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# AGRICULTURAL RESEARCH IN HONDURAS

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Tegucigalpa, D. C. 1978 Honduras, C. A.

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# AGRICULTURAL RESEARCH

# IN HONDURAS

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# AGRICULTURAL RESEARCH IN HONDURAS

A report to the Minister of Natural Resources on measures to strengthen the national agricultural research organization. Prepared by members of the National Program for Agricultural Research (PNIA) with collaboration from experts provided by the International Agricultural Research Service (IADS).

January 30, 1978

Ministerio de Recursos Naturales
Tegucigalpa, D.C.
Honduras, C.A.

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CRONYMS USED IN "AGRICULTURAL RESEARCH IN HONDURAS"

| | |
|---|---|
| ID | Banco Interamericano de Desarrollo |
| NF | Banco Nacional de Fomento |
| AR | Comité Asesor Regional |
| ATIE | Centro Agronómico Tropical de Investigación y Enseñanza |
| CIA | Comité Consultor de Investigación Agrícola |
| EDIA | Centro de Documentación e Información Agrícola |
| IAT | Centro Internacional de Agricultura Tropical |
| IMMYT | Centro Internacional de Mejoramiento de Maíz y Trigo |
| IP | Centro Internacional de la Papa |
| NAG | Centro Nacional de Agricultura y Ganadería |
| OHBANA | Corporación Hondureña del Banano |
| OHDEFOR | Corporación Hondureña para el Desarrollo Forestal |
| ONSUPLANE | Consejo Superior de Planificación Económica |
| URLA | Centro Universitario Regional Litoral Atlántico |
| AR | Dirección Agrícola Regional |
| GOA | Dirección General de Operaciones Agrícolas |
| ESAGRO | Dirección General de Desarrollo Agropecuario |
| ESARRURAL | Dirección General de Desarrollo Rural |
| AP | Escuela Agrícola Panamericana |
| NA | Escuela Nacional de Agricultura |
| ADS | International Agricultural Development Service |
| HCAFE | Instituto Hondureño del Café |
| HMER | Instituto Hondureño de Mercadeo |
| IICA | Instituto Interamericano de Ciencias Agrícolas |
| INA | Instituto Nacional Agrario |
| INTSOY | International Soybean Program |
| MRN | Ministerio de Recursos Naturales |
| PCCMCA | Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios |
| PNIA | Programa Nacional de Investigación Agropecuaria |
| PROMYF | Proyecto Piloto Maíz y Frijol |
| SIATSA | Servicio Investigación Agrícola Tropical Sociedad Anónima |
| STICA | Servicio Técnico Interamericano de Cooperación Agrícola |
| USAID | United States Agency for International Development |

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## SUMMARY AND RECOMMENDATIONS

In response to a need recognized by the MRN, a study of restructuring and strengthening PNIA was made during the period October 15 - December 15, 1977. The Study Group consisted of members of PNIA and experts provided by IADS.

The objectives of the study were to: 1) develop recommendations as to the size, scope and administrative organization of PNIA, 2) make recommendations for optimal growth of the restructured organization, 3) recommend mechanisms to improve coordination between PNIA and other relevant organizations in Honduras, 4) identify areas requiring technical assistance, and 5) estimate costs to strengthen the program. To fulfill these objectives, the Study Group: 1) analyzed the role of agriculture in the national economy and planning in order to determine research priorities, 2) reviewed the current research programs in the country, 3) identified elements of strategy to strengthen PNIA, 4) described a reorganized system, and 5) made recommendations for implementation with funding implications.

Priorities for PNIA are implicit from an analysis of the role of agriculture in the national economy and in national planning: 1) research should focus primarily on the small to medium farmers (both independent and in the agrarian reform sector) that produce most of the country's basic food crops; and 2) continued stress should be on the basic foodgrains with medium to long-run emphasis on vegetables, oilseed crops and livestock (Ch. III).

A review of current PNIA activities revealed: 1) a program restricted largely to station-based varietal testing and agronomy trials; 2) a basic network of research stations in need of considerable improvement; 3) a serious shortage in trained manpower; 4) productive limited linkages with other foreign and domestic research institutions; and 5) lack of administrative control over the research budget (Ch. III).

Four elements of strategy were identified to make research more effective: 1) farmer-oriented, inter-disciplinary research; 2) strengthening of the

national research station network; 3) a strong manpower development program; and 4) exploitation of opportunities to link with other agricultural research and development institutions engaged in activities complementary to those of PNIA (Ch. III).

The proposed reorganization and reorientation of PNIA is focused on research at the farm level with farmer participation (Ch. VIII). As recommended, PNIA would consist of three basic organizational units: 1) Regional Units, 2) a Central Unit and 3) Headquarters. A Regional Unit would normally be based at an experiment station and work in close collaboration with the DAR. It would consist of two elements: a) a farming systems team responsible for off-station work in system and problem identification, orientation of station research, and evaluation of improved systems; and b) station based technical support teams responsible for development of improved systems components (Ch. IV). The Central Unit would be located at the experiment station at Comayagua with national responsibilities for training, support services and research. The Headquarters would be a small administrative unit a the MRN in Tegucigalpa.

Implementation of the proposed reorganization of PNIA will require a number of decisions, including substantially increased financial support over the five-year period under consideration. The major recommendations follow:

1. In order to have a coherent national program and to operate with the required flexibility, it is recommended that PNIA have full control over the approved research budget and its personnel (Ch. VIII, IX).

2. It is recommended that a Consultative Committee on Agricultural Research (CCIA) be established, with representation from appropriate interested organization* , to advise the Director

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* Extension, INA, CONSUPLANE, Planificación Sectorial, etc.

General of Agricultural Operations on the program of PNIA (Ch. VII, VIII, IX).

3. It is recommended that CAR be charged with the responsibility of insuring review of research at the regional level, and its coordination with related activities under the DARs (Ch. VII, VIII).

4. It is recommended that an extensionist be integrated into each farming systems team (Ch. VI, VII, VIII, IX). While remaining administratively responsible to Extension, the extensionist would provide a critical link between research and technology transfer. It is also envisaged that CAR at the regional level, and the CCIA at the national level, can be effective in linking research and extension.

5. It is recommended that a Central Unit for training, support services, and special research be established at the experiment station at Comayagua (Ch. V, IX).

6. A phased program is recommended for strengthening of the national research station network (Ch. V). Important to this is a master plan of development for the six stations in the network. Transportation requirements should receive particular attention.

7. It is recommended that a technical manpower development program be continued and strengthened, which includes increase in number of scientists and improvement in qualifications (Ch. VI). Included are in-service, in-country training (principally at Comayagua) in-service training at international centers, and training for advanced degrees - primarily at the Master's level. Until PNIA staff are substantially strengthened, both short-term consultants will be needed for advice, training and program implementation.

8. It is recommended that PNIA strengthen and increase linkages with national and international research organizations whose work complements that of its own (Ch. VII).

Support for the proposed program over the next five years will involve a substantial increase in the operating or locally-funded budget, as well as the budget derived from externally-supplied funds (Ch. IX) Part of the latter will be provided by a loan from the World Bank to be administered by IICA. There is a prospect of a second loan from BID in support of research. Additional external support will be needed, and other concerned organizations such as USAID should be approached.

In the last analysis the success of a restructured PNIA will depend on a long-range committment by the Government to support it adequately, and to provide it with the needed degree of flexibility.

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## INTRODUCTION

Honduras is classified as a "Food Priority Country" by the World Food Council, indicating actual and anticipated foodgrain deficits with possible constraints on the financing of future foodgrain imports[1/]. While hunger is not a common occurrence, more than 70% of the population may suffer to some degree from malnutrition. Food production has increased at an annual average rate just about sufficient to keep up with the population growth rate. The annual rate of increased food production is expected to be about 5% in the early 1980s if projected crop production programs are implemented.

The ability of Honduras to reach and sustain its targeted levels of increased food production, and improved nutrition of its people, will require, among other things, a constant source of improved technology, which will require a strengthened national agricultural research system.

The Ministry of Natural Resources (MRN) has become increasingly aware of the need for an effective agricultural research and technology transfer service emphasizing the small and medium-sized farmers who produce the bulk of the country's basic foodgrains (maize, beans, sorghum and rice). Recognition of this need was heightened by the meeting of Government officials with the Tripartite Commission in March 1977. To this end, the MRN has decided to restructure and strengthen research, giving it the administrative flexibility and technical capacity to provide to farmers technology appropriate to their needs.

1/ Food Investment Strategy, 1978-1985. The Government of Honduras Technical Secretariat for Economic Planning. Tegucigalpa, June 1977 Other statistics in this paragraph are from the same source.

Arrangements were made with the International Agricultural Development Service (IADS) to assist in a study of the Honduran agricultur research. The specific objectives of the study are to:

- Develop recommendations as to the size, scope and the administrative organization of the national agricultural research organization.
- Develop recommendations for a strategy, or alternative strategy, for optimal growth of the restructured organization. (these would include financial projections with considerations of financing from external sources, need for laboratory and library, details on a training program, and salaries of professional staff).
- Recommend specific mechanism to assure coordination of activities of the national agricultural research entity with relevant programs of other public and/or private entities in Honduras.
- Identify those aspects that call for technical assistance, with estimates of dates and time needed.
- Estimate the costs and delivery dates of equipment needed to strengthen the program.

To fulfill these objectives the following methodology was used: 1) an analysis of agriculture in the Honduran economy to determine the role and general priorities of research and technology transfer 2) an analysis of the current national agricultural research programs in the country; 3) identification of a strategy (or elements of strategy) to strengthen the national system; 4) description of the new system; and 5) recommendations for phased implementation, including funding implications

This study was made during the period October 15 - December 15, 1971 by members of the National Program of Agricultural Research of the MRN (PNIA), and experts provided by IADS (see Appendix 1).

Key persons in the MRN, and in other government and non-governmental organizations, were interviewed, relevant documents were reviewed, and several agricultural regions were visited. The latter improved understanding of regional research relationships of research to other regional activities, and problems encountered in the interactions of research with the farmer and with extension.

Effort was made to contact as many people as feasible who could contribute to the study, but we were unable to meet all of them due to time constraints. We have tried to include their valuable suggestions, and trust that the report duly reflects them. Appreciation is expressed by the Study Group to all who assisted, but responsibility for the report itself - with all its limitations - rests solely with the Study Group.

## II. AGRICULTURE IN THE HONDURAN ECONOMY[1/]

### A. Current Status

Agriculture is the dominant sector in the Honduran economy, accounting for 37% of the gross domestic product (GDP) and 65% of exports. Seventy percent of the population is rural, with 60% of the labor force in agricultural production. During the 1960s, the population grew at a rate of 3.5% (doubling time: 20 years). The total growth in agricultural production has been higher, primarily because of increased banana and coffee exports. However, the average annual total production and yield of the main cereal crop, maize has been constant during the last decade. Honduras has gone from a significant exporter of both maize and beans (in the early 1970s) to a marginal importer or exporter. With the exception of rice, yields of other food crops have also been constant. Over this same period, livestock production in general has increased somewhat. An increasing amount of wheat and flour is being imported. Other significant imports include edible fats and oils, and milk and other dairy products.

The current agricultural situation is reflected in the low nutritional status of the population. Domestic production provided the average Honduran only 6% more food in 1976 than during the period 1961-65. Per capita GNP income is $340, the lowest in Central America. For the rural population this figure may be less than $100. The poorest half of the population consumed only 68% and 61% of the minimum daily requirements of calories and protein, respectively.

A national food strategy was developed in 1977 to combat malnutrition. This strategy is considered a major step toward redirecting overall agricultural policy to emphasize greater food production.

Sources of information used are listed at the end of this chapter.

This, in turn, would improve the nutritional status of the rural and urban poor.

B. Basic Government Strategies

The Government plans to attain a rapid increase in food production and improvement in nutrition principally by expanding production and improving distribution of the basic food grains - maize, beans, sorghum and rice. This short-run strategy will be complemented in the medium - to long-run by emphasizing crop diversification, expansion of livestock, vegetables, fruits, root crops, soybeans, fisheries, composite flour, and by expanding and improving food storage facilities and indigenous food processing industries.

Initial priorities on basic food grains reflect their importance in the tradicional diet, their relatively low costs, and their predominance in farming systems of small farmers. These flour crops supply about 5% of the calories and 50% of the protein in the Honduran diet, and are cultivated by 70% of all farmers. These crops and livestock provide the principal sources of farmers' incomes.

C. Recent History of Agriculture in Development Plans

The Government has begun to take significant steps to improve the agricultural situation of the country. The first 5-year plan (1974-78) has goals which include increasing per capita GDP by 6% per year over the plan period, more equitable distribution of income, less unemployment and underemployment, and greater integration of the agricultural sector into the national economy.

To implement these objectives, the Government is relying on the Agrarian Reform Law of 1975, the improved performance of existing public organizations, improved technologies to apply to the farming sector, and more development-oriented economic and financial policies

D. Resources for Agricultural Development

1. Land. Honduras is characterized by numerous small agricultural valleys separated by many partial mountains ranges which run in various directions. More than 50% of the land area is mountainous and best suited for forest and lumbering activities. The best soils for agriculture are found in the northern and southern coastal plains, and in the major river valleys.

Of Honduras' 112,088 $km^2$ one third (3,800,000 ha.) is suitable for agriculture. Of this area, one-half (1,900,000 ha.) is suited only for cattle grazing. This leaves about 1,900,000 ha. to be considered for cropping. Crops currently occupy 600,000 ha. - about 30% of the potential crop land. The Government hopes to bring 295,000 more hectares into cropping in 20 major agricultural valleys by the year 2000 (Plan Maestro Vial de Honduras), mainly through proposed irrigation projects, which will account for 77% of the total projected budget for the implementation of the Plan Maestro Vial.

2. Climate. Much of the country is characterized by a bimodal rainfall pattern which, with sufficient rainfall, results in two cropping cycles per year. The climate is tropical and subtropical in the lowlands and coastal areas, and temperate at higher elevations. In no areas are temperatures below freezing. Because of the rugged terrain, there are wide variations in rainfall.

3. Population. Populations is currently increasing at 3.1% annually, with a doubling time of 23 years. Infrastructure (and other) constraints have limited population expansion into several areas with higher quality land, resulting in a concentration of farm population in areas of lower land quality, primarily in the West. Population density ranges from more than

50 persons per $km^2$ in the South to less than 5 persons per $km^2$ in the East.

4. Infrastructure. About one-third of the tillable land is without all-weather roads. The existing roads have been largely concentrated in the more highly populated western third of the country. A general lack of penetration roads into the northeast presents input supply and marketing problems for this area, but steps are being taken to improve the situation.

5. Irrigation and Drainage. A recent estimate places the irrigated area at 54,000 ha., most of which is in the North. A program of small irrigation works currently provides irrigation for an additional 600 - 1,000 ha. per year on farms in the agrarian reform sector (asentamientos). It is expected that emphasis will be placed on bringing substantially more area under irrigation during the next plan period. Flooding and standing water are major problems in the North, but have received little attention.

6. Markets, Price Supports and Storage. A large number of intermediaries participate in assembly and wholesale of basic grain and other food products. Itinerant truckers are the principal link between the farmer (or local buyer) and the main consumption centers or the Banco Nacional de Fomento (BNF) grain buying stations.

The BNF provides minimum price support (delivered to select buying stations) for maize, beans, sorghum and rice. It has purchased little or no grain during the past 3 years, as the market price for these grains has consistently been higher than or equal to, the support price.

Grain is stored on farms and at various wholesale and retail outlets. Losses during storage, especially at the farm level, are reportdly high. National estimates for 1975 were 20 - 50% for maize and 10 - 30% for beans. The Government plans to examine the problems of post-harvest management, especially storage losses, beginning in the region of Olancho. The problem is most severe at the small farm level.

Because of recurrent marketing constraints and difficulties, the Government will create a new autonomous institute - The Honduran Institute of Marketing (IHMER).

7. Other Important Inputs.

a. Credit: credit is supplied primarily by the BNF. Other institutions involved in credit include the network of national banks, Corporación Hondureña del Banano (COHBANA) for smallholder bananas, and Instituto Hondureño del Café (IHCAFE) for smallholder coffee. BNF loans were provided in 1976 to about 36,000 farmers of 50 ha. or less (around 25% of the total farmers in this group). Somewhat more than half of the amount loaned was in cash; the remainder was in kind.

Traditionally most independent farmers with less than 4 ha. have been ineligible to receive loan, as they have no clear land title. Now, however, some without other collateral may pledge their forthcoming crop, and thus become eligible for credit if they agree to use a complete package of recommended practices and accept technical supervision. Special considerations are made for asentamientos.

b. Improved Genetic Stock: improved seeds and/or nursery stock are produced and distributed by the MRN, COHBANA, IHCAFE, The National Agrarian Reform Institute (INA)

(selected development projects) and some private companies. Only a small portion of farmers growing basic foodgrains use improved seed. Two seed processing plants are operated by the MRN - one at Tegucigalpa; the other at San Pedro Sula.

c. Fertilizer: all chemical fertilizer used in Honduras is imported. During the period 1965-74, consumption of nitrogen averaged 12,500 M.T./year; $P_2O_5$ averaged 1,810 M.T./year, and $K_2O$ averaged 6,000 M.T./Year. Use of all three basic nutrients has increased by more than 100% during this period. Fertilizer is distributed by the BNF, COHBANA, IHCAFE, INA (selected development projects), and some private companies. Most is used on bananas, coffee, cotton and sugarcane.

d. Mechanization: labor is often a binding constraint for small farmers during period of land preparation, sowing and harvesting. There is excess labor available during much of the remaining cropping season. The MRN provides some assistance in mechanization through its agricultural services in the DARs. Attention is also being given to the feasibility of a simpler approach to mechanization (USAID support for work through the Panamerican School (EAP) at Zamorano).

E. Production Patterns

1. Land Tenure and Farmer Organization. As of 1968, 48% of Honduran farmer worked 4 has. or less. Traditionally they have received little specific attention from research or in support of services such as extension and credit.

Large tracts of fertile land have often been used for either unimproved pasture or left fallow. The Agrarian Reform

Act of 1975 attempts to substitute technically-developed agricultural units, including asentamientos, for the system of large farms and minifundias. With the exception of lands in bananas, sugarcane, oil palm, coffee, pineapple, citrus and tobacco, holdings above 100 ha. in irrigated districts, and above 2,000 ha. in less developed areas of the country, are all subject to expropriation. A large part of these lands is being grouped into cooperative farms (called asentamientos) of sufficient size to take advantage of some economies of scale, and to permit the members easier access to credit. This represents the agrarian reform sector. Here former landless laborers cooperatively cultivate crops, using a variety of arrangements. As of 1977, some 30,000 farm families were settled on 105,000 has. in about 1,100 asentamientos of cooperative farms. This reformed sector represents between 5-10% of the total farming population.

2. Production Systems. The current types of farming systems may be classified into the non-reformed land and the reformed sectors, as follows:

a. Non-Reformed Sector.

(1) Large-scale commercial plantations, principally sugarcane, oil palm and pineapple.

(2) Independent commercial producers of bananas, coffee, plantains, sugarcane, cotton, fruit and livestock.

(3) Individual small farmers producing basic food crops and rearing some livestock.

b. Reformed Sector.

(1) Agricultural cooperatives producing primarily cereal grains and some vegetables.

(2) Small farmer organizations (mainly asentamientos) producing primarily basic foodgrains.

About 60% of the farming population operates under conditions of low technology and very limited capital. Small and medium size farms (holdings of less than 50 ha.) currently produce about 82% of the maize, 87% of the beans, 49% of the rice and 87% of the sorghum.

3. Regions. The MRN has divided Honduras into seven agricultural regions (Figure 1). The North and parts of the Litoral Atlantic are characterized by intensive cultivation of bananas, pineapple, citrus and oil palm. Maize, rice, beans and cattle are also important.

The West, Central and Central East regions grow maize, beans, potatoes and coffee, cotton, vegetables and cattle. The South produces sorghum, maize, sesame, cotton, coffee, rice, sugarcane and cattle. The East is underdeveloped agriculturally, but has high potential. It produces maize, beans, cotton and livestock.

4. Specific Crops and Livestock.

a. Crops. Bananas account for about 40% of the total cash value of all food crops, but are only cultivated on 4% of the crop land. Among other industrial crops, coffee (over 100,000 ha.), sugarcane (20,000 ha.) and cotton (4,000 ha.) are the most widely grown.

Among foodgrains, maize is grown over the largest area (about 320,000 ha.) with a part associated with other crops. The approximate area devoted to other important food crop is: beans, 75,000 ha., sorghum, 55,000 ha., plantains, 20,000 ha., and rice, 15,000 ha. Cassava, 4,000 ha. and potatoes, less than 1,000 ha., are less important food crops. On a national basis, the 4 basic grain crops represent about 72% of the area planted to all commercial crops (Table 1).

LA CEIBA
REGION No. 4
(LITORAL-ATLANTICO)
SAN PEDRO SULA
GUAYMAS
REGION No. 3 (NORTE)
CATACAMAS
JUTICALPA
REGION No. 5 (ORIENTAL)
STA ROSA
DE COPAN
REGION No. 7
(OCCIDENTAL)
COMAYAGUA
REGION No. 2
(CENTRO OCCIDENTAL)
LA ESPERANZA
REGION No. 6 (CENTRO-ORIENTAL)
DANLI
LAS ACACIAS
REGION No. 1
(SUR)
CHOLUTECA
LA LUJOSA
DIRECCIONES REGIONALES
ESTACIONES EXPERIMENTALES

Table 1

Average Area, Production, and Yield of Four Basic Food Crops, Three-Year Average (1973/74-1975/76) Honduras

| rop | Area Cultivated Ha. | % of All Cultivated Crop Area | Total Production M.T. | Yield M.T./Ha. |
|---|---|---|---|---|
| laize | 320,000 | 50.6 | 319,000 | 1.00 |
| leans | 73,300 | 10.6 | 36,000 | 0.49 |
| orghum | 54,600 | 8.7 | 48,500 | 0.89 |
| ice | 15,800 | 2.3 | 23,100 | 1.45 |
| | | 72.2 | | |

ource: Compendio Agropecuario. Boletin Estadístico de Dirección de Planificación Sectorial del MRN, Febrero, 1977

The yields of maize, beans and sorghum have remained relatively constant during the past decade, while rice yields have increased. More of the drier lands in the South are being planted to sorghum. Maize production has fluctuated between 300,000 and 350,000 M.T./year since 1970. The Government's first 5-year plan proyected about 470,000 M.T. by the year 1978. Reaching this goal may be difficult, so much emphasis will need to be given, to this important crop in the future to avoid substantial imports.

b. Livestock. Cattle, swine and poultry play an important role, both in agriculture and in the national economy, accounting for 24% of total agricultural output and 9% of the GDP in 1974. Livestock ranked fourth ( after bananas, coffee and wood products) in total export value.

(1) Cattle: a major portion of income from livestock is derived from dual purpose cattle, producing both meat and milk (Table 2). In 1974, there were between 1.7 and 2.0 million head of cattle in the country, 80% of which were on farms of less than 50 ha. While 26% of the cattle are concentrated in the North (440,000 head), the remainder are fairly evenly distributed throughout the other 6 regions. Ranching and dairying takes places on about 2.3 million ha., some 21% of the national land area. Pasture with some improvement accounts for about 44% of this land.

The genetic potential of the predominant breed is at present less limiting to production than are nutrition and herd management. Milk produced under the once-a-day milking system is either consumed on the farm, sold as fresh, or processed and later marketed. As of 1974, per capita consumption of

Table 2

Average Gross Income, 1975, For 1,100 Small (Independent) Farms, Honduras[1/]

| Income Group | Clients of BNF Lps | Clients of BNF % | Non-Clients of BNF Lps | Non-Clients of BNF % |
|---|---|---|---|---|
| Crops | 1325.8 | 63 | 1129.6 | 65 |
| Fruit and Horticulture | 30.3 | 1 | 34.6 | 2 |
| Animals and their by-products | 664.5 | 31 | 479.8 | 28 |
| (Cattle-meat products) | (254.3) | (12) | (172.0) | (10) |
| (Cattle-milk and dairy products) | (186.3) | ( 9) | (124.0) | ( 7) |
| Forest Products and Miscellaneous | 90.3 | 4 | 86.7 | 5 |
| Rent of Land, Animals, Machinery, etc. | | | | |
| Total Gross Income: | 2122.3 | 100 | 1737.7 | 100 |

Source: USAID-sponsored interview of 1,100 small farmers conducted in 1975 by ATAC (American Technical Assistance Corporation), in three agricultural regions: the North, South, and East (Olancho),

milk was about 81 liters/year, 10% of which was imported. The same year, 35,400 M.T. of beef was produced, of which 55% was exported and 45% was consumed internally for an average per capita consumption of 5.83 kg. Export quota have always been met.

(2) Swine: Pigs are concentrated on small farms scattered throughout the country. During 1974, 8,600 M.T. of pork was produced, all of which was consumed internally. Swine do not assume the importance in the small farm family that cattle and poultry do.

(3) Poultry: Honduras is self-sufficient in both poultry and eggs. Income from policy and eggs represents 3.9% of the total agricultural output. Traditional poultry and egg production supplies 1.6 million birds (25% of national production) and 43.5 million eggs (19% of national production) annually. Production under this traditional system is low. Diseases are responsible for high rates of mortality and morbidity, since chickens on small farms are not vaccinated.

5. Importance of Crops and Livestock on Small Farms. (from a survey of 1,100 independent small farmers and 180 asentamientos done in 1975 with USAID sponsorship).

a. Small Independent Farms. For the sampled group of 1,100 farmers, an average of 54% of the total value of agricultural production came from maize, 6.5% from sorghum, 8.5% from beans, and 10% from rice. Crops represent about 64% of overall gross farm income, while livestock in general represents about 30%. Meat and milk dominate the livestock production on small farms (Table 2), and represent about 64% of the total value of all animal products. Sale and

consumption of milk represents 27% of this, while cattle sales and home consumption of beef represent 37%. Animal products are available for sale throughout most of the year and have a stabilizing influence on farm income.

b. Asentamientos. Livestock is of little importance on the surveyed collective farms, contributing only about 2.5% of total gross farm income. Crops were much more dominant on collective farms, accounting for more than 91% of total gross incomes. This may in part reflect the fairly new status of many of the asentamientos, and also demonstrates that there is clearly more room for emphasizing livestock on reformed sector holdings.

In summary, these data clearly indicate the importance of basic food crops and of livestock in the nutrition and income of the small farm family.

F. Potential for Increasing Production

The Honduran small farmer currently faces limited alternatives for increasing his personal income. To attack this general problem, the area under cultivation may be expanded (only about one-third of crop land is now under cultivation), or modifications of management and technology can be introduced into the farmers' present farming systems to raise per area yields.

Much of land suitable for cropping is being underutilized because of a lack of access roads, land ternure problems, health problems in the lowlands, and flooding. The potential for increased irrigation is substantial, given proper development and management inputs. However, the initial per family costs may be prohibitively high to warrant rapid massive investment in irrigation infrastructure.

G. Implications for Research.

1. Target Groups. Small to medium sized farms, both in the non-reformed and in the reformed sectors, produce most of basic food crops and livestock products. They are also in greatest need of improved technology to increase productivity and improved income. National priorities continue to place emphasis on the poorest Hondurans: the urban poor and the rural small farmers. Research will, therefore, also stress these groups.

2. Areas. Regional priorities should be determined by several different, and not necessarily complementary, criteria, including proportion of small farmer families, production of the basic food crops and livestock, infraestructure, activities of other national and regional institutions, and potential for impact of research.

3. Commodities. During the last decade production and yields of most basic food crops have remained constant, while internal demand has increased. Livestock is an important component of the small to medium farmers' enterprise as food and a source of income. For these reasons, initial research stress should be placed on the basic grain crops and medium to long-term stress on livestock, vegetables, oilseed crops and crop diversification.

4. Post-Harvest Problems. Consideration must be given to marketing, and to on-farm storrage facilities. When on-farm agronomic experiments show promise for increased production of a given crop, prompt attention should be given to the existing marketing structure. If the crop is a new one in the region, all the steps involved in marketing and processing must be considered. Placing priority on on-farm storage facilities should allow the small farmers to reduce losses and to escape the worst effects of the post-harvest, price fluctuations.

This chapter relies heavily on these sources:

1. Written reports by Ralph Cummings Jr. and Jerome Maner, acting as IADS consultants on Agriculture in the Honduran Economy, and Animal Production and Research, respectively.
2. Draft copies of several 1977 USAID agricultural sector analysis papers, including those by Marvin Brandt (Infrastructure), Antonio Gonzalez Chapel (Agricultural Planning), Roger Sandage (Agricultural Production Base), and Hernán Charneco, Enrique Ortíz, and Pedro Negrón (Credit).
3. Plan Nacional de Desarrollo, 1974-78 (First 5-year Plan).
4. National Investment Strategy for Increasing Food Production: Honduras Prepared by CONSUPLANE for the Consultative Group on Food Production and Investment in Developing Countries, June 23, 1977.
5. Plan y Metodología para Evaluar Resultados del Plan Nacional de Investigación y Extensión Agropecuaria, Mayo 1976 (revisado), Dirección General de Operaciones Agrícolas del MRN, Tegucigalpa, D.C.
6. Compendio Estadístico de ANUARIOS. Dirección General de Estadísticas y Censos: cifras preliminares de 3°Censo Nacional Agropecuario 1973/74.
7. Select findings from the Study of Agricultural Marketing and Inputs Supply for Cooperatives and Asentamientos Campesinos prepared by INVEST, Sept., 1977.
8. ATAC (American Technical Assistance Corporation) Survey of Small Farmers, Conducted in 1975 for an AID-sponsored agricultural sector analysis.
9. Meetings with representatives from:

   a. CONSUPLANE (Technical Secretariat for Economic Planning),
   b. Dirección de Planificación Sectorial del MRN,
   c. AID-sponsored agricultural-sector analysis, 1977, and
   d. Extension Nacional del MRN.

## III. AGRICULTURAL RESEARCH NOW.

### A. Introduction

Here we will consider the history and present status of agricultural research in Honduras under the MRN in terms of organization and administration, experiment stations, staff, program, domestic and external linkages and budget. Our conclusions will be used in later chapters for developing specific recommendations for strengthening PNIA.

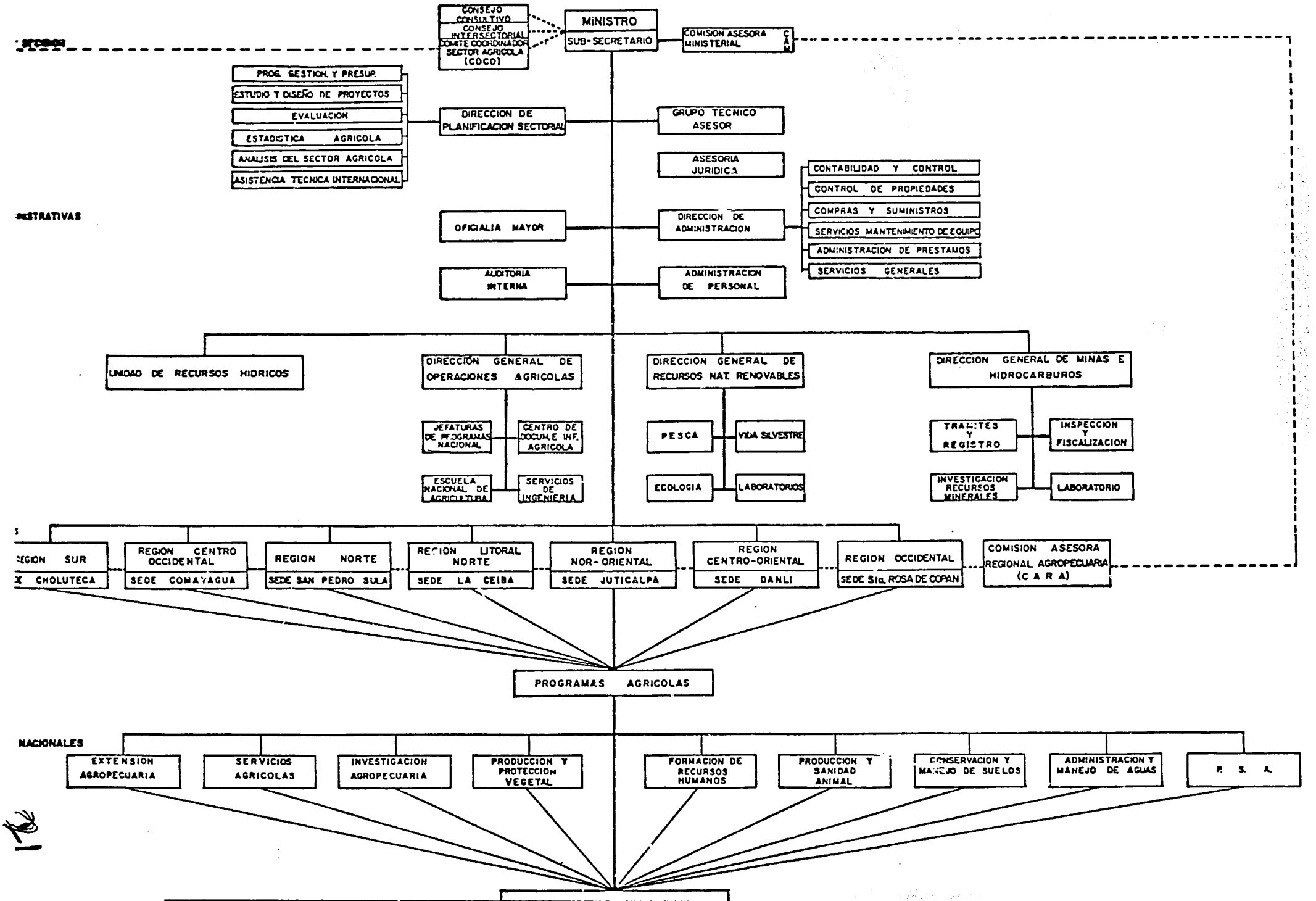
Research in the MRN began in the early 1950s with the Inter-American Technical Service for Agricultural Cooperation (STICA), which was responsible for both research and extension. STICA was superceded by DESARRURAL (Cooperative Service for Rural Development, later the Directorate of Rural Development). In 1974 DESARRURAL was included in the new Directorate General of Agricultural Development (DESAGRO), later called the Directorate General of Agricultural Operations (Dirección General de Operaciones Agrícolas - DGOA), the current title. Research has continually emphasized increased production of basic foodgrains.

In the early 1970s a loan was made by the Inter-American Development Bank (BID) to Honduras to strengthen both research and extension. This loan enabled substantial improvement in the facilities and equipment of the six experiment stations, and the training level of the research staff. The MRN began to emphasize diversification during the loan period, reflected by limited research on oilseed crops, vegetable crops and other cereal crops, including wheat.

### B. Current Organization and Administration of Research

Agricultural programs are generally under the DGOA (see Figure 2) although autonomous institutes are responsible for bananas (COHBANA), coffee (IDCAFE), and forestry (COHDEFOR). Water Resources (Unidad de Recursos Hídricos) reports directly to the Minister.

# SECRETARIA DE RECURSOS NATURALES 1978 HONDURAS C. A.



Programs under the DGOA, which are implemented regionally by the Regional Agricultural Directorates (Direcciones Agrícolas Regionales - DAR), are noted as "Unidades Desconcentradas" in Figure 2. These include Extension, Research, Agricultural Services, Plant Production and Protection, Animal Production and Health, Soil Management and Conservation, and Training (Figure 2 under "Programas Agrícolas Nacionales"). Regional Directorates have the administrative authority and budget control to enable them to execute these programs.

The headquarters of PNIA are at Tegucigalpa in the MRN. Regionally-based research staff are located at the six research station (see Figure 1) and constitute part of the DARs' staff. The experiment stations are generally near these DARs, thus facilitating interaction of research with other regional activities, particularly Extension.

The operation of PNIA as a national entity is complicated by the MRN organizational and administrative structure. The head of PNIA has limited authority to implement approved programs because he does not control regional expenditures of PNIA's budget. The Regional Directors control these, and thus can name and manage research personnel, including their travel both within and outside their region. This makes it impossible to have a strong coordinated national research program. Further complicating the issue, is that the different regional directors control the regional research budgets to various degrees.

## C. Experiment Stations (Infrastructure)

There are six experiment stations in the country (Figure 1 Chapter II, and Table 3). The stations are sufficiently near urban centers

Table 3

Experiment Station Location, Elevation, Size and Areas of Research

| Station | Location | Elevation (m) | Area (ha) | Areas of Investigation 1/ |
|---|---|---|---|---|
| Catacamas 2/ | Region No. 5(Oriental) Olancho, Valle de Catacamas | 440 | 15 | Maize, beans, sorghum, rice, vegetables, soybeans, peanuts |
| Comayagua | Region No. 2 (Centro-occidental) Comayagua, Valle de Comayagua | 600 | 70 | Vegetables, sorghum, maize, rice, beans, soybeans, castor beans peanuts |
| Las Acacias 3/ | Region No. 6 (Centro-oriental) El Paraíso Valle de Jamastrán | 450 | 54 | Beans, maize, sorghum, soybeans, peanuts |
| La Esperanza | Region No. 2 (Centro-occidental) Intibucá | 1,800 | 18 | Potatoes, maize |
| La Lujosa | Region No. 1 (Sur) Choluteca, Choluteca | 60 | 140 | Sorghum, rice, sesame, maize, soybeans |
| Guaymas 4/ | Region No. 3 (Norte) Yoro, Valle de Sula | 60 | 280 | Maize, rice, vegetables soybeans, peanuts, Cropping systems |

1/ Crops are arranged in order of importance within the region. Those underlined indicate that National Program Leader is working at that station.

2/ Catacamas is located at the National School of Agriculture (ENA), about 5 minutes from the city.

3/ The station is about 20 km from Danlí on an unpaved road.

4/ Guaymas is about one hour east of San Pedro Sula on a paved road.

suitable for staff and family accomodations, with the exceptions of Las Acacias (Region No. 6) and Guaymas which is about one hour by paved road from San Pedro Sula. The Comayagua station (Region No. 2) is adjacent to the National Center for Agriculture and Livestock (CNAG) which produces improved cattle and nursery stock. This will be useful when livestock research is initiated.

All stations, except Catacamas (Region No. 5) have a reasonable amount of land for crop research. The station land at Catacamas is on loan from the National School of Agriculture (ENA). A larger tract of land (about 30 has.) might be obtained in the area from INA. Maintaining the station at ENA would facilitate relations between agricultural research and agricultural education. No station is adequately developed and a master plan is needed for each.

Five of the stations are located between zero and 600 meters of elevation, while La Esperanza (Region No. 2) is at 1,800 meters, meeting research needs for potatoes and high altitude maize.

The important agro-climatic zones are reasonably well represented, with the possible exception of the Aguan Valley (Region No. 4). This valley is the target of strong agricultural development efforts which may need direct support during the next five years. Farm-based research should be initiated in Region No. 7, the other region without a station, during the next five years, but technical support from the other regions should be sufficient, thus obviating the need for a station there.

The stations vary in infrastructure (see Table 4). Las Acacias has no permanent structures yet, but office space and a house will be constructed there in 1978 using BID loan funds. Construction at Catacamas will be delayed until long range needs for land are worked out. Considerable investment will be needed to meet

Table 4

Existing Constructions in the Experiment Stations

| Station | Office | Laboratory | Storage | Workshop | Sheds | Houses |
|---|---|---|---|---|---|---|
| Guaymas | 1 | 2 | 2 | 1 | - | 4 |
| Comayagua | 1 | 2 | 2 | 1 | 1 | 4 |
| La Lujosa | 1 | - | 1 | - | 1 | 2 |
| Las Acacias 1/ | - | - | - | - | - | - |
| Catacamas | - | - | 1 | - | 1 | - |
| La Esperanza | - | - | 1 | - | 1 | - |
| TOTAL | 3 | 4 | 7 | 2 | 4 | 10 |

1/ At Las Acacias a house and office space will be constructed in 1978 using BID loan funds.

the infrastructure requirements of all stations. The Program of Soil Conservation and Management, under the DGOA, has a soils laboratory located in Tegucigalpa which will soon have a new building. The lack of other laboratories is not an immediate concern.

All stations have two or more vehicles, and all but Las Acacias have at least one tractor with a set of basic implements (see Table 5). Approximately 25% of the vehicles are fairly new, while the rest are generally in poor running condition. This reflects a lack of routine maintenance and repair as none of the stations have the basic tools and equipment for this.

The limited library and publications services available to researchers are from the Agricultural Documentation and Information Center (CEDIA) of the MRN, which is located in Comayaguela. None of the stations maintain working libraries. CEDIA maintains subscriptions of technical journals and other publications of interest to agricultural scientists. It has photocopy and micro-film services, and can provide copies of journal articles. It also distributes periodically a list of publications received. Few requests are received from the stations for library services. A more complete library is found at the Panamerican Agriculture School at Zamorano. CEDIA also has printing facilities for MRN publications, but serious delays are often involved in publishing research results

## D. Staff

PNIA currently has 39 technical staff including four with Ph.D., three with M.S., one with a B.S., 24 with the Ing. Agr., and seven Agrónomos. Six (including all the Ph. Ds.) are based in Tegucigalpa, while the others are at the six experiment stations (see Appendix 5). At least four persons are expected to return

Table 5

Vehicles and Major Field Equipment at the Experiment Stations[1/]

| Station | Vehicles[2/] | Equipment[3/] |
|---|---|---|
| Guaymas | 5 | 4 |
| Comayagua | 2 | 2 |
| La Lujosa | 3 | 3 |
| Las Acacias | 2 | 0 |
| Catacamas | 3 | 1 |
| La Esperanza | 2 | 1 |
| Total | 17 | 11 |

1/ About 90% obtained under a BID loan

2/ Approximately 25% are fairly new, with the rest in poor repair and likely to need a replacement during the next few years. One additional vehicle is used by PNIA staff in Tegucigalpa.

3/ Only tractor and basic implements.

from studies in 1978 (one Ph.D., two M.S. and one Ing. Agr.). Two others with the M.S. may also join PNIA in 1978.

The staff in Tegucigalpa represents the disciplines of agronomy, plant pathology, plant breeding, entomology and agricultural economics, and supports the experiment station staff with disciplinary and crop-oriented expertise. These staff members are recent arrivals and have had little time to develop their work programs. The location of these researchers is a serious question, considering the shortage of trained staff. Some experiment staion staff have national responsibility for crop investment program.

Shortage of staff and uncertainties of budget and transportation, confine most of the research to the experiment station. The researchers have had limited on-farm research experience and little success with the few farm trials planted.

E. Program

All of the PNIA research is crop-oriented, and mostly directed to basic foodgrains. Smaller programs are being developed on oilseed crops, vegetable crops and cropping systems. Crop research generally consists of varietal testing and selection, some breeding and some work on agronomic practices. Farming systems research uses the methodology of CATIE, and is strengthened by a CATIE staff member based in Region No. 3. Disciplinary support of crop investment research is very limited. The amount of research can be appreciated by noting the number of projects approved for 1977, They are shown below by crops:

| | |
|---|---|
| Maize | 67 |
| Beans | 59 |
| Sorghum | 64 |
| Rice | 75 |
| Oilseed Crops | 124 |
| Vegetable Crops | 61 |
| Cropping Systems | 10 |

Of these 377 were located on experiment stations with 83 on farmers' fields. Most of the latter could not be properly attended and were not harvested.

Despite their importance, there is very little research on soil and water management, either within or outside of PNIA. A small number of fertilizer response trials are conducted at the experiment stations, but PNIA has no work on irrigation.

Under the DGOA there is a soil conservation and management program which is concerned with development activities. It is engaged in soil mapping and has a soil testing laboratory, but has no effective working relationship with PNIA.

The Water Resources Unit in the MRN has responsibility for the design and development of irrigation projects. It does not have responsibility for research on water management at the farm level. This is a logical function of PNIA, but again PNIA has no staff with training in water management research. It was noted earlier that the Government expects to place considerable emphasis on irrigation during the next 5-Year Plan.

There is also no research on livestock. Due to the importance of livestock, as an export commodity and in the nutrition and economy of the small and medium-sized farmers and their families, animal research should be started in the near future.

As in many developing countries, research in Honduras has had little impact on farmers yields, or on national production. This may reflect a lack of understanding of the biological and socio-economic constraints of the farmers, resulting in research leading to technologies inappropriate to farming reality. There is a growing tendency to remedy this by carrying out a large part of research at the farm level, with the active participation of the farmer.

F. Other Research

As mentioned, COHBANA, COHDEFOR and IHCAFE are the autonomous national institutes responsible for all aspects of production, including research for bananas, forestry products and coffee, respectively.

There are four agricultural education institutions in Honduras: The ENA in Catacams, the John F. Kennedy School in San Francisco (Atlántida), the Panamerican Agricultural School (EAP) in Zamorano, and the Regional University Center of the Litoral Atlántico (CURLA) at La Ceiba. The EAP collaborates with the MRN in crop research, with the University of Florida in livestock, and with the MRN under contract with USAID for research on appropriate agricultural technology. Similar collaboration probably could be arranged with ENA and CURLA.

Two transnational companies, United Fruit and Standard Fruit, have research departments in Honduras which specialize in banana and pineapple production. Tela Railroad Co. (the local subsidiary of United Fruit) does contract research through Servicio de Investigación Agrícola Tropical, S.A. (SIATSA). SIATSA has had a contract for research in several crops with the MRN since 1975, with less than satisfactory results and their assistance is now limited to the plantain production program. Standard Fruit is also becoming involved in contract research in the country.

G. Linkages.

PNIA, as mentioned, is severely limited in farmer contact and in interactions with extension. While there is some informal interaction between the national research program and the EAP, opportunities exist to expand cooperative research with EAP, ENA, CURLA, COHBANA, IHCAFE and SIATSA.

The MRN also has agreements with the international centers CIMMYT, CIAT, CIP, and CATIE which provide assistance to national agricultural research and development activities, including in-service training. Through the PCCMCA (Cooperative Program for Improvement of the Food Crops), exists much cooperation among the research programs of the Central American countries, México and the Caribbean countries.

## H. Budget

The operating budget for PNIA for 1976 was about L. 830,000, around L. 1,240 million for 1977 and the approved budget for 1978 is approximately L. 1.6 million (Appendix 2). The Research budget for 1976 represents about 0.5% of estimated value of the crops produced that year for which the national agricultural program has a responsability. As mentioned, there is little assurance that the full amount in the approved budget can be used by PNIA, as budgteray pressures at the regional level commonly has resulted in some diversion of research funds to other programs.

These budget figures do not fully reflect inputs from outside organizations. For example the costs of the CATIE specialist in farming systems and the BID fellowships are not included.

The PNIA prepares a preliminary budget proposal, which is discussed with the DGOA and the Directorate of Sectorial Planning before being submitted to the Minister of Natural Resources. Upon approval of the latter it is submitted to the Ministry of Finance.

Once the budget is approved, it is divided and assigned to the Regional Directorates, effectively removing these funds from the control of PNIA, and reducing greatly the chances of a coordinated national research program.

## I. Conclusions

The present research systems has several important strengths and weaknesses which are noted below, and expanded in the following chapters.

1. Decentralization of program implementation and budget control encourages small self-contained regional programs rather than coordinated national efforts. Administrative restrictions also seriously hamper logistically the execution of approved research projects (see Ch. IX).

2. There is a reasonably good network of experiment stations although some deficiencies remain in their development. More attention should be given to library and publication services (see Ch. V).

3. Staff is limiting both in terms of numbers and training (see Ch. VI).

4. PNIA is almost exclusively crop and experiment station oriented, lacking in farm research, disciplinary research, animal science and socio-economics (see Ch. IV).

5. Useful linkages have been established among PNIA and various international organizations, such as CIAT, CIP, CIMMYT, and CATIE. Domestic relations among PNIA, farmers, extension, agricultural education, national planning, and institutions concerned with agricultural credit, inputs and marketing should be improved (see Ch. VII).

The preceding points to four basic factors or elements of strategy, that must receive attention in order to strengthen PNIA. These are: 1) a farmer-focused integrated multidisciplinary approach to research and technology transfer, 2) a national experiment station network, 3) manpower development and 4) linkages with domestic and external institutions. These are treated in the following chapters.

# IV. THE MULTIDISCIPLINARY APPROACH

## A. Introduction

Farming systems, at any level of technology, include all the interactions of the commodity or commodities with all the physical, biological, economic and sociological factors of their environment. Such range from the greatly simplified monocultures, stabilized by large amounts of external energy such as machinery and agricultural chemicals, to the more complex and internally stable systems of the small or traditional farmers. As with any system, a holistic approach must be taken to effect and consolidate an improvement in its efficiency or productivity. Emphasis will, of course, vary from modifying external energy inputs to maintenance of internal stability associated with the given farming system.

The need for improvement of the modern monoculture has been largely met by technological packages of practices, which provide the necessary energy and biological inputs for increased yield with little consideration for the pre-existing traditional system. Improvements in the traditional farming systems, per se, have been few, because agricultural research has usually ignored their inherent complexity and stability. Included in this external stability are the farmer's society and financial situation which often lack many change factors for increased production, including credit, energy inputs and opportunities to sell at a reasonable profit.

Small traditional farmers thus work without the high management level of technology so commonly associated with agricultural research because they typically operate on profit margins that encourage risk minimization. To face this farming reality, agricultural research in Honduras will use a multidisciplinary approach to develop improvements in the production systems of the country's largely traditional farming systems. This approach must be sufficiently flexible to recognize and react to the different research requirements of the

many systems extant. The majority of the farm in Honduras, however, are small or medium size and produce most of the country's food; generally by traditional methods. An important group of large farms (asentamientos) are found in the agrarian reform sector, and are usually run by former landless laborers using a varying mixture of traditional and modern farming methods. These facts imply the need for an agricultural research system which emphasizes the needs of traditional farming systems, but with sufficient flexibility and creativity to meet the unique requirements of the asentamientos and other special farm groups.

The multidisciplinary approach is a necessity if one is to understand these multifactor systems sufficiently well to improve them in a manner acceptable and beneficial to the farmer or farmer group. This approach is also indicated for research programs limited in manpower and funds, as the benefits of working together across disciplines are much greater than the costs of dilution and dispersion of a purely commodity- or discipline-oriented approach. This does not imply abandoning the disciplines, Multidisciplinary research implies the integration of disciplinary expertise into a directed effort, in this case the improvement of agricultural systems. Honduras' agricultural scientists must develop their expertise as before, but forego the assumption that the unilateral application of their discipline will have a major impact at the farm level.

The multidisciplinary approach must be applied at two levels. (1) Farming systems research, a holistic farm-based and-oriented approach. (2) Farming systems components research, a simplistic experiment station-based and commodity-, or discipline-oriente approach to technical support of the farming system research.

## B. Farming Systems Research

The approach described below is similar to that of ICTA of Guatemala and of CATIE which will be used as points of departure in

developing a similar system adapted and modified to meet the realities of Honduras agriculture. This approach includes the following steps: (a) Selection of target farmer groups and geographical areas of concentration, (b) Gathering of agro-socioeconomic information, (c) Selection of improved systems components, (d) Technical validation, (e) Farmer evaluation, and (f) Evaluation of acceptability. Although these steps are discussed briefly and separately below, in practice they form a dynamic research system and will often be conducted concurrently; with information for one or more steps being gathered from the same trials, or during the same year.

This research will be carried out by regional or sub-regional multidisciplinary farming systems teams supported by commodity and discipline-oriented teams from the experiment station network. Each farming systems team should contain representatives of socio-economics, crop and animal sciences and extension. The participation of extension agents is important for two reasons. Their experience and knowledge of a region and its farmers will be of great importance during the initial orientation of the systems teams, and their active participation in the development of new or improved farming systems will help to insure that these are promoted by the rest of the extension service when the time comes to encourage widespread farmer acceptance. Because the role of the systems teams is to study, understand, evaluate and improve farming systems, the team members will live and work within their target regions and will operate in such a manner as to maximize their contact and communication with the target group farmers.

(1) Selection of Target Groups and Geographical Areas of Concentration

The target groups of farmers are to be defined by the farming systems chosen for study, which, in turn, should be defined by the commodity research and farm group priorities set at the national agricultural policy level.

If the commodities maize and beans are given priority along with traditional farmers, then systems with maize and beans associated in space or time would be likely candidates for study. Defining target groups by their farming systems is an effective means of identifying homogeneous farmer groups. Farmers who have adopted similar farming systems have probably been affected by the same factors in approximately the same magnitude and could therefore be expected to respond in a like manner to improved farming systems. Consideration of ecological factors become important at this point also, as these may be important keys to drawing general conclusions across systems, regions, or farmer groups.

Geographic areas of concentration should be determined by the presence of the selected farming systems and by the regional priorities set, again, at the national agricultural policy level.

(2) Agro-socioeconomic Information

This will be gathered by the farming systems teams through initial regional surveys and simple daily farm records, with the primary purpose of identifying factors common to the system across farms, and assessing their relative importance to the generation of system improvements. A secondary goal of this will be to familiarize the team members with the farmers and to open communication between the two groups,

(3) Selection of Improved Systems Components

In general this step consists of evaluation of experiment station-generated technology components within the given farming system and under farmer conditions. Continuing the maize-bean example, these could include new maize and/or

bean genotypes, promising spatial arrangements or new pest control techniques. Because of their in-depth knowledge of the components, staff responsible for experiment station-based research will direct this step, while the systems teams will be responsible for evaluation and acceptance because of their familiarity with overall farming systems.

This step will provide for critical interaction among commodity-problem-oriented and farming systems researchers. Communication at this point will be essential if new components are to be understood by the farming systems teams and if the experiment station researchers are to appreciate the environment in which their research results are to be used.

(4) Technical Validation

Once new alternatives have been identified, they must be evaluated by system teams under farmer's conditions, in comparison with the farmer's actual practice. The farmer should be an active participant in the process, both from the point of view of making him aware of the new possibilities and from the point of view of using his experiences and opinions as part of the evaluation.

These trials may be of two types, one more intensive and aimed at component evaluation and the other more extensive and aimed at evaluating new or improved systems.

(5) Farmer Evaluation

Once the farming system teams are satisfied with a system, it remains to be demonstrated that proper application of the systems is within the farmer's capabilities, and better

than his system. At this time the farmer implements the new system with only the technical advise of the systems team, and in comparison with his normal practices.

(6) Evaluation of Acceptability

Once it has been demonstrated that the farmer can use an improved farming system, one must also demonstrate that there is some degree of preference for it by the farmer, before recommending it to extension as a viable alternative. This preference may be measured by studying the degree of adoption of the system by the farmers who tested in the previous season.

C. Farming Systems Components Research

A common procedure in traditional commodity or discipline-oriented research has been to isolate the variable in question, through experimental control, so as to have the clearest possible understanding of its nature. This is essential in understanding single variables, but obviously unmanageable at the complex systems level. A compromise will have to be reached in the Honduras situation and might include: (1) Isolation for study of various factors or components of given farming systems. (This would be done by the farming systems team and would essentially be the primary means for setting of the research goals of the station-based research program. In our maize-bean example such components might include the architecture of the maize plant and the maturity of the associated bean variety) (2) Development of alternatives for these components under controlled conditions, within the experiment station network. (Continuing with our example, the national maize might then begin developing several maize varieties with more open canopies, while the national bean program would concern itself with producing several experimental earlier-maturing bean varieties.) and, (3) Evaluation and selection, under farm conditions, of those

alternatives which fit into and improve the given farming system. (Those maize and bean varieties which helped increase net farm income would then be selected as components for improved systems.) Less detail has been given here than in the discussion of farming systems research as (1) and (3) were discussed and there is ample precedent for (2).

This type of research will have to be conducted on the research station by technical support specialists trained in the commodities or disciplines, but with an interdisciplinary approach to agricultural research. To do otherwise would restrict progress in component development for lack of good experimental control and in-depth knowledge of the relevant disciplines. A lack of improved components would likewise restrict progress in system improvement.

It stands to reason, however, that this type of research must be conducted in an environment as close to that of the target farmers as possible. This increases the probability of the new components fitting and working well within the given farming system. Commodity and problem-or discipline-oriented research is currently being conducted in Honduras, but lacks effectiveness, in part, because of the lack of orientation towards the farms and farming systems within which the research results must fit.

The need to orient such research towards this complex reality calls for the multidisciplinary approach. Breeders must seek uniform environments that represent well the farm reality. Plant protection specialists must consider crop genotypes, associated crops, and farmer pest control resources. In other words, the more aware a researcher is of how his given component fits into the farming system, the more likely it is that his research results will fit into and improve the system in actual practice. This awareness must be fostered through continual communication among the individual researcher and other members of the commodity-discipline-oriented team and with the farming systems team members during the selection of components for on-farm trials. This again emphasizes the

importance of this critical link between these two components of the national agricultural staff.

D. Conclusions

To implement such a program will involve a number of basic considerations in relation to the current Honduran agricultural research program. These include:

(1) The implementation of the new program will be a gradual process due to a shortage of manpower and more critically to inexperiences in this approach under Honduran conditions.

(2) Staff development will be critical, both in reinforcing on-station research of the commodity/discipline teams, and in training and orienting technicians for the farming systems teams. This latter will be the more difficult, again for lack of experience and precedent in this country for this approach.

(3) Staff mobility will be critical, especially for the systems teams which will need constant contact with the farmers to be effective. Mobility will also be essential for the vital contacts between both types of teams during component testing and evaluation on-farm.

(4) Cooperation with extension will be important if research results are to be distributed to the greatest possible number of farmers in the shortest possible time. The extensionist working with the systems teams will have to have job definitions which permit their full participation in the research process.

(5) Experiment station workers must be provided the necessary facilities to effectively support the system team with improved systems components. Many of these components may come from adaption and modification of foreign technology, available from such sources as international agricultural research centers and universities. During the early years of the program, manpower shortages will probably dictate a greater reliance of the sources than when the program is more fully developed.

## A NATIONAL RESEARCH STATION NETWORK

A national research station network provides farming systems researchers and the technical support scientists a base of operations with facilities and support services. A coordinated national agricultural research system requires interaction among stations in terms of personnel, materials and information.

### A. General Requirements

The number and placement of stations must be such as to represent the major agroclimatic zones of the country. One station should be near the national capital, with responsibilities for specialized research, training, and support services not necessary regionally. Such a station also facilitates communication among interested government and private groups. Regional stations should represent the region and its agriculture. Accessability of an urban center is also important as staffing in isolated stations may be difficult

Station size should be sufficient for current as well as long-range needs. Infrastructure should be sufficient for experimental control, training and administrative and personnel requirements. Both on-farm and on-station researchers must be sufficiently equipped for all phases of their work, especially in terms of transport. Finally, the research staff must receive enough support so that they may devote full time to their work and not be concerned with unnecessary administrative detail.

### B. Strengthening the National Research Station Network

The following are comments on the experiment station network based on the implications of Chapters III and IV. A five-year development period is used, although longer-range requirements are kept in mind.

There are now six experiment stations, which could, if properly developed, meet most of the needs for 1978-1982, with the possibl exceptions of Regions 4 and 7. The Aguan Valley (Region 4) development project may require experiment station support in the near future. A farming systems team should start in the region, working from rented land, until it is decided whether or not a permanent facility is necessary. This system might also be used when research is started in Region 4, and in other relatively isolated areas.

There is a strong need for a central experiment station for training, research and support services for other stations. The station at Comayagua is the most suited for this purpose: it is the closest to Tegucigalpa (an hour and a half by paved road), is the most centrally located, has adequate land and has more and better than average infrastructure.

The six regional stations are reasonably well located. More satisfactory arrangements should be worked out at Catacamas with ENA for land use. Having the research station at the ENA will encourage collaboration between research and teaching staff. The amount of the land at the stations is adequate except for Catacamas although it may be desirable to use some CNAG land for livestock at Comayagua.

Drainage and irrigation are needed in the following order of priority: Las Acacias, Guaymas, La Lujosa, La Esperanza, Comayagua and Catacamas. A master plan is needed for station development, and use of a consultant is recommended.

Las Acacias and Catacamas are most lacking in station buildings (see Table 6) although all stations lack some building space. Laboratory requirements are modest and generally can be met by assigning office space to this purpose. Plant and soil analyses should be done by the soils laboratory in Tegucigalpa. Guaymas,

Table 6

Estimated Building Needs for the Experiment

During the Period 1978-1982

| ATION | HOUSE | OFFICE | LABORATORY | LIBRARY | WORKSHOP | SHEDS | COLD STORAGE | GREEN HOUSE |
|---|---|---|---|---|---|---|---|---|
| Lujosa | A | B | C | C | C | C | C | D |
| ayagua[1/] | A | A | A | C | B | C | C | C |
| Esperanza | C | C | C | C | C | B | D | C |
| ymas | A | A | A | C | C | C | C | B |
| Acacias[2/] | C | C | C | C | C | C | D | C |
| cacamas | C | C | C | C | C | B | D | D |

end: A: Available and adequate

B: Available but needs to be modified/increased in size/number

C: Not available but will be needed

D: Will not be needed

Not including livestock research requirements

At Las Acacias a house and office space are under construction in 1978 using BID loan funds. A screenhouse will aso be needed at this station.

Las Acacias and La Lujosa lack electricity, which must be remedied as soon as possible to allow initiation of the radio communication network.

Livestock research requirements have yet to be defined but likely research will start using the facilities of the CNAG, until the program is better defined.

Las Acacias needs at least one 4-wheel tractor with basic implements. Tractors will need to be replaced at other stations, and all locations need basic facilities to maintain equipment (see Table 7). Laboratory equipment is hard to specify, but may include microscopes, balances, moisture meters, and refrigerators. Soil and plant samples for both crop and livestock research should be handled by the soils laboratory at Tegucigalpa, with the understanding that a modest amount of additional equipment may be required.

Transportation requirements will be substantial (see Table 8). A three-man farming systems team in each region would require 14-28 vehicles, using a 2:1 or 1:1 technician: vehicle ratio, including the extensionist. Purchase of the right kind of vehicles should be phased over the next five years due to the high costs involved. The rate of staff expansion may modify this schedule.

Support staff will be needed in at least experiment station management, laboratory operations, administration, transportation operation and maintenance, and secretarial services. Only one station now has support personnel for farm management and administration, and three are without secretaries. PNIA personnel might be needed during the next five years to strengthen library and publishing services of CEDIA.

C. Resume and Recommendations

Stations are adequate in number and location for the next five years,

Table 7

An Estimate of Equipment Needs of the Experiment Stations for the Period 1978-1982

| ATION | TRACTORS & IMPLEMENTS[1/] | OTHER: FIELD RELATED EQUIPMENT[2/] | WORKSHOP[3/] | LABORATORY[4/] | OFFICE[5/] |
|---|---|---|---|---|---|
| Lujosa | B | B | C | C | B |
| ayagua | A | B | C | B | B |
| Esperanza | B | C | C | C | B |
| aymas | A | B | C | B | B |
| Acacias | C | C | C | C | C |
| tacamas | A | C | C | C | C |

Key: A: Available and adequate
B: Available but needs to be replaced/repaired/increased in number
C: Not available, but will be needed

Four-wheel with basic implements.
Includes plot and head threshers, rototillers, seed cleaners, balances and sprayers.
Space and tools for repair of field equipment.
Variable, including microscopes and precision balances.
Including typewriters, duplicators, calculators, files, projectors, bookcases for working library.

Table 8

An Estimate of Vehicles for the Period 1978-1982

| | 1977 (Actual) | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|
| No. Needed | 18 | 30 | 40 | 47 | 50 | 54 |
| No. becoming unserviceable 1/ | | 6 | 3 | 3 | 6 | 5 |
| No. replacements | | 12 | 16 | 10 | 6 | 9 |

1/ The assumption is made that all of the vehicles now on hand will need to be replaced by the end of 1981. Some of those purchased early in 1978 would be replaced toward the end of 1982.

with the possible exception of the Aguan Valley. Comayagua should play a national role in research, training and support. Here additional land may be arranged with CNAG for livestock research. PNIA and ENA should make a long term arrangement on land use, with cooperative activities, at Catacamas. All stations are lacking in farms development, equipment, transportation, and support services.

The following recommendations are made:

1. The Comayagua station should be a national center for research, training, and research support.

2. Arrangements should be worked out with PNIA at Catacamas for land, and for cooperatives research and training.

3. Livestock research should be started at Comayagua in cooperation wirh CNAG

4. A master plan of station development should be prepared.

5. Library and publication services should be improved by strengthening CEDIA.

# VI. MANPOWER DEVELOPMENT AND PERSONNEL MANAGEMENT

## A. Introduction

The reorganization of the PNIA research system, and its implementation over a five year period, will involve both a substantial increase in the actual number of technical personnel, as well as in training requirements. The on-farm systems research alone (see Chapter IV) will require at least 21 persons, plus seven persons assigned by extension, to have at least one farming system team of three investigators and one extensionist in each of the seven regions by the end of the fifth year. Since initiation of livestock research is of high priority, some of the team members for farming systems will have to be animal scientists. This, as well as the need for staff in soil and water management and economics, will increase the scope of training further, as PNIA currently has few or no personnel trained in these fields.

The training requirements will need to be met in a number of ways: in-service training in Honduras, at the international centers, in similarly-oriented national research programs, and foreign graduate study. ICTA is presently a likely source of training at the national program level. Short, to long term foreign technical assistance will be required, but this need will be reduced as trained nationals return to the program.

Finally, improved working conditions, salary levels, and other incentives for the staff will be needed to insure the development and continuity of a strong permanent program staff.

## B. Size of the Technical Staff

At the end of 1977 the PNIA technical staff stands at 39. Seven of these (including two expatriates) have advanced degrees. Four in addition to the 39 on location are now studying abroad for

advanced degrees. Thus, by early in 1979, there should be at least 43 technical staff, of which 8 nationals would have M.S. or Ph.D. degrees. Some 6-9 staff will leave to study during 1978.

Considering the multidisciplinary approach (Chapter IV), a projection has been made of staff requirements by the end of 1982. Manpower within the experiment station network seems nearly sufficient for crops research, so most expansion will be to fill the requirements of the farming systems teams and livestock research. Details on a station to station basis are found in Appendix 5. The number should increase from the current 39 to about 76 by the end of the five year period. Table 9 shows the actual and projected number of technical staff on the basis of the kind of research service activity they will be involved in. The four-man farming systems team (including one extensionist) in each region accounts for the largest proposed increase. Secondly, development of a modest research program in livestock will call for a sizeable number of additional persons[1/].

Regionally-based multidisciplinary teams of researchers working at the farm level are critical to efficient development of appropriate technology for the target group of Honduras farmers, the small and medium independent farmers, or asentamiento members in the agrarian reform sector. Because of its importance, livestock must be included with crops in the proposed research scheme.

## C. In-Service Training in Honduras

Much of the training for the farming systems teams will be in-service, given the lack of precedent for this approach (see Table 10). It is recommended that Comayagua staff be responsible for

1/ The rationale for livestock research, with details on suggested staffing, is given in Appendix No. 6.

Table 9

Projected Increase in Research Staff, by Activity
Over the Next Five Year Period

| Activity 1/ | (Actual) 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|
| Maize | 8 | 6 | 6 | 6 | 6 | 6 |
| Beans | 3 | 5 | 5 | 5 | 5 | 5 |
| Sorghum | 2 | 3 | 3 | 3 | 3 | 3 |
| Rice | 5 | 5 | 5 | 5 | 5 | 5 |
| Oilseed Crops | 5 | 5 | 5 | 5 | 5 | 5 |
| Vegetables | 5 | 5 | 5 | 5 | 5 | 5 |
| Tuber Crops | 4 | 4 | 4 | 4 | 4 | 4 |
| Animal Science | 0 | 3 | 5 | 7 | 8 | 9 |
| Farming System 2/ | 1 | 6 | 9 | 12 | 15 | 21 |
| Experiment Station Management | 1 | 3 | 4 | 5 | 5 | 6 |
| Unidad Central | 5 | 6 | 6 | 6 | 6 | 6 |
| Jefatura | 1 | 3 | 3 | 3 | 3 | 3 |
| Total | 40 | 54 | 60 | 66 | 70 | 78 |

1/ In some cases persons with the Unidad Central or Farming Sistems will also serve as head of the commodity research program at a national or regional level, or nationally in a particular discipline (e.g. soil management).

2/ Farming systems teams will consist of 2-3 persons for research, plus one extensionist.

Table 10

Projected PNIA Training Program, 1978 - 1982

| Type of Training | 1978 | 1979 | 1980 | 1981 | 1982 | Total |
|---|---|---|---|---|---|---|
| In-Service (Honduras)1/ | 4 | 6 | 6 | 6 | 6 | 28 |
| Advanced Degree2/ | 9 | 4 | 8 | 8 | | 29 |
| Short Courses | 3 | 5 | 5 | 5 | 5 | 23 |

1/ In-Service training in farming systems research with Unidad Central in Comayagua for 6-8 months.

2/ In-Service training, as above, will be a prerequisite as soon as possible.

3/ Normally at international, or national centers such as CIMMYT, CIAT, CATIE and ICTA.

in-service training. They will be elaborating, implementing and modifying the farming systems research methodology, and will train mostly by example or demonstration. The possibility exists also to train graduate students in teams for farming systems research.

Although some of the member of the basic group to be located in Comayagua have been trained in multidisciplinary research, the experience of working here as a team, and of training other teams in farming systems research, is new for Honduras. Since the approach of ICTA and CATIE are quite similar to that proposed here, full use will be made of their experiences.

Farming system team training is of high priority and should be initiated as soon as possible. A training period should cover at least a full cropping cycle, from initial surveys and planning through harvest. A minimum period of eight months seems reasonable. Allowing for some overlap, some 10-12 new systems team members might be trained per year by the group members. Availability of candidates may be more limiting than the group's capacity to train them.

The extensionists selected to work with these teams shoudl be trained in a similar manner, not only to give them needed experience, but to use their experience to enrich the training program.

Advanced Degree Training Outside of Honduras

Projections call for about 30 additional persons with advanced degrees by the end of 1982 (see Table 10). As mentioned earlier, there are now 7 staff (two being expatriates) with graduate degrees and four currently outside the country in degree programs. Thus, taking into count these 11, it is projected to send about 30 additional persons during the period, some of whom will not return until the end of 1984.

In general they will be sent for M.S. degrees both to strengthen experiment station personnel and the farming system teams. Areas to be emphasized include: ruminant nutrition, forage management, weed science, plant nutrition, farm-level agricultural economics and sociology, crop ecology, and soil and water management.

Degree candidates will have experience with the in-service farm level research and training programs. Those that expect to return to work with on-farm teams should have first completed in-service training. They may also undergo additional training at an appropriate international center.

In programing graduate training, plans will be made for the formation of one or more multidisciplinary graduate student terms. This approach is applicable to either commodity or systems related projects, and should produce scientists who can contribute to all levels of research in the national program. Some of the current research staff have experience in such an approach. Considerable planning and communication with the involved universities will be required before any such teams are formed.

E. International Centers

A number of research staff have already spent some time at the international centers, particularly CIAT and CIMMYT. Crop and livestock-oriented staff doing research on the experiment station should have continued opportunities for training at these centers. Visits to Honduras and short courses by centers' staff should also be encouraged. Projected short course training needs of international centers are shown in Table 10.

The work of CATIE's crop and soils department, and of ICTA at Guatemala, is particularly relevant to that planned for the farming systems teams. CATIE and CIAT can provide training in livestock research. Arrangements should be made with these institutions to

maximize contact and communication in the form of training and periodic visits.

## F. Consultants

During the next five years consultants will be needed to help strengthen various aspects of the research program. Some will be needed for relatively short periods, from a few weeks to a few months; others will be required for longer periods. In all cases, arrangements should be made to insure that the consultant is located in the appropriate place, has specified work to do, and has complete cooperation from the national agricultural research program.

Estimates for consultant needs are given in Table 11. As noted, some of the longer term assignments will be met under World Bank loan funds through an arrangement with IICA. Short term consultancies will be required in a number of areas, but in most cases should consist of periodic visits of 1-2 weeks of staff from institutions (e.g. international centers) or specific international projects which have or will develop linkages with the Honduras agricultural research program (e.g. INTSOY).

## G. Non-Research Staff

Administrative and other support staff are needed at headquarters, as well as at the experiment station at regional levels. Included are persons concerned with accounting, experiment station and laboratory operations, secretarial work, transportation, and library and publication. As noted in Chapter III, non-research supporting staff in general is deficient, and will need to be strengthened substantial during the next five years if the research personnel are to be utilized efectively.

An estimate of support staff needs is given in Table 12. Needs are particularly great in experiment station farm management and

Table 11

Estimation of Consultant Needs During the Period 1978-1982

| Area of Specialization | Year Needed | Duration |
|---|---|---|
| A. Longer Term | | |
| 1. Research administration (1)[1/] | 1978 | 3 years |
| 2. Technology transfer (1)[1/] | 1979 | 3 " |
| 3. Animal Sciences (4)[1/] | 1978 (1) | 3 " |
| | 1979 (1) | 3 " |
| | 1980 (2) | 2,3 " |
| 4. Agricultural economics (2)[1/] | 1978 (1) | 3 " |
| | 1979 (1) | 3 " |
| 5. Sociology (1) | 1979 (1) | 2 " |
| 6. Soil management (1) | 1979 | 3 " |
| 7. Post-harvest technology (1) | 1979 | 2 " |
| 8. Weed science (1) | 1979 | 3 " |
| 9. Experiment station mgt. (1) | 1978 | 2 " |
| B. Shorter Term | | |
| Biometrics, plant protection, water management, farming systems, foodgrains, vegetable crops, soybeans, peanuts, other crops, animal science socio-economics, library/publications | Periodic visits during the 5-year period. | |

1/ Four consultants will be provided under the Worl Bank loan: research administration, technology transfer specialist, an agricultural economist, and an animal scientist.

Table 12
Estimation of Needs for Support Staff (Non-Research)
for the Period 1978-1982

| Station | Station Management[1/] | Administration[2/] | Lab[3/] | Library Publications[4/] | Secretarial |
|---|---|---|---|---|---|
| Headquarters | D | C | B | C | B |
| La Lujosa | A | B | D | D | B |
| Comayagua | C | C | C | D | B |
| La Esperanza | C | C | D | D | C |
| Guaymas | C | C | C | D | B |
| Las Acacias | C | C | C | D | C |
| Catacamas | C | C | D | D | C |

Legend: A: Available and adequate
B: Available but needs to be strengthened
C: Not available but will be needed
D: Will not be needed

Positions exist and are expected to be filled in 1978

These consist of administration and those who have responsibility for accounting, personnel records, purchasing, etc.

Laboratory assistants will be needed only at Comayagua. However, some limited laboratory space and equipment may be required at other locations. Plans call for a strengthening of library and publications service at headquarters with a likely need for some staff. Staff for this service alone will not be required at the individual stations.

administrative services. However, the former positions exist and are expected to be filled in 1978. Only three of the six stations have secretaries - La Lujosa, Comayagua and Guaymas.

H. Working Conditions, Salary Levels and Other Incentives

In order for the research program to have continuity, it must develop the capacity to retain its personnel after they have been trained. This will be related to salary levels, which must take into account, in addition to the academic training, experience and background. Further, a system of differential compensation is needed for work posts in the different regions of the country.

Salaries have to be reasonably competitive,but beyond a certain point other factors have a decisive influence. These include: a stable and coherent institutional policy, reasonable scope for creative work, an organization with flexibility and without an excess of bureaucracy, and a high probability that the work will result in something worthwhile to the community.

Good morale results when the organization and job assignments are reasonable and understood by all, when there are opportunities for interaction with relevant national and international institutions, facilities to publish results, and a library and other needed support readily available.

A projected advancement of research staff over the next five years is shown in Table 13. This advancement is based on a classification of staff in four categories (I - IV) with associated salary scales, and would reflect experience, training and responsibility. The proposed salary ranges seem realistic in relation to the current ones.

Table 13

Projected Advancement of Research Staff in Classification and Salary Scale Over a Five Year Period

| Classification[1/] | 1977 ( Actual ) | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|
| | NUMBERS | | | | | |
| I | 0 | - | 1 | 2 | 3 | 4 |
| II | 4 | 5 | 8 | 10 | 12 | 15 |
| III | 6 | 16 | 18 | 18 | 19 | 20 |
| IV - V | 30 | 32 | 33 | 36 | 36 | 37 |
| TOTAL | 40 | 53 | 60 | 66 | 70 | 76 |

1/ The classes relate to proposed salary scales as follows:

I - L. 3,000 - 3,500 per month
II - L. 2,000 - 3,000 per month
III - L. 1,500 - 2,000 per month
IV - L. 900 - 1,500 per month
V - Less than 900 per month.

## I. Resume and Recommendations

One of the most critical constraints in PNIA at this time is a lack of technically-trained personnel with continuity. The incorporation of livestock research and farming systems teams into agricultural research will require a substantial increase in number of technical staff over the next five years. This increase in staff must be accomplished by using a phased program of both in-service and advanced degree training. It is estimated that about 28 persons will need in-service, in-country training to equip them to work as members of the farming systems teams. Approximately 30 persons will need to be sent outside of the country for advanced degree training, primarily at the Masters levels. A number of expatriate consultants will assist the national program.

The international centers (CIAT, CIP, CIMMYT, and CATIE) offer relevant in-service training which should be included in the overall plan for staff development. Short-term interchange of personnel and constant communication between ICTA of Guatemala and Honduras staff also seems important.

In view of the projected strengthening of the national agricultural research system,and in recognition of the current constraint in technical manpower, the following recommendations are made:

1. As early as possible in 1978 a farming systems, research and training program at the farm level should be initiated. This research training program should provide at least one farming systems team for each of the seven regions by 1982. In-service training should also involve relevant international centers and national programs.

2. Arrangements should be made with the head of Extension, and with the Regional Directors of Agriculture to assign

an extensionist to each of the farming systems teams, for the training as well as for the subsequent on-farm research.

3. The advanced degree program should continue and, from 1978, be geared to the anticipated number and kind of technicians needed to strengthen the program. To the extent feasible, only advanced degree candidates with experience in the new research approach should be sent to study. Emphasis should be placed on a multidisciplinary approach to problem solving, where possible to the extent of forming graduate student teams.

. Special attention should be given to training requirements to start a modest livestock research program during the next five year period.

5. Since training and/or experience are deficient in a number of areas, a number of consultants should be brought in. This sort of support will diminish in importance as the training program progresses.

6. Salary levels, prerequisites and work environment are important considerations in the morale and continuity of staff, and should be reviewed regularly.

## VII. LINKAGES WITH INTERNAL AND EXTERNAL INSTITUTIONS

### A. Introduction

There are several reasons for the national agricultural research entity of Honduras to develop viable links with other institutions that are engaged in or that support agricultural research and technology transfer. Firstly, research is not the only essential element to rapid agricultural development, and cannot be effective when isolated from other critical factors such as extension, supply of inputs, credit and market. Secondly, research is expensive and the Government cannot and should not finance research which would duplicate work already being done by other national or foreign institutions, if results are readily accessible. Thirdly, national and international research for the agriculture of developing countries has greatly expanded and has produced much technology relevant to countries such as Honduras. Such resources can accelerate development and evaluation of needed technology, but only if a strong national agricultural research systems is present to adapt, modify and transfer foreign information and technology to the domestic agricultural reality.

Such relationships are numerous for the Honduran national agricultural research program, but must be restricted to be effective because they require time and dedication on the part of both parties. Below are listed what we consider the most important domestic and foreign relationships for PNIA to develop or maintain.

### B. National Linkages

PNIA must work well with the following groups: 1) farmers, 2) the extension service, 3) DARs, 4) agricultural education institutions, 5) other governmental or private research institutions, 6) economic planning, and 7) institutions concerned with farm credit, inputs

and market. These working relationships will vary in nature but all are important.

The Farmer. Research technology has value only to the extent it is utilized by farmers, and therefore a very substantial part of the research will be done in the farmers' fields and with farmer participation. This is described in Chapter IV.

The Extension Service. Research has the intensive role in technology transfer of proving the worth of new technology with a small number of farmers. The agricultural extension service has the extensive role of reaching as many farmers as possible with proven technology. Not only must these complementary roles be recognized and fulfilled in order to have effective technology transfer, but also there must be efficient transition from the intensive to the extensive phase of transfer. This requires continual communication between research and extension workers, and we therefore recommend that an extensionist be a member of each farm systems team (Ch. IV). This worker would communicate the extension service's broad knowledge of the area to the team and the team's useful research technology to the extension service. Although a full team member, he would remain, administratively, a part of the extension service. Extension at the regional level would therefore participate in the planning and execution of research carried out both on the farm and on the experimen station.

DARs. As noted in Chapter III, most aspects of regional agricultural development under the MRN (including research) are controlled by the Regional Agricultural Director. A strong coordinated national agricultural research program calls for a greater control by PNIA over the approved budget and research personnel regional level. Yet a good working relationship between PNIA and the DARs is imperative.

In our view, this problem can be mitigated by assigning the Regional

Agricultural Committees (CAR)[1/] a specific responsibility for review and evaluation of research. Such an arrangement would enable the Regional Director to have an active role in determining and evaluating the regional research program, while leaving control of the research budget and personnel with the PNIA. Under such an arrangement, it is anticipated that each DAR would make its administrative and other support services fully available to PNIA, thereby obviating the need to develop a parallel set of such services in the latter.

Agricultural Education Institutions. PNIA should have strong links with domestic agricultural education institutions. These have provided most of the research staff and will continue to do so. These institutions also either are or could be engaged in agricultural research.

The four Honduran agricultural education institutions were referred to in Chapetr III. Research interests of the EAP (Zamorano) and CURLA (La Ceiba) overlap with those of PNIA, and considerable scope exists for cooperation especially in use of facilities as staff currently have little time for research. ENA at Catacamas now provides the land for the regional experiment station, with potential for involvement of students and staff in research. The same potential would seem to exist with CURLA. PNIA should cooperate to the extent possible with

1/ CAR, established by Acuerdo No. 209 of the MRN, has the role of coordination of the institutions in the agricultural sector at the regional level. It is chaired by the Regional Director of Agriculture. Other members include representatives from PNIA and BNF; and from IHCAFE, COHDEFOR and COHPANA, where appropriate. Each CAR has a full-time secretary based at Directorate headquarters.

these educational institutions, including financing for cooperative research. Apart from additional research, this should be looked as an opportunity to identify future staff and begin their orientation and training as early as possible.

Other Research Entities. In Chapter III it was noted that other public or private organizations in Honduras with some research responsibility include IHCAFE (coffee), COHDEFOR (forestry), COHBANA (bananas), and SIATSA (food crops). PNIA should keep informed of their on-going research and future plans, and cooperate with then when mutually beneficial situations arise.

There are also several specific area or commodity development projects that, for lack of needed technology, have research activities. These include a pilot project on beans and maize production in the department of El Paraíso (PROMYF) and the World Bank-supported livestock development project in the North. Good working relationships between the national research and such projects are important.

Research priorities for crops, livestock and socio-economic factors of agricultural development, as well as geographic concentration, should be derived through dialogue between PNIA and the bodies responsible for national and regional agricultural planning. Both groups will benefit: research from having well-defined priorities and goals, and planning from the technological and socio-economic inputs that can be provided by research.

The Directorate of Sectorial Planning of the MRN and PNIA should start and maintain this dialogue, informally and formally, as soon as possible. This link will also provide PNIA with indirect access to national planning, as the MRN's Directorate of Sectorial Planning is represented in CONUSPLANE.

Formal dialogue could be implemented by a Consultative Committee for Agricultural Research reporting to the DGAO (CCIA). This committee might also include representatives of other national

groups with interests in agricultural research and development, such as those concerned with credit, inputs or marketing.

C. External Linkages

Honduras has yet to capitalize fully on foreign research and technology applicable to domestic needs (Ch. III and V).

National Research Entities. Neighboring countries have similar types of agricultural and socio-economic problems and should prove to be useful sources of information and experience. The approach being taken by ICTA (Guatemala) is similar to that anticipated by Honduras, and its four years of experience should be useful, particularly in the initial phases of Honduras' new system. Communication should be through exchange visits of scientists, in-service training and perhaps joint workshops.

International Bodies. The PCCMCA enables agricultural scientists of Central America to share information and to discuss problems. Honduras should continue to support and participate in this group.

CATIE is the regional agricultural research-training center of Central America and the Caribbean. It currently has cooperative research and development work in Honduras in farming systems, forestry, and livestock. This center should continue to provide useful assistance.

The internacional centers especially CIMMYT, CIAT and CIP, are assisting with agricultural research in Honduras. Relationships with these centers should be continued and opportunities to link with other such centers and international research projects should be explored.

D. Resume and Recommendations

The PNIA's impact on agricultural production and improved rural

well-being will depend largely on good relations with appropriate entities both within and outside of the country. Important domestic relations include those with the farmer, extension, Regional Directorates, and other institutions concerned with planning, education, research, agricultural credit, inputs and market. Useful ties exist with some international and other national research institutions which should be strengthened and additional ones encouraged.

The following recommendations are made to strengthen these relationships:

1. Emphasis should be placed on farm research with active farmers' participation.
2. An extensionist should be included as a working member of the farm system research teams as described in Chapter IV.
3. The Regional Agricultural Committees (CAR) should advise the Regional Agricultural Directors, and PNIA on research at the regional level.
4. A Consultative Committee on Agricultural Research (CCIA) should be formed to advise the DGOA, with representation from at least:
   a) extension at the national level (Jefe de Extension),
   b) DARs (perhaps 2-3 persons),
   c) agricultural education,
   d) Directorate of Sectorial Planning,
   e) agricultural credit (BNF)
   f) agrarian reform (INA),
   g) farmers' organization, and
   h) the Director of PNIA.

   This committee would be concerned primarily with policy and priorities.
5. Ties with the national and international research institutions that can most contribute to agricultural research in Honduras, should be strengthened and encouraged.

# VIII. THE NATIONAL RESEARCH ENTITY

## A. Introduction

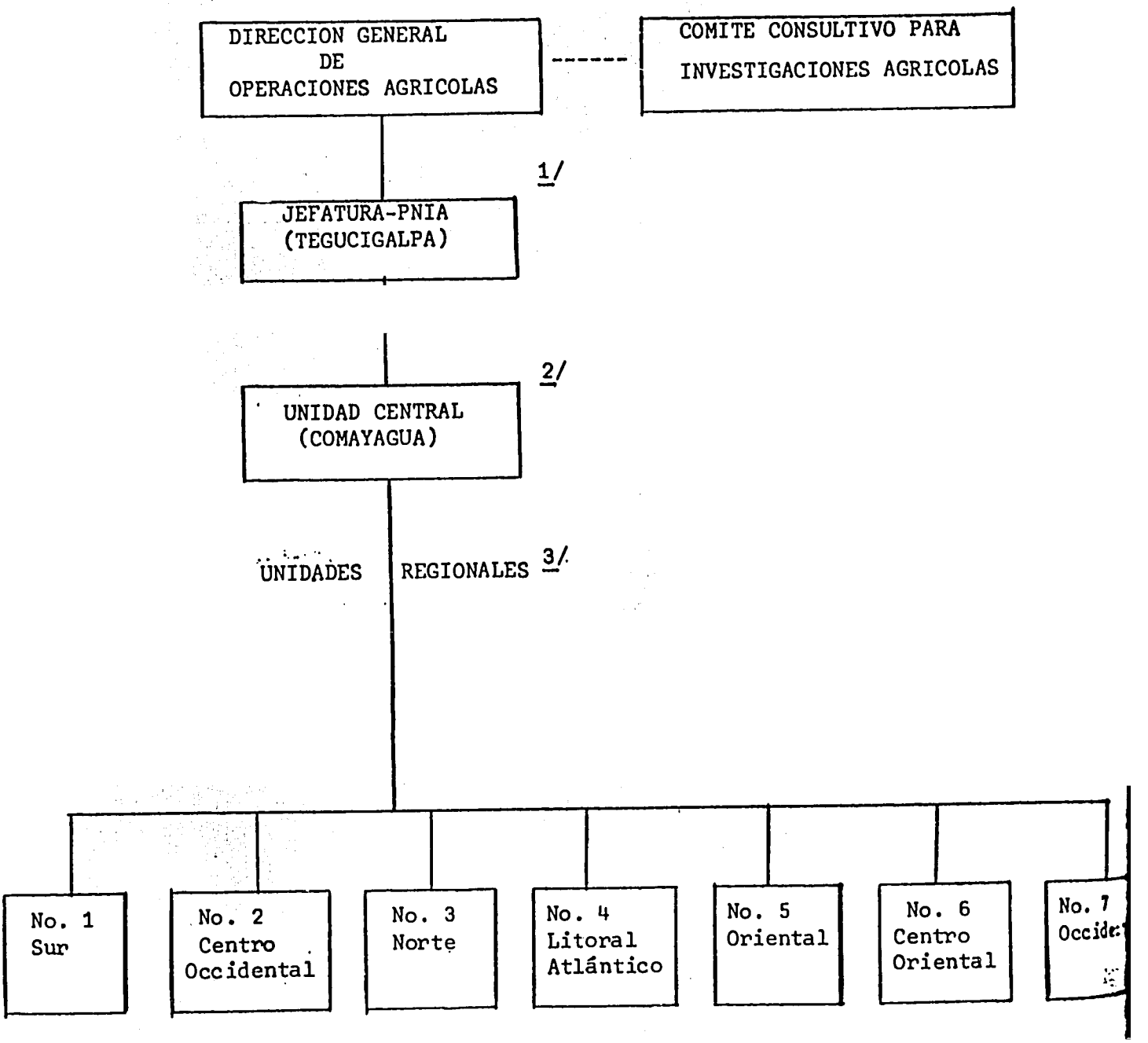
This report has been concerned with: 1) identification of research needs and priorities; 2) the current status of agricultural research; and 3) a strategy for strengthening the national agricultural research system. Research needs and priorities include: 1) emphasis on small and medium farmers; 2) initial focus on regions identified in national plans for agricultural development and for potential impact; and 3) primary attention to the basic foodgrains, with longer range emphasis on vegetables, oilseed crops and livestock. The elements of strategy (see Ch. IV-VII for details) are: 1) a farmer-oriented, multidisciplinary research and technology transfer; 2) a strengthened network of experiment stations; 3) increased size and level of training of the research staff and, 4) increased and strengthened relations with appropriate domestic and foreign research and research-related institutions.

This chapter attempts to synthesize the preceding information to describe the structure, functions, operation and general requirements of the proposed reorganized national agricultural entity. The years 1978-1982 are specifically covered, but continued growth and modification are also anticipated.

## B. Structure and Functions

The proposed structure of the reorganized agricultural research system consists of three principal elements (Figure 3): the headquarters, the Central Unit, and the Regional Units. These will be discussed in reverse order as the regional research unit will interact most with the farmer, and is therefore the most critical to research impact. The other two units exist primarily to support the regional units.

The Proposed Reorganized National Agricultural Research System



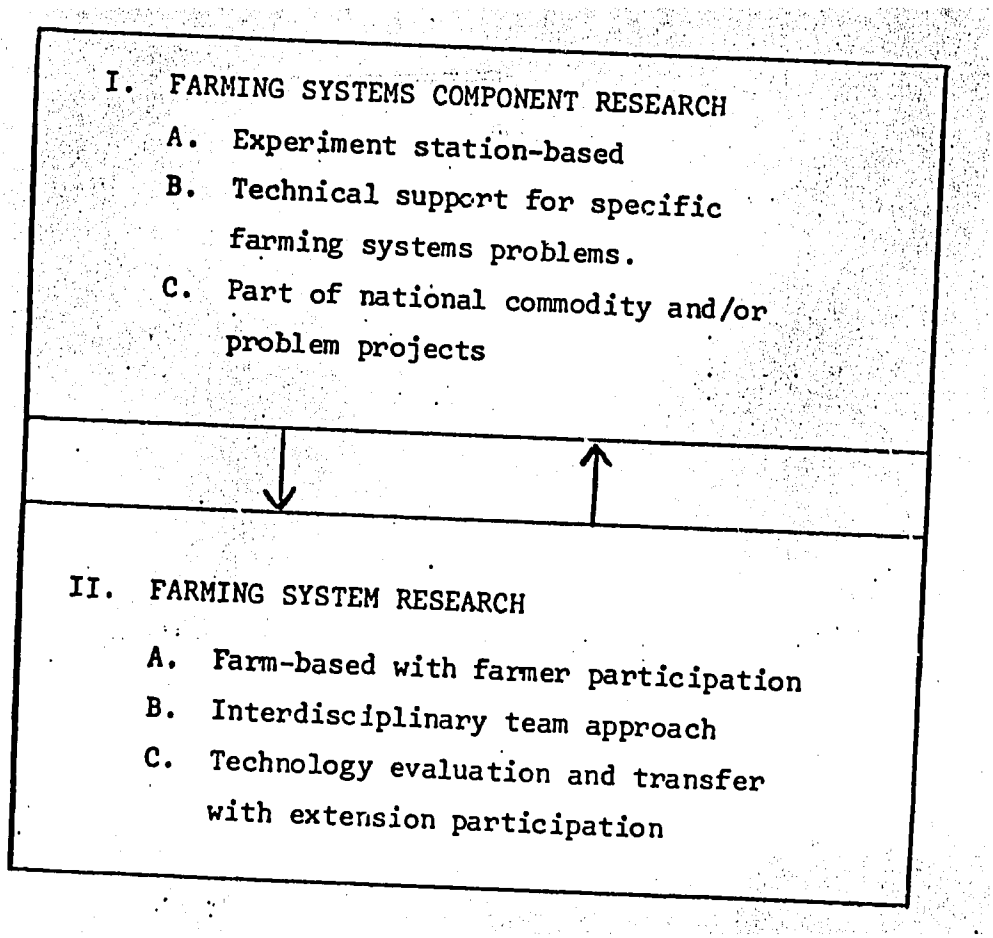

1/ The Headquarters will be the administrative headquarters of PNIA and will be located in the MRN in Tegucigalpa.

2/ This Central Unit will be located at Comayagua and have a country-wide role for training, research and research support.

3/ See Figure No. 4

Figure No. 4

The Unidad Regional[1/]




1/ It generally will consist of two components (I and II above) and be based at an experimental station except in Regions 4 and 7. It will work closely with the DAR.

The Regional Unit. One regional unit is called for in each of the seven agricultural regions by 1982 (Figure 3). Each should consist of a farming systems team, and technical support specialists. This provides research at the farm level with continual technical support from the experiment stations. This latter research will be concerned with specific components of farming systems such as a particular crop or problem (e.g. maize breeding).

The farming systems team will be multidisciplinary in nature, commonly including expertise in crop and animal production sciences, socio-economics, and extension. It will work on-farm with farmer participation, but will be based, when possible, at a regional experiment station. Regions No. 4 and No. 7 have no experiment stations but will receive support from the experiment station network. The farming systems team will perform the following functions:

1. Survey the region to identify target farmer groups and geographical areas of concentration.
2. Gather agro-economic information to better understand farming systems in current use and why these exist.
3. Identify improvable components of farming systems.
4. Determine and evaluate alternative farming systems.
5. Monitor farmer evaluations of the alternative systems.
6. Evaluate acceptance of improved systems by collaborating farmers.
7. Collaborate with Extension to promote improved systems.

Technical support specialists will work on the experiment stations where they will conduct in-depth research on farming systems components identified by a given farming systems team as being important constraints to increased production.

They will also participate in their speciality in nationally coordinated commodity or problem-oriented programs to facilitate transfer of information among regions and with concerned international centers.

The Central Unit. This unit will provide national support in training, laboratory and administrative services, and research and technical specialization which need not be duplicated at each region. It will be located at the Comayagua research station rather than Tegucigalpa to provide the needed research setting. This station is, however, close enough to the capital to maintain good communication with the MRN.

The functions of the Unidad Central will include:

1. Development and implementation of research methodology to be used by the Regional Units.
2. Orientation and training of staff, especially in-service training in farming systems research.
3. Research in support of the regional stations.
4. Coordination and supervision of research on a national basis.
5. Technical assessment of research.

Headquarters. A small technical-administrative headquarters will be located at the MRN in Tegucigalpa, and will have the following functions:

1. Representation of research at the national level.
2. Responsibility for achievement of program objectives.
3. National coordination with domestic and foreign groups interested in Honduras agricultural research.
4. Ultimate responsibility for decisions and supervision of research.
5. General administration and other support services.

C. Pattern of Operation Within the MRN

Under the recommended changes, research would continue to remain under the DGOA (Figure 3). The DGOA would be assisted by the CCIA made up of representatives from government and non-governmental entities directly concerned with agricultural research and development. The suggested composition of the CCIA was noted in Chapter VII. The CCIA would advise the DGOA primarily in matters of policy and priorities. The more technical matters of research would be handled by Technical Committee(s) constituted by the director of PNIA.

The relationship of PNIA to each of the DARs is of fundamental importance. As a coherent national program has to be implemented on a regional basis, it must, to the extent feasible, be integrated with the operations of the DARs. Herein lies a potential basic problem. As described earlier (Chapter III), under present arrangements the DARs have authority over the regional research budgets, including naming and management of personnel. This is unsatisfactory and must be modified if a truly coordinated national research program is to be realized. Thus, under the proposed changes, the head of the national research program will have control of the budget for research. Under this arrangement, there would appear to be two principal means of handling the research budget.

The first and most logical approach would be for regional research funds to be placed with the DARs, but with the explicit understanding that such funds were for research only, and could be committed only by, or with the concurrence of, the national leader of research.

The DARs would provide the administrative and other support services to research, thereby obviating duplication of such in a regional research unit operating outside the framework of the DRAs. This arrangement envisages an active role of the DARs in research program planning and evaluation.

The second approach, less desirable, but possibly the most realistic, is to retain the full research budget with PNIA. If this course is followed, it might be necessary to build into the research entity certain administrative and other support services unless they would be provided by the DARs.

In order to provide PNIA with the budgetary authority needed, while simultaneously insuring an active involvement of the DAR in research, it is recommended that the CAR play a bridging role. The nature and composition of this committee should facilitate a harmonious relationship between research and other agricultural development activities at the regional level.

The farming systems team concept is new to Honduras. Initial implementation of, and training for, such research is proposed to be started in 1978 by the Central Unit in Comayagua. One team should be operating in each region by 1982. Staff is sufficient for the initial research and training effort, if several persons will assume dual responsibilities in the first year or two of farming systems research and training, and integrating station-based technical support specialists into the farming systems program. These specialists are essentially the research technicians of the current national program.

Priorities. Priorities will be given to the small and medium-sized farmers, both independent operators and those in the agrarian reform sector. These groups produce most of the domestic requirements of basic foodgrains and livestock, but are in greatest need of appropriate technologies for increased production and improved income. Geographical research priorities should reflect rural population, priority commodity production, available markets, and potential research impact. Priority will also be given to the research on the basic foodgrains (maize, sorghum, rice and beans), both at the farm and research station level. These programs will

be strengthened by graduate degree programs and by taking full advantage of the information,materials, and training offered by international centers such as CIAT, CIMMYT, and CATIE.

The National Investment Strategy for Increased Food Production[1/] calls for medium and long term expansion and diversification of livestock, vegetables, fruit, root crops, and soybean production. With this in mind, preliminary research will be conducted during the next five years in vegetables and oilseed crops production. A modest research program on livestock will be developed.

Program and Budget Development and Review. The overall program will be developed, and modified, on the basis of individual project proposals originating from the Regional Units. These proposals, as well as the overall regional research programs, should be presented to the CARs by the regional research representative, and reviewed by the committee. They should also be assessed by the national technical support programs, perhaps through annual regional workshops.

The director of PNIA will name (a) technical committee(s) from the research staff to review proposals submitted to him for approval. All proposals will contain an estimate of costs.

Based on all national and regional proposals, the director of PNIA will submit an annual consolidated program and budget to the DGOA, where it could be reviewed by the CCIA.

Services and Facilities. Supporting services and facilities will be required to implement the approved programs. These include:

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1/ See Page 1, for reference.

1) a network of regional experiment stations; 2) transportation; 3) service laboratories (e.g. facilities for soil and forage analyses); 4) library services; 5) documentation; 6) statistical services, and 7) administrative services to the extent they cannot be met by the DARs.

The existing six experiment stations seem sufficient in number, location and size, but substantial improvements will be required (landscaping, irrigation, drainage, buildings, and in laboratory and field equipment - see Ch. V). The farming systems teams will be effective only to the extent they can interact with the farmers and his operations so they must be mobile. The technical support specialists also must have sufficient mobility to carry out their on-station programs, but more importantly to interact with the farming systems teams. Transportation is clearly an element critical to the proposed research system; without it the system will not function effectively.

The needs for laboratory services will be modest, and hopefully can be met, in large measure, through appropriate arrangements with the National Soils Laboratory (see Ch. V). The greatest need is likely to be for analysis of soil and plant samples for determination of fertility or nutritional status. Additional laboratories will be added to the program only after the need for them has been justified through experience.

Needed library services will primarily be provided by CEDIA with some improvements to better meet the needs of research. In addition, small reference libraries will be located at each station. Publication of research information can be handled by CEDIA with some improvements. Statistical analysis of data will be handled largely at the experiment station level, with support being provided as required from the headquarters or the Central Unit (see Ch. V).

Administrative services will be needed by all three organizational elements in the national research system - the headquarters, Central Unit and Regional Units. To the extent feasible, such services should be provided under existing arrangements in the DGOA. In particular, at the regional level, all efforts should be made to utilize the administrative support services of the DARs. This will have to be done, however, under an arrangement where the national director of research has full control of the research budget and research personnel.

Staff Development and Management. The national research staff will require substantial increase in number as well as in academic qualifications (see Ch. VI), due primarily to the manpower requirements of the farming systems teams and livestock research. Both in-service training and advanced degree programs will be used. All members of the farming systems teams will work for 6-8 months in the Central Unit research program. If this training is started early in 1978, there should be sufficient participants to form one team per region by 1982.

Academic training will be largely for the M.S. degree, and phased over the five year period. Returning scientists will be used both as technical support specialists and as farming systems team members. Some 30 persons should be sent for academic training during the five year period.

Staff salaries and perquisites should be compared periodically with those of employers competing with PNIA. This is necessary to insure continuity in the research program. Methods for recognition of superior performance should also be developed.

Important to staff morale and performance is the timely provision of services and equipment to get the job done. The approved budget must be available to PNIA for this to be realized. The recommended control of the PNIA budget shoudl assist materially.

Linkages. For the results of research to be translated into increased agricultural production, the research must relate effectively to the producer, and to other elements affecting agricultural development. The proposed reorganization would improve relations with the farmer and with the extension service. Further, the CCIA is proposed to give representation to groups concerned with national planning, agricultural education, credit and inputs, and the DARs. Relations with international and other national agricultural research centers should be strengthened and increased to insure that Honduras makes full use of relevant foreign research.

# IX. IMPLEMENTATION AND FUNDING

## A. Introduction

The strengthening of PNIA involves an innovative approach to working with and for the farmer. It requires coordinated interdisciplinary research and sufficient budget control to implement planned operations.

Implementation of the measures proposed in this report will require a number of policy decisions within the MRN and a substantial increase in budget support over the next five years.

## B. Policy Decisions

The full research budget should be placed with the head of PNIA to insure necessary administrative control over it and authority for program implementation. Arrangements should be worked out with the DARs for administrative services to avoid unnecessary, duplication, as well as to coordinate agricultural research with other regional agricultural services performed by the DARs. The latter should be informed of the new mode of operation of PNIA, and their full cooperation sought.

The experiment station at Comayagua should be recognized as the site of the Central Unit with a national role for in-service training support services and specific research to support regional programs.

An extensionist should be assigned to each farming system team. One team is planned for each region by the end of five years. The CCIA should be appointed to advise the DGOA on research. Regionally the CAR should advise the DAR on research.

## C. Program Phasing and Estimated Budgetary Requirements

Five-year requirements for strengthening the national research

station network and manpower development are discussed in Chapters V and VI, respectively. The estimated operating, or locally-funded, budget needs are given in Appendix 3; those involving external funding for this five-year period are shown in Appendix 4.

The locally-funded operating budget is summarized in Table 14. From the approved budget of L. 1.623 million for 1978, projected needs would reach about L. 2.987 million by 1982. Increases in salaries and other personnel costs reflect a virtual doubling of technical staff and modest improvement in salary scales. The increases in per diem and supplies (particularly fuel) result, in considerable measure, from the farming systems team approach to farm-level research, which requires much time away from the stations, and a high level of mobility (transportation requirements). Equipment costs are due largely to passenger and transport vehicles.

The largest yearly increase, 36%, in 1979 is required to implement the proposed new research methodology. A focus on farm-level research with farmer participation markedly increases the need for staff and staff support. After 1979 the projected annual increases in the local cost budget are modest - between 9 and 11%. After 1982, the operating budget will depend, to a considerable extent, on how many farming systems teams are operating in each region. Demand for more rapid agricultural development may dictate more than one team in a number of regions.

The local-cost budget projection seems reasonable in terms of the total value of production of crops for which PNIA has responsibility. In 1976 the value of such crops (including livestock) was L. 305 M. Using this as a base, research funds for 1978 would represent only 0.5% of the GDP for those crops; for 1982 the corresponding figure would be 0.8%, assuming a 4.5% annual increase in GDP value of these crops.

External funding will be needed for consultants, staff training,

Table 14

Summary Projection of Local-costs National Research Budget
Over a Five Year Period (1978-1982) (LPS $10^3$)[1/]

| Category | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| Salary, personnel pay | 1,349 | 1,712 | 1,901 | 2,066 | 2,291 |
| Per diem, etc. | 65.6 | 150 | 162 | 180 | 191 |
| Supplies | 119.5 | 175 | 210 | 237 | 260 |
| Equipment[2/] | 71.2 | 185 | 205 | 225 | 245 |
| Potable water supply | 18 | | | | |
| TOTAL | 1,623.4 | 2,222 | 2,478 | 2,708 | 2,987 |
| Annual Increment | | 36% | 11.5% | 9.3% | 10.3% |

1/ See Table 15 for costs of outside consultants, scholarships for advanced study, experiment station infrastructure and major items of equipment (other than vehicles). The assumption is made that those costs will be met, for the most part, under loans from IBRD, BID, etc.

2/ This item consists, in large part, of passenger and transport vehicles.

vehicles, and equipment and building (see Table 15). If the proposed program is followed, such costs should be markedly reduced after 1982.

A loan by the World Bank, to be administered by IICA, will meet some external costs, including four of the longer term consultants. A second loan for agricultural research is under consideration by BID. Further assistance will be needed, however, and other possible sources of support, such as USAID, should be explored.

Evaluation

In the real sense, research is evaluated by its influence on the farmer. However, decisions by farmers to change production systems normally are a result of a number of factors, of which improved technology may be only one. Therefore, research cannot easily be evaluated without simultaneously evaluating, other factors that influence farmer decisions, and the performance of organizations concerned with those factors.

Nevertheless, with the foregoing in mind, and from a practical standpoint, periodic internal evaluation of the research program is essential. Commodity or problem-oriented research will be reviewed during annual workshops when the previous years' results are evaluated, and plans are made for the next year's program. At the regional level CAR would serve both as a review and advisory body. At the national level, technical review would be a function of technical committees established by the leader of the PNIA. Also at the national level, the proposed CCIA would be concerned with broader issues with policy and priorities.

In addition, it is suggested that every few years (perhaps three) the DGOA appoint and ad hoc committee with national and international representation to review the overall research program. This seems important in view of the innovative research approach and the importance of internationally oriented research outside of Honduras, to the needs and interests of the agricultural economy of this country.

Table 15

Summary Projection of External-costs PNIA Budget for the Five Year Period (1978-1982) (U.S. $ $10^3$)[1/]

| Category | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| Consultants: | | | | | |
| - long term[2/] | 200 | 550 | 600 | 350 | 50 |
| - short term[3/] | 12 | 16 | 16 | 18 | 18 |
| Graduate training[4/] | 90 | 130 | 120 | 160 | 160 |
| Short course training[5/] | 6 | 10 | 10 | 10 | 10 |
| Vehicles[6/] | 70 | 70 | 70 | 70 | 70 |
| Station buildings | 95 | 36 | - | - | - |
| Equipment | 70 | 85 | - | - | - |
| Library materials | 3 | 1 | 1 | 1 | 1 |
| TOTAL | 546 | 898 | 817 | 609 | 309 |

1/ The local costs summary budget estimates are given in Table 14.

2/ Consultant costs (salary) are figured at $ 50,000/year

3/ Cost of a 10-day visit is estimated at $ 1,000.

4/ Based on $ 10,000 per year per student

5/ Based on $ 2,000 per student.

6/ This assumes ten vehicles per year.

Appendix No. 1

Persons Primarily Responsible for Preparation of the Report

1. Ing. Antonio Ramón Silva, PNIA, Jefe Nacional (Agronomy)[1/]
2. Dr. Mario Contreras, PNIA, Técnico en Investigación (Plant Pathology)
3. Dr. Franklin Rosales, PNIA, Técnico en Investigación (Plant Breeding)
4. Ing. Juan José Osorto, PNIA, Técnico en Investigación (Plant Breeding)
5. Dr. Frank Peairs, PNIA, Técnico en Investigación (Entomology)
6. Dr. Daniel Galt, PNIA, Técnico en Investigación (Agricultural Economics)
7. Ing. Alvaro Díaz, BID Consultant in Research and Extension (Forage Improvement)
8. Dr. Guy B. Baird, IADS (Agronomy-Research Administration)
9. Dr. Ralph W. Cummings, Jr., IADS (Agricultural Economics)
10. Dr. Robert K. Waugh, Rockefeller Foundation - CIAT, with ICTA in Guatemala (Research Administration, Animal Science)
11. Dr. Peter E. Hildebrand, Rockefeller Foundation, with ICTA in Guatemala (Agricultural Economics)
12. Dr. Jerome H. Manner, Rockefeller Foundation, with RF-EFD Program at the Federal University of Bahia, Salvador, Bahia, Brazil (Animal Science)

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1/ Area of specialization is noted in parenthesis. PNIA is the National Program of Agricultural Research.

Appendix No. 2

PROGRAMA NACIONAL DE INVESTIGACION AGROPECUARIA

PRESUPUESTO 1978 (LPS)

| | TOTAL | OFICINA CENTRAL | GUAYMAS 1/ | LA ESPERANZA | COMAYAGUA | LA LUJOSA | DANLI | CATACAMAS |
|---|---|---|---|---|---|---|---|---|
| 111 Sueldos y Salarios | 1,023,060 | | | | | | | |
| 112 Jornales | 185,000 | | | | | | | |
| 129 Servicios Personales | 150,000 | 150,000 | 56,277 | 11,581 | 23,124 | 43,839 | 29,179 | 21,000 |
| 230 Viáticos dentro del País | 30,000 | 8,250 | 6,500 | 2,000 | 3,125 | 4,500 | 3,125 | 2,500 |
| 231 Viáticos al Exterior | 5,000 | 5,000 | | | | | | |
| 200 Servicios No Personales | 15,150 | 2,150 | 3,500 | 1,000 | 2,000 | 3,000 | 2,000 | 1,500 |
| 361 Combustible y Lubric. | 70,000 | 9,000 | 18,000 | 6,000 | 9,000 | 12,000 | 10,000 | 6,000 |
| 300 Materiales y Suminis. | 45,000 | 2,700 | 11,000 | 2,500 | 4,000 | 10,000 | 10,000 | 4,800 |
| 4 Maquinaria y Equipo | 71,200 | 7,200 | 28,000 2/ | -.- | 28,000 3/ | -.- | -.- | 8,000 4/ |
| 5 Construcción de Pozos | 18,000 | -.- | -.- | -.- | 6,000 | -.- | 6,000 | -.- |
| | 1,612,410 | 184,300 | 123,277 | 23,081 | 75,249 | 73,339 | 60,304 | 43,800 |

1/ Con el presupuesto asignado a Guaymas se reforzará el Plan de Trabajo a realizarse en La Ceiba

2/ Corresponde a dos vehículos Pick-up

3/ Corresponde a un pick-up y una camioneta

4/ Corresponde a una cuchilla niveladora y un rotavator

Appendix No. 3

Projected Local Costs (Lempiras) Budget, 1978-1982[1/]

| LON | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| Sueldos y Salarios | 964,080 | 1.272,000 | 1.406,000 | 1.466,000 | 1.581,000 |
| Jornales | 185,000 | 190,000 | 195,000 | 200,000 | 210,000 |
| Servicios Personales | 200,000 | 250,000 | 300,000 | 400,000 | 500,000 |
| Sub-Total | 1.349,080 | 1.712,000 | 1.901,000 | 2.066,000 | 2.291,000 |
| Viáticos Nacionales | 50,000 | 115,000 | 127,000 | 134,750 | 146,300 |
| Viáticos al Exterior | 5,000 | 20,000 | 20,000 | 15,000 | 15,000 |
| Servicios No Personales | 10,650 | 15,000 | 15,000 | 15,000 | 15,000 |
| Sub-Total | 65,650 | 150,000 | 162,050 | 164,750 | 191,300 |
| Combustibles y Lubric. | 70,000 | 115,000 | 140,000 | 162,000 | 180,000 |
| Materiales y Suministros | 49,500 | 60,000 | 70,000 | 75,000 | 80,000 |
| Sub-Total | 119,500 | 175,000 | 210,000 | 237,000 | 260,000 |
| Adquisición Equipo Oficina | 7,200 | 5,000 | 5,000 | 5,000 | 5,000 |
| Adquisición Equipo Agrícola | 8,000 | 20,000 | 30,000 | 40,000 | 50,000 |
| Adquisición Equipo Transporte | 56,000 | 160,000 | 170,000 | 180,000 | 190,000 |
| Sub-Total | 71,200 | 185,000 | 205,000 | 225,000 | 245,000 |
| Sistemas de Agua Potable | 18,000 | -.- | -.- | -.- | -.- |
| GRAN TOTAL | 1.623,430 | 2.222,000 | 2.478,050 | 2,691,750 | 2.972,300 |
| Serv./Personales/ Total | 83.1% | 77.0% | 76.7% | 76.3% | 76.7% |
| Incremento Anual | 36.8%[2/] | 11.5% | 9.3% | 10.3% | |

See Appendix No. 4 for costs of outside consultants scholarships, advanced study, experiment station infrastructure, and major items of equipment (other than vehicles).

Debido al aumento de personal e insumos necesarios para la implementación del nuevo programa (salarios, viáticos, carros y combustible).

Appendix No. 4

Projected External Costs (U.S. dollar) Budget-PNIA, 1978-1982[1/]

| CATEGORY | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| A. Consultants-Long-term (14)[2/] | | | | | |
| 1. Research administration (1) | 50,000 | 50,000 | 50,000 | | |
| 2. Technology transfer (1) | | 50,000 | 50,000 | 50,000 | |
| 3. Animal Science | | | | | |
| Forage mgt | | 50,000 | 50,000 | 50,000 | |
| Dairy and meat prod. | | | 50,000 | 50,000 | 50,000 |
| Animal nutrition | 50,000 | 50,000 | 50,000 | | |
| Small animal prod. | | | 50,000 | 50,000 | |
| 4. Agric. economics (2) | 50,000 | 100,000 | 100,000 | 50,000 | |
| 5. Sociologist (1) | | 50,000 | 50,000 | | |
| 6. Soil mgt (1) | | 50,000 | 50,000 | 50,000 | |
| 7. Post-harvest mgt (1) | | 50,000 | 50,000 | | |
| 8. Weed science (1) | | 50,000 | 50,000 | 50,000 | |
| 9. Experiment station mgt (1) | 50,000 | 50,000 | | | |
| B. Consultants-Short term (80)[3/] | 12,000 | 16,000 | 16,000 | 18,000 | 18,000 |
| C. Advanced degree training (37)[4/] | 90,000 | 130,000 | 120,000 | 160,000 | 160,000 |
| D. Short course training (10)[5/] | 6,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| E. Passenger/trans. vehicles (25)[6/] | 70,000 | 70,000 | 70,000 | 70,000 | 70,000 |
| F. Experiment station bldgs. (22)[7/] | 95,000 | 36,000 | | | |
| G. Equipment | | | | | |
| Field | 50,000 | 45,000 | | | |
| Office | 20,000 | 15,000 | | | |
| Laboratory | | 25,000 | | | |
| H. Books and journals | 3,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| T O T A L ($) | 546,000 | 898,000 | 817,000 | 609,000 | 309,000 |

1/ The local cost budget estimates are given in Appendix No. 3. External costs might be covered by funds from World Bank, BID, etc.

2/ An estimated average cost of $ 50,000 per year/specialist

3/ Total of $ 1,000/10 day visit - $500 local costs and $500 air fare.

4/ $ 10,000 year/student

5/ $2,000 course/student

6/ Ten vehicles/year, $7,000/vehicle

7/ Construction over a period of two years of 4 houses and 2 offices at $12,500 each, 4 labs and 3 cold storage rooms at $7,500 each, 5 "TALLERES" at $3,000 each, 4 "GALERAS" at $1,250 each, and 3 greenhouse at $2,000 each

Appendix No. 5

Projected Staff-PNIA, 1982

| vidad | Posición | 1977 2/ Actual | 1982 3/ Número | Ubicación | Nivel 4/ |
|---|---|---|---|---|---|
| | Jefe | 1 | 1 | Guaymas | III |
| | Asistente | 2 | 1 | " | IV |
| | " | 2 | 1 | Catacamas | IV |
| | " | 1 | 1 | La Esperanza | IV |
| | " | 1 | 1 | Danlí | IV |
| | " | 0 | 1 | Litoral | IV |
| | " | 2 | 0 | Comayagua | |
| ol | Jefe | 1 | 1 | Danlí | III |
| | Asistente | 2 | 2 | " | IV |
| | " | 0 | 1 | Catacamas | IV |
| | " | 0 | 1 | Comayagua | IV |
| z | Jefe | 1 | 1 | Guaymas | III |
| | Asistente | 1 | 1 | Guaymas | IV |
| | " | 2 | 1 | Choluteca | IV |
| | " | 0 | 1 | Litoral | IV |
| | " | 0 | 1 | Otro | IV |
| o | Jefe | 1 | 1 | Choluteca | III |
| | Asistente | 1 | 1 | " | IV |
| | " | 0 | 1 | Otro | IV |
| ginosas | Jefe | 0 | 1 | Comayagua | III |
| | Asistente | 1 | 1 | Comayagua | IV |
| | " | 2 | 1 | Guaymas | |
| | " | 0 | 1 | Catacamas | |
| | " | 1 | 0 | Danlí | |
| ıjolí | " | 1 | 1 | Choluteca | IV |
| :alizas | Jefe | 1 | 1 | Comayagua | III |
| | Asistente | 1 | 2 | " | IV |
| | " | 0 | 1 | La Esperanza | IV |
| | " | 3 | 1 | Catacamas | IV |
| :rculos | Jefe | 0 | 1 | | III |
| ı | Asistente | 2 | 2 | La Esperanza | IV |
| ı-Camote | " | 1 | 1 | Guaymas | IV |
| :ecnia | Jefe | 0 | 1 | Comayagua | II |
| | Asistente | 0 | 2 | " | III |
| | " | 0 | 1 | Choluteca | IV |
| | " | 0 | 1 | Catacamas | IV |
| | " | 0 | 1 | Guaymas | IV |
| | " | 0 | 1 | Sta. Rosa | IV |
| | " | 0 | 1 | Danlí | IV |
| | " | 0 | 1 | Litoral | IV |
| temas | Socio-economista | | | Catacamas | [illegible] |
| | Agrónomo | 1 | 15 | Choluteca | [illegible] |

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| Actividad | Posición | 1977 Actual | 1982 Número | Ubicación | Nivel |
|---|---|---|---|---|---|
| Sistemas | | | | Danlí<br>Guaymas<br>Sta. Rosa<br>Litoral | III (7) |
| Jefatura | Jefe | 0 | 1 | Catacamas | II |
| Regional | Jefe | 0 | 1 | Choluteca | II |
| | " | 0 | 1 | Danlí | II |
| | " | 0 | 1 | Guaymas | II |
| | " | 0 | 1 | Sta. Rosa | II |
| | | | | Litoral | II |
| Manejo | Encargado | 0 | 1 | Catacamas | IV |
| Estación Exper. | " | 1 | 1 | Choluteca | IV |
| | " | 0 | 1 | Comayagua | IV |
| | " | 0 | 1 | Danlí | IV |
| | " | 0 | 1 | Guaymas | IV |
| | " | 0 | 1 | La Esperanza | |
| Unidad | Jefe | | 1 | Comayagua | I |
| | Técnicos | 5 | 2 | Comayagua | II (2) |
| | " | | 3 | | III (3) |
| Jefatura | Jefe Nacional de Investigación | 1 | 1 | Tegucigalpa | I |
| | Jefe Estaciones Experimentales | 0 | 1 | Tegucigalpa | II |
| | Administrador | 0 | 1 | Tegucigalpa | III |
| Personal de Apoyo | Varios | Varios | Varios | Varios | Varios |
| Jornales | " | " | " | " | " |

1/ It is understood that this list include discipline specialists (e.g. a soil scientist) who would work with national responsibility. He could be located in this table as a Jefe Regional or one of the members of the Unidad Central.

2/ Almost entirely salary level IV.

3/ This projection contemplates a total of 76 research personnel by the end of the five year period, plus supporting staff and daily laborers.

4/ Four levels of research staff are proposed:

I - L. 3,000 - 3,500 / month (4)

II - L. 2,000 - 3,000 / month (15)

III - L. 1,500 - 2,000 / month (20)

IV - L. 900 - 1,500 / month (37)

V - Less than L. 900 / month

The number that would be in each level is shown in parentheses.

Appendix No. 6

# ANIMAL PRODUCTION AND RESEARCH

Jerome H. Maner[1/]

## PRESENT SITUATION

Livestock, including cattle, swine and poultry, plays an important role in Honduran agriculture and in the national economy, accounting in 1974 for 24% of total agricultural output and 9% of the gross domestic product. Livestock was fourth (after bananas, coffee and wood products) in total export value during 1974, reflecting a decline from second place just four year previous (due to declining world beef prices, rising coffee prices, increased importance of forestry products and, possibly, Agrarian Reform policies which emphasized basic grain production).

Cattle: A major portion of income from livestock is derived from cattle including those used both for beef and milk production. The 1974 National Agricultural Census indicated a cattle production of 1.7 million head (other estimates indicate 2.0 million) of which 80% was located on farm units of less than 50 ha. The cattle are distributed throughout the country with greater concentrations in the department of Cortés, Santa Bárbara, Yoro, Olancho, El Paraíso, Francisco Morazán and Choluteca (Table 1).

Land area dedicated completely or partially to cattle production approaches 2.3 million ha., or 20.5% of a total national land area of 11.2 million ha. These lands of extremely variable topography, fertility and usefulness, are distributed throughout the country. Pasture with some improvement accounts for 44% of this area with the remaining 56% covered with native pasture and open forest lands used for cattle range. Secondary growth, brush and weeds

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1/ Coordinator of Agricultural Programs within Rockefeller Foundation, with RF-EFD Program at the Federal University of Bahía, Salvador, Bahía, Brazil. This report was prepared as part of the IADS-assisted review of agricultural research in Honduras. November, 1977.

DISTRIBUTION OF CATTLE AND SWINE BY REGION AND DEPARTMENT
(TERCER CENSO NACIONAL AGROPECUARIO)

| Region & Department | Cattle | Swine |
|---|---|---|
| Region No. 1 | 225,649 | 99,012 |
| Choluteca | 171,316 | 43,392 |
| Valle | 62,470 | 37,936 |
| El Paraíso | 14,110 | 8,468 |
| Francisco Morazán | 7,753 | 9,216 |
| Region No. 2 | 148,452 | 42,243 |
| Comayagua | 77,517 | 20,884 |
| La Paz | 43,278 | 14,053 |
| Intibuca | 27,657 | 7,306 |
| Region No. 3 | 440,110 | 95,367 |
| Cortés | 172,287 | 21,841 |
| Santa Bárbara | 140,001 | 32,596 |
| Atlántida | 36,232 | 10,463 |
| Yoro | 91,590 | 30,467 |
| Region No. 4 | 160,602 | 58,319 |
| Atlántida | 42,123 | 13,191 |
| Islas de la Bahía | 4,403 | 949 |
| Gracias a Dios | 9,792 | 6,178 |
| Yoro | 46,350 | 14,375 |
| Region No. 5 | 190,319 | 69,899 |
| Olancho | 190,319 | 69,899 |
| Region No. 6 | 249,518 | 53,744 |
| Francisco Morazán | 120,721 | 31,905 |
| El Paraíso | 128,797 | 21,839 |
| Region No. 7 | 222,244 | 91,656 |
| Copán | 98,320 | 24,572 |
| Ocotepeque | 42,699 | 7,030 |
| Lempira | 81,225 | 46,440 |
| Intibuca | 22,996 | 13,614 |
| TOTAL | 1,666,894 | 510,240 |

Table 1 (B)

DISTRIBUTION OF CATTLE AND SWINE BY DEPARTMENT
(TERCER CENSO GANADERO, AGOSTO DE 1974)

| Departments | Cattle | Swine |
|---|---|---|
| Atlántida | 78,360 | 23,654 |
| Colón | 57,929 | 23,626 |
| Santa Bárbara | 140,001 | 32,596 |
| Copán | 98,320 | 24,572 |
| Gracias a Dios | 9,729 | 6,178 |
| Yoro | 137,940 | 44,842 |
| Ocotepeque | 42,699 | 7,030 |
| Islas de la Bahía | 4,403 | 949 |
| Cortés | 172,287 | 21,841 |
| El Paraíso | 142,907 | 31,025 |
| Francisco Morazán | 128,474 | 41,191 |
| Olancho | 190,319 | 69,995 |
| Comayagua | 77,517 | 20,884 |
| Intibucá | 50,653 | 20,920 |
| La Paz | 43,278 | 14,053 |
| Lempira | 81,225 | 46,440 |
| Choluteca | 171,316 | 43,392 |
| Valle | 62,470 | 37,936 |
| TOTAL | 1,689,890 | 511,124 |

| Regions | Cattle | Swine |
|---|---|---|
| No. 1 | 255,649 | 99,012 |
| No. 2 | 148,452 | 42,243 |
| No. 3 | 440,110 | 95,367 |
| No. 4 | 160,602 | 58,319 |
| No. 5 | 190,319 | 69,899 |
| No. 6 | 249,518 | 53,744 |
| No. 7 | 222,244 | 91,656 |
| TOTAL | 1,666,894 | 510,240 |

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significantly reduce forage production and quality. In some regions low rainfall during the dry season (generally from December to April) causes a significant decline in forage production during this period, resulting in the need to provide stored or harvested forage (silage, elephant grass green chop, sugarcane, etc.) to prevent body weight loss and reduced milk production.

The majority of the cattle of the country are used for dual purpose production of both milk and beef. On most farms, except those located in the areas of large processing plants, cows are managed under a traditional system of once-a-day milking. Under this system of production, the calves are allowed to run with the cows on pasture durirg the day, suckling the milk that is produced. The calves are separated at night and the cows are milked in the early morning. Some management systems allow the cows to return to the pastures during the night to consume additional forage; others maintain the cows in the corral with no access to feed during the night. The latter system significantly reduces nutrient intake and total milk production.

Milk produced under this system is either consumed on the farm, sold as fresh fluid milk, or processed into cream, butter and cheese for sale when transportation to a market is available. The by-products from this home processing, either skim milk or whey, are utilized to feed other farm animals and especially as a feed for swine.

In areas adjacent to the major processing plants (San Pedro Sula, La Ceiba, Tegucigalpa and Choluteca) a twice-a-day milking system is being adopted. Although this system increases the quantity of saleable milks, it has a detrimental effect on the livability, growth and performance of the calves produced from these cows.

Although Holstein, Brown Swiss, Jersey, Gurnsey and Red Poll breeds have been used to increase the genetic potential for milk production in some areas, and especially in milksheds around processing plants, native cattle (or those with some Cebu breeding) predominate in the country. Genetic potential of the cattle population is at present less of a factor limiting

production than nutrition and management. In fact, genetic potential is probably far ahead of nutrition and management, and gene expression for milk production is reduced because of low levels of nutrition and poor management. Average daily milk production per cow per day during lactation is estimated to be 3 liters with a total per cow lactation production of only 600 liters.

Information from the 1974 Agricultural Census indicates that 179,127 cows were being milked at the time of the census, however, data are not available to indicate the total number of cows that contribute to the annual milk production, which reached 196.1 million liters in 1974. With the importation of the equivalent of 24.9 million liters, 221.0 million liters were consumed in 1974 for a per-capita consumption of 80.6 liters.

Efficiency of production of the national cattle population is low as indicated by a 14.5% extraction rate in 1974 (number of cattle slaughtered in relation to total national population: 236,577/1,689,890). Low birth rate (45-55%), high mortality (18%) and slow growth rate contribute to this low level and efficiency of production. Cattle average 300 to 320 kg at slaughter and produce a carcass weighing an average of 140 to 150 kg. Less than 25 kg of beef are produced annually from each head of cattle in the national herd.

In 1974, 236,557 head of cattle were slaughtered to produce 35,435 metric tons of beef. Of this total 19,539 metric tons were exported and 15,905 metric tons were consumed internally for an average per-capita consumption of 5.83 kg. The export quotas have been met each year up through 1977; however, there are indications that it may be difficult to meet 1978 export quotas without significantly reducing internal availability (Ing. Mario Nufio Gamero - Banco Central).

Swine: Very little information and few reliable data related to swine production are available. Pigs are concentrated on small farms distributed throughout the country (Table 1). Commercial swine operations number only 10 to 15 and production from them represent only a fraction of one percent

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of total national output. The majority of the pigs are raised under an extensive system of management. They are allowed to roam freely on the farms and receive very little care. High mortality, poor nutrition and parasites and diseases combine to reduce production. Few pigs are weaned from each litter and those that do survive require 12 to 18 months to reach an average market weight of 45 kg. Although pigs are allowed to graze and scavenge for food throughout the farm, their diet is supplemented with crops residues, house garbage, milk by-products including whey and skim milk and occasionally bananas and corn.
During 1974 an estimated legal and clandestine slaughter of 267,560 head produced 8,562 metric tons of pork, all of which was consumed internally. Given a national swine population of 511,124 head, this would represent an annual extraction rate of 52%.

Poultry: Honduras is self-sufficient in both poultry and eggs. Both commercial and traditional production contribute to the national output of the more than 6.3 million birds and 230.8 million eggs produced in 1975. Income from poultry and poultry products represents 3.9% of the total agricultural output.

Commercial production of 4.7 million birds and 187.4 million eggs is comtrolled by 56 to 60 major producers who have associated to form a strong national poultry organization. This commercial sector utilizes birds of improved breeding, balanced rations, proper sanitary and disease control, and modern management technology. Protein supplements are imported for mixing with locally produced corn and sorghum grain; however, the present scarcity of feedgrains could have a major effect on commercial poultry production and require that feedgrains be imported to supplement reduced national supplies.

Traditional poultry and egg production supplies 1.6 million birds and 43.4 million eggs annually. Production under this traditional systems is low and diseases are responsible for high rates of mortality and morbidity. Chickens on small farms are not vaccinated and rate therefore susceptible to the

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infections diseases. Chickens receive most of their feed supply from scavenging around the farm consuming worms, grubs, fallen fruit, animal feces, garbage, grass, and other edible farm residues. Poultry and eggs are consumed by the farm family, but also are sold to supplement the farm income.

Other Livestock: Although there are small herds of goats scattered throughout the country, with the largest numbers located in the dryer regions of the country, their role in agriculture and the national economy is insignificant. The Ministry has initiated an extension program to stimulate rabbit production among the poor farm families along the border with Guatemala, but as yet neither production nor income is of any nutritional or economic importance in the country.

## IMPORTANCE OF LIVESTOCK ON SMALL INDIVIDUAL OWNED FARMS AND ON COLLECTIVE FARMS

The importance of livestock in the national economy has been previously noted. Information collected by an AID-sponsored survey conducted by the American Technical Assistance Corporation allows a more detailed description of the importance of livestock in the economy of 1100 individually-owned small farms located in the North, South and Olancho regions of the country. Data are also available on 180 collective farms.

Small Individual Farms: As indicated by the survey, livestock and livestock products represent 28 to 31% of the total gross farm income on individual farms, in comparison to crops which represent 63 to 65% of overall gross income (Table 2). Cattle and their by-products, meat and milk, dominate the livestock production on small farms and represent 61.6 to 66.3% of the total value of all animal products (Table 3). Sale and consumption of milk represent 25.8 to 28% of this total with cattle sales and home consumption of beef representing 35.8 to 38.3% of the total. Eggs also are important sources of food and income and contribute 16.9 to 22.0% of the total livestock income. Contributions of other livestock are of much less importance (see Table 3).

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Table 2

AVERAGE GROSS INCOME FOR THE YEAR 1975 OF 1100 SMALL FARMERS INTERVIEWED BY ATAC-AID[1/]

| | Clients of BNF | | Non-Clients | |
|---|---|---|---|---|
| | Lps | % | Lps | % |
| CROPS | 1325.8 | 63 | 1129.6 | 65 |
| Fruit and Horticulture | 30.3 | 1 | 34.6 | 2 |
| Animals and by-products | 664.5 | 31 | 479.8 | 28 |
| Forest Products and Misc. | 90.3 | 4 | 86.7 | 5 |
| Rent of Land, Animals | 11.3 | 1 | 6.9 | .05 |
| Total Gross Income | 2122.3 | 100 | 1737.7 | 100 |

1/ USAID sponsored survey for Sectorial Analysis conducted in 1975 by American Technical Assistance Corp. McLean, Virginia

Table 3

AVERAGE GROSS INCOME FOR 1975 OF 1100 SMALL FARMERS INTERVIEWED BY ATAC-AID[1/] EXPRESSED BY ANIMAL PRODUCT OR SERVICE

| | Clients of BNF | | Non-Clients | |
|---|---|---|---|---|
| | Lps | % | Lps | % |
| INCOME FROM ANIMALS | | | | |
| Cattle | 254.3 | 38.3 | 172.0 | 35.8 |
| Pigs | 43.6 | 6.6 | 34.8 | 7.3 |
| Goats | 2.8 | .4 | 1.3 | .2 |
| Work Animals | 32.8 | 4.9 | 19.5 | 4.1 |
| Bees | .3 | - | 1.0 | .2 |
| Chickens | 9.6 | 1.4 | 3.5 | .7 |
| INCOME FROM BY-PRODUCTS | | | | |
| Milk Products | 186.3 | 28.0 | 124.0 | 25.8 |
| Eggs | 112.0 | 16.9 | 105.5 | 22.0 |
| Honey & Wax | 2.2 | .3 | .5 | .1 |
| ANIMALS USED FOR WORK IN CROPS | 20.2 | 3.1 | 17.7 | 3.7 |
| TOTAL INCOME | 664.5 | 100 | 479.8 | 100 |

1/ See Table 2

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Table 4 indicates the use made of animals and their by-products. One-half or more of the products are consumed on the farm, or reinvested to increase production, with the remainder being sold to supplement cash flow. It should be noted that animal products are available for sale throughout most of the year and have a stabilizing influence on farm income.

Data on land use (Table 5) indicates that less than an average of 2 mz of land are dedicated to pasture and, of this, only about one-half is considered to be improved pasture. Pasture represents approximately 20 to 21% of the total land area of these individual farms which average between 8.77 and 8.96 Mz.

In summary, these data clearly indicate the importance of livestock and their products in the nutrition and income of the small farm family, and further confirm the dominant role of dual purpose cattle used to produce meat and milk.

Collective Farms: Livestock is of little importance on the collective farms surveyed, and in 1975 contributed only 2.5% of the total gross farm income (Table 6). This reflects the dominant role of crops (more than 90%) on collective farms and the minimal role that livestock and livestock products play in family nutrition and income on collective farms (Table 7). This low production occurs even though there are an average of more than 40 mz on each collective farm consisting of improved and native pasture (11 to 20.7 mz), lands not used for crop production due to lack of resources (8.7 to 20 mz), and woods and mountains (9.0 to 9.9 mz). (Table 8).

Table 4

USE MADE OF ANIMALS AND ANIMAL BY-PRODUCTS BY 1100 INDIVIDUAL FARMERS IN ATAC-AID SURVEY[1/]

| | Clients of BNF Lps. | Non-Clients Lps. |
|---|---|---|
| Animals & By-products sold | 338.3 | 168.6 |
| Consumed by Family | 203.6 | 165.4 |
| Reinvested | 132.6 | 142.8 |
| TOTAL | 664.5 | 479.8 |

Table 5

LAND USE BY INDIVIDUAL FARMERS[1/]

| | Clients of BNF mz. | Non-Clients mz. |
|---|---|---|
| 1. Crops | 6.20 | 5.09 |
| 2. Improved Pasture | .96 | .66 |
| 3. Native Pasture | .94 | 1.12 |
| 4. Woods | .06 | .20 |
| 5. Fallow Land for Crops | .17 | .42 |
| 6. Land Use by others | .10 | .36 |
| 7. Land for Crops Not Used for lack of Resources | .25 | .61 |
| 8. Land used for buildings roads, drainage, etc. | .28 | .30 |
| TOTAL AVERAGE FOR FARM | 8.96 | 8.77 |

1/ See Table 2.

Table 6

AVERAGE GROSS INCOME OF GROUPS ON COLLECTIVE FARMS 1975 ATAC-AID[1/]

| | Non-Model Farms Lps. | % | Model Farms Lps | % | All Farms Lps. | % |
|---|---|---|---|---|---|---|
| Crops | 20,142.7 | 92.6 | 75,523.3 | 91.2 | 24,208.2 | 90.6 |
| Animals | 233.2 | .6 | 5,758.8 | 7.3 | 663.0 | 2.5 |
| Others | 1,482.5 | 6.8 | 1,218.9 | 1.5 | 1,857.3 | 6.9 |
| TOTAL | 21,758.5 | 100.0 | 79,501.0 | 100.0 | 26,728.5 | 100.0 |

1/ See Table 2.

Table 7

USE MADE OF ANIMALS AND ANIMALS BY-PRODUCTS ON COLLECTIVE FARMS IN ATAC-AID SURVEY -1975[1/]

| | Non-Model Farms | Model Farms |
|---|---|---|
| Total number in sample | 166 | 14 |
| Animals and By-Products | Lps. | Lps. |
| Sold | 71.4 | 836.7 |
| Consumed by Family | 22.7 | 631.7 |
| Reinvested | 139.1 | 4290.4 |
| TOTAL | 233.2 | 5758.8 |

1/ See Table 2

Table 8

LAND USE BY COLLECTIVE FARM GROUP[1/]

| | Non-Model Farms Mz | Non-Model Farms % | Model Farms Mz | Model Farms % |
|---|---|---|---|---|
| Total Average Land Area | 145.8 | 100 | 228.0 | 100 |
| A. Utilized Collectively | 115.3 | 79.1 | 169.3 | 74.3 |
| 1. Crops | 69.7 | 47.8 | 129.7 | 56.9 |
| 2. Improved Pasture | 3.9 | 2.7 | 12.5 | 5.5 |
| 3. Native Pasture | 7.1 | 4.9 | 8.2 | 3.6 |
| 4. Wood and Mountains | 9.0 | 6.2 | 9.9 | 4.3 |
| 5. Fallow Land Crops | 5.2 | 3.6 | - | - |
| 6. Land for crops not used-Lack of resources | 20.0 | 13.7 | 8.7 | 3.8 |
| 7. Land used for buildings, roads, etc. | .5 | .3 | .3 | .1 |
| B. Other Uses | 30.5 | 29.0 | 58.7 | 25.7 |
| 1. Individual cultivation | 28.5 | 19.5 | 53.4 | 23.4 |
| 2. Houses | 1.3 | .9 | 1.9 | .8 |
| 3. Rented to others | .7 | .5 | 3.4 | 1.5 |

1/ See Table 2.

Present Research

There is no animal research in the national agricultural research organization. With the exception of a beef cattle crossbreeding study being conducted at the Panamerican School of Agriculture, in collaboration with the University of Florida, and a similar study being conducted on a private farm in Trujillo, little if any attention has been given, to animal research. There is a widespread need for management, nutrition, breeding, disease and parasite control, and socio-economic research to generate appropriate technology to support the animal industry. Most information being utilized at present is obtained from other countries and international centers, and is being employed without being tested or adapted to local conditions. Neither the institutional infrastructure nor sufficiently trained human resources are available to organize, develop and carry out the research program required to generate and adapt appropriate technology to the needs of the livestock industry, especially to the specific needs of the small farmer.

Government Policy

Honduras is classified as a "Food Priority Country", and it is estimated that more than 70% of the population suffers to some degree from malnutrition. The World Food Council indicates an actual and anticipated food grain deficit, with the possible constraints on the country's ability to finance its future grain requirements. Initially, the Government seeks to attain a rapid increase in food production and improvement in nutrition, principally through expanded production and distribution of the basic grain crops; maize, beans, rice and sorghum. This policy is closely related to the fact that these grains form part of a traditional national diet and that they are the staple crops produced by small farmers.

Increased crop production will be complemented in the medium and long-term by programs for the diversification and expansion of the production of livestock, vegetables, fruits, root crops, soybeans and other agricultural produc

As a part of its effort to diversify the diet and help to improve the nutritional status of the population, the Government is promoting a series of

programs aimed at increasing production and consumption of animal protein: meat, dairy products and eggs.

Considerable investment is anticipated to finance increased and improved livestock production. The Government will emphasize the used of public sector and external concessional funding for promoting the production and consumption of milk and meat through an increase in the production of livestock by small farmers. The financial requirements for a program of technical and financial assistance to aid small farmers in livestock production is estimated at US$ 1,000,000 over a period of four years.

The funding for the production and processing of beef from the farms of larger-scale and relatively more advanced technology will be sought from private equity capital and commercial loan sources. About 30% of the total loans being made to the agricultural sector is invested in livestock production and roughly 60% of these loan funds is supplied by the commercial banking system.

## Research Priorities

Established and well-defined Government agricultural policy and development goals, and a sound understanding of the factors which limit livestock production, are needed to establish firm research priorities. With the understanding that the initial efforts of the farming systems teams and technical support specialists will be to define the technological factors which limit production, the farmers' needs and desires, and the socio-economic implications of applying adapted and improved technology, I will focus my comments on those areas of research which appear at present to be priority areas and which are in keeping with national needs and potentials. In relation to species priorities, emphasis should be given first to cattle and second to poultry and swine.

CATTLE: In the livestock sector primary emphasis should be given to ruminant animals since they do not compete with humans for their feed supply. In the case of Honduras this implies the bovine species (Cattle) because of their wide distribution, large present population, and universal acceptability.

milk was about 81 liters/year, 10% of which was imported. The same year, 35,400 M.T. of beef was produced, of which 55% was exported and 45% was consumed internally for an average per capita consumption of 5.83 kg. Export quota have always been met.

(2) Swine: Pigs are concentrated on small farms scattered throughout the country. During 1974, 8,600 M.T. of pork was produced, all of which was consumed internally. Swine do not assume the importance in the small farm family that cattle and poultry do.

(3) Poultry: Honduras is self-sufficient in both poultry and eggs. Income from policy and eggs represents 3.9% of the total agricultural output. Traditional poultry and egg production supplies 1.6 million birds (25% of national production) and 43.5 million eggs (19% of national production) annually. Production under this traditional system is low. Diseases are responsible for high rates of mortality and morbidity, since chickens on small farms are not vaccinated.

5. Importance of Crops and Livestock on Small Farms. (from a survey of 1,100 independent small farmers and 180 asentamientos done in 1975 with USAID sponsorship).

a. Small Independent Farms. For the sampled group of 1,100 farmers, an average of 54% of the total value of agricultural production came from maize, 6.5% from sorghum, 8.5% from beans, and 10% from rice. Crops represent about 64% of overall gross farm income, while livestock in general represents about 30%. Meat and milk dominate the livestock production on small farms (Table 2), and represent about 64% of the total value of all animal products. Sale and

it provides the major portion of the nutrient intake of cattle and is the basis for any successful program.

Initial short-run emphasis should include a grazing and supplemented forage system that will supply as good a year-around grazing program as possible. Pasture management and control of brush and weeds may be looked upon as an initial step in improving forage yields and quality, and should involve few risk factors if these practices are carried out during slack seasons with on-the-farm labor. A second phase should include a study to assess the feasibility of replacing native pasture with improved pasture species. These early efforts should be based on the improved grasses and forages presently being grown successfully in the various regions, and which have been shown to produce adequate forage during much of the year with little if any fertilizer. Present pasture grassess being utilized include: star, alicia, guinea, jaragua and elephant. Forages being used to supplement pastures during the dry season include sugarcane and sorghum. The development testing and evaluation of these practices should follow the same plan outlined for crops and should include farm trials, farmers' tests and evaluation.

Medium and lon-run priorities should include the establishment of a sound pasture and forage research program for the introduction, testing, selection and distribution of grass and legume species that are adapted to the various ecological regions of the country where major emphasis is being given. Outstanding selections would be introduced into the systems testing program as they become available and are shown to offer potential for high yields, better nutrients quality and/or more stable year-around forage production.

CIAT and CATIE should be able to provide excellent support to this program.

b) Supplemental feeds: As the program develops, experiment station and farm tests should be made to evaluate crop residues and feed

supplements (molasses, urea, African oilpalm, grains, etc) in relation to their ability to support economic increases in production and in relation to farmers acceptability and adoption. It is very difficult to apply such research results to small farm situations because of the difficulty encountered in making these products available at the farm level. These products, if economically feasible, will probably be more applicable at the asentamiento or cooperative farm level.

Attention should also be given to mineral nutrition. Deficiencies of phosphorus can have a significant depresssing effect on fertility and growth. A simple but complete mineral nutrition program should be established to overcome the mineral deficiencies of the various regions. Attention should be given to calcium, phosphorus, salt and the trace elements.

2. Management System: Management systems must be established to support efficient animal production. In the traditional system of production, in many cases, the calf which represents a significant portion of the total gross income, is not given the attention required for fast efficient growth. Efforts should focus on the development of feeding and management systems that will support the maximum economical gain and production of calves from the dual purpose system. A combination of management and feeding systems should also seek to extend the period of lactation of the cow and schedule breeding and calving to make maximum advantage of seasonal forage production as well as seasonal milk and dairy product price fluctuations. These management studies should possibly include:

   a) Cow grazing schedules
   b) Calf grazing and feeding systems
   c) Breeding systems to allow calving during proper season of year
   d) Milking and milk handling facilities
   e) Vaccination programs for disease prevention
   f) Parasite control programs

3. Breeding Program: Breeding programs to improve the genetic potential of

the cattle are of lower priority than nutrition and management programs. Until nutrition and management reach a level which allows native cattle to produce at the maximum of their genetic potential, breeding to increase genetic potential for milk production will be of little value, and could possibly have a detrimental effect on both milk and meat production, since it has been shown that crossbreed cows (Holstein, Brown Swiss, etc.) are more demanding in nutrition and management. It has been further shown that breeding efficiency is reduced in the tropics and semi-tropics when increased levels of dairy breeding are incorporated into the herd.

After careful study of results of local (Panamerican School of Agriculture) and international (Colombian Agricultural Institute) studies of crossbreeding using Holstein and Brown Swiss to improve milk production of native cattle, an experimental crossbreeding study should be initiated to measure benefits of such an up-grading program and to evaluate the major breeds. The Panamerican School of Agriculture is interested in such a study if financing can be obtained.

4. Socio-Economic Studies: Broad based socio-economic studies should be carried out to determine the role that livestock play in overall farm economy, stability, capital development and reduction of risk.

In summary, cattle research should be initiated to improve the efficiency and economics of the traditional milk and meat production systems on small and collective farms. Efforts should focus on increased milk production while at the same time providing a production system that will make maximun use of the calf for beef production. Nutrition and management should be given first research priority, followed by genetic improvement studies once a satisfactory level of production is establsihed with the presently available cows. It is important to understand the socio-economic role of livestock in the nutrition and economy of the small farm systems.

POULTRY AND SWINE

It is much more difficult to conceptualize a research program and projects with

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these two species. The initial programs should be kept as flexible as possible and develop along the lines required to generate technology to provide solutions to the problems and bottlenecks encountered after careful analysis of the traditional systems now being employed. Both poultry and swine are grown under a very extensive system management with little if any care, except occasional and limited quantities of farm grains and by-products.

1. Poultry. Of the two, poultry should be given priority since it appears to contribute more to overall farm income. Egg production is very important and systems to improve production should be studied. Initial emphasis should be given to a program to control the many diseases that cause high mortality among small farm flocks. A vaccination program either at the farm level or through a program of distribution of previously vaccinated birds should be studied. Poultry responds to improved management and nutrition. Farm grown grains and other crops should be studied in relationship to their affect on economic production. It is very difficult to introduce commercial supplements into a traditional small farm system unless this is done through a cooperative system. Studies must be made to determine if these increased risk factors can increase economic production and are widely accepted by the farmer.

The possibility of introducing small well-organized poultry units onto larger collective farms should also be studied. Small model units should be developed on the experiment station and where possible tested on a wide variety of collective farms.

Swine: Swine respond rapidly to improved management and nutrition.

Management systems on small farms should concentrate on efforts to reduce baby pig mortality from birth to weaning, and to develop feeding systems utilizing basically farm grown feeds that will support more rapid growth and more economic production. Although total feed intake is commonly limiting, protein, vitamin and mineral deficiencies greatly reduce the level and efficiency of production. Since these

supplements are not available within the country, these defiencies must be overcome through other means. Studies should test the value of legume forages such as desmodium, stylosanthes, cowpea vines, etc. in the overall feeding system for both sows and their pigs up to market. Basic data on the nutritional value of many farm grown feeds are available from work completed in CIAT.

## Staffing Pattern and Human Resources Development

Few well trained animal scientists are available in Honduras. It will be most difficult to initiate a program with young, untrained staff. Every effort should be made to identify a livestock program leader who has good background and experience in Latin America. Young staff should be selected and employed as early in the program as funding will permit, and sent abroad for short course and graduate training. It is not logical to think that a national animal program of research and production will be run by a few people. Each area of production (cattle, poultry, swine and pasture) presents its own set of problems that require specific attention if useful solutions are to be found.

Although they will be difficult to identify and employ, the following personnel and schedule for employment are recommended.

| PERSONNEL | | 78 | 79 | 80 | 81 | 82 |
|---|---|---|---|---|---|---|
| Cattle Program - Dairy - Beef | | | | | | |
| 1. Leader of Livestock Program | AS-Ph.D. | + | + | + | + | + |
| 2. Area Specialist-Dairy-Beef | AS-B.S. | 0 | + | + | + | + |
| 3. Area Specialist-Dairy-Beef | AS-B.S. | 0 | + | + | + | + |
| 4. Area Specialist-Dairy-Beef | MV-B.S. | 0 | 0 | + | + | + |
| 5. Pasture Program | IA-MS | + | + | + | + | + |
| 6. Area Specialist-Pastures | IA-BS | 0 | + | + | + | + |
| 7. Area Specialist-Pastures | IA-BS | 0 | 0 | + | + | + |
| Swine Program | | | | | | |
| 1. Swine Program | AS-MS | + | + | + | + | + |
| 2. Area Specialist-Swine | AS-BS | 0 | 0 | + | + | + |
| Poultry Program | | | | | | |
| 1. Poultry Program | AS-MS | + | + | + | + | + |
| 2. Area Specialist-Poultry | AS/MU-BS | 0 | 0 | + | + | + |

| Animal Scientist on System Teams | | 78 | 79 | 80 | 81 | 82 |
|---|---|---|---|---|---|---|
| 1. Region No. 1 | AS-BS | + | + | + | + | + |
| 2. Region No. 2 | AS-BS | 0 | + | + | + | + |
| 3. Region No. 3 | AS-BS | 0 | + | + | + | + |
| 4. Region No. 4 | AS-BS | 0 | 0 | + | + | + |
| 5. Region No. 5 | AS-BS | 0 | 0 | + | + | + |
| 6. Region No. 6 | AS-BS | 0 | 0 | 0 | + | + |
| 7. Region No. 7 | AS-BS | 0 | 0 | 0 | 0 | + |
| | | 5 | 10 | 16 | 17 | 18 |

Initial emphasis should be to acquaint the staff as quickly as possible with available technology and production systems. Excellent short-term (short-course) training in beef cattle, pasture and forages and swine can be obtained in CIAT. Other projects, such as the small dual purpose dairy-beef project in Panama, should be visited and available results valuated.

Long-term graduate training should be scheduled for each staff member if he is to develop professionally and if the program is not allowed to stagnate. During the initiation of the project, program should be sacrified in order to speed-up the training process. Once sufficient core staff to maintain the programs are trained, new staff should be allowed to begin graduate training after one year of local in-service training and one year as a regional specialist or system-team member.

Select good, properly motivated young scientists, train them well and provide adequate stimulus and incentives so that they become an integral and permanent part of the program.

Implementation of the Program

The first step in the initiation of a sound livestock program will be to recruit the best staff available. A well experienced leader must be identified as early as possible. Since adequately trained staff are not available, this position must be filled from outside the country. The leader in collaboration with the Research Director should select young professionals for work and early training.

As soon as possible a small research unit (40 to 60 mz) should be established at Comayagua. This unit should include a small dual purpose dairy unit utilizing native cows from the region and utilizing a traditional system of production. Several sub-units of this sytem can be used to introduce and test innovations and to evaluate their effect on both milk and beef production. Introduced technology should help with those factors identified by the systems teams which limit on the farm production. Once these innovations are introduced and tested on the experiment station, those that are proven of value should be introduced onto small farms for further testing.

At the same time a small herd of native x Holstein and native x Brown Swiss cows should also be formed. Using the native herd and the crossbreed herd it will be possible to simultaneously test innovation at two levels of genetic potential and to evaluate the two breeds for crossing. The formation of this herd will be difficult because it will be necessary to know the background and genetic make-up of each cow. It will probably be necessary to produce these animals on the experiment station utilizing cows and bulls of known genetic background.

Expansion of research to other experiment stations should follow a detailed study of the needs of each region. It is suspected that stations will be required in the North, South, Central and Olancho Regions. Each station area should be kept to a minimum. Large dairy and beef units are expensive and in many cases do not represent the farmers we wish to serve. Although some sophistication may be necessary to properly organize, generate, test and

evaluate new technology, as far as possible these units should reflect the farm situation we wish to improve in relation to area, cattle facilities, management, etc.

The Comayagua unit should be utilized as the central headquarters and will serve as a center for in-service training of young professionals.

A well-defined pasture and forage program oriented to the short-run and long-run should be initiated at Comayagua as soon as possible. Based on presently available local information and that might be available from other countries and international centers, the most promising pastures and forages should be selected for testing. I would discourage extremely large introduction gardens that attempt to collect, introduce and maintain all available pastures and legumes. These are expensive, hard to maintain and quite often are of little value. Some criteria should be used to select the most promising in order to give more concentrated attention to their testing both at the agronomic level and under actual grazing conditions. The adaptability and testing of these promising species should be carried out over a wide range of climatic and ecological zones. Initially they should be considered as agronomic trials and can be tested along with other crop species. Those proven to be useful should enter the national testing program as soon as possible.

This large-range research program should be completed by a short-run program geared to obtain rapid results and visability. The pasture program should study the station and farm observations and results, and select those grasses that are presently widely utilized as livestock pastures. These grasses selected by regions should be included in farm trials during the first year and in farmer test and evaluation in subsequent years. These would later be placed by higher producing species as they become available from the experiment station trials.

The pasture and forage program at CIAT should be able to provide excellent training and provide seed of some of the promising grass and legume species.

Swine and Poultry

It is almost impossible to duplicate the traditional on-the-farm conditions under which swine and poultry are raised. Therefore much of the work on these species must be carried out on small farms if the results are to be useful. On the other hand, some basic studies will need to be carried out at the experiment station level.

It is recommended that all initial work be carried out under actual farm conditions, and that maximum use be made of technology available from many sources (CIAT, INIAP-ECUADOR, ICA-COLOMBIA, INIA and CHAPINGO-MEXICO). Small experimental units can then be established in one or two zones where poultry and swine are of most importance.

An alternative to this recommendation would be to establish a small central unit at Comayagua that could be used for controlled research and as a center for the training of both professionals and farmers.

Swine units should be kept small and breeding herds should never surpass 20-25 sows. Poultry units should also be small and should be developed to house not more than 500 to 1000 broilers and 200-300 laying hens.

The best way to initiate both programs will be to integrate the professionals during the first year with the farm systems teams. Following this first year of work and study on farms it should be easier to conceptualize a program that will best serve to generate technology for the small farmers.

Additional Notes and Thoughts

(1) Provision should be made for chemical analysis of feeds and forages. The following will be required

a) Crude Protein

b) Fiber - acid detergent fiber - cell-wall constituents

c) Ether extract

d) Moisture

e) Ash

f) Mineral - Ca, P, Cu, Zn, Mn, S, etc.

(2) Although it is generally recommended that too high a level of Holstein and Brown Swiss breeding could be detrimental in the tropical and semi-tropical zones, it is possible that in the high altitude areas of the country, 3/4 or even purebreds of these breeds may survive and produce well under good conditions of management and nutrition.

(3) Cattle recommendations do not rule out the possibilities that beef cattle, and not dairy cattle or dual purpose cattle, may be of more importance. The pasture systems developed for the dual purpose system will be applicable, and a beef breed such as Cebu will be used instead of Holstein or Brown Swiss for breed improvement.

(4) Due to my limited knowledge of all of these areas of the country and experiment stations I have made no attempt to detail where animal research should be located outside of the central headquarters at Comayagua.