

SMALL FARMER DEVELOPMENT

PROJECT REVIEW

Prepared for
USAID/E1 Salvador

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I N D E X

	Page
I SUMMARY	3
II BACKGROUND	7
A. Introduction	7
B. Target Group	9
III PROJECT DESCRIPTION	13
A. Goal, Purpose and Outputs	13
B. Project Elements	13
1. Research	13
2. Training	17
3. Small Animals and Hogs Reproduction Centers	19
4. Extension	20
IV FEASIBILITY ANALYSES	22
A. Economic Aspects	22
1. Irrigation and Drainage	22
2. Land Transfers	23
3. Agricultural Production Intensification and Diversification	24
Financial Requirements	28
Fruit Production Intensification Price Effect	31
B. Technical Aspects	32
1. Introduction	32
2. Product Diversification	33
Multiple Cropping	34
Fruits	35
Small Animals	36
3. Importation of Plant Material and Livestock	37
4. Technical Assistance	38
C. Institutional Aspects	38
1. CENTA	38
Background	38
Organization	39
Research	40
Agricultural Economics	43
Seed Technology	45
Extension	47
2. Direccion General de Ganaderia	49
Background	49
Organization	50
Small Animals and Hogs	50
Extension	52
3. Conclusions	53
D. Financial Aspects	54
1. Project Cost	54
2. Cost Information	61
3. Farm Models	63
4. Net Cash Increases	66
5. Project Net Cash Flow and Financial Internal Rate of Return	70

V	APPENDIX A: PER HECTARE COST OF PRODUCTION AND FAMILY INCOME	72
VI	APPENDIX B: CENTA ORGANIGRAM	76
VII	APPENDIX C: DGG ORGANIGRAM	79

I SUMMARY

The 1977 Agricultural Sector Assessment (ASA) for El Salvador identified numerous constraints impeding the development of the small farm sub-sector. The Small Farmers Development Project will address a first set of priorities among these constraints through several project specific components.

In this report the feasibility of the expansion of permanent crop production, establishment of livestock improvement centers, improvement of extension training to facilitate the transfer and adoption of appropriate technologies and expansion of data collection and analysis capabilities in MAG to facilitate improved program and policy formulation and evaluation for the small farm sub-sector has been analyzed.

The USAID/El Salvador Mission's goal in the agriculture sector is to increase production, productivity, income and employment of the rural poor target group that includes 83.5 percent of the rural population or about two million people.

By the end of this four year project it is expected to increase by:

- a) 2,000 the number of new farmer owner-operators;
- b) 1,500 the number of small farms with irrigation;
- c) 150 the number of extensionists trained in new production techniques;
- d) 4,500 the number of farmers receiving information from qualified extensionists;
- e) about 30 the number of MAG technicians and professionals trained abroad in new production techniques.

Based on the budgeted differences between a three hectare traditional farm and a model farm of the same size, it was determined that the new agricultural product diversification was economically feasible. This was found true even when conservative estimates of project efficiency were used.

Assuming only 50 percent of the expected annual increase in cash income were to be realized, still the 4,500 farmer-participants will have increased their average annual family income \$425 by the fourth year of the project and by the ninth year by \$1,092 per family. The employment effect due to product diversification will be about 25 percent per farm. The economic impact of the project, again assuming 50 percent of expected efficiency, results in a financial internal rate of return of 59 percent.

To attain project outputs and goals, some technical and institutional constraints will have to be overcome. Four types of research are recommended in the project: a) testing of improved vegetable seed and fruit plant materials; b) field trials and demonstrations; c) economic research; and d) hog research.

A variety of training activities will be needed to assure project success in generating and facilitating the adoption of appropriate technology and improving the technical capability of the Centro de Tecnologia Agropecuaria (CENTA) and Direccion General de Ganaderia (DGG). At least 20 extensionists should receive in-country training in one or two of the following subjects: fruits, vegetables, small animals and hog production, agricultural economics and home economics, resulting in about 150 extensionists trained. Short and long term training abroad has been estimated at about 260 person months.

The total needs of short and long term technical assistance to carry out project research and training activities has been estimated at about 142 person months.

To attain project goals and outputs it will be necessary to increase the number of small animals and swine reproduction centers. It has been estimated that three new small animals centers plus three new swine reproduction centers will be needed.

The problems expected during the implementation of the project will depend very much on the commitment of human and financial resources made by CENTA and DGG. It has not been detected, talking to CENTA's management and staff, that the fruit and vegetable subproject will receive stronger support in human and financial resources in the future. The implementation of the project will require allocation of more of CENTA's technicians working in fruit, vegetables and agricultural economics. Also, CENTA will have to improve salaries of extension technicians in order to reduce turn over in personnel.

The adoption of the new production techniques and changes in farm plans to increase the area under permanent plantations and livestock production will increase farmers' financial needs. The Interamerican Development Bank (IDB) has provided to the Banco de Fomento Agropecuario (BFA) a loan for \$15 million in 1977 to promote fruit and livestock production among small farmers. This loan will reinforce BFA lending capacity during the 1977-1980 disbursement period contemplated in the IDB loan project, but it is expected that project target group financial needs will peak the fourth year after initiation of the project. BFA lending capacity and credit programs for production diversification for small farms will need special attention before and during the implementation of the project. This lending capacity is very welcome since lack of medium and long-term credit would be a serious constraint for small farmers in their efforts to adopt the new activities considered in the project.

Generation of marketing information about prices and marketing channels will help small farmers to get better prices for their products. Helping farmers to market their production at early stages of the implementation of the project will provide information and experience to government technician

and marketing personnel in marketing the new products and the increase in production due to the project. If export marketing is envisaged, there are the buyer contacts, grading, export legal requirements, packaging and crating that must be studied and perfected. This information will help farmers to remove some of the marketing uncertainties for the new products and will accelerate the rate of adoption of the new techniques.

II BACKGROUND

A. Introduction

The Agricultural Sector is the most important sector in the Salvadorean economy. As of 1975, it accounted for 25 percent of GDP, 61 percent of total export earnings, and 37 percent of total employment.

Between 1960 and 1970 agricultural production grew at an annual average rate of 3.0 percent, below the 3.2 percent population growth rate^{1/}. This situation improved during the 1970-1975 period, when production increased at an annual average of 4.4 percent. Most of this expansion has been due to the rapid development of the poultry and milk industry in the country.

Salvadorean agriculture presents a dualistic system: modern, medium and large scale farms engaged in the production of export crops (coffee, cotton and sugar) with access to quite developed marketing systems, side by side with subsistence agriculture, producing mainly basic grains (corn, beans, rice and sorghum), some chickens and hogs, using low levels of technology and limited access to the markets.

Basic grains constitute the basic diet of the rural population, which is deficient in proteins, calories and vitamins. About 25 percent of the total population of El Salvador is consuming less than 1,900 calories per day and 73.4 percent of the children under five are considered malnourished^{2/}.

With the actual production mix of basic grains the average small farm family income is about \$228 per hectare cropped, while with permanent and specialty crops it is about five times as much per hectare cropped^{3/}.

¹Diagnostico del Sistema Agropecuario, 1960-75, Oficina Sectorial de Planificacion Agropecuaria, Ministerio de Agricultura y Ganaderia (MAG) El Salvador, July 1976.

²Nutrition Assessment Report for El Salvador, USAID, May, 1977.

³Agricultural Sector Assessment, USAID/El Salvador, August, 1977.

According to the 1971 census the total number of farms were 270,868 and approximately 50 percent of these farms are below one hectare in size while an additional 21 percent are below two hectares. The census also shows that 92 percent of the farms in El Salvador contain less than ten hectares and that farms of less than two hectares rent more than 50 percent of their land.

To supplement their income a large proportion of small farmers engage in other activities through the year and migrate to work in harvest of cotton, coffee and sugar cane.

Skewed land distribution, limited access to land through medium and long run rental agreements, lack of enough medium and long term credit, lack of available technology and marketing channels for high value production diversification are some of the factors that are constraining the rural poor who want to increase their income above poverty levels.

The Ministry of Agriculture and other government agencies have concentrated many of their activities on small farmers: e.g. the initiation of a small animals reproduction center program by the Direccion General de Ganaderia (DGG), the Banco de Fomento Agropecuario (BFA) credit program to "grupos solidarios"^{1/} and cooperatives, the support prices program for basic grains; the creation of the Salvadoran Institute of Agrarian Transformation (ISTA) in 1975 to secure land tenure rights for low income rural families; and the Price Stabilization Institute (IRA) program to purchase basic grains at guaranteed minimum prices.

The GOES medium term strategy (1968-72) for the agriculture sector includes in its objectives: a) increase the income generated by the sector

^{1/} Group of three to ten farmers with less than two hectares, owned or rented solidarily responsible for paying back the loan. They receive credit for basic grain production and technical supervision from the Centro de Tecnologia Agropecuaria (CENTA).

and improve its distribution; b) promotion of employment-generating production; c) promote import substitution, principally in basic food commodities, and, d) promote a balanced development among the various regions of the country^{1/}.

The 1977 Agriculture Sector Assessment (ASA) identified numerous constraints^{2/} impeding the development of the small farm sub-sector.

This project will address a first set of priorities among these constraints through several project specific components. The project components are: a) the creation of a pilot land purchase program for small farmers in support of GOES land tenure reform; b) continued support of multiple cropping research; c) expansion of permanent crops production; d) establishment of livestock improvement centers. (This component would focus on minor livestock species which are currently important elements in small farmer income); e) improvement of extension training to facilitate the transfer and adoption of appropriate technologies facilitated by the activities of b, c and d above; f) expansion of data collection and analysis capabilities in MAG to facilitate improved program and policy formulation and evaluation for the small-farm subsector; g) expansion and improvement of village-level, self-help irrigation systems.

AID/EI Salvador has requested technical services to analyze the feasibility of activities "a" and "g" above and in this report we will be dealing with a preliminary appraisal of the economic, technical and financial feasibility of activities c,d, e and f.

B. Target Group

The benchmark set by AID in its reply to the Congressional Mandate establishes US \$150 per capita in 1969 dollars as a reasonable upper limit

^{1/}From ASA, USAID/EI Salvador, August 1977, Page 76.

^{2/}ASA USAID/EI Salvador, August 1977, Page 74.

for incomes of those defined as among the rural poor target group. A series of other benchmarks were also established, including infant mortality, nutritional intake, etc. The purpose of the following is to outline a reasonable income definition of the rural poor in El Salvador.

Since the most recent small farm income figures available to the Mission are in 1976 Colones, and since the exchange rate has been stable for many years, all that is needed to compare 1969 to 1976 income is to inflate the 1969 figure to 1976 terms. An annual inflation rate of 6% is assumed between 1969 and 1976 giving a 1976 value of US \$225 per capita as the upper limit on target group incomes. Using the available population and income data, the following table was prepared which indicates the number of people in the target group by region:

Table 1. Rural Poor Target Group: Extended Farm Families
and Landless Rural Workers

Region	Number of Farms	Farm Family Population	Landless Population
West Region	47,979	275,623	
Central (West)	62,565	356,025	
Central (East)	36,664	213,272	
East Region	77,348	475,079	
All Regions	224,556	1,320,099	720,508
Total Target Group Population (Farm & Landless) = 2,040,607			

SOURCE: 1977 Agriculture Sector Assessment

As illustrated above, the rural poor target group includes about two million people or 83.5 percent of the rural population. Sixty-five percent of the target group are members of extended farm families residing permanently on farms while the remainder are landless farm worker families. This constitutes the target group toward which this project is directed.

Net farm income per capita and by region on small farms is presented below:

Table 2. Net Farm Income Per Capita by Farm Size and Region On Small Farms

Farm Size	Net Farm Income per Capita in US\$			
	West Region	Central Region	Central Region	East Region
.5 to 1 Ha.	67	58	57	51
1 to 2 Ha.	125	101	75	74
3 to 4 Ha.	293	283	195	241
5 to 10 Ha.	725	303	303	242
10 to 20 Ha.	1,739	552	497	348
All farms 0-20 Has.	\$ 223	\$ 128	\$ 116	\$ 107

Source: Samuel Daines & Dwight Steen, Statistical Analysis of the Total Target Group. Table 83, page 91. Prepared for USAID/El Salvador, April, 1977.

As we move to the eastern part of the country, for a given farm size, income per capita decreases. It is lowest in the east region where poor soils and unpredictable weather conditions are common. In this area live-stock production predominates, however small farms grow basic grains--corn and sorghum. Available technology in multiple cropping developed by University of Florida has been tested in the east region, but only can be recommended in certain areas close to the central east region (Mercedes Umara -RIVB, see map in Appendix B).

These limitations in available technology in some way restrict the area of influence of the project. In order to alleviate in some aspects the situation of the small farmer in the east region, small animals production could be promoted.

Given the magnitude of the target group (224,556 farms) and the resources available for the project, it is recommended to concentrate in a smaller area in the central regions of the country.

The number of farms that will be affected directly by this project is an estimated 4,500 farms of five hectares or less, with a family population of approximately 27,000 people. It is expected that through the demonstration effect, the number of farms and people benefiting from the project will be greater.

It is expected that farmers will accept the new technology and the shift to permanent plantations rather gradually. Conversations held with some farmers, personal communications of Peace Corp volunteers, and studies on El Salvador show the Salvadorean farmer is not bound by traditions as in other Latin American countries, he is open to change. One small farmer visited was trying a multiple cropping system of corn-tomato. He was ready for harvesting the tomato and was quite satisfied with the results. Another small farmer visited was trying some of the new multiple cropping systems developed by the University of Florida and explained to us that many neighbors came to see his farm and were asking questions about the new system. He also mentioned that he had bought more land for his children.

Farmers in El Salvador, when they can, try to be more productive and adopt new practices that result in higher benefits. Access to information about new techniques, market risk, lack of enough credit, and access to markets are the factors that impede change, not his lack of willingness for change.

III PROJECT DESCRIPTION

A. Goal, Purpose and Outputs

The USAID/EI Salvador Mission's goal in the agriculture sector is to increase production, productivity and income and employment of the rural poor target group^{1/}. The proposed project would impact on all of these concerns by addressing many of the constraints identified in its 1977 ASA.

The purpose of the project is to create new and improve existing agricultural delivery systems essential to addressing the land tenure problem and development of the small farm sub-sector.

By the end of this four year project it is expected to increase by:

a) 2,000 the number of new farmer owner-operators; b) 1,500 the number of small farms with irrigation; c) 150 the number of extensionists trained in new production techniques; d) 4,500 the number of farmers receiving information from qualified extensionists; e) about 30 the number of MAG technicians and professionals trained abroad in fruit and vegetable production, marketing techniques and processing, agricultural economics, home economics, small animals and hog production.

B. Project Elements

In the institutional and technical analysis presented in Section IV B and IV C of this report, some constraints were found in terms of research capability, training of personnel and production capacity of small animals and hog production centers in order to attain the project goals. These needs must be addressed to assure project success.

1. Research

Four types of research are needed in the project: a) testing of improved seed and fruit plant materials; b) field trials and demonstrations;

¹Small Farmer Development, PID, AID/EI Salvador, 1977.

c) economic research; d) hog research.

a. Testing of Improved Seed and Fruit Plant Materials

In a study conducted by Madsen^{1/}, he reports that about 88 percent of vegetable producers have farms of less than four hectares and 51 percent between 0.7 and 3.5 hectares. To most families interviewed in the survey, the production of basic grains was the primary crop and mainly for consumption, and vegetable production was for selling in the market. Small scale vegetable production could be an extra source of income for small farmers.

Research in vegetables should be directed into testing varieties that perform well under unirrigated conditions. Presently, research is aimed to grow vegetables under irrigation conditions during the dry season, limiting the possibilities for the majority of the small farmers who do not have land under irrigation.

Research should look into disease resistant varieties, in developing new cultural practices and in determining optimum plant density, planting period and fertilization rates for different species.

Research in fruits should look into selecting local materials that show good disease resistance and yield potential and in the introduction of new materials from countries with similar ecological conditions to El Salvador. Introduction of musaceous^{2/} resistant to "Panama" and "Moko disease" could result in an expansion of the area planted and in a reduction of musaceous imports. In 1976 about 50 percent of the total value of fruit imports was in musaceous.

¹Albert G. Madsen, El Salvador's Market System, USAID/El Salvador, June, 1975. page 70.

²Scientific name referring to different banana species.

Imported new vegetable seeds and plant materials should be tested in different regions of the country for adaptation, disease resistance and yield potential.

b. Field Trials and Demonstrations

In support of the research conducted in the experimental stations, research should be done through farm cooperators in the different microclimate zones of the country. Farmers involvement at early stages of the research program will result in a significant contribution to the researcher through farmers' comments and observations. Also, field trials could be used for demonstration purposes helping to disseminate information to other farmers.

Extensionists' participation in carrying out research with farm cooperators will result in on-the-job training for the extensionists and the researcher will have time to attend more field trials. Communication of experiences between researcher, extensionist and farmers will increase the training effects expected in the project.

Field trials could also serve as a source of multiplication and distribution of fruit plant materials to small farmers.

c. Economic Research

The project will require generation of information at the farm level to improve farm management techniques and farm planning of the 4,500 small farmers participating in the project.

Information on farm size, land tenure status and farm crop mix specialization for different regions will be needed. Information about resource use in terms of land owned or rented by the farmer, labor and capital, will allow generation of recommendations for using resources more efficiently.

The economic analysis of previously generated technology packages should be used with the farmers to analyze production alternatives in order to modify traditional farm plans in such a way as to yield higher income and employment.

Information about marketing possibilities for the new production activities recommended will have to be generated. Price analyses (trends, cyclic and seasonal movements) for different products will have to be made and the information will have to be interpreted and explained to the farmers to help them in making decisions.

Analysis of time series yield data by region or department, if available, could provide some information about risk for different activities.

Price and yield variability could be used in developing different farm plans and, depending on the financial and economic conditions of the farmer and his risk aversion, different recommendations could result. Some farmers will prefer farm plans with lower income possibilities if they will assure a certain minimum income under unfavorable price and weather conditions.

This information should be part of the material to be presented in training courses to extensionists and other professionals and it also should be distributed to extension agencies.

Farm level generated data could be used to evaluate the impact of the project in the target group and for national level policy recommendations and regional program planning.

d. Swine Research

Hog production among small farmers is very common. The Agriculture Sector Assessment mentions that about one third of small farmer income comes from livestock production, ten percent from hogs. The small farmers usually have one or two "criollo" pigs and chickens fed with left overs and some corn.

The "criollo" pig, even though it has adapted to survive under this type of management, seems to be very inefficient in transforming food into meat. The high cost of hog rations based on grains and the low transformation rate of the "criollo" pig are two of the main obstacles in expanding hog production among small farms.

Coffee, sugar cane and cotton by-products present potential for reducing feed costs. A tropical crop "malanga" (*Colocacia Sculenta*) with high yield per hectare produces a root with high starch content and could also result in lower feed costs.

At present hog research is conducted in CEDA-Izalco where they have 30 Landrace type sows and different "criollo" type sows to test production potential.

Research in terms of using by-products and other products to reduce feed cost is needed. Also, a breeding program trying to incorporate some of the positive characteristics of the criollo pig, prolific and rustic, into some of the highly efficient improved breeds (Duroc, Landrace, etc.) should be attempted.

2. Training

In the institutional analysis presented in Section IV C of this report the need for training of researchers and extensionists of CENTA and DGG was mentioned. A variety of training activities should be included in the project to assure success in generating and facilitating the adoption of appropriate technology by the target group and improving the technical capability of CENTA and DGG. These will include on-the-job training, academic training and short term training of technicians in production,

post harvest handling, marketing and processing techniques of fruits and vegetables and in production and management of small animals and hogs. Training in agricultural economics (production, marketing and farm management) and home economics will also be needed.

A total of approximately 150 extensionists and home agents of CENTA and DGG should receive general training for a period of no less than 14 days each in new multicropping techniques, fruit, vegetable, small animals and hog production, and home economics during the four years of the project (i.e. six five-day courses during the first year of the project).

Some of these extensionists should receive more intensive training in one or two of the subject areas mentioned above including farm management techniques (i.e. cost data collection, budgeting techniques, farm planning).

It is roughly estimated that no less than 20 should receive training in one or two of these areas (fruits, vegetables, agricultural economics, small animals, hogs, and home economics) for a period of about 24 to 30 days^{1/} that will result in about 150 extensionists trained. Some of the researchers working in these areas could also benefit on these four to five week courses.

The type of training mentioned above will be done in the country by MAG professionals and contracted short term training specialists.

Project funds should also be used for academic training abroad. It is roughly estimated that no less than 14 DGG technicians should receive short term training abroad in hog and small animals production and management for periods from three to six months with a total of 60 person months.

Short term training abroad in extension, home economics, fruit and vegetables production will also be needed to upgrade the level of training

¹Academic courses taught by short term contracted and MAG training specialists, six days per week.

of CENTA technicians. It is estimated that a total of 80 person months will be required.

Funds for MS training on fruit, vegetables and agricultural economics will be needed. It is estimated a minimum of 120 person months will be needed for this training.

On-the-job training will also be provided by the long term technical assistance personnel suggested in the project for fruit, vegetables, small animals and hog production.

3. Small Animals and Hogs Reproduction Centers

During the implementation of the project three Small Animals Reproduction Centers (SARP) are expected to be implemented in the Centros de Desarrollo Agropecuario (CEDA), Izalco (R1), Morazan (R1V) and Chalatenango (R11A). Each SARP will multiply dual purpose chickens, rabbits and bees. The estimated number of multiplier animals in each center will be approximately 240 dual purpose chickens, 72 rabbits and 50 bee hives.

Two demonstration centers will be implemented in the "Centros Zootecnicos"^{1/} of Juacotecti in the north central and Jocoaitique in the northeastern regions of the country where the poorest farmers of the target group live.

Farmers and farmers' families involved in the project will be trained in these centers in improved methods of small animals management and marketing. They will also learn about the economic benefits of adopting the new techniques. DGG (small animals) and CENTA extensionists will provide follow up technical assistance to the families involved in the project through farm visits, farmers' meetings and general promotion activities of a similar nature.

Hog reproduction centers should be located in CEDAs Morazan (R1V) and Chalatenango (R11A) while CEDA Izalco could be the central testing station

^{1/} These centers like the CEDA are used for demonstration and training purposes but are smaller in terms of physical facilities. They do not have more than 2.5 hectares of land.

for the improved breeds as well as a reproduction center.

From the reproduction centers improved hogs are to be sold to the target group for meat production and for breeding purposes through extension promotion, farmer training activities and field day demonstrations in the reproduction centers.

4. Extension

CENTA has 200 extensionists and 106 home agents (Educadoras del Hogar) distributed in 72 extension agencies and DGG has 13 technicians working in the field in small animals production and 13 in hog production.

DGG technicians in the field have as a base of operation CENTA's extension agencies. In locations where CENTA doesn't have any agency, DGG has its own offices or the DGG technicians have an office in some other government building.

Given the size of the country and the number of agencies, DGG offices (15)^{1/} and CEDAs, accessibility to the extension agent should not present major difficulties. Also, the size of the farms are so small that in a given area the extension agent has access to many farmers without having to spend too much time traveling.

The transfer of new and improved technology in crops, permanent plantations and minor livestock species should be done by the extension service of CENTA and DGG, through on-farm visits, advice to small farmer groups (i.e. Grupos Solidarios, cooperatives, women's clubs, etc.), farmers' short courses, field days, demonstration farms, youth clubs, radio and other relevant means.

Promotion actions during the first year of the project should concentrate more in those activities which show high returns in a short period of

¹Agr. Pedro Mejia, Hog Program, DGG, Personal Communication.

time (i.e. honey, papaya and in some of the new high return and low risk multiple cropping systems) in order to help target group farmers to increase their actual income and at the same time gain farmers' confidence in the new recommendations. Also, technical assistance should be provided to increase yields of farmers' traditional activities in basic grains and help them by providing marketing information to get better prices for their products.

Farmers usually have some fruit trees. Helping them in improving yields through fertilization, use of pesticides, proper harvesting techniques and post harvest handling and providing information about alternative fruit marketing channels and prices should result in farmers getting higher income from fruit trees and realizing some of the possibilities of gradually shifting more land area to permanent plantations.

Farm planning will play an important role once the farmer realizes the economic possibilities of new activities. In developing new farm plans, extensionists, with the farmer's assistance, should start from the present organization of the farm. Taking into consideration the present level of technology, his preferences, skills and financial situation, the farmer should be led to consider alternative ways in which he can reorganize the use of his land in order to get a higher income. The new alternatives learned because of field days, demonstration plots, etc., and their economic and financial implications should be suggested. Information about credit also should be provided. If land is not being used, production alternatives for using it should be analyzed. Finally, a new plan proposed by the farmer after he considers the alternatives could be prepared to gradually change to a more profitable crop mix.

The experience learned through talking to the farmers should go back to the researchers. Training courses for extensionists, research developed

with farmer demonstrators and extensionists assistance, as well as extensionist reports will help to improve communication of farmers' problems to researchers and thus permit researchers to adapt their work to farmers' needs.

As extensionists, researchers and farmers get more training, research results and information, the number of farmers in the target group receiving technical assistance, improved technological packages and small livestock species is expected to increase from 500 during the first year of the project to 1,000, 1,500 and 1,500 new farmers during the second, third and fourth years respectively for a total of 4,500 farmers getting new technology and higher incomes by the end of the project.

IV FEASIBILITY ANALYSES

A. Economic Aspects

USAID/El Salvador's Agricultural Sector Assessment identified:

1) small farm irrigation and drainage, 2) agricultural production intensification and diversification, and 3) land transfers to poor small farmers, as three actions having the highest potentials for raising incomes of the rural poor. Increased land and water resources per poor farmer and the introduction of higher valued and more labor-intensive farm enterprises are the mechanisms proposed to provide not only more income but to generate new employment opportunities for rural workers as well.

1. Irrigation and Drainage

The technology of irrigation and drainage is especially relevant because of the extreme limitations of agricultural land in the country. The application of this technology will permit intensified use of the suitable soils. Tables on page 371 of El Salvador's Diagnostico for Agriculture (July, 1976) show good irrigation possibilities for 183,700 hectares of land while only 33,270 hectares had been put under irrigation by 1975.

2. Land Transfers

The potential effect of land transfers would be to put income producing resources into the hands of the numerous rural poor who have little or no land resources at their disposal.^{1/} Rural poor families have considerable knowledge of the benefits of simple, appropriate cultivation techniques and would use those within their reach should they have land available to them.^{2/} The high degree of rural unemployment and underemployment among the target group are shown in the following two tables on labor utilization rates:

Table 3. Under-utilization of Labor In Agriculture
Comparisons with other latin American Countries

	<u>Total Underutilization of Agricultural Labor as a Percent of Rural Economically Active Population</u>
El Salvador	47%
Mexico	46%
Paraguay	35%
Peru	31%
Brazil	30%
Colombia	25%
Panama	24%
Chile	20%
Venezuela	19%
Costa Rica	18%
Argentina	10%
Uruguay	9%

Source: International Labor Office, *The Employment Problem in Latin America: Facts, Outlooks and Policies*, Santiago, 1976, Table 6 (estimates circa 1970)

¹ From Annex 1 of Agricultural Sector Assessment, Annex 1, Page 36

² Investigation of the Social and Economic Aspects of a Tenure and Production Program in El Salvador, Allen LeBaron & Associates, Page 4.

Table 4. On-Farm Employment
(Utilization Rates for Small Farms by Farm Size)

Farm Size	On Farm Labor Utilized as a Percent of Farm Labor Available
.5 to 1 Ha.	23.8
1 to 2 Ha.	32.6
3 to 4 Ha.	46.7
5 to 10 Ha.	61.0
10 to 20 Ha.	79.6

Source: Samuel Daines & Dwight Steen, Statistical Analysis of the Rural Poor Target Group, Table 71, prepared for USAID/El Salvador, April 1977.

Placing land area resources in the hands of competent people from the target group would directly increase their labor utilization, their incomes, and their standard of living.

Table 5. A Profile of Land Profitability on Small Farms

Net Income* Per Hectare In The Farm

Farm Size	Net Income (US\$) per Hectare in the Farm			
	West Region	Central (West)	Central (East)	East Region
.5 to 1 Ha.	\$450	\$403	\$355	\$343
1 to 2 Ha.	492	479	252	308
3 to 4 Ha.	494	320	323	276
5 to 10 Ha.	554	264	248	242
10 to 20 Ha.	637	237	210	179
All Small Farms (0-20 Ha.)	\$482	\$404	\$298	\$303

Source: Samuel Daines & Dwight Steen, Statistical Analysis of the Rural Poor Target Group, Table 83.

*Net returns to land, capital, and family labor.

3. Agricultural Production Intensification and Diversification

USAID/El Salvador's Agricultural Sector Assessment identified continued work in multiple cropping and agricultural product diversification as two of the highest potential means of raising rural poor incomes: through the introduction of improved technology in multiple cropping systems and through the introduction of higher value (and more labor-intensive) farm enterprises to

the poor small producers and through the provision of new employment opportunities to under-employed farm families as well as to the landless laborers.

The potential income and employment effects of higher technology levels through cultivation techniques (multiple cropping, pest management, etc.) and specialty crop production as opposed to monoculture in traditional crops are illustrated in the following two tables:

Table 6. Crop Profitability on Small Farms by Crop Type and Region

<u>Region</u>	Net Farm Income per Cropped Hectare (US\$)	
	<u>Basic Grains Cotton and Sugar Cane</u>	<u>Permanent and Specialty Crops</u>
West Region	\$253	\$1,356
Central (west)	248	1,075
Central (east)	210	1,072
East Region	200	923

Source: Samuel Daines & Dwight Steen, Statistical Analysis of the Rural Poor Target Group, Table 83.

Table 7. Labor Requirements by Crop and Technological Level

<u>Crop</u>	Man Days of Labor Required Per Cultivated Hectare Per Year		
	<u>High Level</u>	<u>Mid Level</u>	<u>Low Level</u>
Pineapple	384	285	203
Tobacco	290	255	238
Coffee	188	138	84
Coconut	188	94	10
Bananas	145	92	83
Corn & Beans	129	140	139
Corn & Sorghum	118	116	107
Sisal	153	77	38
Sugar Cane	99	108	125
Cotton	96	108	83
Sesame	80	71	55
Oranges	80	--	--
Beans	70	63	62
Sorghum	59	59	48
Corn	56	83	75
Rice	23	83	66

Source: Ministerio de Agricultura y Ganaderia, El Empleo en El Salvador, San Salvador, 1975, Tables 15, 16 and 17.

Another important area of diversification is found in livestock production which generates more than one third of net farm income on target group farms. Swine and poultry are the predominantly appearing small animals on target group farms with swine accounting for a minimum of 10% of total farm receipts in each region while poultry (eggs and meat combined) contributed 5% to 7% for each region. The following table shows the degree to which livestock contributes and consequently the extent to which improved production efficiency can increase net incomes of the poor small farmer.

Table 8. The Sources of Net Income on Small Farms
by Region and Farm Size

Farm Size & Region	Net Income US\$/Farm	Percentage of Net Income by Source		
		Basic Grains Sugar Cane & Cotton	Permanent Specialty Crops	Livestock Products
.5 to 1 Ha.				
West Region	\$323	41.4%	27.0%	31.5%
Cent. West	291	45.6	24.3	30.0
Cent. East	259	43.2	16.3	40.3
East Region	253	46.2	12.7	41.0
1 to 2 Ha.				
West Region	669	39.0	37.9	22.9
Cent. West	524	45.9	27.2	26.8
Cent. East	479	46.0	17.1	36.7
East Region	426	45.0	18.0	36.9
3 to 4 Ha.				
West Region	1,705	22.6	63.9	13.3
Cent. West	1,113	36.1	37.9	25.9
Cent. East	1,117	42.9	29.5	27.5
East Region	959	38.2	31.7	29.9
5 to 10 Ha.				
West Region	3,965	11.1	80.2	8.6
Cent. West	1,858	29.7	40.8	29.3
Cent. East	1,751	36.6	35.3	27.9
East Region	1,714	37.1	32.0	30.8

Source: Samuel Daines & Dwight Steen, Statistical Analysis of the Rural Poor Target Group, Table 81

In order to analyze the economic feasibility of the new agricultural product diversification, we first looked at the profitability of specific crops and activities (see Annex A). Potential profitability is demonstrated in the Financial Aspects section.

The direct income effects of agricultural product diversification on the 4,500 target farms will not reach their maximum until several years after the project finishes. Based on net family income^{1/} on a model farm of three hectares, it is estimated that by the fourth year of the project these 4,500 small farmers will have increased annual family income by \$1.9 million (assuming 50 percent of efficiency) or about \$425 per family and by the ninth year their increased annual family income will total about \$4.9 million or about \$1,092 per family.

The employment effects due to product diversification will also be significant. Comparing the current utilization of family labor with projected labor requirements for the new activities, the 4,500 target farms will generate an additional 346,400 days of labor or about 25 percent more per farm.

¹Net returns to land, capital and family labor.

Table 9. Labor Requirements

Crop	Traditional Farm		Modern Farm	
	ha	man days	ha	man days
Corn-beans	1.5	198	1	132
Rice	0.5	43		
Corn-Peanuts			0.2	23
Corn-sesame			0.3	38
Majoncho			0.5	24
Fruits	0.1	18	0.2	37
Coffee			0.2	17
Vegetables ^{1/}				16
Others ^{2/}	0.2	46	0.25	95
Pasture	0.2		0.2	
Forest	0.5		0.15	
	<u>3.0</u>	<u>305</u>	<u>3.00</u>	<u>382</u>

Source: Costos de Produccion de Granos Basicos, Hortalizas, Frutales y Cultivos Agro-Industriales, CENTA, MAG. January, 1977. Manual de Costos y de Ingresos Agricolas, Facultad de Ciencias Agronomicas, Publicacion No. 75-1, Universidad de El Salvador, Nov. 1975. Information provided by El Instituto Nacional del Cafe, San Salvador.

¹A total of 1,000 square meters of cucumbers and tomatoes, intercropped with corn-beans. Man days labor requirements were estimated based on a schedule of production operations provided by Dr. John Bieber of University of Florida Mission in El Salvador.

²Labor requirements for taking care of chickens and hogs. In the northern farm it includes additional labor requirements for 50 dual purpose chickens and 20 bee hives.

Conservative estimates of the economic impact of the project (50% of efficiency) results in a financial internal rate of return of 59 percent. It is expected that there will be some spread effect to other farmers resulting in a higher but unestimated rate of return.

a. Financial Requirements

The adoption of the new technology and changes in the crop mix will require additional working capital and funds for purchase of trees, bee hives and small animals.

Based on the farm budgets for the traditional and modern farm, an annual estimate of the increase in financial needs is presented in Table 10.

Table 10. Non Labor Production Expenses

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Traditional Farm	1,556	1,556	1,556	1,556	1,556	1,556
Modern Farm	<u>3,887</u>	<u>4,192</u>	<u>4,059</u>	<u>3,511</u>	<u>3,534</u>	<u>3,707</u>
Increase in financial needs (colones (US\$))	2,321 (\$928)	2,636 (\$1,054)	2,503 (\$1,000)	1,955 (\$782)	1,978 (\$791)	2,151 (\$860)

It is assumed that farmers involved in the project will start investing in small animals and permanent plantations during the first three years of the project and after the fifth year permanent plantations will be in full production requiring heavier fertilization rates and pesticides.

The annual total increase in financial needs for the 4,500 farmers expected to be reached by the project is presented in Table 11.

Table 11. Total Annual Increase in Financial Needs

<u>Year</u>	<u>Increase in Financial Needs per farm</u>	<u>Annual Total Increase in Financial Needs</u> (in US\$ 000)	<u>Number of Farms</u>			
			<u>Year 1</u> 500	<u>Year 2</u> 1,000	<u>Year 3</u> 1,500	<u>Year 4</u> 1,500
1	928	464	464	928	1,392	1,392
2	1,054	1,455	527	1,054	1,581	1,581
3	1,000	2,946	500	1,000	1,500	1,500
4	782	4,364	391	782	1,173	1,173
5	791	4,258	395	791	1,186	1,186
6	860	3,894	430	860	1,290	1,290
7	860	3,649	430	860	1,290	1,290
8	860	3,766	430	860	1,290	1,290
9	860	3,870	430	860	1,290	1,290
10	860	3,870	430	860	1,290	1,290
11	860	3,870	430	860	1,290	1,290
12	860	3,870	430	860	1,290	1,290
13	860	3,870	430	860	1,290	1,290
14	860	3,870	430	860	1,290	1,290
15	860	3,870	430	860	1,290	1,290

If we assume that farmers will borrow the extra cash needed to finance non labor production expenses, the extra financial needs during the fourth year of the project will be about \$4.3 million.

Information about money lent by the BFA during 1975 and 1976 is presented in Table 12.

Table 12. Banco de Fomento Agropecuario Loans
During 1975-1976 (in thousands of Colones)

	<u>1975</u>	<u>1976</u>
Crops		
Basic Grains ^{1/}	31,140	33,837
Export Products ^{2/}	21,052	27,976
Vegetables	729	1,154
Permanent Plantations	183	172
Others	475	804
Livestock	5,391	9,838
Machinery	557	1,634
Agro Industry	67	--
Others	<u>14,501</u>	<u>12,097</u>
Total	74,095	87,512
(US\$)	(29,638)	(35,005)

Source: Memoria del Banco de Fomento Agropecuario de 1976, BFA, El Salvador, February 1977.

¹Corn, sorghum, beans and rice

²Cotton, coffee and sugar cane

The BFA's largest proportion of funds lent to farmers during 1975-76 corresponds to basic grains and export products.

The maximum increase in financial needs (\$4.3 million) due to the project would result in about a 12% increase in the demand for BFA funds relative to 1976. This increase mainly will be for funds for permanent plantations and small animals production.

The Interamerican Development Bank (IDB) has provided to the BFA a loan for \$15 million in 1977 to promote fruit and livestock production among small farmers. This loan will reinforce BFA lending capacity during the 1977-1980 disbursement period contemplated in the IDB loan project, but it is expected that project target group financial needs will peak the fourth year after initiation of the project and will remain high after that. BFA lending

capacity and credit programs for production diversification for small farms will need special attention before and during the implementation of the project. Lack of medium and long term credit for product diversification could result in a very serious constraint for small farmers seeking to change their farm plans and to adopt some of the new activities considered in the project.

b. Fruit Production Intensification Price Effect

The total area planted to fruits in 1976 was 14 thousand hectares ^{1/}, mainly coconut (3,800 has), oranges (3,900 has), musaceous (2,600 has) and pineapple (1,610 has)^{2/}. The area planted to vegetables was 3,700 hectares during the same period.

Annual imports of fruits and vegetables during the last ten years were about 63,000 tons per year^{3/} with a total annual value of about \$3 million. During 1976, musaceous^{4/} represented about 50 percent of the total value for imported fruits^{5/}.

It is expected that by the end of the project the area planted in fruits will increase by about 2,700 hectares. That would result in an increase of approximately 19 percent in the area devoted to fruits in 1976.

Depending on the type of fruits being promoted in the project, the effect on price will vary. If we assume that demand price elasticity for fruits in El Salvador is about -0.70, an increase of 19% in the area planted with fruits would result in a price decrease of about 27%, per capita income and

¹Plan Anual Operativo del Sector Agropecuario, Oficina Sectorial de Planificación Agrícola (OSPA), MAG, February, 1977.

²Anuario de Estadísticas Agropecuarias 76-77, Edición No. 16, Dirección de Economía Agropecuaria, MAG, June, 1977.

³A total of 38,000 tons of vegetables and 41,000 tons of fruits were imported during 1976

⁴Banano, Platano and Majoncho, which is a type of Platano.

⁵About \$1.8 million of fruits and \$2.0 million of vegetables were imported during 1976.

population remaining the same. Even with a fall in prices of 27 percent for some fruits, farm family income still will be higher than producing basic grains.

If we assume that the increase in the area planted will be mainly in musaceous and fruits where El Salvador has a deficit, import substitution would result and a significant drop in prices is not expected^{1/}.

B. Technical Aspects

1. Introduction

As mentioned in the Agricultural Sector Assessment of El Salvador, reports, personal experience of the University of Florida staff, and other investigations, favorable opportunities exist to diversify production which can increase income for small farmers.

Among the products that may be considered for promotion under this project are:

Oranges and other fruits

Musaceous

Coffee

Vegetables

Bees

Dual purpose chickens

Hogs

Some of these products are already being produced on a small scale in El Salvador.

¹In the model farm presented in the financial aspects section, majoncho (a type of musaceous) cost-benefit information was used to illustrate the amount of family income generated by musaceous production. It is not the type of musaceous that El Salvador imports most, so other types will have to be tested and promoted to avoid significant drops in prices.

The changes proposed to shift from the traditional system to the modern system are gradual, trying to maintain the actual multiple cropping system of corn-beans, or corn-sorghum practiced in the country by the small farmer. These products constitute an important component of their diet and income.

Care must be taken in the transitional years, however. There are several difficulties and dangers to be overcome or avoided. New producers of these crops must develop confidence in their ability to manage them, and their production on individual farms should constitute only a small portion of the total cultivated area at first. During the time period between planting and profitable production, a way must be found to at least maintain family income on the smaller amount of land traditionally cropped. This time period may be three to seven years depending on the trees planted, and the most convenient way to cover this problem is through such programs as improved technology packages for annual crops (multiple cropping, insecticides etc.), small animals production (mainly bees), and more profitable multiple cropping combinations already used by some farmers, along with basic grain price supports to shield the early adopter from uncertainties of intra-year price fluctuations.

Farmers are not the only ones who must feel their way in a shift to high valued crops. Government technicians and marketing personnel must learn, too. Even if they already have had experience with marketing the crop, there is the problem of discovering how large a quantity the market will take without sustaining sharp price breaks. And if export marketing is envisaged, there are the customer contacts, grading, export and import legal requirements, packaging and crating that must be studied and perfected.

2. Product Diversification

a. Multiple Cropping

Ecological variability in El Salvador is significant. Varieties which perform well in one zone do not perform satisfactorily at all 60 miles away. Beans perform well 1,300 feet above sea level but not in the coastal area. Variations in temperature are closely related to elevation, and the entire country has a distinct dry season from approximately November through April, making the timing of annual crops highly variable from place to place even though most of them are produced at some time during the rainy season.

Small farmers try to use land as intensively as possible, using multiple cropping (relay intercropping)^{1/} as a system of production. The most common multiple cropping system used by small farmers is corn-beans and corn-sorghum in the eastern part of the country due to poor soils and unpredictable weather conditions.

Corn is planted in May and when corn reaches physiological maturity in August, beans or sorghum are planted. Some of the multiple cropping packages developed by the University of Florida Mission (e.g. corn-beans: cucumber, corn-beans: tomato) are very profitable (see Annex A), but very site specific. They perform well in the Ahuachapan area (Region 1), San Vicente (R 111) and Mercedes Umana (R IV B, West)^{2/}.

In these multiple cropping activities when beans are planted with corn in May the corn then cannot be weeded with oxen. Instead it has to be done by hand which is slow, tedious, and requires a high amount of labor. This is difficult, too, since labor is scarce when everybody is planting and weeding at the same time.^{3/} Also, another difficulty with the newer technology is that cucumber and tomato diseases require special attention and

¹Relay intercropping is a type of multiple cropping and consists of growing two or more crops simultaneously during part of the life cycle of each. In El Salvador beans are planted between corn rows after corn has reached physiological maturity, but before it is ready for harvest.

²Dr. John Biever, University of Florida personal communication.

³David B. Quarles, PSC, Assistant GDO, AID/El Salvador, personal communication.

are difficult to control without a sprayer, especially during the rainy season.

Some other relay intercropping alternatives are corn-sesame and corn-peanuts. Corn is planted in May, as the farmer is used to do, and when corn reaches physiological maturity in August peanuts are planted. Peanuts are a low-risk crop due to drought tolerance, low cost requirements, and high market prices. Sesame, on the other hand, is planted after harvesting the corn, and like peanuts, sesame is a low-risk crop. It possesses drought tolerance and brings a high market price, too.

A corn-cassava system may supplement the basic grain system since it occupies labor at different times and combines both high returns and low risks.

The multiple cropping systems mentioned above have already been tested and adopted by some farmers.^{1/}

In the three hectare model farm presented in Section D, Financial Aspects, the traditional corn-bean multiple cropping activity is maintained and some of the new multiple cropping activities are introduced into the model to estimate the benefits of adding these activities in the project.

b. Fruits

At present CENTA has only three fruit plant distribution centers, San Andres (R11B), Izalco (R1) and Santa Cruz (R111), all of them along the coastal area. In San Andres they mainly have citrus, mangos, and cashews; in Izalco, avocados and papayas; and in Santa Cruz, musaceous.

Each one of these species has special requirements with respect to climate and soil conditions. Papayas produce the highest yields in farms

¹David B. Quarles, PSC, Assistant GDO, AID/El Salvador, personal communication.

located between 300 and 2,600 feet above sea level with good soils and under irrigation. CENTA has imported some papaya varieties from Hawaii and Puerto Rico in the past, but with poor results. At present, CENTA is working in the selection of local material, having obtained good results with one selection.^{1/}

Citrus are more adaptable than papayas. They can be grown in altitudes that vary from 1,000 to 3,000 feet depending on the variety, and produce well without irrigation.

In musaceous, CENTA has two varieties, Pelipita and Cavendish, for multiplication, which are resistant to "Mal de Panama" and "Moko" disease.

CENTA's Seed Technology Division has an annual fruit tree multiplication capacity of 20 thousand citrus, 10 thousand mangos, and 10 thousand aguacates. This amount of material would plant in total no more than 200 hectares of fruit trees.

It is expected that the project needs for fruit trees will exceed their multiplication capacity. Also, the number and location of these centers is a serious constraint to small farmers' access to the improved materials. Means to increase the number of tree distribution centers should be considered in the project. In addition, farmers wanting to buy trees have to go to CENTA headquarters in Santa Tecla and pay before getting the trees. This system is cumbersome and time consuming for small farmers who in general do not have their own means of transportation. The project should consider ways to increase the availability of this improved genetic material.

c. Small Animals

DGG has one small animals reproduction center in Soyapango (twenty

¹El Cultivo del Papayo, Circular No. 4, CENTA, MAG, 1974.

minutes drive from San Salvador) where they have dual purpose chickens, bees, and rabbits. They are planning to start another in CEDA-Izalco (R1) where they already have a reproduction center in bees and carry on DGG hog research. The DGG is planning to develop other reproduction centers in CEDA-Morazan (R1VB) in the north east and CEDA-Chalatenango (R11A) in the north central area of the country where a large proportion of project target group farmers live.

Honey production has become very important in recent years due to high domestic and export prices for honey. DGG is selling bee hives to farmers at \$20 per hive. Farmers are trained in bee keeping in two-day courses organized by the DGG in CEDA-Izalco before receiving the hives.

DGG equipment and facilities for small animals and swine production will have to be increased to carry this project.

3. Importation of Plant Material and Livestock

Importation of plant materials and livestock is regulated by the Departamento de Defensa Agropecuaria of the MAG.

There exist certain limitations on importing trees, seeds and roots from countries where pests and diseases not found in El Salvador are known to exist. There are similar restrictions for importing livestock from countries with foot and mouth disease.

All plant and tree materials have to be imported without soil attached to the roots. The paper work required by the Department to import plant material and livestock consists of filling out a form specifying the kind of material, quantity, country of origin, etc.

Other than these constraints, there seems to be no major problem in bringing new materials to El Salvador

4. Technical Assistance

Success in obtaining the expected output from this project will require a considerable amount of technical assistance and training as is mentioned in the analysis of the agency's capability to implement the project. Some of the expertise required for training extensionists and home agents could be provided by CENTA and DGG. However, outside assistance will be needed to carry out the plant introduction research program, to develop a research program to grow vegetables under unirrigated conditions, to plan and organize the small animals reproduction centers and to give advice on swine research and production. Some outside assistance will be needed for short term training in fruit and vegetable production, post harvest handling, marketing, agricultural economics, home economics and small animals and hog production.

C. Institutional Aspects

The two main project implementing agencies in product diversification and extension are analyzed below.

1. CENTA

a. Background

CENTA operations started in 1942 with the assistance of the USDA. CENTA main activities are in research and extension. The research division is divided into departments, and extension activities consist of advising farm families in production techniques, home economics and youth work.

CENTA's main thrust in research and extension has been in basic grains in the past and it continues to be so.

CENTA is receiving technical advice from CIMMYT in corn and sorghum, from CIAT in rice, beans and cassava, and from IDB a US \$600,000 grant for research in corn and beans. It receives technical assistance from The University of Florida on multiple cropping (AID-Intensive Small Farm Management Project) and IICA is sponsoring a specialist from CATIE to work in

Agricultural Production Systems for small farms.

CENTA's budget in 1977 was about \$3.4 million for operating expenses and \$2.6 million for investment in special projects. Forty percent of CENTA operation expenses were allocated to extension and thirty six percent to research while the remaining funds went to management, administration and the Seed Technology Division.

b. Organization

CENTA is organized in four groups, a management and administration group and three divisions: research, seed technology and extension.

The management and administration group consists of the offices of the General Director, planning, administration, personnel, audit, shops and maintenance, CENTA-AID loan project for plant construction, field operations, legal counsel, external assistance and administration of 72 extension agencies (see Appendix B).

The Research Division has eight departments:

- Plant Science
- Soils
- Plant Parasitology
- Animal Science
- Agricultural Chemistry
- Agricultural Engineering
- Agricultural Economics
- Biometrics

The Seed Technology Division has three departments:

- Production
- Seed Certification
- Seed Processing Plants

The Extension Division has six regional offices, 12 zonal offices and 72 extension agencies.

c. Research

CENTA, starting in 1976, has organized research efforts through interdisciplinary teams. The basic grains programs has four projects (corn, beans, rice and sorghum) each with an interdisciplinary team and about 160 experiments.

CENTA research activities also include industrial crops, vegetables and fruits.

Research activities in vegetables were minimal before 1976, with the exception of technical assistance provided by a University of Florida specialist who worked on peppers, cucumbers and tomatoes. During 1976 a total of three professionals were assigned to work full time in the vegetables program with part time assistance of CENTA specialists in soils, plant disease, etc.

The priorities of this program are directed to those products in which El Salvador is not self sufficient. At present they are working on tomatoes, cabbage, potatoes, peppers, carrots, cassava, sweet potatoes and onions.

The potato research has been under way for four to five years. They are exchanging germplasm materials with CIP and they introduced some potato varieties from Canada. Multiplication of promising potato varieties has begun in CENTA.

Research in cassava has included 51 varieties and they expect to have some of them ready for distribution to farmers in two years. They continue testing for disease and pest resistance and yield potential in introduced varieties of tomatoes, cabbage, peppers, carrots, sweet potatoes and onions.

They do not yet have final results or recommendations to be distributed to the farmers.

Research in broccoli, melon and water melon is not being carried out by CENTA because they are not considered priority products by the government.

CENTA's work in fruit production is small in scale but they have identified fruits with economic potential in the different geographical zones. CENTA staff working in fruit production before 1976 consisted of one professional who was also in charge of vegetables research. In 1976 three Agronomists were assigned to the fruit program.

CENTA's research in fruits is concentrated on about six crops: musaceous, citrus, mango, aguacate, pineapple and cashew. They are also planning to start work on apples, peaches and pears for a small farmer project to be carried out in the northern part of the country.

CENTA research in fruits and vegetables is carried at a sub project level with very little support in human and other resources. CENTA professionals working in fruits and vegetables have very little experience and they have not received any specialized training except for an Agronomist (Ingeniero Agronomo) who received eight months training in citrus and grape production in Peru with AID funds and another Agronomist who went for short term training to a branch of the International Potato Center in Mexico.

Technical assistance to develop a research program to grow vegetables under small farm conditions is needed. Vegetable production in El Salvador is mainly under irrigated conditions. Current research is aimed at growing vegetables under irrigation during the dry season. CENTA research in vegetables should look into imported varieties from neighboring or other countries which perform well under unirrigated conditions. Experiments should be carried out not only at the experiment station level but also through farm cooperators in the different micro climate zones of the country. This will provide a vast experience in a short period of time and also allow

feed back information from the farmer to the researcher. Farmers' involvement at early stages of the research program is very important. Farm production conditions are different than under experimental conditions and farmers' comments should be taken into consideration because they are the ones who will produce the vegetables. Extensionists should assist the researcher in carrying out research with farm cooperators. This will give on-the-job training to the extensionist in the new technology who will then be better trained to help farmers to use the new techniques.

The situation in the fruit research subproject is not different to the one in vegetables. There has not been any significant introduction of new materials in the past and the agronomists lack the experience needed to carry a major research effort in the area.

To carry out the plant introduction research program will require the assistance of a highly experienced professional in the area. Long term technical assistance to develop this program should be considered in the project.

To detect adaptation and production potential of new varieties takes several years. Importation of the appropriate varieties, buds, grafted trees, and trees that could have some chance of success in El Salvador should be sought world wide, particularly in those countries with similar ecological conditions to El Salvador. After initial observation for diseases, insects and general performance, plant materials should be distributed to the regional fruit tree distribution centers where they should be tested and multiplied to be distributed to the farmers. Local plant materials that show good production characteristics and market possibilities should not be overlooked. This plant material could rapidly be multiplied and distributed to the farmers.

Local training should be provided to fruit and vegetable researchers and extensionists in production, post harvest handling and marketing. Losses from handling and transportation are usually high; correct maturity stage for harvest, appropriate handling and use of appropriate containers extend the market life. Researchers should also take these post harvest losses into consideration by selecting varieties that are resistant to less than optimum means of transportation and marketing conditions existing today in El Salvador.

To secure a self-sustaining program after the life of the project, short term training abroad and at the MS level should be provided to CENTA personnel in such fields as fruit production and marketing techniques. Training CENTA personnel at the Master of Science level in fruit and vegetable processing should be considered in the project.

There will be a need in the future for processing facilities which can absorb excess supplies in peak periods and products not acceptable for the fresh market so as to preserve or transform these products for later consumption. The idea is that of developing small facilities with very low overhead cost, located in the production areas.

This expansion in CENTA fruit and vegetable research activities will require an increase in human, material and financial resources above those included in the US \$1.4 million budgeted for CENTA's Research Division in 1978^{1/}.

d. Agricultural Economics

The Department of Agricultural Economics is in the Research Division. The department has a staff composed of a department head and

¹ Ing. Roberto Vega Lara - Head of CENTA's Research Division, personal communication.

three agronomists who have received short term training in economics through one week courses organized by The University of Florida.

The activities of this department are basically directed at generating information through socio-economic studies in different regions of the country in order to recommend production research activities to CENTA's Research Division. The objective of their activities is to provide information for CENTA activities.

In a publication describing future agricultural economics activities, they include the measuring of the social benefits of new technology^{1/}. They do not have the technical capability nor the information for doing some of these studies. There is sufficient literature showing the social benefits, costs and returns to investment in research. Therefore, this is an area where the department should not put resources.

The department staff should work in coordination with the researchers to make the economic and risk analyses of the different technological packages being tested and in developing economic information to be distributed to the farmers to help them in making decisions. More economic information at the farm level is required (e.g. what is the decision making mechanism of the small farmer? How does he decide what to produce and when to buy or sell? What are the management, production, financial and marketing constraints restricting his being engaged in more profitable production activities?).

Generation of farm management information and assistance to the small farmer in reorganizing farm plans should be included in the project.

Working in coordination with extensionists, good input-output data could be collected and implementation of a simple farm record system with small farmers should be tried.

¹ Integracion de Actividades del Departamento de Economia Agricola en la Generacion y Transferencia de Tecnologia producida por CENTA, DEA, MAG. October 1977.

Development of very simple budgets and farm plans easily understood by the farmers could be used by extensionists for on-farm visits and field demonstration days. This will help small farmers to make better use of their resources and to consider alternative ways of modifying traditional farm plans.

More human resources in the Agricultural Economics Department will be needed and local short term training in budgeting and farm planning techniques for extensionists as well as long term training at the MS level for researchers should be contemplated in the project.

An agricultural economist from The University of Florida arrived recently at the post to provide technical assistance to the department. Mr. Tom Walker will spend 60 percent of his time on institution building and 40 percent on multiple cropping economics.

e. Seed Technology

CENTA's Seed Multiplication staff consists of four agronomists and four technicians (Agronomos) assigned to the seed multiplication task and from those, one agronomist and three technicians work in the fruit multiplication centers in San Andres (R11B) and Izalco (R1) and Santa Cruz (R111). In the Seed Certification Department they have 11 technicians working in seed certification and four in the seed laboratory.

Basic grains seed multiplication is their first priority followed by oil seeds, fruit trees and roots. In fruits the priority this year is for fruits adapted to a temperate climate (apples, peaches, pears), species in which they don't have experience, for a small farm development project in the Northern part of the country.^{1/}

¹Ing. Enrique Abel Rubio, head of the CENTA's Seed Technology Division, personal communication.

The Seed Technology Division's present activities in fruits consist of multiplying the trees, but without CENTA making any real effort to promote fruit production through extension. Farmers wanting to buy fruit trees have to go to CENTA headquarters in Santa Tecla (20 minutes drive from San Salvador City), pay for the trees and go to one of the three distribution centers to get the trees. This mechanism and the lack of more distribution centers is a serious constraint for the small farmer who wants to have access to improved materials.

Superior seed stock is in very short supply. Except for some papayas that were imported from Hawaii and Puerto Rico, there has been no importation of new materials for fruit multiplication.

The materials they are using for citrus multiplication are trees that were imported from Florida several years ago. In aguacate they are working with varieties that were imported 20 to 25 years ago and they are using these materials for multiplication in spite of not having the technical approval of fruit researchers. Coordination between the Research and Seed Technology Divisions do not seem to be as good as is necessary.

Coordination of activities between the Research and Seed Technology Divisions will have to be improved. The delimitation of functions between the two Divisions is not clear and there seems to be certain duplication of activities. The introduction of new fruit tree materials is the responsibility of the Seed Technology Division but testing and recommendations to initiate tree multiplication for distribution to the farmers is the Research Division's responsibility.

The Seed Multiplication Division's budget for 1978 has been reduced by 1.1 million colones, leaving just 600,000 colones for operations.^{1/} This

^{1/} Ing. Enrique Angel Rubio, head of CENTA's Seed Technology Division, Personal communication.

reduction in budget will result in a substantial reduction in their volume of activities. As mentioned in the Technical Aspects section, it is expected that the Project needs in fruit multiplication will exceed actual capacity. Means to increase the number of fruit tree distribution centers will have to be considered in the Project.

f. Extension

CENTA has 71 Extension Agencies located throughout the country. They depend on 6 Regional Offices and 12 Zonal Offices. Next year they are planning to add 10 more agencies and five years from now they plan to have a total of 125.

An extension agency has a staff consisting of the agency head, agricultural technicians (less than B. S. degree), a 4-c agent (youth program) and one or two home agents (Educadoras del Hogar). The total number of personnel working in extension is 200, plus 106 home agents.

CENTA's Extension Division has a budget of \$1.3 million for 1977 which is about 40 percent of CENTA's budget. They expect to have the same budget for 1978.^{1/}

Extension's main activities are to provide technical assistance in basic grains production to medium, small and solidary farmer groups. A total of 1300 solidary groups (6-7 farmers per group) received technical assistance in 1976 and the target for 1977 is 1400. Combining individuals and groups they are expecting to provide technical assistance to about 15,000 farmers during 1977.^{2/}

Extensionist also work with farm cooperators in setting up demonstration plots. A total of 840 basic grains and 300 relay intercropping plots were

¹Ing. Agr. Jose Mauricio Manzano, CENTA's Extension Head of Regional Operations. Personal Communication.

²Plan Operativo 1977, CENTA, MAG.

programmed for 1977.

Technical assistance in fruit and vegetable production is not considered a priority in extension programs, so work in that area is marginal. The extension technical assistance target for 1977 is 400 fruit producers plus 1,000 in vegetables. In general extensionists do not have technical information in fruit and vegetable production to disseminate to the farmers.

Lack of technical support from the specialists is not restricted solely to fruits and vegetables. Extensionists have very few opportunities to upgrade their training except for a few short courses organized by CENTA with AID funds.

The CENTA-BID program contemplates sending 5 agricultural technicians for short term training (6 months) in corn and beans production, 1 Agronomist to receive training in plant disease control, and another to get a MS in Agronomy at Chapingo, Mexico.

Extension personnel salaries are low (\$200 per month) compared to what they can get working in the private sector or in other government offices. This results in a high turn over in personnel. Last year approximately 10 percent of the extension personnel left CENTA.

Home agents deal in nutrition, home improvement, clothing, sewing, family planning and handicrafts. They work with about 9,000 families a year through home visits, and Homemakers' Clubs (Clubes de Amas de Casa). There are in total 343 clubs with 14,000 members.^{1/}

Home agents only have high school training and they receive from 8 to 10 weeks training at CENTA before going to work in the field. Their monthly salary ranges between \$140 and \$190. Home agents turn over is not very high compared to extension agents.

¹Poly Fortier Harrison, Women in El Salvador: Some Basic Facts for Development Planning, USAID/El Salvador, April 1977.

Short term local training of extension and home agents should be an important component of the Project.

Increasing the level of income and standard of living of the small farmer will depend very much on the flow and quality of information about production alternatives reaching the farmer. Extensionists and home agents are the ones that work with the farmers. The best research results are worth nothing if they remain on the researcher's desk. The flow of information from research to extension should be continuous through involvement of extensionists in some aspects of the research work at the farm level, and through short courses during the months when field activities are low.

Consideration should be given to sending some abroad for higher level of training in fruit and vegetables production and marketing.

Home agents need home economics training. Some training could be provided locally or in neighboring countries, like Guatemala where there seems to be a good Home Economics School for El Salvador needs.

Two of CENTA's home agents are getting Home Economics training in the U. S. at their own expense.^{1/} They could help, when they come back, in training home agents.

2. Direccion General de Ganaderia

a. Background

The Direccion General de Ganaderia (DDG) is in the Ministerio de Agricultura y Ganaderia and its main functions are research and extension in livestock production. The Direccion General de Ganaderia is receiving technical assistance from the British Government in laboratory techniques and from USDA in epidemiology (Foot and Mouth disease).

¹Ing. Jose Mauricio Manzano, CENTA's Extension Division, personal communication

b. Organization

The Direccion General de Ganaderia organization consists of national headquarters, four regional offices and three Experiment Stations (Centros de Desarrollo Agropecuario-CEDA) in Regions I, II and IV. (See Appendix C)

The DGG budget was about \$2.1 millions for operating expenses and \$0.7 million for special projects in 1977. The Livestock Technology Division (LTD), in charge of extension and training activities in beef, hogs and small animals production shares 20% of the DDG budget.

c. Small Animals and Hogs

The small animals production program is in the LTD and it was initiated in 1975. They have a reproduction center in the DDG headquarters in Soyapango, about 20 minutes drive from San Salvador.

In Soyapango they are working with rabbits, dual purpose chickens and bees. The breeding stock in rabbits consists of about 100 animals and they are expecting that a total of 1600 baby rabbits will be distributed to farmers during the present year. The dual purpose breeding stock consists of 250 hens and they are planning to distribute 39 thousand chicks to farmers during 1977.

The demand for chickens and rabbits largely exceeds the capacity of the facilities in Soyapango so the DGG is planning to start another reproduction center in CEDA-Izalco, Sonsonate -(R1) in 1977 and in the other two CEDA in the future.

They have assigned 26 technicians to the small animals project and through the training departments they have organized 4 short courses in small animals production, to upgrade the level of training of their technicians and 92 short courses on small animals management techniques for farmers, during 1977.

The DGG Small Animals Program is new but is receiving support from DGG. They consider this program an important means in helping small farmers to increase their income.

Short term technical assistance to train DGG small animals professionals in planning, organizing, and managing small animals reproduction centers will be needed.

Implementation of at least two more small animals reproduction centers in different regions of the country will be required. For that purpose, breeding stock and equipment not available in El Salvador will need to be imported.

The DGG has been working on swine production for more than 10 years. In 1975 they received technical assistance on artificial insemination through a British Government program. Research swine production is being carried out in CEDA-Izalco, (R1) where they have 30 Landrace sows. DGG is also working with "criollo swine" in order to estimate their production potential.

Swine facilities in CEDA-Izalco have capacity for about 300 sows and were built about 10 years ago through a program financed by AID. At present they are not fully utilized because most of the activities has been concentrated on research. They are testing different feed combinations in order to find rations that could result in a lower cost. This seems to be one of the main constraints to increased swine production in El Salvador today.

The Swine Extension Program has 16 technicians: the program head, one in artificial insemination, one in marketing and 13 working in the field. Of the 13 technicians working in the field 4 are agronomos, 7 have a high school degree in agriculture and 2 are Agronomy students. Their main

activity is to provide assistance to small and medium size farms.

They have a technical assistance program to the Community Cerron Grande in Chalatenango (R 11A North) where there are about 600 families with an average of 2 hectares per family. In that community there are 150 families who have from two to five hogs. They are planning to extend their technical assistance program to eight more communities in the northern part of the country in 1978.

Hog production shows potential if feed cost can be reduced. Small farmers as an average have one or two "criollo" type pigs. They consider raising pigs as a kind of savings account event though they realize that it is not very profitable. In case of an emergency they sell the pigs to get some extra cash. There is some potential of reducing feed costs by using coffee, sugar cane and other by-products and crops like "Malanga" (Colocacia Sculenta).

Long term technical assistance in hog production and management should be analyzed to be included in the project.

d. Extension

Extension services for small animals and swine is in the LTD and consists of on farm visits and training activities. Training is done in CEDA-Izalco, through one to two days courses. Technical assistance through on farm visits, field days and other means is done by extensionists located in the DGG offices in different regions of the country.

Hog and small animals technicians are distributed in about 12 DGG offices and where CENTA has Extension Agency, the DGG technician is located in the Extension Agency. About 50% of the hog program technicians are in CENTA's Extension Agencies, resulting in a better coordination of extension activities between the two institutions, and a more efficient use of their resources.

Conclusions:

The two institutions, CENTA and DGG, responsible for the implementation of the project have experience in managing technical assistance projects and they have as a priority assistance to small farmers. The success expected during the implementation of the project will depend very much on the commitment of human and financial resources made by these two institutions.

It has not been possible to detect any indication, talking to CENTA management and staff, that the fruit and vegetables subproject will receive stronger support in human and financial resources in the future. CENTA's budget figures were not available for 1978, but indications were that it would be the same as in 1977 for fruit and vegetable work.

The implementation of the project will require allocation of more personnel in the Research Division working in fruit, vegetables and agricultural economics. Long term training of 2 professionals in each of these areas would reduce by more than 50 percent their staff available to carry out the added research activities required by the project. If more personnel is not forthcoming, short term and long term technical assistance personnel in some instances will not even have a counterpart with which to work. Also, CENTA will have to improve salaries of extension technicians in order to reduce turn over in personnel.

The DGG has a program in small animals with a total of 26 professionals and technicians. The hog program has 17 in total. Based on information collected during this analysis, these two programs have very strong support for DGG management.

Mobility, materials and equipment seem to be scarce in both institutions. Success in the implementation of the project will depend very much on the availability of these elements. Special consideration should be given to

this area.

In both institutions, a large proportion of personnel are agricultural technicians (less than BS level) and Agronomists without any kind of post graduate training. Short and long term training should start during the early stages of the implementation of the project.

D. Financial Aspects

1. Project Cost

A cost estimate and disbursement schedule for the four year project is presented in this section.

The cost information has been estimated based on expressed CENTA and DGG management needs of material and equipment to carry out the project. Project cost estimates should be considered as an approximation, based on the best information available at this time.

Cost of Project Elements

(in U.S. \$)

Project Element:

1. Research - Introduction of vegetable seeds, buds, grafted trees, roots, etc.	40,000
- Establishment of a bud bank, fruit tree nursery and maintenance during three years.	46,000
- Materials, equipment, and tractors for vegetable and fruit tree experimental plots and field demonstration trials.	208,400
- Office and laboratory, equipment	157,900
- Research literature, etc.	24,000
- 24 person months of long term T.A. in fruit tree research and plant introduction at a cost of \$6,000 per month.	144,000

- 48 person months of long term T.A. in vegetable production research. 288,000

- 24 person month of long term T.A. in small animals production and reproduction centers organization and management 144,000

- 24 person months of long term T.A. in hog production and feed research 144,000

Research Total A.I.D.

1,196,300

2. Training - 4 person months of short term specialists to train CENTA personnel in fruit production, post harvest handling and marketing techniques, at a cost of \$5,000 per month (about 30 persons-extensionists and researchers-per course of 4 to 5 weeks). A total of 90 people trained. 20,000
- 4 person months of short term specialists to train CENTA personnel in vegetable production, post harvest handling and marketing techniques, at a cost of \$5,000 per month (about 30 persons-extensionists and researchers-per course of 4 to 5 weeks). A total of 90 people trained. 20,000
- 6 person months of short term specialists to train CENTA personnel in farm management and farm planning, at a cost of \$5,000 per month. (About 30 extensionist per course of 4 to 5 weeks). A total of 120 people trained. 30,000

- 4 person months of short term specialist to train CENTA home agents in home economics at a cost of \$5,000 per month (about 30 home agents per course of 4 to 5 weeks). A total of 90 people trained.	20,000
- 4 person months of short term specialists to train DGG personnel in small animals and hog production and management (about 30 persons - DGG and CENTA extensionists ^{1/} and DGG researchers per course of 4 to 5 weeks). A total of 90 people trained.	<u>20,000</u>
Sub-Total A.I.D.	\$ 110,000
- 80 person months of short term training abroad in extension, home economics, fruit and vegetable production, for periods of three to twelve months, at a cost of \$1,500 per month.	120,000
- 60 person months of short term training abroad in swine and small animals production and management for periods of three to six months, at a cost of \$1,500 per month.	<u>90,000</u>
Sub-Total A.I.D.	\$ 210,000
- 120 person months of M.S. level training in fruits, vegetables and agricultural economics at a cost of \$1,100 per month.	<u>132,000</u>
Sub-Total A.I.D.	\$ 132,000
Training Total A.I.D.-----	<u>\$ 452,000</u>

¹The number of DGG technicians working in the small animals and hog program is reduced for the needs of the project and CENTA extensionist could provide technical assistance to farmers in these areas if they are trained.

3. Small Animals and Swine Reproduction Centers.

- Construction of physical plant for three small animals reproduction centers	18,900
- Three 4-ton trucks for ration transportation, etc.	24,000
- Construction of physical plant for three chicken incubation centers	12,600
- Three incubators of 5,000 eggs each	15,000
Equipment	2,280
- Construction of facilities for three dual purpose chickens breeding stock centers	47,998
Equipment	1,080
- Construction of facilities for three rabbit multiplication centers	23,400
Equipment	30,375
- Equipment for three bee multiplication centers	15,660
- Construction of three swine multiplication centers	45,462
- Importation of breeding	
Stock	10,000
Vehicles	72,000
Equipment	22,650

Reproduction Centers Total A.I.D. \$ 341,405
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4. Extension

- Equipment and materials for field days and extension activities in general	10,295
	<hr/>
Extension Total A.I.D.	\$ 10,295
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S U M M A R Y
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1. Research	\$ 1,196,300
2. Training	452,000
3. Reproduction Centers	341,405
4. Extension	10,295
	<hr/>
Total A.I.D.	\$ 2,000,000

FINANCIAL REQUIREMENTS PER GROUP OF ITEMS

	<u>Materials and Equipment</u>	<u>Construc- tions</u>	<u>Technical Assistance</u>	<u>Training Abroad</u>
1. Research	471,300	5,000	720,000	
2. Training				
Short Term			110,000	210,000
Long Term				132,000
3. Reproduction				
Centers				
Small Animals	88,395	102,898		
Hogs	104,650	45,462		
4. Extension	10,295			
	<hr/>	<hr/>	<hr/>	<hr/>
Total A.I.D.	\$ 674,640	153,360	830,000	342,000
	<hr/>	<hr/>	<hr/>	<hr/>

Total A.I.D. \$ 2,000,000

Total GOES (salaries,
equipment, supplies
etc.) \$ 2,000,000

Project Cost \$ 4,000,000

Contingency and Inflation 400,000

Total Project Cost ----- \$ 4,400,000

ESTIMATED DISBURSEMENT SCHEDULE

	Year	Year	Year	Year
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1. Research Equipment	219,300	84,000	84,000	84,000
Construction	5,000			
T.A.	288,000	288,000	72,000	72,000
2. Training	113,000	113,000	113,000	113,000
3. Reproduction Centers	170,703	170,702		
4. Extension	2,574	2,573	2,574	2,574
TOTAL A.I.D.	798,577	658,275	271,574	271,574
TOTAL GOES	500,000	500,000	500,000	500,000
TOTAL	<u>1,298,577</u>	<u>1,158,275</u>	<u>771,574</u>	<u>771,574</u>
Contingency				
Inflation	129,858	115,827	77,157	77,158
TOTAL....\$	<u><u>1,428,435</u></u>	<u><u>1,274,102</u></u>	<u><u>848,731</u></u>	<u><u>848,732</u></u>

2. Cost of Production Information

A summary of cost data published by CENTA, information provided by Dr. John Bieber of The University of Florida on relay intercropping and other sources is presented in Appendix A.

The cost information corresponds to 1976. Some of the fruit yields presented in CENTA publications were under irrigated conditions and for the cost-benefit analysis were reduced by about 20 percent in order to represent growing conditions without irrigation^{1/}. Fruits are assumed to reach the maximum yield between the third and the sixth year, depending on the variety. Oranges in general continue increasing their yield until the tenth year. On the yield side, estimates were made reflecting variable growing conditions through time.

Small animals cost of production was estimated based on input-output information obtained from Mr. Jaime Eduardo Lara^{2/} of the small animal program, DGG. This information was provided during an interview and the information was given from memory. Some of the price and yield information was double-checked from other sources and the cost was estimated. Depreciation of equipment was not included in the cost estimates of broilers and dual purpose chickens because of lack of information. According to Mr. Lara, very little investment is needed in equipment because he recommends the use of materials available on the farm. Based on Mr. Lara's input information, small scale broiler production is not very profitable. Cost information that we found

¹The orange yield considered in the analysis represents about 50 percent of the yield that can be obtained according to "El Cultivo de los Citricos en El Salvador", Boletin No. 57, MAG.

²Mr. Lara had taught small animal production in the Escuela Nacional de Agricultura. He is a person with practical experience and he has developed a kind of intermediate technology for small farmers using cans, bottles, bamboo, etc., to build chicken facilities.

later on broilers and dual purpose chickens shows a profit of \$0.46 per broiler^{1/}. Mortality was not considered in this cost estimate and the feed conversion rate was overly optimistic for chicks raised under farm conditions. With this new cost information, fattening 50 broilers four times per year with a mortality rate of six percent will result in a family income of about \$86. Dual purpose chickens cost estimates also show higher family income, about \$950 per year for 50 dual purpose chickens. We feel safer using the lower income estimates, for broilers and dual purpose chickens, included in the cost information presented in the appendix.

Honey yield under optimum conditions in El Salvador is 80 kg per hive per year. For the purpose of the analysis and trying to represent less than optimum conditions we used 45 kg per hive per year.

The cost and family income generated by fattening four improved hogs per year is \$108^{2/}. These hogs are assumed to be bought at a cost of \$17 each, fed during 150 days and sold when they weigh 180 pounds. The hog cost information is presented to show other alternatives for increasing target group incomes, but it was not included to estimate the benefits of the project.

Based on the cost information presented in Appendix A, two representative farm models (one for a traditional farm, the other for a "modern" farm) were developed to illustrate the possible impact of the project on the target group.

¹Information provided by Ing. Ricardo Alfredo Flores Huezo, Small Animals Program, DGG. MAG.

²Information provided by Mr. Jose Eduardo Ramirez G., Hog Program, DGG, MAG.

3. Farm Models

The traditional farm presented in Table 13 represents the activities of low income farm families in the central region of El Salvador.

The representative farm family income which can be described as the return to family labor, capital and land is \$1,089. The average farm family in that area has about six members resulting in a per capita income of \$180 per year below the \$225 (in 1976 prices) level defined as the rural poor.

The representative "modern farm" (Table 14) shows the mix of activities during the sixth year after initiation of the project. From the traditional system, farm plans were redrawn to include crops and practices which produce a higher return to land, family labor and capital. It was assumed that hired labor was not used. Financial charges were included at an annual interest rate of ten percent.

The family income by the sixth year of the project would be \$3,266 resulting in a per capita income of \$544.

Table 13. Family Income of Traditional Farm

Crops	Ha	Yield ^{4/}	Price	Gross Income	Production Expenses	Family Income
				(Colones)	(Colones)	(Colones)
Corn	1.50	60	15	1,350	550	800
Beans ^{1/}		17	45	1,147	681	466
Rice	0.50	70	22	770	325	445
Pasture	0.20					190
Fruits ^{2/}	0.10					400
Forest	0.50					
Other ^{3/}	0.20					400
	3.00					2,701
						(US \$1,080)

¹Relay intercropping. Beans are planted after corn has reached physiological maturity, but before it is ready for harvest.

²Oranges, Mango, Papaya.

³House, storage, hogs and chickens facilities.

⁴Yield is expressed in quintales (1 quintal = 100 pounds).

Table 14. Income of Modern Farm
Sixth Year After Initiation of Project

Crops	Ha	Yield	Price	Gross Income (Colones)	Non labor Production Expenses (Colones)	Family Income (Colones)
Corn	1.00	70	15	1,050	385	665
Beans ^{1/}		23	45	1,035	454	581
Corn	0.20	70	15	210	77	133
Peanuts ^{1/}		15	88	264	66	198
Corn	0.30	70	15	315	115	200
Sesame ^{1/}		15	63	283	84	199
Majoncho ^{2/}	0.50	1,000 ^{3/}	3.6	1,800	178	1,622
Fruits ^{4/}	0.20			870	68	802
Coffee	0.20	20	170	680	120	560
Pasture	0.20					190
Forest	0.15					
Vegetables ^{5/}				976	230	746
Other ^{6/}	<u>0.25</u>			4,189	1,930	<u>2,269^{7/}</u>
	3.00					8,165 (US \$3,266)

¹Relay intercropping.

²Majoncho is a type of musaceous and the variety considered in this analysis is Pelipita.

³Banana bunches

⁴The area under fruits has been increased by 0.1 ha with 50 percent oranges and 50 percent mangos.

⁵A total of 1,000 square meters of cucumbers and tomatoes intercropped with corn-beans.

⁶Includes space for drying coffee, house, facilities for 50 layers, 20 bee hives and hogs.

⁷Income from 50 dual purpose chickens, 20 bee hives and 1 pig raised under the traditional system.

During the transitional years the shift to permanent plantations has been gradual in order that producers of these crops develop confidence in their ability to manage them. Permanent plantations at first constitute only a small portion of the total farm area. During the time period between planting and profitable production that lasts two to four years or more depending on the trees planted, family income is maintained through programs of improved technology packages for traditional basic grains, introduction of high value new crops like peanuts and sesame, intercropping vegetable production technology and small animals production, mainly bees.

It is estimated that an average family of six will have enough family labor to meet all the labor requirements on the modern farm.

This comparison between the traditional and modern farm shows that it is profitable for low income families to change their actual farm plans, assuming that:

- they receive technical assistance in farm planning, production, post harvest fruit handling, marketing and small animals management.
- They receive enough credit.
- There are tree nurseries and small animals reproduction centers nearby their farms.

Total labor requirements for the traditional and modern farms were presented in Table 9. Comparing the current utilization of family labor with projected labor requirements for the modern farm results in an increase of about 25 percent.

4. Net Cash Increases

Table 15 shows total family income ^{1/} and the increase in annual cash income per farm due to changes in farm plans and adoption of new tech-

¹Net returns to land, capital and family labor

nology. Family income increases by \$263 during the first year of the project and reaches the maximum during the sixth year after initiation of the project.

The total increase in annual cash on the combined 4,500 target farms is presented in Table 15. It reaches its maximum during the ninth year after initiation of the project. It is assumed that the number of farmers in the target group receiving technical assistance, improved technological packages and small livestock species will increase by 500 during the first year of the project, then by 1,000, 1,500 and 1,500 new farmers during the following three years for a total of 4,500 farmers getting new technology and therefore higher incomes as a result of the project.

Table 15. Computation of Net Cash Increases
For Typical Farm Size of Three Hectares
 (US \$)

	Corn	Beans	Rice	Livestock Products	Fruits	Peanuts Sesame	Coffee Platanos	Vegetables	Family Income	Increase in Annual Cash Income per Farm
Traditional Farm Net Cash	320	186	178	236	160				1080	
Project										
Year 1	345	213	178	239	168		(99)	298	1343	263
Year 2	292	170	178	817	210		(117)	298	1848	768
Year 3	410	214		980	242	90	153	298	2387	1307
Year 4	409	228		980	296	154	656	298	3021	1941
Year 5	409	228		980	313	154	869	298	3251	2171
Year 6	409	228		980	321	154	875	298	3265	2185
Year 7	409	228		980	321	154	875	298	3265	2185
Year 8	409	228		980	321	154	875	298	3265	2185
Year 9	409	228		980	321	154	875	298	3265	2185
Year 10	409	228		980	321	154	875	298	3265	2185
Year 11	409	228		980	321	154	875	298	3265	2185
Year 12	409	228		980	321	154	875	298	3265	2185
Year 13	409	228		980	321	154	875	298	3265	2185
Year 14	409	228		980	321	154	875	298	3265	2185
Year 15	409	228		980	321	154	875	298	3265	2185

Table 16. Computation of Total Increase in Cash Income

Year	Increase in ^{1/} Annual Cash Income per Farm	Total Increase in Cash Income (in US\$000)	Additional Farmers in Project			
			Year 1 500	Year 2 1000 (in US\$000)	Year 3 1500	Year 4 1500
1	263	131	131	263	394	394
2	768	647 ^{2/}	384	768	1,152	1,152
3	1,307	1,815	653	1,307	1,960	1,960
4	1,941	3,823	970	1,941	2,911	2,911
5	2,171	6,138	1,085	2,171	3,256	3,256
6	2,185	8,134	1,092	2,185	3,277	3,277
7	2,185	9,444	1,092	2,185	3,277	3,277
8	2,185	9,810	1,092	2,185	3,277	3,277
9	2,185	9,831	1,092	2,185	3,277	3,277
10	2,185	9,831	1,092	2,185	3,277	3,277
11	2,185	9,831	1,092	2,185	3,277	3,277
12	2,185	9,831	1,092	2,185	3,277	3,277
13	2,185	9,831	1,092	2,185	3,277	3,277
14	2,185	9,831	1,092	2,185	3,277	3,277
15	2,185	9,831	1,092	2,185	3,277	3,277

¹From Table 15

²\$768 times 500 farmers plus \$263 times 1000 farmers

5. Project Net Cash Flow and Financial Internal Rate of Return

In order to estimate the project net cash flow and the Financial Internal Rate of Return (FIRR) it is assumed that the three ha. model farm presented in Table 14 represents the average farm of participants in the project and that the total number of farms to receive extension services during the four year project will be 4,500.

The Financial Internal Rate of Return is computed and displayed in Table 17. Rather than compute the FIRR with the expected net cash flow, a more conservative approach was followed. The FIRR was generated by the use of only 50 percent of the expected net cash flow. Even though this conservative posture was taken the Financial Internal Rate of Return was still 59 percent.

Table 17. Project Net Cash Flow and Financial Internal Rate of Return

(US \$000)

Year	Combined Project Costs and Disbursements of USAID and GOES	Increase in Annual Cash of Target Farms		Net Cash Flow	
		Expected Income	50% of Expected Income	Expected Flow	50% of Expected Flow
1	1428	131	65	(1,291)	(1,363)
2	1274	647	323	(627)	(951)
3	849	1,815	907	966	58
4	849	3,823	1,911	2,974	1,062
5		6,138	3,069	6,138	3,069
6		8,134	4,067	8,134	4,067
7		9,444	4,722	9,444	4,722
8		9,810	4,905	9,810	4,905
9		9,831	4,915	9,831	4,915
10		9,831	4,915	9,831	4,915
11		9,831	4,915	9,831	4,915
12		9,831	4,915	9,831	4,915
13		9,831	4,915	9,831	4,915
14		9,831	4,915	9,831	4,915
15		9,831	4,915	9,831	4,915

Financial Internal Rate of Return on 50% of expected net cash flow
59%

PPENDIX A: PER HECTARE COST OF PRODUCTION
AND FAMILY INCOME

PER HECTARE COST OF PRODUCTION AND FAMILY INCOME

Crop	Yield	Unit	Price	Gross Sales	Non labor Production Expenses	Family Income
<u>Relay Intercropping</u>		Quintales (qq)			(Colones and US\$)	
Corn-Beans	Co. 70	quintales	15	1,050	367	1,264
	B 23	quintales	45	1,035	454	(\$ 505)
Corn-Cassava	Co. 85	quintales	15	1,275	732.50	2,615
	Ca. 314	quintales	6.60	2,072.4		(\$1,046)
Corn-Beans Cucumber	Co. 85	quintales	15	1,275	2,133.00	5,137 (\$2,055)
	B. 11	quintales	45	495		
	Co. 550	sacks	10	5,500		
Corn-Beans Tomato	Co. 85	quintales	15	1,275	2,090.00	8,635 (\$3,454)
	B, 10	quintales	45	450		
	T 900	boxes	10	9,000		
Corn-Beans Sweet Potato Polebeans	Co. 85	quintales	15	1,275	1,116.00	3,259 (\$1,304)
	B 10	quintales	45	450		
	SP. 157	quintales	10	1,570		
	P. 24	quintales	45	1,080		
Corn-Beans Polebeans-Sorghum	Co. 85	quintales	15	1,275	1,017.00	3,791 (\$1,516)
	B. 10	quintales	45	450		
	P. 28	quintales	45	1,260		
	S. 62	quintales	13	806		
Corn-Peanuts	Co. 85	quintales	15	1,275	367.30	1,810
	Pe. 14	quintales	88	1,232	329.00	(\$ 724)
Corn-Sesame	Co. 85	quintales	15	1,275	367.30	1,584
	Se. 15	quintales	63	945	269.00	(\$ 634)

PER HECTARE COST OF PRODUCTION AND FAMILY INCOME

Crop	Yield	Unit	Price	Gross Sales	Non labor Production Expenses	Family Income
<u>Permanent Crops</u>						
Oranges ^{1/} (6th year after planted)	43,000	oranges	0.04	1,720	94	1,626 (\$ 650)
Mango ^{2/} (6th year after planted)	32,000	mangos	0.04	1,280	442	838 (\$ 335)
Majonche ^{3/} (3rd year after planted)	1,000	banana bunches	3.60	3,600	339	3,561 (\$1,424)
Banano ^{3/} (3rd year after planted)	1,000	banana bunches	4.80	4,800	339	4,461 (\$1,784)
Coffee ^{4/} (4th year after planted)	20	quintales	170.00 ^{5/}	3,400	600	2,800 (\$1,120)
Avocado "criollo" (6th year after planted)	27,000	avocados	0.05	1,350	337	1,013 (\$ 405)
Pineapple (3rd year after planted)	23,000	pineapple	0.18	4,140	431	3,709 (\$1,483)
Papaya (During the second year after planted)	21,000	papaya	0.38	7,980	2,165	5,815 (\$2,326)
<u>Hog fattening</u>						
Hogs	4	hogs	234	936	664	272 (\$ 108)
<u>Vegetables</u>						
Cabbage	30,000	cabbage	0.20	6,000	902	5,098 (\$2,039)
Lettuce	30,000	lettuce	0.10	3,000	687	2,313 (\$ 925)
Tomato	900	boxes	10	9,000	1,737	7,263 (\$2,905)
Cucumber	550	sacks	10	5,500	571	4,929 (\$1,971)

PER HECTARE COST OF PRODUCTION AND FAMILY INCOME

Crop	Yield	Unit	Price	Gross Sales	Non Labor Production Expenses	Family Income
<u>Small Animals</u>						
Broilers ^{6/}	188	broilers	4.00	752	744	8 (\$ 3.2)
Dual purpose Chickens	8,056 23	eggs hens	0.15 10	1,208 230	1,000	438 (\$ 175)
Rabbits	200	rabbits	9	1,800	1,367	433 (\$ 173.2)
Bees ^{8/}	900	kg	3	2,700	930	1,770 (\$ 708)

Sources: Costos de Produccion de Granos basicos, hortalizas, frutales y cultivos agro-industriales, CENTA, MAG, Jan. 1977

Information provided by Dr. John Bieber of University of Florida Mission in El Salvador.

Information provided by Mr. Jaime Eduardo Lara, Programa de Especies Menores, Direccion General de Ganaderia

Information provided by Institute Nacional del Cafe, San Salvador

1/ Orange Trees start producing during the third year.

2/ Mango trees start producing during the fourth year.

3/ Musaceous start producing during the second year.

4/ Coffee trees start producing during the third year.

5/ Average coffee price paid to producers during 1975-1976 harvest
Campania Salvadorena de Cafe, S. A. Memoria Ejercicio 1975/76, El Salvador.

6/ Fattening of 50 broilers four times per year with a mortality rate of 6%.

7/ Fifty dual purpose chickens with a mortality rate of 6%.

8/ Twenty bee hives.

APPENDIX B: CENTA ORGANIGRAM

ESQUEMA DE REGIONALIZACION Y ZONIFICACION DEL CENTA

GUATEMALA

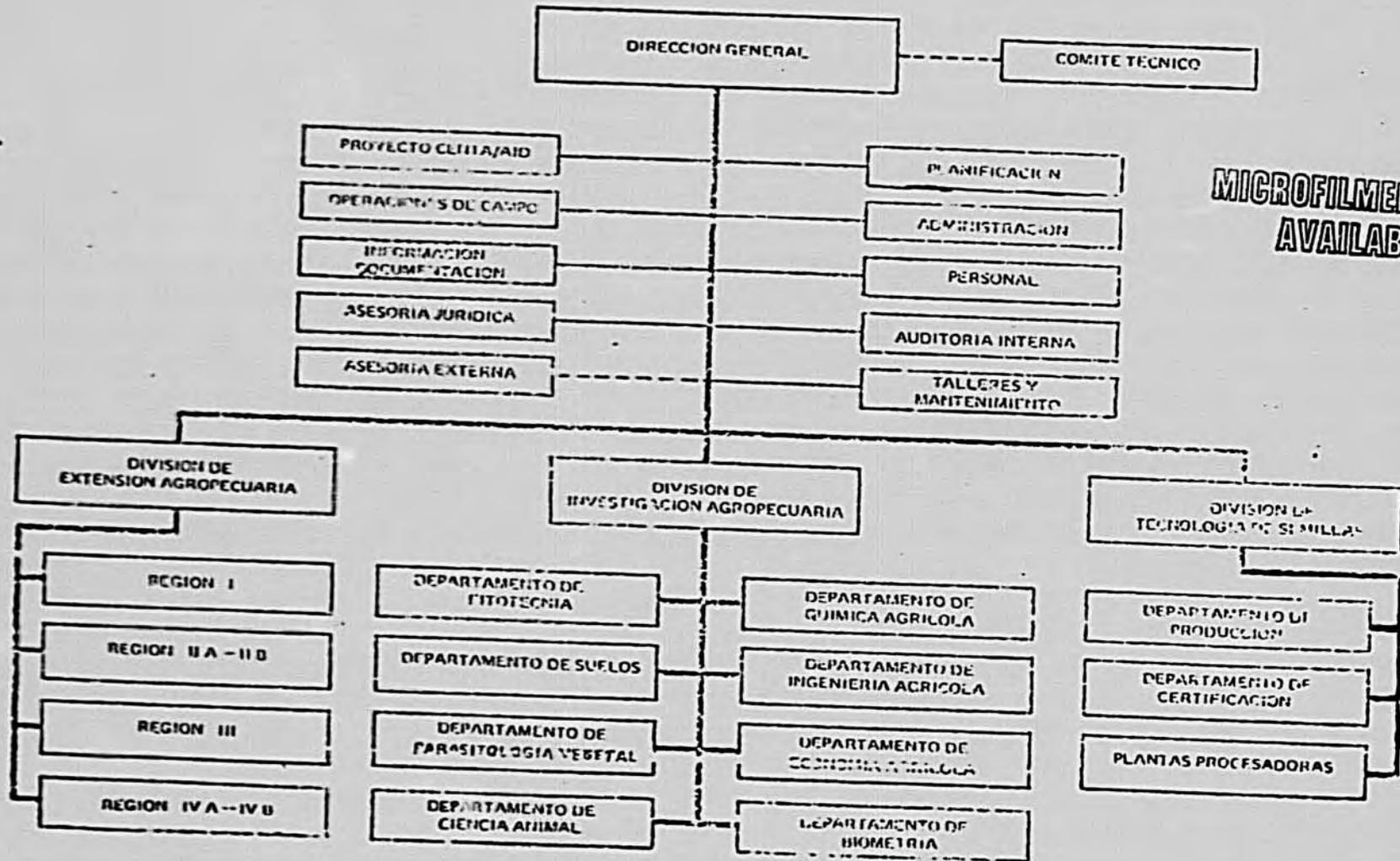
HONDURAS



OCEANO PACIFICO

SIMBOLOGIA	
—	DIVISION REGIONAL
—	DIVISION ZONAL
- - -	DIVISION DEPARTAMENTAL
○	AGENCIA DE EXTENSION
●	SEDE ZONAL

ORGANIGRAMA DEL CENTRO NACIONAL DE TECNOLOGIA AGROPECUARIA
PARA 1977

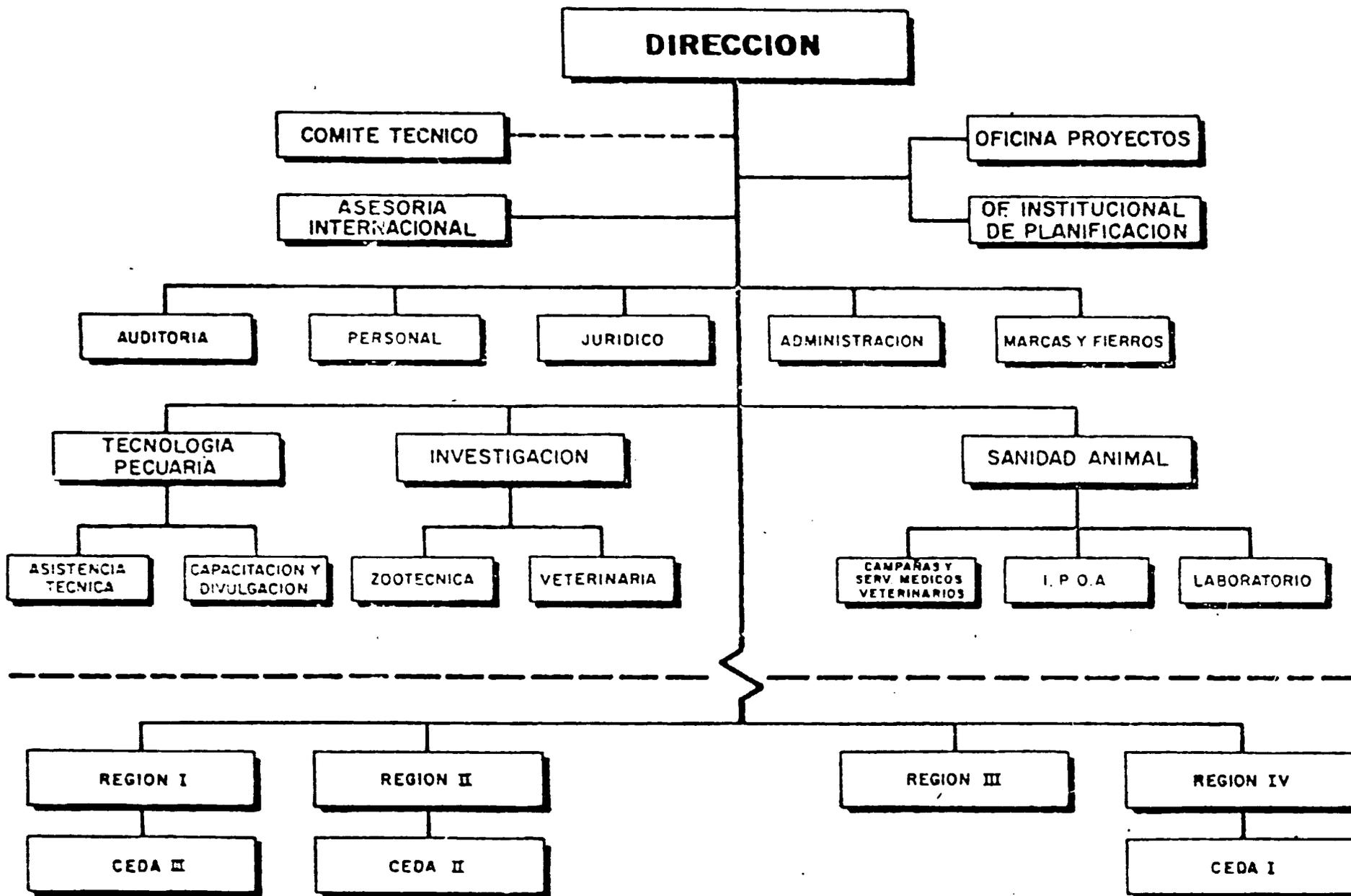


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APPENDIX C: DGG ORGANIGRAM

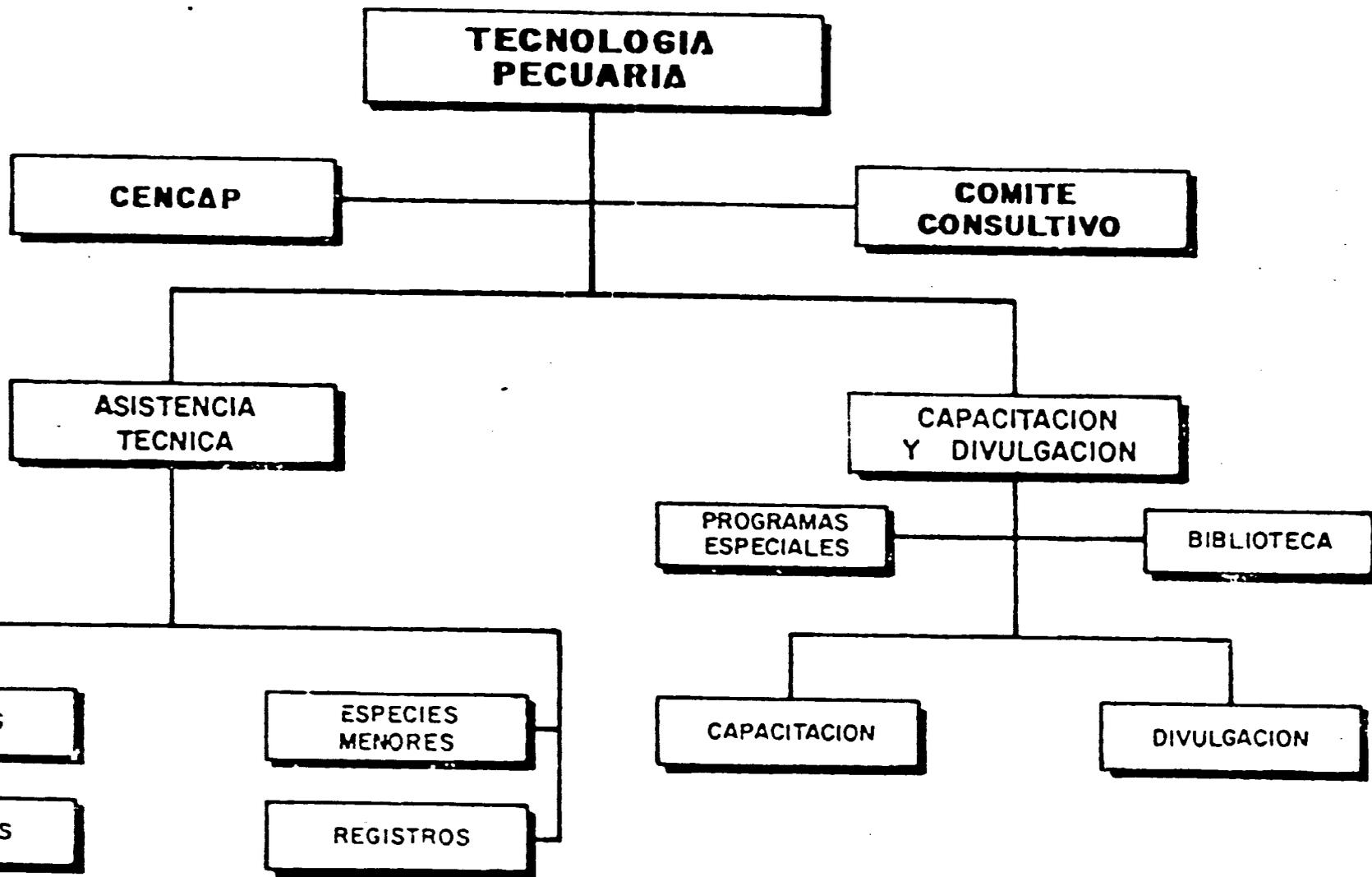
ORGANIGRAMA DE LA DIRECCION GENERAL DE GANADERIA.

Ministerio de Agricultura y Ganadería



ORGANIGRAMA DE TECNOLOGIA PECUARIA

Dirección General de Ganadería



ORGANIGRAMA DE CAPACITACION Y DIVULGACION

Dirección General de Ganadería

