilities in relation to the "Unidad Técnica de Producción, Unidad de Servicios Administrativos, Unidad de Planificación y Programación". Such arrangement could help in improving the support to Regional operations, in general.
11. The decentralization of the activities of the "Unidad de Servicios Administrativos y Financieros" and of the "Unidad de Planificación y Programación" has fallen short of expectations. It is recommended that these services be further decentralized so that Regional Directors may have a better control of the support services which are necessary for the success of their activities.

NOTE

The numbering of recommendations in the English version does not correspond to the Spanish version. However, the recommendations are similar in both versions.