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ECONOMIC DEVELOPMENT OF
THE SWINE INDUSTRY IN HONDURAS; PROBLEMS AND
RECOMMENDED SOLUTIONS^{1/}

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^{1/} A Study of the Economic Feasibility of Expanding the Honduran Swine Production and Pork Processing Industries--Conducted by the U.S. Feed Grains Council, 1575 "Eye" Street, N.W., Suite 1000, Washington, D.C. 20005, U.S.A. Telephone (202) 789-0789, Telex 440064 USFGC UI

AUTHORIZATION FOR THIS STUDY

The United States Agency for International Development Mission to Honduras Contracted the U.S. Feed Grains Council for this investigation and report.

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OBJECTIVES

The general objectives of this study were (1) to determine or re-affirm the problems confronting the economic development of the swine production and meat processing industries in Honduras and (2) to recommend promising courses of action to solve those problems and constraints which limit reasonable growth and development of the swine industry.

Specific objectives of this study were to investigate the following eight major interest areas:

1. Verify the general overall status of the swine sector in Honduras.
2. Evaluation of present and potential markets for swine meat and the most acceptable forms for export and domestic consumption (i.e., fresh, processed, frozen, etc.).
3. Evaluate the current level of the meat processing industry in Honduras and to develop recommendations for the input requirements to modernize that industry in the processing of swine meat.

4. To evaluate the effectiveness of existing swine producer groups and to determine what assistance they would require to become a more effective spokesman in helping both large and small swine producers improve their operations.
5. To evaluate the agricultural extension capability and potential within the Honduran government to help educate swine growers.
6. Review of small-farm swine producers to determine their specific needs and develop recommendations to meet those needs.
7. Review the current Honduran governmental policy and attitudes toward swine production and evaluate those policies as to their impact on a programmed expansion of the swine sector.
8. Develop a coordinated recommendation for a multi-year program which will produce a modern, efficient, and profitable swine sector in Honduras.

Lastly, during the course of this study it became apparent that a need existed for a concise listing of factors which favor expanded pork production in the broadest sense of social, economic and political advancement of Honduras.

PERSONS CONTACTED DURING THIS STUDY

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Atlantic Regional University Center (CURLA), La Ceiba

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Mr. Jorge Alberto Torres, Genente General

Honduras Swine Producer's Association, San Pedro Sula

Mr. Roberto Leiva, President

Mr. Jose H. Ayala, Vice President

Mr. Ralph Eskelssen

Mr. Hector Osorio

Mr. Gustavo Ustariz

Swine Production Farms Visited

Mr. Roberto Leiva, San Pedro Sula

Mr. Jose H. Ayala, San Pedro Sula

Mr. Hector Osorio, San Pedro Sula

Mr. Gustavo Ustariz, Puerto Cortes

Mr. Gamez Moises, Cofradia

Zamorano Agroindustrial S.A. de C.V.

Mr. Jorge Alberto Torres, Gerente General

Escuela Agricola Panamericana, El Zamorano

Atlantic Regional University Center (CURLA), La Ceiba

Slaughter Facilities Visited

Zamorano Agroindustrial S.A. de C.V.

Mr. Jorge Alberto Torres, Gerente General

Escuela Agricola Panamericana, El Zamorano

Dr. Guillermo Torres Y., Professor in Charge

Municipal Slaughter House, Tegucigalpa

Dr. Valdez, Veterinarian Inspector

El Marranito, La Ceiba

Mr. Jose Herrero, Owner and Manager

Pork Processing Facilities Visited

Zamorano Agroindustrial, S.A. de C.V.

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Escuela Agricola Panamericana, El Zamorano

Dr. Guillermo Torres Y., Professor in Charge

Embutidos Delicia, San Pedro Sula

Mr. Roberto Leiva, Owner and Manager

El Marranito, La Ceiba

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Delikatessen, Zamorano Agroindustrial, S.A. de C.V.

Tegucigalpa, D.C.

Supermercado Fransen, San Pedro Sula

Central Market, Tegucigalpa, D.C.

Pheripheral Market, Tegucigalpa, D.C.

EXECUTIVE SUMMARY

In its in-country study, the U.S. Feed Grains Council team looked briefly at the traditional swine production system but made a more intensive study of its present modernized production system. Much information was already available on the traditional system. The team's recommended solutions are to take a gradual, rather evolutionary approach to the traditional swine industry, with present emphasis on input supplies and in first-hands marketing. Improved education of producers and all others involved in the swine industry has to be the highest priority if success is to be realized. An epidemiological study is needed to determine what diseases and parasites are endemic to the native swine population and to assess their implications for swine production and human health.

More immediate effects on swine supply can be obtained by concentrating on the modern production sector. In general, the team recommends increasing the technological support being given to this sector, adopting some sort of quasi-extension program to inform potential producers of its possibilities, monitoring the domestic demand-supply balance, and detailed investigation of potential export market.

INTRODUCTION

The swine industry in Honduras is important to the continuous economic welfare and development potential in several ways.

1. It can obviously supply a source of high quality protein food for Honduran consumers. Because Honduran consumers are potential producers of goods and services, it is axiomatic that good human health and nourishment are important.

2. Swine production can be an important potential outlet for domestically-produced grains and other feedstuffs. A glance at the map is sufficient to indicate Honduras' problems in transporting agricultural commodities to markets over hilly terrain. Faced with somewhat the same problems, early 19th century corn farmers in America's midwest solved transportation problems by marketing their crops in the form of pork and bourbon whiskey. Leaving whiskey aside, present day economics of moving agricultural commodities by overland transportation are such that livestock still generally moves to the feed source rather than the converse.

3. Another reason for the importance of the Honduran swine industry is that it is a potential foreign exchange earner if processed pork products can be exported successfully. Until realized, increased domestic production would at least contribute to the conservation of foreign exchange, since some pork is now presently imported.

4. One last major reason for establishing the industry is that it is a source for increasing employment. The industry has the potential of employing more farmers and on-farm laborers. Several firms and agencies provide various inputs to production and swine marketing services because pork processing is relatively labor intensive compared to the beef industry.

The attitude of the Honduran Government with regard to the swine industry was summarized as follows:

1. There appears to be positive government interest in any effort which will improve the swine production sector in Honduras.
2. The government will assist in the dissemination of program results to the small family farmer and his family.
3. The success of an information and educational program designed to disseminate data on swine nutrition, management, and sanitation to the small family farmer will require improvement in the rural extension service of the Government.
4. Although an extensive Government program to initiate swine production in Honduras may not occur, there did not appear to be any Government-imposed obstacles in the way of any developmental program which would be initiated.

AN ECONOMIC OVERVIEW OF THE HONDURAN SWINE INDUSTRY

Characteristics of current swine production and supply and of current and projected demand for pork products in Honduras can be used to analyze what should be done for the industry in the context of fostering overall economic development. This strategy emerges from analyses of what is known and what can be reasonably inferred about the current status of supply and demand in the country.

Supply

Depending on which set of figures one chooses to believe, swine production has been either static or has been increasing but starting from a comparatively low level (Table 1). Time has not permitted the U.S. Feed Grains Council (USFGC) team to reconcile these data. The World Bank and U.S. Department of Agriculture's Foreign Agricultural Service (USDA/FAS) use the static series, as does the Honduran Ministry of Natural Resources, so this series will be adopted here. These data (column 1, Table 1) indicate that swine production has been static over the 1970-81 period. Juxtaposed with the price series in Table 2, the data show no particular relation with either nominal or real prices. This suggests that the supply of swine and pork in Honduras is highly inelastic with respect to price. This means that numbers of swine raised in farms and the quantity of pork products marketed in Honduras is at present little affected by price changes, either increases or decreases. If one adopts Larson's

production data, the inference about supply inelasticity stands, since supply increased despite declining real prices received.

It is not clear whether either production series includes on-farm slaughter and illegal slaughter (conducted outside municipal abattoirs) estimates. Time did not allow the USFGC team to pursue this question. If they do, then, such as they are, they should be accepted as they stand. If they do not, users of this report should bear in mind that they underestimate total pork production by the unknown (and perhaps unknowable) amount of on-farm and illegal slaughter.

Static, inelastic supply is consistent with observation of traditional Honduran swine production. Extensive description of traditional production methods are available (Kroeske and Creupelandt, Damm), so only a brief summary is presented here. Swine production by Honduran campesinos is a supplementary, scavenger enterprise using forage, table scraps, offal, and home-grown corn or sorghum. Virtually no purchased inputs are used, and labor requirements are small. Pigs are sometimes penned but more often roam freely as scavengers. Health aspects of this system will be treated elsewhere in this report, but the swine supply implications are apparent: variable costs of traditional production are virtually zero, so price reductions have no effect on production. By the same token, the system is incapable of responding to price increases on any sustained

basis because of nutritional limitations. These limitations will be discussed more fully later. Such growth as has taken place in swine numbers is probably more related to the rate of campesino household formations than anything else. Swine are said to be a form of crop insurance as well as a source of food for campesino farm families. Instances have been cited to the USFGC team of campesino farmers turning to their swine herd for food and some cash income when drought has caused crop failures. In any case, the traditional production system is subject to supply shifts due to the above mentioned factors and others, such as cholera outbreaks, but is not and cannot be responsive to prices

CURRENT AND POTENTIAL DEMAND FOR PORK

Potential demand for pork in Honduras is rising with increasing population. This increase is accentuated by the rising proportion of the Honduran populations in urban areas, so that the visible demand for pork and other meats--meats vended through municipal markets, food stores, supermarkets, and so forth--are increasing at a greater rate than the overall population, irrespective of changes in consumer incomes. Table 3 presents demographic data from the 1961 and 1974 Honduran population censuses to document this point. Annual rates of population growth from 1961 to 1974 were 3.2%, 2.3%, and 5.6% for the total, rural and urban population respectively. It is likely that these differentials in growth rates have continued, if not increased, since 1974.

It is not surprising that the collision of static supply and rising population have led to increased imports. Pork import data are available only since 1975, but show a definite increase (Table 4).

Larson's AID report has documented the story of Honduras' experiment with price controls from 1973 through 1981. The fact that price controls were imposed in a period of rapid world-wide inflation and adjustments in nominal prices occurring only at irregular intervals is sufficient to explain why real farm prices for pork fell throughout this period. However, the amount of the decline is inconsistent with the notion that really severe demand pressures had built up in the pork market. If such pressure had built up, nominal pork prices would probably have been increased more often and by greater amounts, so that real farm prices would have declined more slowly. The amount of price disequilibrium that had built up is demonstrated by Larson in comparing retail pork prices before and after the lifting of price controls. Retail pork chop prices in Tegucigalpa were last set at L2.00 per pound in June 1981, and held at this level until the expiration of controls in December, 1981. Three months later, pork chop prices had risen 50% to L3.00 per pound. Our observation in July 1982 found prices in the L2.80 - 3.00 range. Price increases of similar magnitude occurred for other pork products and for beef. Chicken, on the other hand, rose only slightly, from L1.60 to L1.65 per pound. These cooperative price changes provide a clue to the key role of poultry in alleviating demand pressures during the control period.

Table 5 shows beef and poultry supplies available for domestic consumption and combined beef, pork and poultry supplies for the 1971-81 period. Beef supplies have been adjusted for exports, but pork and poultry have not, although some exports, largely unregistered, of these commodities occur.

It can be seen from the table that net beef supplies were similar to pork in that they also showed little or no growth over the period. Poultry production, primarily by the modernized production sector, exhibited substantial growth and, indeed, provided virtually all the growth in total meat supplies. Total meat supplies grew at an average rate of 3.2% over the 1971-81 period. This was just equal to the population growth rate between censuses, as documented in Table 3.

With these facts in mind, it is fairly clear what happened to meat demand during the price control era. With both pork and beef effectively rationed by supply inelasticity, Honduran consumers were forced to substitute poultry in their diets. Since this substitution was forced by the supply situation in the controlled price environment, the conventional ideas of substitution in free markets in response to changing relative prices does not apply. Therefore, no cross price elasticity estimates were attempted. They would have little relevance in the post price control era, anyway. However, the forced substitution of poultry does have ramifications

for the post price control era. Since people tend to form and retain consumption habits, the probable effect has been to establish poultry firmly as a substitute for pork and beef.

This substitution effect limits what could be done to stimulate increased pork supply through mandated price increases, even if swine production were not so price inelastic. Increased pork prices would lead to further substitution of poultry for pork, causing pork demand to decrease and a disequilibrium situation would occur. Efforts to manipulate the swine and pork markets by such floor price increases would probably break down more rapidly than the previous system of mandated price ceilings. Thus, attention should be given to means to increase the pork supply function.

There are essentially three ways to increase Honduras' pork supply function. These are (a) to reduce the prices of swine production inputs; (b) to increase pork imports; and (c) shift the basic swine production functions. The first method, of attempting to reduce input prices, is undesirable insofar as the traditional swine production system is concerned. This would mean attempting to reduce grain prices, and since grains are a more important component of campesino farm income than swine, the infeasibility of such a policy becomes obvious. Increasing imports to make up domestic pork supply deficits is also unwise. Honduras needs to conserve foreign exchange wherever possible to invest in employment-creating domestic industries.

Shifting the basic swine production function is the optimum development policy. In noneconomic terms, this means to make Honduras' swine industry more technologically efficient so that greater outputs per unit of input can be obtained. The USFGC team's primary objective was to study the current status of swine production in Honduras and to suggest ways of improving it. Thus, the team's efforts were focused on the appropriate development objective.

TABLE 1. Alternative Data Series on Honduran Pork Supply, 1970-81

	Column 1 ^{a,b}		Column 2 ^c
	1,000 M.T.	1,000 Quintals	1,000 Quintals
1970	10.1	223	101
1971	8.9	196	108
1972	8.7	192	115
1973	8.7	192	123
1974	9.0	198	130
1975	9.3	205	139
1976	9.9	218	149
1977	10.2	225	159
1978	10.4	229	170
1979	10.0	220	174
1980	11.0	243	176
1981	11.0	243	186

a Units of measurement. Original data are quoted in metric tons, but have been shifted to quintals (1 quintal=100 pounds) because domestic pork marketing is in pounds.

b Sources: 1970-78: Central Bank of Honduras
1978-81: USDA/FAS

c Source: Larson, D. W. "The Problems and Effects of Price Controls in Honduran Agriculture", AID, April 1982. Larson also cites the Central Bank of Honduras as the source of his data.

TABLE 2. Nominal and Real Prices Paid to Farmers for Pork

	Nomimal Price ^a	Real Price ^b
	<u>Per Quintal of Pork</u>	<u>Per Quintal of Pork</u>
1970	64.00	58.45
1971	66.00	59.24
1972	67.00	56.92
1973	69.00	55.07
1974	77.00	55.15
1975	79.00	52.14
1976	81.00	49.75
1977	87.00	48.47
1978	89.00	45.10
1979	92.00	41.76
1980	100.00	39.48
1981	107.00	39.22

^a Source: Central Bank of Honduras

^b Source: Larson: Data are Nominal prices deflated by the GDP Deflation Index, 1966=100.

TABLE 3. Distribution of Population by Residence, 1961 and 1974^a

	<u>1961</u>		<u>1974</u>	
	Number	Percent	Number	Percent
Rural	1,532,485	76.8	2,056,667	68.6
Urban	463,700	23.2	939,577	31.9
Total	1,996,185		2,996,244	

^a Source: 1961 and 1974 Censuses of Population, Secretario De
Economico Direccion General De Estadisticas Y Censos.

TABLE 4. Fresh, Refrigerated, and Processed Pork Imports By Product Weights, 1975-1981^a

<u>Y E A R</u>	<u>QUANTITY</u> ^b Kilograms
1975	--
1976	4,607
1977	5,723
1978	523
1979	1,935
1980	125,363
1981	179,427

^a Source: Secretaria De Economico

^b Includes both "Con Permiso" and "Sin Permiso" Imports. We are told that import permits granted to slaughter plants on occasion are actually exclusions from import duties. Slaughter plants can import any amounts of pork desired at any time under tariff, unless blocked by other factors, such as the current (1982) rationing of foreign exchange.

TABLE 5. Beef, Poultry, and Total Meat Supplies, 1970-1981

	^a <u>Beef Production</u>	^b <u>Poultry Production</u>			^c <u>Total Meat Supplies</u>
	Net of Exports	Modern	Traditional	Total	
	1,000 Quintals	1,000 Quintals			1,000 Quintals
1970	441	71	9	80	744
1971	435	79	10	89	720
1972	373	88	11	99	664
1973	454	98	13	111	757
1974	494	110	14	124	816
1975	472	123	16	139	816
1976	478	137	18	145	841
1977	472	153	20	173	810
1978	487	170	22	192	908
1979	463	190	25	215	898
1980	463	213	28	241	947
1981	507	269	35	304	1,054

^a Source: 1971-78, Central Bank of Honduras
1979-81, USDA/FAS.

^b Source: Larson.

^c Includes Domestic Pork Production (Table 1, column 1).

SWINE PRODUCTION

Perhaps the area of greatest weakness in the Honduran swine industry is the inadequate technology available to successfully raise swine. This is particularly evident in the areas of management and nutrition both of which are closely influenced by endemic disease and parasitism in the swine population.

The campesino farmer markets a pig ranging in weight from 100 to 250 pounds (1 to 2 years of age) as evident by the pigs observed at a municipal slaughter house. This range in weight is undoubtedly due to not only economic factors, which may have forced the farmer to sell, but the nutrition and disease/parasite problems inherent in the campesino system probably prevented him from achieving further pig growth. These hogs are raised under an extensive management system, roaming freely while receiving minimum attention. In addition to the occurrence of high mortality with small pigs, the breed is of poor quality and inherently fat and short. Castration is often delayed or not conducted at all. Females kept for breeding are not genetically capable of producing large numbers of pigs nor milking heavily. Consequently, the pigs are small throughout life and under constant exposure to poor nutrition and disease conditions.

Swine raised under commercial conditions utilize the Landrace, Yorkshire, Duroc and (or) Hampshire breeds producing a pig of

excellent quality. Weanling pigs from this cross would not, however, as indicated by a campesino farmer, tolerate the extreme nutritional and disease hardships as would the native Criollo pig when raised under the current "backyard" system. Because of the poor genetic capability of the domestic pig, its future potential for improving the swine industry in Honduras is extremely limited. The use of the improved breeds mentioned above in an effective crossbreeding program, under intensive confinement facilities, is the most rapid and practical way Honduras can increase the quality of pork for both local consumption and future export.

The managerial skills of the farmer in the commercial operations was decidedly superior to that of the campesino farmer. Their managerial knowledge about raising swine was generally adequate but limited to minimal levels in the area of nutrition and disease control. These farmers were generally producing an adequate number of pigs per litter (i.e., 7 to 9) and market animals, but were not using modern formulations or dietary antibacterial agents, as evident by the uneven pig size within pens. In addition, the feed quality of some diets appeared to be of poor quality, high in fiber with protein sources of medium or poor quality. Diets were either mixed on the farm, where inadequate nutritional and feed mixing knowledge was observed, or they were using commercial feed mixes (discussed elsewhere in this report).

Many of the commercial swine operations observed by the team had been constructed within the past 3 years. It was our feeling that if a disease outbreak occurred, the managers would need additional outside technical advice to prevent problems.

Although the managers of the campesino farms were generally well educated, the labor force most often was not.

The facilities on commercial farms were relatively good, but with much variation from one farm to another. Perhaps the most effective growing-finishing production facility had a sloping concrete feeding floor, pens holding 10 to 15 pigs with self-feeders and automatic nipple waterers (these should be adjustable and not permanently mounted as observed at most locations) provided, a shaded roof area and a solid wall about 2 feet high. Fencing extended above this wall prevented the pigs from jumping out of pens. Manure was generally hosed from the floor with water. It was noticed that water from this source may have entered the self-feeder allowing the development of molds in the feed. Sprinklers to cool the pigs may be more effective as a cooling device and not result in feed contamination with water. Fine feeds in the corners of the self-feeders could also result in weevil infestation and in fact was observed. More frequent cleaning of non-consumed residue from the feeder base should be encouraged.

The University Swine Unit at La Ceiba was also visited. Although the individual in charge was not present to explain the program, there were several areas of concern observed by the team. Growing finishing hogs were not of the improved quality that commercial production units had available. We were informed that boars and gilts from this herd were sold to campesino farmers. Their quality, although perhaps better than the domestic pig, was not of the type that should be sold or produced in a university. In addition, the disease carrier problem was also of concern as to the distribution of these hogs (see below).

Boars were observed not castrated up to 75 pounds body weight; great variation in pig sizes were evident within each pen; water drains were plugged in the farrowing house causing a potential disease buildup and the feed in the bags for sows and litters was formulated for poultry (layers), not swine. One group of pigs in the grower unit, numbering around 15 to 20, was suspected to be extremely infested with parasites and(or) disease and could be a potential problem to the future productivity of the other animals in the same complex. Student training under such conditions is of questionable value. It was our understanding that new facilities are to be constructed, but much could be done to improve existing conditions without great expenditure of money.

In contrast, the swine unit of the Pan American Agriculture School appeared to be under good managerial control. Students were involved in daily operations with supervision provided by other students and (or) faculty. The building was a practical productive unit. There was an indication of some disease (i.e., MMA) in newly farrowed sows, but it appeared to be of a low magnitude. Growing-finishing pigs were housed and fed on pasture, which was a potential parasite problems but none was observed in the carcass as observed later in the slaughter house. Perhaps a 4th year program with emphasis toward specialization (e.g., swine production) would be a desirable direction for this school.

Availability of Feeds (Domestic and Imported) and Nutritional Limitations

From our observation, most of the "backyard" pigs fed by the campesino farmer utilized available feedstuffs. Forage, namely grasses, were pastured by the pig from the roadside or surrounding areas. Pigs were tethered or allowed to roam freely. Table scraps and small quantities of grains are provided to the pig as available. Although the nutritional quality of the forage, particularly grass, is minimal and the use of table scraps and grains has variable nutritional value, particularly for protein and macro-minerals, the disease transfer potential between animals far outweighs any nutritional inadequacy problems. The nutritional limitations of

such a feeding regimen along with parasite infestation undoubtedly is the major reason for the poor growth rate and emaciated look of many of the Criollo pigs.

Relatively speaking, swine require larger quantities of energy than protein for optimum development. Consequently, if a producer desires to increase his herd size he must have an outside source of both nutrient groups available to purchase. The larger commercial pig producer must, therefore, have available to him outside sources of both. He must use not only native domestic by-product feedstuffs when available, but may have to utilize imported feeds in order to feed a balanced diet throughout the swine production phase.

The production of energy feedstuffs in Honduras from waste fruit production (i.e., banana, plantain) may be available in limited quantities for swine feeding, but additional energy sources must either be produced within Honduras or imported if hog production is to be increased. The domestic production of maize and sorghum apparently is increasing. Of those we interviewed, most felt that the source of these grains would be increased, largely due to government encouragement. Both grains are excellent sources of energy, also providing some protein. In addition, much of the nutritional research with these grains has already been conducted where direct application of the findings can be readily applied to Honduran conditions.

Although some research has been done with banana and plantain, they have some nutritional limitations. For example, bananas are an excellent energy source, but they should be ripe and peeled prior to feeding. If bananas are used as the sole energy source and fed with a vitamin-mineral protein supplement, research has indicated excellent results, although animal performance is somewhat lower than a comparable maize-supplement combination. Although cassava and plantain are not raised extensively in Honduras as livestock feed, they could be used if available, particularly in locales where they may be produced in abundance. Various research workers have used cassava for growing finishing swine and have reported excellent responses to this product, but it should be dried or cooked prior to feeding and fed as a complete feed rather than feeding free choice. Free choice cassava feeding has been less successful due to its lower palatability and its potential content of hydrocyanic acid (HCN). Therefore the available waste energy feeds from fruit produced in Honduras can and should be effectively used; but to achieve maximum swine performance it would be best not to consider them as the sole energy source in swine diet formulation.

Protein sources to supplement the diets of swine are not produced in Honduras in the quantities needed nor are they of adequate quality to achieve optimum swine performance. Protein, or the amino acids of protein, must be blended with energy sources so that adequate levels of essential amino acids are provided. If the energy

feedstuff contains some protein, less protein supplement will generally be needed. For example, cassava having a crude protein content of approximately 4.0% will require more protein supplementation than maize which has a 8.5% protein level. There was some indication that some by-product protein sources from the fish industry (i.e., shrimp) and meat scraps from slaughter/processing houses might be utilized in the animal feed chain. Both products must be dried, an antioxidant added to prevent rancidity, and a homogenous product produced. In addition, the materials must be heat treated to prevent potential disease transfer from animal to animal.

Blood and other animal by-products are available from the packing plants upon occasion, but they must also be heated to prevent disease transfer from animal to animal. Amino acid availability is reduced by such heating, lowering the protein quality of the blood meal.

Whey, a by-product from the manufacture of cheese, is a good quality protein sources available for swine feeding. It should, however, largely be restricted to the young pig (under 50 pounds) since digestive utilization of this product is lower with older swine and can cause diarrhea. The high moisture content of fresh whey limits its use in small pigs because of their smaller tract capacity while with mature animals its high lactose content limits its effective

use. Thus to be most effective it should be dried and fed to pigs from weaning to 50 pounds body weight.

Feather meal, a by-product from the poultry processing industry, is a relatively poor protein source for swine. Hydrolysis of the feather is essential to increase amino acid availability, but even so, it is of limited value. In practice, levels of 3 to 5% of hydrolyzed feather meal could be effectively used in growing-finishing swine diets. It should not be fed to younger swine.

Cottonseed meal is available in Honduras for feeding swine. Although this product is a potentially excellent plant protein source for swine, its gossypol content is toxic to swine if fed in excess. Clinically, pigs suffering from gossypol are listless and inactive. When cottonseed meal is fed, higher levels of iron (i.e., around 200 PPM from ferrous sulfates) should be added. Due to pesticide treatment of cotton, hydrocarbon content of fat and lean tissue would need to be conducted to verify tolerable levels. Cottonseed meal should probably not exceed 10% of the total diet.

Copra meal or coconut meal is also available as a protein source in Honduras but its nutritional value for swine is limited due to its lower protein digestibility and relatively high fiber concentration.

Consequently, it is apparent that to optimize swine feedlot performance in Honduras, domestic production of soybeans must be increased or soybean meal imported. Soybean meal is one of the best protein sources when blended with maize or sorghum. Whole soybeans can be fed but they must be heated to destroy a protein digestion inhibitor; but once done it is an effective protein source.

From those that we interviewed, the general feeling was that, of the soybean meal imported, most of it was utilized in the poultry industry. Since swine are nonruminant animals, the same as poultry, their nutritional amino acid needs for a quality protein source is just as high as that for boiler and egg production.

Vitamin and mineral sources are extremely critical for swine. Long-storage periods in the hot, humid Honduran environment could result in vitamin deterioration. Consequently, adequate storage facilities which are cool and dry should be available for the storage of these ingredients.

Mineral mixes were generally not available except for those used by commercial feed mixers. Bone meal, processed from slaughter houses if properly processed to remove potential diseases can be an excellent calcium and phosphorous source.

In Honduras where cassava, banana and plantain can be of potential value as an energy source, trace mineral and vitamin supplementation is especially critical since these feedstuffs are particularly low in these nutrients.

Although meat and bone scraps, fish meal and shrimp meal are potential protein sources, they also contain sizable quantities of macro-minerals, mainly calcium and phosphorus. Consequently, a homogenous source of these products, of known composition, free from disease should be used.

Feed Mill Formulation and Capacity

There is a limited number of available feed mills, both private and commercial, in Honduras for processing feed. Inadequate nutritional knowledge and a limited number of feed formulas for the various growth stages of swine greatly reduces the effectiveness of a mill in being a positive factor in efficient pork production. This was particularly evident in the private on-farm mill visited. The capacity of commercial feed mills appeared adequate to be able to not only handle the present swine numbers but also could increase the production of swine feeds when swine production expands. Private mills presently could not obtain micro-ingredients,

but they also probably did not have the expertise to mix them properly. The lack of competition between the commercial mills could allow high markups by the manufacturers and thus discourage swine production. This, however, was not apparent in any of our interviews with producers.

Nutritional dietary standards from the U.S. or Europe for swine at the various production stages were apparently not available nor used except in the commercial feed mill where Cargill was involved. The evaluation of several dietary formulas, utilizing domestic energy and protein sources as well as various combinations of imported protein source needs to be conducted at the University farms and published.

Feed tags were evident on the feed bags observed in commercial feed mills. However, the information provided was extremely minimal. Laboratory analyses conducted by the commercial company appeared to be more stringent than that conducted by the government. Although it was indicated during several interviews that random feed samples were routinely collected by the government, no effective enforcement procedures toward maintaining minimum nutritional standards was evident. Protein, ash and fiber were the routine analyses conducted by the government, but only inadequate protein level was subject to fines and even then the acceptable variation was quite high (plus or minus 2%). No analysis was conducted for non-protein nitrogen. The

high fiber content of some diets undoubtedly contributed toward reduced swine performance, particularly with young swine, consequently maximum dietary levels need to be published on the tag. Minimum phosphorus levels should also be published on the tag. Maximum and minimum levels of calcium should also be established and identified on the feed tags. Although other nutrients could be analyzed (i.e., fat, lysine), the above appear to be more critical. The labeling of the feed tag for these nutrient levels would provide more information than is currently available. Government regulations concerning the feed industry were considered by the team to be less than that necessary to insure a quality product that the farmer could purchase and obtain consistently good performance.

The presence of mold contamination of the feed, as evidenced by enlarged vulva and teats of commercial market pigs suggests that the shelf-life of mixed feeds in Honduras is short.

Parasite and Disease Conditions

If one were to characterize the porcine epidemiological status in Honduras today, only one word is needed to accurately summarize; unknown. Due to the nature of the existing national swine herd, little or no data base has been established. This is unfortunate, in that for lack of evidence it is commonly accepted that no disease problems exist within country. From the observation of the team we could not agree with this viewpoint, for the following reasons:

1. The majority of the Honduran swine population exists in a semi-feral state. As such these animals rarely come into contact with qualified veterinary professionals and thus are not under disease prevention programs.
2. Although limited, the number of imported animals themselves would serve as carriers of disease endemic to their country of origin. Since many of the animals came from the U.S., Canada, Mexico, etc., it is logical to expect that some, if not all of the swine disease recognized in these countries would be introduced if not already endemic to Honduras.
3. Illegal immigration from the Carribean and the other Central American countries makes an epidemiological study of swine disease a regional as well as a national program. The total numbers of swine crossing the Honduran border is estimated in excess of 15,000 head as reported in a recent F.A.O. survey. This, compounded by the import of illegal meat products and pork by-products, greatly magnifies this problem.
4. Veterinary services and personnel in Honduras are already extended beyond their capability to be truly effective. Limited numbers of practitioners, inaccessible to a majority of animals due to location and transportation, are contributory factors. There is also a lack of clinical

swine disease experience in existing veterinarians in Honduras. This is understandable due to the higher economic importance placed on the cattle industry.

5. A lack of disease managerial knowledge on the part of individual campesino producers makes effective veterinary services difficult. If producers are unaware of the proper questions to ask, they are unable to utilize this technical resource effectively.

6. An important part of the contribution veterinary medicine makes to the national food supply, and simultaneously, to the health of the human population is in its professional capacity as livestock sanitarians. This function is vital to ensure a safe food supply and in eliminating disease common to man and animals alike. This function is well recognized in Honduras as witnessed by the economic importance of beef exports in respect to Honduran foreign trade. Without following world standard sanitary practices, this would not be possible. This same quality control practice is lacking in the swine processing industry.

The data pertaining to governmental structure of the federal veterinary service, including the numbers of private practitioners and their location is well documented in earlier studies. The infrastructure of regional laboratories, backed by the Federal Central

Laboratory is also documented and overall is a sound concept. It has primarily been functioning, however, in the areas of bovine brucellosis and tuberculosis identification. The system falls short, however, in swine health practices. Laboratory practices for identification of swine diseases are more sophisticated, requiring proper sampling and handling procedures as well as skilled technicians. In viral disease identification, the training of technicians is time consuming and expensive. Consequently, concentration of resources (i.e., to the Tegucigalpa facility) is necessary in view of the economic considerations. However, items 1, 4 and 5 of the above section negate this advantage. In establishing national disease incidence a more effective system must be developed.

THE NATIONAL HERD - A CHARACTERIZATION

The Foreign Agricultural Organization (F.A.O.) and World Bank data support the observation that 80 to 90% of all pork available to the consumer is of campesino origin. These animals exist in the semi-wild state. The problem this presents in terms of disease and sanitary controls is significant. Feral animals tend to express disease by exhibiting high morbidity but low mortality rates when challenged with a specific pathogen or pathogens. Consequently, those animals which survive remain as reservoirs of the disease showing no clinical signs but remaining as carriers capable of infecting animals with which they come into contact. Assuming that

a commercial industry will use imported animals, some of the potential endemic disease problems (i.e., swine cholera) would be serious problems to successful acclimatization of these animals. This is true because:

- 1) Contact with feral animals, farm workers who own such animals, or from feed made from the by-products of diseased animals will enhance disease transfer.
- 2) Current vaccines and vaccination practices are not adequate to completely remove the disease risk.

The Criollo pig although recognizably important to the socioeconomic well being of the campesino farmer remains a potential threat to the establishment of a viable, economic swine industry in Honduras.

In terms of zoonotic diseases; the Criollo pig is equally suspect. It is widely recognized that swine internal parasitism is a serious problem in Honduras. Due to current "management" practices of the campesino farmers and the climate of Honduras, it is impossible to break most, if not all, parasitic cycles these animals play host to. Veterinary meat inspectors have recognized this fact as reflected in routine carcass inspection procedures. However, there is a question as to the effectiveness of contaminant carcass identification and the rigidity whereby condemnation is enforced. Current statistics

of slaughter house condemnations used to reflect national incidence of type and severity of parasitism and pathogenic conditions seriously underestimate actual clinical involvement. The reasons for this are:

- 1) Lack of adequately trained professional and lay meat inspectors.
- 2) Inefficient and inadequate sampling techniques. This was borne out in several facilities by re-inspection of previously passed carcasses, a significant number of which were found to be contaminated with larval forms of the tapeworm, *T. Solium*.
- 3) Basic Economics - If the number of condemnations actually approached true incidence, at least 30% less pork would reach the consumer through normal retail channels. In one instance, carcasses marked for condemnation at a slaughter facility visited by the team, were thought to be seen later that day at a local market. Finally, considering that most hogs are privately slaughtered and used for local consumption their contribution to statistical study of zoonoses cannot be currently estimated. It is a safe assumption that these animals only would magnify the statistical significance of this problem to alarming proportions. It

would be an interesting exercise to examine public health records as regards incidence of trichinosis and tapeworm infestation in human urban and rural populations. Such data would provide valuable evidence as to true incidence of these problems.

HONDURAS SWINE EPIDEMIOLOGY

Of the disease of swine, only one, hog cholera, is recognized as being at endemic levels in the area. Since our exposure was primarily with commercial units and limited to the campesino pig, only limited observations can be addressed. No indication of upper respiratory infections were observed in any of the herds visited. After questioning, salmonellosis was admitted in several herds, but the clinical history provided made this diagnosis suspect in several cases, with viral agents being more likely. Both MMA and TGE were recognized problems. In every herd serious mycotoxicosis was observed and in each case unrecognized by the herdsman. In one unit, animals were observed with the symptomology characteristic of leptospirosis as it appears in young animals. Nutritional deficiency syndromes were frequently observed as well as the ever-present external and internal parasitism, except in units using higher quality feeds and on a routine worming and de-lousing schedule.

Our exposure to the campesino pig was primarily after slaughter where ascarid and *C. Cellulosae* contamination were much in evidence.

PORK PROCESSING

Many things are being done correctly in the swine slaughtering and pork processing industries in Honduras. For example: most slaughter floors are well ventilated and well lighted in the interest of the workers' comfort, safety and good sanitation. Carcasses are generally completely washed and cleaned; carcasses and meats in coolers are well refrigerated. Most processors make a wide variety of products for the market and products generally are nicely wrapped or encased for delivery.

On the other hand, most slaughtering and processing facilities have some real deficiencies in the application of existing better technology. For emphasis, some but not all of these deficiencies are listed as follows:

1. Existing slaughter plants have an inadequate supply of slaughter hogs.
2. Most slaughter animals are of very low quality, light in weight, low yielding and provide a lower quality of pork.
3. Because the hogs have a low average weight, dressing costs per animal are excessive in terms of labor and in terms of poundage of pork produced against the capital investment of the plant itself.

4. Some slaughter floors are entirely too slick for good walking traction and worker safety.
5. In some instances, flies were not controlled and were observed to be excessive in slaughter and processing areas.
6. Dogs, cats, rats and roaches always need special attention to keep them out of all meat processing areas.
7. Some work areas were poorly lighted--a condition conducive to poor worker comfort, safety and general plant sanitation.
8. Light fixtures were unprotected, thus allowing the hazard of broken glass falling on workers and on/in meat products.
9. Hogs were being stunned by sledge hammer--more humane methods in practice are electrical stunning and CO₂ immobilization.
10. Streamlining of most slaughter and meat processing procedures is badly needed--this would result in increased volume per unit labor and against fixed costs; less handling would provide meats with lower bacterial loads, improved storage quality and safer meat products for human consumption.

11. Some plants do not have cooking or freezing capability, thus tapeworm infested carcasses are totally condemned--an action under the circumstance that is correct. However, some such infested meats can be salvaged if properly cooked or frozen sufficiently if done completely under responsible meat inspection.
12. Wooden table legs and cutting boards harbor spoilage and food poisoning organisms and continuously spread these to meats and also workers who then handle meats.
13. Rusty hooks, hanging rails and corroded containers are impossible to clean properly.
14. Wooden racks used for curing and product storage are difficult to clean. Stainless steel, though expensive, is preferred. Galvanized metals corrode easily.
15. Product containers were being placed on floors--products being processed or are finished should always be in meat trucks, on dollies or on acceptable racks.
16. Meats were being processed in unrefrigerated areas. Processing and shipping areas should be kept at 45 to 50°F.

17. There is a need for a more thorough veterinary inspection of animals/carcasses/vital organs and lymph nodes to more adequately identify diseases and parasitized meats and where appropriate prevent those meats from entering the consumer market.
18. There is a need for improved quality control procedures-- from the standpoint of use of approved ingredients, product composition objectives, foreign matter contamination levels and bacteriological standards. This would work ultimately to the benefit of the processor and consumer alike.
19. Some facilities cannot convert bones, fats, blood, viscera and condemned materials to useable products such as bone meal, inedible fats, blood meal and tankage or meat scraps.
20. Selling lard is a problem--need to develop alternative uses or export trade.

Most all the deficiencies listed above as well as those not singled out to mention can be corrected with adequate attention--proof of this capability in Honduras can be seen in the levels of meat inspection and plant sanitation in force at those Honduran cattle slaughter facilities that export beef to the U.S.

THE MARKETING SYSTEM

Production and supply aspects of the traditional system have already been covered in the economic problem statement, so attention will be directed immediately to the marketing system connected with it. The marketing system starts with the country buyers, merchants who seek out farmers with hogs for sale, purchase them, and resell them to pork vendors. These country buyers fill several roles: they seek out available supply, they assemble small lots of animals into larger lots of suitable size for vendors, they provide the bulk of such market information that farmers receive about the quality of animals desired in the market and prices paid, and by no means least, they are the ones that put cash into the hands of the farmer when a transaction is made. They are ubiquitous in virtually every commodity in practically every country throughout the developing world. They are heartily cursed by farmers everywhere, by development experts everywhere, but they fulfill several vital functions, howbeit quite expensively.

The archetype vendor purchases lots of swine from country buyers, has them butchered at local municipal abattoirs, and then retails the carcass and by-products as fresh meat or as crudely processed pork products. Cooked pigskins and the sausages put up in corn shucks are examples of such products. Most pork in Honduras is marketed this way and will probably continue to be so. Some of the meat shops in

the municipal markets display more elaborately processed products, such as hams and bologna, but the majority of their shelf and working space is given over to fresh and own-product marketing.

These pork marketing patterns are economically determined by the level and the distribution of income in Honduras. Tables 6 and 7 (pages 52 & 53) provide some ideas as to income levels, income distribution, and expenditure patterns in Honduras. In 1978-79, median family income was in the L1500-2000 range for both urban and rural families. Even though no income elasticity measures for pork demand are available, these levels and distributions of income make it unlikely that the market for highly processed pork products can be more than a small portion of the total pork market.

Economics of Production Improvement In The Traditional Sector

It is anticipated that traditional swine producers will gradually evolve towards more modern methods if there is a modern production sector in the country from which to draw technological knowledge and modern livestock. There is evidence that this is already beginning. A modern farrow-finish operation in Copan Department has been receiving requests from local campesinos for feeder pigs. These farmers can recognize superior pigs when they see them. Unfortunately, the yard manager reports that the pigs have not done at all well on traditional diets and living conditions, so he has had no repeat customers. However, at some point some campesinos are going

to want to know why they failed. It is important to have some means of letting them know why they failed and what can be done about it. Suggestions for things that could be done to provide extension-type services are presented elsewhere in this report.

Another future source of improved feeder pigs in the future will be the sow improvement program being undertaken by the Ministry of Natural Resources. Details of this project are in Damm's FAO report.

Marketing Improvements In The Traditional Sector

Two improvements in the first-hand live hog marketing system are worth experimentation. The first is an idea of the Ministry of Natural Resources to improve farm slaughter conditions. Small farmers who slaughter a hog for their own use cannot use all the meat immediately themselves and have no means of preserving it for future use. Consequently, they must sell the remainder in their village, often at very low prices. The change that the Ministry of Natural Resources would like to see is this: Local abattoirs would slaughter hogs on a "custom" basis for farmers, collecting their normal slaughter tax and operating fees in doing so. They would sell the hams and loins, the higher-valued cuts, for the farmer and pay him the proceeds. They would also return to the farmer the lower valued cuts and by-products, the head, shoulders, belly, skin, and lard, for his own use.

This system would provide cash income for the farmer and meet his own pork needs. The system would also encourage farmers to select for hogs with heavier hams and loins since they would be paid by weight for these cuts. Under the present country buyer system, swine are purchased on a per-head basis, so there is no direct information being fed back to the farmer about market weights or animal conformation.

The second system deals directly with the first-hands marketing system by making some changes in the functions being performed. The system would be to establish live hog markets in villages, with hogs being weighed at the time of sale by portable scales brought in for the purpose. Initially, the government or some government-sponsored agency would have to organize the sale and provide the scales. Sales could be held in each village once every week or so. Portable scales would be used so they could be moved from village to village. If successful, conduct of the markets could eventually be turned over to private individuals who would conduct them for a fee. Such local livestock markets operate routinely in developed countries, usually as auction markets, and local swine buying stations have been observed in at least one developing country (Thailand).

Such markets would have several advantages over the current system. First, they eliminate the task of seeking marketable swine by buyers. Farmer-sellers are self-selective in any central market

system, and some of the savings in eliminating the expensive search process can adhere to them. A second advantage is that they foster competition by concentrating buyers and by making it easy for a new buyer to enter a market. Whether a market is conducted by auction or sequential bargaining, the fact that a number of buyers and sellers are together will foster interchange of price and quality information, which is the basis for competition. Perhaps most importantly, it will allow farmers to see each others' hogs being sold and make them aware of the importance of weight and quality on the revenues they receive.

Obviously, country buyers will resist any such innovation, because they will perceive, and rightly, that it will reduce their importance and ultimately their numbers. Net profits to those traders remaining, however, may turn out higher because their operating expenses would be less. Honduras' valley topography seems an excellent setting for such a market system, since the mountains provide natural market area boundaries.

Organizers of such an effort would have to be persistent because it would probably take a long time before any substantial numbers of sellers would venture to try it and before buyers would become reconciled to it. Apparently, the Ministry of Natural Resources has done something similar in milk marketing, with eventual success.

Economics Of The Modern Swine Production And Marketing Sector

Development of a successful modern swine production and marketing system requires a system approach in which a number of factors have to be initiated more or less simultaneously. Such a system exists now, albeit in an infant state, in the San Pedro Sula area. A fairly reliable feed source is available in the ALCON Mill. Some technical expertise is also available from ALCON. Capital has been available from the Central Bank of Honduras. Finally, a market is available in that the processing plant in San Pedro Sula is anxious to obtain more hogs, but cannot get them from the inelastic traditional sector. Much of the USFGC team's effort went into an appraisal of the technological aspects of swine production and pork processing. Some comments on the economic aspects of it follow.

All swine producers interviewed throughout the county plus one that was contemplating becoming a producer were questioned as to their estimate of the internal rate of return from their swine enterprise. All were essentially businessmen, and all understood the question and answered in such a way that it was clear they had been thinking in those terms. The answers were very illuminating. Those producers who had installed and were operating fully modern swine operations estimated their internal rates of return as exceeding 20%. Obviously, they were finding their 16% Central Bank loans profitable and were expanding. Those without direct experience in

fully modern enterprises estimated their potential rate of return at 12-14%. Accordingly, they considered the 16% rate offered by the Central Bank too high and were not interested in entering or expanding production. Also significantly, the individuals that gave these responses were not in the San Pedro Sula area.

While only a few producers of each type were interviewed, apparently there is a significant gap in perceptions as to the potential in modernized production. Knowledge of the potential is evidently restricted to the San Pedro Sula area. On the other hand, the production and marketing system that is capable of yielding a high level of performance is also limited to the San Pedro Sula area. Modern hog production can expand in that area, but efforts to extend it to other areas must include delivery of all components of the system.

Current investment requirements for a 100-sow farrow-finish system are estimated by the Central Bank at L150,000 for fixed facilities and an additional L150,000 for stock and working capital. However, one producer estimated his facilities investments requirement at L270,000 for a 300-sow unit. Further work needs to be done to determine whether this difference represents economies of size or individual efficiency.

The scope of the market being served by the modern hog sector is a matter of concern. Currently, there seem to be only three plants making processed pork products. All were visited and all indicated

potential for expansion at current price levels. However, the income and expenditures data in Tables 6 and 7 suggest that the market for such products is thin. Median personal income for urban Hondurans in 1978-79 was in the L4,500-6,000 bracket, and the top quartile fell in the L6,000-7,000 bracket. Even including the rural population, only about 340,000 Hondurans had incomes exceeding L8,000 (\$4,000 U.S.). Although, of course, some processed pork products will be purchased by people with incomes below this level, the income and income distribution data suggest that the potential market in the entire nation is roughly equivalent to just one medium-sized U.S. city.

One packer indicated an awareness of this and expressed an interest in developing export markets. Investigation of specific export potentials is beyond the scope of the USFGC study, but it should be carried out. All that was found out about exports at the present time is (1) that shipping routes into the Caribbean are very limited, (2) Honduras has bilateral trade agreements with Nicaragua and Guatemala that would allow exports to those countries on a duty-free basis. No such agreement exists with El Salvador. This subject deserves careful investigation. An export capability is probably necessary to allow a sizable expansion of Honduras' modern swine sector as it is currently constituted.

**Table 6. Income Distribution and Food Expenditures
1978-79**

Nivel Ingreso Anual del Hogar	Familias			Personas			Gasto Anual en Alimento por Familia (Miles p.s.)		
		Urbana	Rural	Total	Urbana	Rural	Total	Urbana	Rural
De 0 a menos de 500	500	6,312	15,629	21,941	48,721	69,200	117,921	1.46	.49
De 500 a menos de 1,000	1,000	4,766	70,917	75,683	20,361	346,825	367,186	.89	.66
De 1,000 a menos de 1,500	1,500	7,521	107,535	115,056	35,544	559,570	595,114	1.26	.87
De 1,500 a menos de 2,000	2,000	15,910	58,787	74,697	81,557	357,263	438,820	1.51	1.14
De 2,000 a menos de 2,500	2,500	12,456	34,858	47,314	67,975	234,200	302,175	1.79	1.34
De 2,500 a menos de 3,000	3,000	10,717	24,109	34,826	59,612	170,663	230,275	1.55	1.63
De 3,000 a menos de 3,500	3,500	11,329	16,266	27,595	62,602	119,085	181,687	2.18	1.71
De 3,500 a menos de 4,000	4,000	20,883	8,420	29,303	29,345	139,059	168,404	1.69	1.74
De 4,000 a menos de 4,500	4,500	7,083	4,693	11,776	43,301	27,741	71,042	2.46	1.98
De 4,500 a menos de 5,000	5,000	7,993	6,363	14,356	49,989	41,160	91,159	2.52	2.00
De 5,000 a menos de 6,000	6,000	13,074	4,359	17,433	79,603	30,407	110,010	2.88	2.32
De 6,000 a menos de 7,000	7,000	10,734	1,875	12,609	64,413	15,679	80,092	2.93	2.62
De 7,000 a menos de 8,000	8,000	8,404	2,179	10,583	56,511	22,737	79,248	3.04	2.35
De 8,000 a menos de 9,000	9,000	6,423	585	7,008	39,231	5,041	44,272	3.34	3.86
De 9,000 a menos de 10,000	10,000	5,598	0	5,598	33,850	0	33,850	3.55	0.00
De 10,000 a menos de 11,000	11,000	4,009	0	4,009	26,171	0	26,171	3.74	0.00
De 11,000 a menos de 12,000	12,000	3,607	68	3,675	24,740	475	25,215	3.83	1.39
De 12,000 a menos de 13,000	13,000	2,752	1,235	3,987	18,553	6,173	24,756	3.95	3.28
De 13,000 a menos de 14,000	14,000	1,944	0	1,944	13,369	0	13,369	4.59	0.00
De 14,000 a menos de 15,000	15,000	1,626	0	1,626	10,901	0	10,901	3.98	0.00
De 15,000 a menos de 20,000	20,000	5,176	0	5,176	33,683	0	33,683	4.29	0.00
De 20,000 a menos de 25,000	25,000	3,120	205	3,325	18,959	1,023	19,982	4.51	3.93
De 25,000 a menos de 30,000	30,000	1,653	0	1,653	9,453	0	9,453	5.30	0.00
De 30,000 a menos de 35,000	35,000	985	0	985	5,779	0	5,779	5.67	0.00
De 35,000 a menos de 40,000	40,000	560	1	561	3,742	0	3,742	6.92	1.00
De 40,000 a menos de 45,000	45,000	274	0	274	1,662	0	1,662	6.16	0.00
De 45,000 a menos de 50,000	50,000	286	0	286	2,319	0	2,319	6.08	0.00
De 50,000 a menos de 999,999	999,999	1,151	0	1,151	7,154	0	7,154	6.74	0.00
TOTAL		176,346	358,084	534,430	949,110	2,146,301	3,095,411		

Source: CONSUPLANE

Table 7. Detailed Expenditures by Income Distribution
1978-79

Nivel de Ingreso Anual (Lempiras)	Alimento	Vivienda	Vestuario	Salud	Cuidado Personal	Diversio- nes	Bebidas y Tabaco	Transpor- te	Otros	Total
TOTAL	837,164.0	153,429.0	164,839.0	86,835.0	33,836.0	49,498.0	109,993.0	65,467.0	275,162.0	1,776,223.60
0 a menos de 500	16,893.3	2,145.0	7,768.8	700.9	893.7	1,848.1	2,769.5	75.6	2,250.1	35,345.00
500 a menos de 1,000	51,184.7	5,858.4	4,532.5	2,711.6	166.2	217.9	6,665.8	1,187.8	5,268.1	77,792.99
1,000 a menos de 1,500	103,473.0	10,128.7	11,711.1	6,608.6	516.9	1,770.7	15,454.5	3,952.4	9,779.3	163,395.20
1,500 a menos de 2,000	91,241.4	7,956.1	11,751.1	8,781.6	1,586.4	3,445.3	11,178.7	3,310.1	8,799.3	148,050.00
2,000 a menos de 2,500	68,875.6	6,788.2	9,423.9	5,382.3	1,042.3	2,782.8	8,897.5	3,770.5	7,886.6	114,849.70
2,500 a menos de 3,000	60,159.0	5,366.0	8,590.5	4,365.8	961.6	2,283.0	7,071.7	2,267.2	8,409.5	99,474.29
3,000 a menos de 3,500	52,473.3	5,501.6	12,962.2	2,320.2	1,219.1	1,246.4	6,803.9	2,493.1	8,060.7	93,080.49
3,500 a menos de 4,000	50,025.1	4,617.8	13,838.7	5,022.6	3,020.5	5,201.6	6,089.8	2,051.8	15,722.8	105,590.70
4,000 a menos de 4,500	26,724.5	4,355.8	4,208.1	1,917.7	931.9	951.7	3,143.8	1,380.2	7,272.0	50,885.70
4,500 a menos de 5,000	32,888.6	4,803.2	9,003.9	4,285.3	1,139.7	1,440.2	4,073.9	2,023.3	12,176.5	71,834.59
5,000 a menos de 6,000	47,815.0	9,780.2	7,992.1	4,801.0	2,331.0	2,617.3	6,792.7	2,634.4	14,839.7	99,603.39
6,000 a menos de 7,000	36,402.9	6,843.9	8,048.2	4,145.0	1,923.8	2,080.4	4,936.0	3,090.0	14,514.1	81,984.29
7,000 a menos de 8,000	30,639.2	7,115.9	6,850.0	4,306.3	1,900.5	2,541.0	3,400.9	2,543.9	13,571.7	72,869.39
8,000 a menos de 9,000	23,686.3	4,690.7	5,413.1	8,699.6	2,047.7	1,397.1	2,578.1	2,091.9	13,175.6	63,780.10
9,000 a menos de 10,000	19,859.5	5,790.9	4,633.2	1,633.8	1,591.5	1,704.3	2,825.1	2,542.5	11,098.3	51,679.10
10,000 a menos de 11,000	14,993.2	4,087.8	4,382.3	1,397.4	1,308.0	1,808.0	2,225.2	1,259.5	15,800.3	47,261.70
11,000 a menos de 12,000	13,193.2	4,351.6	3,862.5	3,247.8	1,118.2	1,232.9	1,417.0	2,194.5	7,048.8	37,666.50
12,000 a menos de 13,000	14,932.1	4,774.9	3,893.9	1,202.7	863.6	1,256.5	2,824.7	2,058.7	6,973.2	38,780.30
13,000 a menos de 14,000	8,922.7	2,518.7	2,845.5	1,172.7	783.4	1,009.3	1,190.2	969.7	8,208.4	27,630.60
14,000 a menos de 15,000	6,222.5	2,631.4	1,915.6	852.9	670.9	715.0	612.2	1,870.7	4,562.2	20,155.40
15,000 a menos de 20,000	22,184.5	10,275.8	6,905.3	3,854.0	2,424.1	3,080.0	3,052.0	4,797.0	19,742.4	77,315.09
20,000 a menos de 25,000	14,862.4	8,506.0	4,890.2	3,127.5	1,758.8	2,447.9	2,073.9	3,458.1	21,784.2	62,909.00
25,000 a menos de 30,000	8,764.6	8,473.7	3,513.1	1,330.2	1,156.4	1,770.6	1,228.6	3,656.2	10,839.0	40,732.40
30,000 a menos de 35,000	5,581.6	2,700.3	1,093.2	536.0	477.4	956.0	731.5	2,108.1	5,996.7	20,180.80
35,000 a menos de 40,000	3,881.8	2,320.9	1,548.2	1,863.9	484.7	753.3	562.6	1,792.3	5,565.6	18,773.30
40,000 a menos de 45,000	1,688.9	1,228.8	610.6	201.1	273.6	390.7	147.8	662.8	1,866.8	7,071.09
45,000 a menos de 50,000	1,739.7	1,672.7	630.3	160.1	255.0	129.4	183.7	545.6	2,251.9	7,577.39
50,000 a menos de 999,999	7,755.3	8,144.2	2,022.3	1,196.7	988.4	2,418.2	1,062.4	4,679.6	11,698.0	39,965.10

Table 7

Source: CONSUPLANE

CONSTRAINTS

A. GENERAL

Profit is essential for the swine industry to maintain its current level of production and to prosper sufficiently for any significant expansion in the future. Here "swine industry" is used broadly to include all production interests, all marketing interest (such as auction markets, middlemen collecting hogs for slaughter and wholesaling and retailing interests) and all hog slaughter and pork processing interests. Broadly speaking then, for the entire swine industry to be profitable, each link of the chain must be sound and operating at equal efficiency. For example, if slaughter and processing procedures are inefficient and costly and if those industries are to remain profitable, they must expense inefficiencies against either the producer or the consumer or both. Similarly, marketing and production inefficiencies would put a pressure against hog slaughter and meat processing profits-- assuming of course that there would be some limit to prices paid by consumers. For this reason it is necessary to include in constraints limiting the development of the "Swine Industry" the areas of production, marketing, and slaughter and processing. To remove constraints in only one area would limit overall success.

B. Swine Production Segment

1. **Inadequate Education Transfer:** The campesino farmer is not exposed to nor was it apparent that he would respond to advanced technologies even if available. A low number of pigs weaned per sow and the large variation in swine market weights is reflective of the poor managerial ability of the campesino farmer. The large variation in market pig weights not only reflects the campesino farmer's inability to manage, but the lack of recognition of problem areas. The trial by error approach works only if you know what the optimum should achieve.

2. **Inadequate nutrition of the Criollo pig** has resulted in slow growth rates and fatter pigs which are more susceptible to parasitic and disease infections. Improved feeds, elimination of grass and garbage as feed sources are essential.

3. **Traditional buying practices** do not transmit information about desirable swine conformation or condition to campesino farmers.

4. **Genetic capability of the Criollo pig** results in poor meat quality and low reproductive performance. Although the improved crossbreeds will enhance these traits, they must be raised in an intensive not an extensive system in order to be successful.

5. Lack of facilities for the Criollo pig results in poor pig performance as well as high disease and parasitic infestation. Intensive confinement is essential, along with proper knowledge of castration, feeding, and worming programs, etc.

6. Inadequate knowledge of nutrition and disease control procedures will greatly curtail commercial swine producers if they run into a problem. Several commercial producers, from our interviews, had gone out of the swine business because of problems they could not correct.

C. Feed Formulation and Nutritional Content

1. Although more energy feedstuffs are available in Honduras than are protein sources, they must both be amply available once the commitment is made to increase swine production. Hopefully the government will continue to encourage maize and sorghum production. Maize and sorghum production levels are currently below that necessary for high swine expansion programs.

2. Inadequate supplies of protein feedstuffs sources will limit swine production. Protein sources must either be imported or raised within the country to balance the diet for swine. Poultry and swine utilize similar feedstuffs. Since diets for poultry can be produced, a similar situation could exist for swine.

3. Feed quality is often times poor in mixed feed. For example blood meal or feathermeal are poor quality protein sources and their dietary levels should be minimal. Nutritional limitations of various feedstuffs is not understood by commercial swine producers.

4. Various potential diet formulations particularly using different feed sources for the different production stages of swine are minimal. Generally only 2 diets are available for raising swine under commercial conditions. Nutritional standards are needed to formulate to specific dietary allowances. This in conjunction with using good quality feeds are needed to insure optimum performance.

5. Due to the hot-humid environment, vitamin stability in premixes and mixed feeds for long periods is questionable.

6. Mold development in mixed feeds if at high levels will reduce growth rates and reproductive efficiency.

D. Feed Mill Formulations and Capacity

1. The limited number of feed mills and slaughter facilities leaves both the commercial and campesino farmer caught in the middle. When profits are slim for the feed man or for the meat processor, the farmer will be hurt the most, thus not encouraging expansion in the swine business.

2. Governmental regulations of feed sample analysis do not result in a consistent product for feeding swine.

3. Feed tags should more accurately reflect the contents of the diet, and analytical laboratories should monitor the industry more closely.

E. Veterinary Services

1. Inadequate epidemiology of existing endemic disease and parasitic infestation levels are not known.

2. The Criollo pig if infected may become a carrier for various disease and parasites.

3. Inadequate nutrition of the Criollo pig will enhance disease and parasitic susceptibility.

4. Inadequate diagnostic tests in the state laboratory for various swine diseases prevents rapid curtailment of disease problems.

5. The feeding of garbage or table scraps increases the possibility of human infestation.

6. Veterinary personnel are inadequately trained clinically to handle swine disease problems.

7. The presence of worm cysts in swine carcasses which have passed inspections is a serious health problem for the human population and will not enhance the image of pork for the consumer.

8. Hog cholera was recognized as a problem in Honduras, but no specific quarantine procedures are followed once an outbreak is identified.

F. Processing Sector

Meat Inspection. There is a need to upgrade and broaden the responsibilities of the Honduran meat inspection service because it will prove beneficial to pork producers, slaughtering and processing plants and ultimately to consumers.

Meat inspection should be responsible for all plant sanitation requirements--with the full authority to shut down sections of plants till cleaned properly. Clean utensils, equipment and clean workers, potable water supplies, clean dressing procedures are all matters that should be subject to inspection rules and regulations.

Meat inspection should be responsible for antimortem and postmortem inspection to insure that animals, carcasses and edible offal items are free of abscess, disease and parasitic infestations such as tapeworm and liver flukes (largely in cattle). Dead animals and dying animals should be condemned as unfit.

Meat products should be labeled correctly, just exactly what it is, with a complete list of ingredients in the formulated type products. "Water added" designations should be indicated on the label if added water exceeds a certain level.

Not all ingredients have a place in modern meat processing, notably nitrates and nitrites should have a maximum allowable level. Preservatives such as antibiotics, sulfites, borates and formaldehyde should be prohibited; no inference is intended here.

Disease and parasitic conditions of animals are always of importance to producers and government officials as well as to consumers. Many disease conditions are first detected at point of slaughter by competent inspectors--in particular, cholera, and aflatoxin from moldy feeds. Disease outbreaks are often noticed first at the slaughterhouse and therefore there is a real need to reflect back such information to the farm and farmer where it originated.

Pork Carcass Grading. Classification and grading is important in the marketing process. Grades give an identity or definition to carcasses of different uses and of different value due to differences in ratio of waste fat and bone to usable red meat. When carcasses are well defined and homogenous in a grade, then those grades can be used in pricing--so one packer's bid can be compared against another. Grades allow market quotations and market news to be published thereby enabling producers to have an idea what his live animals are worth.

While grades, live corresponding to carcass, may not be used extensively in actuality, they still could be used in marketing. In the U.S., grades are used in all market news--radio, T.V., daily papers and monthly magazines; more often than not, the carcasses are not officially graded--buyers and seller have learned to use the system unofficially and to a helpful degree. Carcass values of hogs slaughtered in Honduras vary widely in actual, but perhaps not realized, value--carcass weight differences, fatness differences, flesh quality, differences, singly or in combinations, make up most carcass value differences. These cannot be differentiated in the present system of purchasing on a per head basis.

Streamline-high volume orientation. There is a need for all processors to become more production oriented, to produce more product per unit investment in labor, plant, and equipment. If the processor

is inefficient, his higher unit of production cost must be at the expense of the producer or consumer or both if he expects to make a profit. Modernization is critically important here.

New Products: Restructured-Reformed products are making headway in consumer acceptance in the U.S. Presently intact boneless muscles are flaked at a sub-freezing temperature, formulated with beef, dried milk or textured vegetable proteins to lower ingredient costs, compressed back solid and any thickness chop or roast made therefrom. A product with pork chop flavor and texture can be made from many parts or all of the pork carcass as desired. These types of products can be formulated to lower ingredient cost and thereby a new type, entirely acceptable, lower cost product can be offered to consumers.

New Methodology: Several plants in the U.S. have installed skin pullers in the pork dressing operation--they resemble hide pullers used in cattle dressing. Use of the skin puller in dressing hogs provides pork carcass with a lower microbial count than obtained through the scalding method. Further, the pig skin then has a value when converted to leather--a "value added" to a raw material.

Skin pulling equipment blends in well to streamlining the dressing operation and this type of automation usually lowers cost of slaughtering hogs, depending on the relative costs of labor and capital.

More Complete Use of By-Products: Some plants have such a low volume of by-products that it is not feasible to purchase rendering equipment--this is the case with many plants in the U.S. The solution to such a problem is for an independently owned large rendering plant to purchase materials from several slaughtering and processing facilities. Such rendering plants collect daily the following types of materials: inedible offal, condemned carcasses, heads, feet, blood, bones. They make bone meal, tankage, meat scraps and blood meal as well as an inedible fat (for humans) that can be fed back to animals at certain levels.

RECOMMENDATIONS

A. Development of Swine Production Skills

The technological knowledge of the campesino farmer regarding good swine husbandry practices is extremely poor. The technology necessary to establish a complete swine operation (i.e., farrow to finish) for him could be overwhelming and disastrous if applied at one time. Therefore, a gradual transition with a very small financial investment appears to be the most feasible plan for the campesino. The following proposal would require one highly trained technical advisor from either A.I.D. or the commercial feed industry who would indirectly supervise the following.

1. A Commercial Farrowing Unit: This unit utilizing improved breeds of swine would be under contract to provide feeder pigs for distribution to either campesino farmers or the school agriculture program. The unit would start with 50 sows each farrowing twice yearly (e.g. 25 females every 3 months) providing approximately 1,600 feeder pigs annually. This unit would perhaps best be located in the San Pedro Sula area utilizing existing feed mill and slaughter facilities. The technical advisor would indirectly supervise this facility. The unit should be under contract to sell feeder pigs for at least a 5-year period to one of two groups.

2. Feeder pigs from this commercial unit would be used as indicated above, in one of two channels (i.e., the campesino farmer or agricultural school program with the youth or both). Contracts for a 3-year period would be established for finishing out hogs under the supervision of the technical advisor. The individual with which the contract is established would be paid a salary on a per-pig-marketed basis (approximately L6/pig) for his labor in feeding, manure disposal, etc. Concrete floors with shade and homemade feeders would be constructed for 15 hog/lots (suggest 2 lots/unit). Feeder pigs, feed and construction

costs would be paid out of a rotary fund available to the technical advisor. The advisor would be responsible in training the individual to operate the enterprise after the 3-year period and advise him on the economic procedures. Upon completion of the 3-year period, the facilities would be turned over to the individual.

3. As interest in the enterprises increases, the farrowing unit and additional finishing units could be increased or another started.
4. When the campesino farmer becomes knowledgeable about swine husbandry practices then they could be advised to increase their market pig facilities, under conventional loan practices.
5. Other facilities in the western section of Honduras, the La Ceiba or the southern Honduran area could be constructed following the successful implementation of this program in the San Pedro Sula area. The San Pedro area was initially selected because of its greater chance of success.

6. Local swine associations as sub-chapters of the National Swine Association, should be encouraged to start in these ensuing areas, with the thrust toward education. Much of the extension activity of the technical advisor and(or) university personnel could use this forum to channel training sessions.

7. The technical advisor should also be available as a consultant to the Ministry of Natural Resources' swine breed improvement program.

B. Increase University Effort

At both the Pan American school and the University at La Ceiba, there needs to be more specialization emphasis in swine production practices. Faculty at both locations should be trained in swine production practices with a M.S. or preferably Ph.D. degree. At least 25% of their appointment should be involved in extension activities where they would be involved in the farm visits within their locale, on an advisory basis. Other specific suggestions for each school are listed below:

1. Pan American School

(Note: The team understands that this is not a Honduran school but a multi-national institution. These suggestions are made in the light that if adopted, Honduras would benefit, along with other countries having students in the school.)

- a. Increase the schooling to a 4-year program with the 4th year involving a specialization (e.g., swine production) of the students choice.
- b. Construct facilities for a model swine set-up. The farrowing area may need to be increased but facilities for fattening and gestating hogs need to be constructed. A small feed mill needs to be constructed for educational purposes.
- c. Conduct demonstration research on the school farm for evaluating diet formulations, management systems, etc. Fourth year students could be responsible for the operation of this segment and write their results for distribution.

2. La Ceiba University

- a. Increase the number of courses in the areas of swine production, nutrition, livestock diseases, meats and economic principles.
- b. Construct facilities for a model swine set-up. The farrowing house needs renovation. Breeding and gestation housing as well as facilities for growing swine need to be built. A small feed mill needs to be constructed for student instruction.
- c. Raise enough feeder pigs of improved quality and contract the pigs to local farmers as outlined in the previous section. The feeding of these pigs must be supervised by university personnel.

C. Development of Nutritional Standards and Feed Quality Control

Feedstuffs in Honduras are more varied in their available quantities in various locations than in the United States. The following are items that need to be implemented in the order indicated:

1. Encourage the evaluation of several feed formulas for the various energy and protein sources available in Honduras in the University swine herds. Simple diets and mixing techniques can be evaluated and published for on-the-farm mixers.
2. Dietary nutrient allowances need to be established and published for each phase of swine production. The U.S. standards as proposed by the National Research Council (swine publication) can be used directly. These standards need to be published for commercial producers so that they can become aware of nutrient needs of the various swine production phases. Education of the commercial producers will hopefully in time be transmitted to the campesino farmer.
3. Develop more stringent governmental feed tag regulations and enforce them. All ingredients used for the formulation of the diet should be listed on the tag in descending concentration order. Random microscopic examination of feed samples, by a trained technician will identify those in violation.
4. Feed tags should identify the amount of crude protein, fat, fiber, calcium, phosphorus, non-protein nitrogen and salt. State analytical laboratories run by government personnel

should conduct feed analyses for the above listed nutrients. Tolerances for protein should be within 1% units of that stated on the bag with no non-protein nitrogen. Maximum fiber levels, minimum phosphorus, minimum and maximum calcium, should be established with levels checked by governmental laboratories. The frequency of random sample collection should be twice monthly.

Optional tests for mold, lysine, fat and trace minerals should be made available on a cost basis after the above are well implemented.

5. Establish health standards for preventing disease transfer in the following feed ingredients:
 - a. Shrimp and fish by-products
 - b. Meat and bone meals
 - c. Bone meal

6. Although garbage feeding will undoubtedly continue for many years, its use should not be encouraged.

D. Increased Effort in Veterinary Service and Disease Identification

To effectively establish a commercial industry and in its spin-off, a more profitable income source for the campesino, the introduction of improved breeds and intensive methods are suggested:

1. It is essential that the true disease status of the national swine herd be established. Once accomplished, disease prevention programs including importation or national production of the proper vaccines and vaccination practices can be implemented. The greatest disease threat is the campesino pig, consequently these animals must be clinically examined by a team consisting of a trained paristologist, a pathologist, an experienced clinician and a USDA meat inspector. Slaughter facilities in key swine producing regions should be identified. The hogs processed through these plants will provide the data base needed to establish the scope of the problem. Sampling should be done over a 12 month period of time at a frequency of every three months. The sampling period should last for a period of 4 to 7 days at each facility testing at least 25% of all animals that are processed. Data collected should include an estimated age, body condition and point or origin. Plasma and serum samples should be taken for serilogic and blood chemistry analysis. Severity of parasitic load and species involved should be scored and identified. Carcass quality etc., should also be determined for each animal sampled.

2. Intensified training of lay inspectors should be part of the objectives of the team. On-spot inspection at retail outlets should be encouraged and organized.

3. Producers, regardless of size, should be made aware of swine disease symptomatology. This could be done via meetings organized by local feed processors, producers' associations or lending agencies and conducted by team members or trained in-country personnel.

4. The importance of nutrition to animal health cannot be over-emphasized. Such programs as described above should integrate these two disciplines at all times.

5. Assistance should be given both to the central and regional laboratories in diagnostic procedures of swine diseases and in ensuring the technical abilities of those responsible. Selected veterinarians at the regional level should be taught the skills needed to be effective swine practitioners by advanced study at institutions in the U.S. or elsewhere. These men would then be the focal point of industry development, at least as it pertains to health. Laboratory technicians both at the central and regional level should be given adequate supervised training in analytical techniques and sample handling to ensure adequate backup to field clinicians.

E. Provide Pictorial Extension Program For Campesino Farmer

It is estimated that at least 60% of the campesino farmers are illiterate, thus, written bulletins will be not be effective in educating this large segment of the population. Consequently, pictorial bulletins and video tape recorded management procedures, disease prevention feeding programs, etc., should be helpful on a temporary basis.

F. Modernization of the Meat Processing Industry

Few packing plants employ "second best" hog slaughtering and pork processing by design. Oftentimes there is a lack of money which prevents modernization. More frequently than not, however, lack of modernization in the packing industry is a lack of appreciation of what new technology offers in terms of economic return. There is a need for a meat processing short course for meat plant owners and managers. A considerable impact in technology transfer could be achieved in a three or four day course presented in Honduras. Such a course should attract all major meat processors, and it should be held in a plant where equipment and meat would be available.

G. Marketing Recommendations

1. Monitor the domestic market for processed pork products to determine when and if expanded output brings price pressures to bear on processor margins and on producer profits in the modern swine production sector.

2. Initiate a study to discover potential export markets for processed pork markets, to include:
 - (a) identification of nations having market potential,
 - (b) identification and assessment of trade and transportation barriers involved in exporting to these nations,
 - (c) determination of products demanded and assessment of required product qualities in the nations identified in (a),
 - (d) transmission of results to processors and swine producer associations.

3. Implement on a test basis the custom slaughter and marketing system for campesinos described previously.

4. Implement on a test basis at first, the local liveweight hog markets for campesinos described earlier in this report.

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