

in Honduras, indicates lower figures for live born and weaned farrows than the Ministry of Agriculture's breeding station in San Pedro Sula.

On the average hogs are slaughtered at the age of 6 months when feed and managed appropriately.

### 3.2.2 Management.

Hogs on moderns farms are permanently confined to pens, although some farms have small enclosed pastures, where growing pigs, sows and boars may spend part of the day. Most of the pens have concrete floor. Some pig farms have running water through the pen.

According to extension agents of the Hog Improvement Project, cleanliness vary widely among pig farms and to some extent is related to the quality of the facilities and equipments.

Not all hog farmers are good record keepers, which occasionally may hinder good management, due to inadequate selection of sows and boars for reproduction, insufficient control of feed consumption and weight increase and lack of timely knowledge of changes in the cost-income relations.

Since hogs are confined farmers have to carry out at least the most elemental works, like feeding twice daily, periodical cleaning of pens, covering of sows, etc., which requires labor force. According to visited hog farmers it is rather difficult to find worker who are willing to work with hogs. It is even more difficult to train workers to perform their work efficiently. Since hogs must be attended every day, even on holidays, many workers prefer to work on the fields five to six hours during five days weekly. Presently daily wages paid by hog farmers vary from

L. 10.00 to L. 30.00, depending on the ubication of the farm, capacity and experience of the worker and the level of technification of the operation.

### 3.2.3 Alimentation,

Most hog farmers use concentrate feed to raise their pigs. The majority of them buy the feed needed from some of the concentrate feed mills located in San Pedro Sula or Tegucigalpa. According to some independent hog farmers feed quality vary frequently which affects adversely the weight increase and the health of hogs. In addition, several hog farmers reported irregular supply of concentrate feed.

Several larger hog farmers prepare their own concentrate feed and some of them produce their own corn, sorghum and soybean on the farm. According to various hog farmers productivity improves when feed is prepared locally, but feed components are very difficult to obtain, specially protein carriers like soybean meal, boon meal, blood meal and fishmeal, as well as milling industry residues, molasses and vitamin or mineral concentrate.

It has been reported that a large concentrate feed manufacturer with interests in the floor milling and the meat processing industries, absorbs most of the byproducts of these industries for concentrate feed. This Corporation is the largest concentrate feed producer in the country, not only for hogs, but also for cattle and poultry.

Imported feed components are scarce on the local market due to foreign exchange shortage. Feed mills import the feed components required from foreign supplier but most hog farmers who make their own concentrate

feed do not operate on sufficiently large scale to import feed components and in addition it is rather difficult for them to obtain foreign exchange.

Several hog farmers think that the cooperatives should take over the importation and feed milling operations. In the past there have been a few negative experiences in such ventures, because members of cooperatives received the feed on credit which they never paid and the feed mill had to be shut down. But still this may be a viable solution under adequate management and strict control.

There are only a few farmer feeding hogs partially with alternate foods, like: banana (*Musa sapientum*), platano (*Musa paradisiaca*) and cassave (*Manihot esculenta*). Around Tegucigalpa and San Pedro Sula there are several hog farmers who recollect kitchen residues from hotels and restaurants or vegetable and fruit remainders from the marketplace and supermarkets to feed hogs. Some other hog farmers feed sugar mill residues (molasses) during the milling season. Alternate feeds are supplemented with concentrate feed rations.

At present relatively few hog farmers use alternate feeds, the great majority of them depend on concentrate feed prepared by the three major manufacturers. Grazing of swines has no significant impact on concentrate feed requirement, because hog farmers do not cultivate high protein carrier leguminous pastures.

According to hog farmers and professionals working in the Hog Improvement Program it takes around 342 Kgs. of concentrate feed to raise and finish a hog for the market in approximately 6 months time (Table No. 5).

TABLE NO. 5

FEED CONSUMPTION REPORTED AT THE BREEDING STATION OF THE HOG IMPROVEMENT PROGRAM IN SAN PEDRO SULA. MARCH 1991.

AGE IN WEEKS	INITIAL WEIGHT Kgs.	FINAL WEIGHT Kgs.	FEED CONSUMPTION Kgs.	FEED PRICE L./Kg.	SUB-TOTAL FEED COST L.	FEED CONVERSION Kgs.
1-10	1.81	25.45	45.32	1.39	62.99	1.78
11-16	25.45	58.18	101.82	1.19	129.17	3.70
17-25	58.18	100.00	194.68	0.88	171.52	4.66
TOTAL OR AVERAGE			341.82	1.04	355.48	3.42

Source: Hog Improvement Program, Ministry of Agriculture, San Pedro Sula. March, 1991.

When concentrate feed is partially substituted with alternative feeds it may take longer to finish hogs for the market with a live weight of 100 Kgs.

#### 3.2.4 Animal Health.

The major animal health problem on modern hog farms in Hog Cholera (*Tor-tor suis*), inspite of widespread vaccination programs with the Chinese strain, strict sanitation and control of human traffic as well as the movement of pigs. In the past there have been several outbreaks of hog cholera, the latest of them in 1988 in the Breeding Center of the Hog Improvement Program of the Ministry of Agriculture in Comayagua, where all Hogs have been destroyed and the Center remained shut down from early 1988 to mid 1989.

It is rather difficult to implement a Cholera eradication program in Honduras due to the large number of hogs roaming freely all over the country, many of which probably developed certain level of immunity to hog cholera, but may be carrier of the virus.

Leptospirosis (*Leptospira icterohaemorrhagiae*) due to a microscopic parasite resembling a tiny pice of twisted wire, also affects hog farms.

It is suspected that rats are the carriers of this parasite, which they liberate in their urine. Although some hog farmers try to control rat population within the premises of the hog farm, it is a rather difficult task because of constant reinfestation from the neighboring field. There is at least one hog farm in the area of Comayagua where hogs are presently under veterinary care due to Leptospirosis.

Mange, probably sarcoptic and demodectic, affects occasionally animals on hog farms. The sarcoptic mite burrows into the hog's skin for the purpose of obtaining food and laying eggs while the demodectic mite attacks the hair follicles and sebaceous glands of the skin. This external parasite is more frequent on freely roaming hog of traditional pig keepers, due to lack of sanitation. It has been also reported by a few hog farmers as a minor health problem.

Atrophic Rhinitis, an infectious transmissible disease of swine, characterized by the atrophy of the turbinates has been reported on some hog farms.

Endema (swellings) have been observed by hog experts and veterinarians on several hog farms, but its origin has not been identified.

Cysticercosis (*Cysticercus cellulosae*), infection of hogs in modern hog farms is very rare, since hogs are confined to clean pens the only source of infection is mechanical transmission or water supplied from rivers or canals. According to officials of the Hog Improvement Program, animals on hog farm are practically free of tape worm cysts.

Swine dysentery due to *Escherichia coli* is the most serious infectious disease of farrows on hog farms. But it is not the main origin of swine dysentery, which is due most frequently to feeding problems, like sudden changes of ingredients and decayed components.

Several internal parasites affects animals on hog farms and most owner regularly apply treatment against them. Farm owners and officials of the Hog Improvement Program are of the opinion that internal parasites

only constitute a minor health problem in modern hog farms, but no research has been conducted to prove it and may be of considerable economic impact on the productivity.

Mastitis of sows has been occasionally reported in some hog farms, but it is not a major health problem. According to some hog experts other diseases may be present in Honduras, but up to the present very little investigation has been made on swine diseases in Honduras and some times sick animals are slaughtered before the origin of the disease is established.

#### 3.2.5 Reproduction.

The major supplier of purebred boars and purebred or crossbred sows are the Breeding Centers of the Hog Improvement Program of the Ministry of Agriculture, located in Comayagua and San Pedro Sula. According to the Managers of these Breeding Centers, at present the demand exceed considerably the amount of boars and sows they can supply.

Most of the hog farmers keep crossbred sows born on the farm for reproduction and buy only boars, if available purebred Duroc, Landrace or Yorkshire and if not a crossbred of these three lineages. On better managed hog farms new boars are bought two to three times a year.

It has been reported that not all hog farmers can purchase boars from Breeding Centers or from other farmers, due to which they use boars born on the farm. In opinion of hog experts of the Hog Improvement Program this practice is quite frequent on smaller hog farms and lead to deteriorating genetic characteristics of the breeding stock.

### 3.2.6 Economic aspects.

During most of the decade of the eighties hog farmers enjoyed rather favorable conditions, due to which the industry expanded considerably. Food components and veterinary products were relatively cheap, due to governmental policies to keep to exchange rate at two Lempiras per U.S. dollar and to grant preferential assignments of foreign exchange for the importation of agricultural inputs. Agricultural production, including hog farming, enjoyed increasing indirect subsidizing until 1987, when foreign exchange deficit began to reach critical level in the Central Bank of Honduras.

During 1987 and 1988 hog farmers confronted rising production costs, because growing number of inputs had to be imported with foreign exchange purchased outside of the banking system. Increasing demand of foreign exchange in the black market combined with decreasing supply due to changing political conditions in Central America, raised the price of U.S. dollar from L. 2.80 in early 1987 to L. 4.00 at the end of 1988. Since basic feed components, like corn and soybean meal as well as veterinary products were imported with foreign exchange purchased on the black market, gradual cost increase could not be avoided.

At the same time the Government forced retailer to keep meat prices unchanged through price control measures, due to which farm gate prices began to lag behind cost increases. In the beginning of 1989 the recently elected incoming Government introduced radical monetary policy modifications, which resulted in the devaluation of the Lempira to 5.30 per U.S. dollar, but at the same time restrained consumer price in-



crease of meat until October. In addition, official basic grain prices were substantially increased to stimulate production.

During 1988 and 1989 agricultural input prices rised slowly, although at increasing rate, but during the first months of 1990 some input prices rised suddenly between 50 and 150%, which ruined many hog farmers who were operating already without profit. Although in the second half of 1990 farm gate prices of hogs began to move upwards, the lag between input costs increase and output price increase was to long for many farmers, who already sold their breeding stock when meat prices finally began to catch up with input prices during the first months of 1991.

According to hog farmers, the increase of farm gate prices of hogs diminished demand for meat and processed hog products due to diminished purchasing power of the population, whose salaries continue to lag behind commodity price increases.

According to officials of hog farmers cooperatives, during 1989 and 1990 several farmers abandoned hog farming totally and many other reduced considerably their breeding stock. The impact of feed and other input price increase was so severe, specially in 1990, that officials of some cooperatives could not keep up to date the changing status of their members. Some of them do not know how many of their member are still in the hog business and what is the size of the stock on existing hog farms.

In Juticalpa one of the largest hog farmer is going out of business. This farmer managed a vertically integrated operation, from the production of corn and soybean an his own land to the processing of hogs. He used to keep up to 50 sows, but his breeding stock has been reduced to 20 and he

is about to sell these sows too and close the meat processing plant. According to his declarations, he can make more profit selling the corn and soybean harvested than feeding it to hogs. He thinks that farm gate prices of hogs are still too low and so are retail prices of processed meat, but he thinks that further increase will shrink even more the demand.

According to officials of the Hog Improvement Program during the first half of 1988 the cost of raising and finishing a 100 Kgs. hog for the market was around L. 370.00 by a efficient hog farmer, who obtained on the average 2 litters per sow yearly and weaned on the average 17 farrow during the same period. Most hog farmers are not as efficient as the above example. The Central Bank of Honduras reported for 1990 an average farm gate price of L. 3.85/Kg. of live hogs. Since a 100 Kgs. hog sold for L. 385.00, after deduction of production costs of L. 370.00, the producer was left with only L. 15.00 profit per hog, if he was efficient producer, if not he lost money.

Up to March 1991 production costs increased approximately 30% according to observed input prices. For example, concentrate feed for pregnant sow increased from L. 616.00/MT. to L. 1,034.00/MT., for young pigs (initiator) from L. 1,056.00/MT. to L. 1,322.00/MT. and for adult pigs (finisher from L. 833.00/MT. to L. 1,100.00/MT. Veterinary product increased in the range of 75-200% in the same time. These input price increases rose production costs in the neighborhood of L. 555.00 for finished 100 Kgs. hogs.

Farm gate prices for live hog increased to L. 6.60/Kg. according to contacted hog farmers, which means that farmer get L. 660.00 per finished

hog weighting 100 Kgs. After deducting L. 555.00 production costs, the farmer obtain L. 105.00 profit per hog sold, which is better than the net income received in 1990. Farm gate price increase of live hogs resulted from sharp decrease of supply in 1990.

The recuperation of hog farmers is confronted with severe financial constraints. It has been reported by farmers that private banks do not loan money for hog farming because of the high risks attached to this industry. There are no fund availables from Government controlled financial institution. Furthermore interest rate are up to 30% in private banks, which makes it prohibitive for hog farmers to get an unqualified general purpose loan and use it as working capital.

Due to substantial increase of construction materials prices and the high interest rate it is very expensive to build facilities for new hog farms. Unless medium to long term credit is made available at reasonable interest rate hog farming may remain in recession.

Some hog farmers sell live animals to intermediaries, who may resell live animals to wholesaler or slaughter the hogs and sell the carcass to retailer. But most larger hog farmers sell live hogs or the carcass to meat processing plants or to supermarkets in the major cities on contract basis.

According to one hog farmer carcass price in March 1991 was up to L. 9.40/Kg.

#### IV. COMAYAGUA AND SIGUATEPEQUE

According to the agricultural census of 1974, there were 11,078 pig keepers in the Department of Comayagua holding in total 20,884 swines, which indicates that on the average there were only 1.89 pigs per keeper. Since most of the hog farmers located in the Department of Comayagua initiated operations during the 1980's the number of pigs indicated in the 1974 Agricultural Census were owned by traditional keepers.

There is no recent information on the present state of traditional pig keeping. In the opinion of agricultural extension agents and official of the Hog Improvement Program, the inventory of traditionally managed pigs did not change much since 1974.

With respect to hog farms, there are 21 of these enterprises, 8 in the neighborhood of Comayagua and 13 around Siguatepeque. Of the 21 hog farms 14 are affiliated to the only Hog Farmer's Cooperative in the Region (Cooperativa de Porcicultores de la Zona Central Ltd. (COOPORCAL)) and the remaining 7 are independents. Most of the hog farms are owned by retired military men, active professionals like lawyers, doctors, agronomist, etc. and businessmen. Many of the owners do not live on the farm, some of them visit it daily, but other only once or twice weekly. There is usually an employee in charge of the management.

Among all hog farms there are presently 386 sows, which makes on the average 18.38 sows per farms. The range is from 3 to 90 sows per farm. There are in total 38 boars on 21 farms, giving 1.81 boars per farm with a range of 1 to 10.

In addition there are around 2,000 hogs of all ages on the 21 hog farms,

which gives an average inventory of 95.23 heads per farm.

All pigs are improved breeds of Duroc Jersey, Landrace and Yorkshire, most of them crossbreeds of these lineages, excepting some of the boars and a few sows, which are purebreds.

Eleven of the 14 hog farms affiliated to COOPORCAL produced last year (1990) 3,264 hogs, which gives an average of 296.73 hogs per farm. There is no information available of the other hog farms and they could not be visited due to time constraint.

None of the interviewed farmers or officials of the Hog Improvement Program could provide information on the status of pure criollo pigs in the Region of Comayagua and Siguatepeque. According to some of these people it may be possible to find them in remote areas, which are not visited by agricultural extension agents.

All hog farmers affiliated to COOPORCAL slaughter their animals, usually in the facilities of the city of Comayagua or Siguatepeque and sell the carcass to supermarkets, meat retailer or meat processor plants. Carcass price paid to hog farmers in March 1991 varied between L.8.80/Kg. and 9.90/Kg., depending of terms of the contract.

Around 90% of the hog farmers buy concentrate feed from plants located in Tegucigalpa or San Pedro Sula. Concentrate feed costs per hog vary from one farm to another between L.161.50 and L.333.50, being for most farmers over L.300.00. Two hog farmer who reported low concentrate feed costs, L.278.00 and L.161.50 per hog finished for the market provide alternate feed, bananas, plattains and vegetable or fruit remainders from

the market place.

Only two hog farmers of the 11 surveyed reported that they make their own concentrate feed and only one of them could provide information on the cost of finishing a hog for the market, which is L.247.48, lower than the costs of those farmers who buy prepared feed. This is the largest hog farmer of the region, with 90 sows and a yearly production of 851 pigs, which allow him to operate on relatively large scale and by mixing his own feed he gets better and more stable quality.

Hogs are sold for the market usually at the age of 150 to 180 days and with live weight of 82 Kgs. to 100 Kgs. Carcass weight has been reported to be only around 65% of live weight, in which the head, feet, intestine and other internal parts are not included, which are frequently given to workers in the slaughterhouse or sold separately by the hog farmers.

The major hog disease in the region is hog cholera (*Tortor suis*). Other minor diseases observed are Mastitis of unidentified origin, Leptospirosis (*Leptospire icterohaemorrhagiae*), Mange (probably both sarcoptic and demodectis), Swine Dysentery in some cases due to *Escherichia coli*, but mostly to feeding problems, Atrophic Rhinitis of unidentified origin and Edemas (swellings) of different kinds.

The Hog Improvement Program has no veterinarian assigned, but there are two veterinarians in the Regional Office of the Livestock Division of the Ministry of Agriculture who attend also hog farmers when their services are required. Major hog farmers also hire the services of private veterinarians when they have serious health problems. Furthermore, they are visited occasionally by salesmen of veterinary drug distributors.

According to officials of the Hog Improvement Program non of hog farmers depends exclusively of income generated from sale of hogs produced on the farm. Since the owners are usually active professionals or businessmen they receive income from other sources, which frequently is considerably higher than the income generated by the hog farm. It has been reported that some farmer support the operation of the hog farm, at least temporarily, with income generated from other sources.

There is no information on the income of farmers generated by the production of hogs and attributable to other activities, to evaluate the rentability of hog farming. Hog farmers are inclined to keep confidential their income and financial state, due to the implications of this kind of information on taxes, loans with financial institutions, credit in commercial establishment and governmental or international assistance.

It is estimated by officials of the Hog Improvement Program, that hog farmers earned an average net income of L.40.00 per hog sold in 1990. Net income per hog marketed was considerably higher during the first two months of 1991, according to preliminary estimate over L.100.00.

Non of the few interviewed traditional pig keepers could provide information on the contribution of hog keeping to their total income. Most of them qualified hog keeping as a marginal activity, to use crop and kitchen remainders. Several of them prefer to sell hogs before Christmas to get some cash. Other reported selling hogs when the children enter the school.

TABLE NO. 6  
 PRODUCTION COEFFICIENTS OF ELEVEN HOG FARMS IN THE DEPARTMENT OF COMAYAGUA, AFFILIATED TO COOPORCAL.

#	FARM	OWNER	NUMBER OF SOWS	NUMBER OF BOARS	YEARLY HOG PRODUCTION	DAILY FEED <sup>1)</sup> CONSUMPTION Kgs.	FEEDING COSTS <sup>1)</sup> L./Hog	CARCASS PRICE L./Kg.
1	Finca San Jose de las Palmas	Theo Hersperger	90	10	851	909	247.82	9.90
2	Finca El Porvenir	Wilfredo Guerra	3	1	64	35	278.00	9.46
3	Finca Calan	Noe Meza	29	3	300	277	320.00	8.80
4	Finca w/n	German Paz	40	2	450	682	316.50	9.46
5	Finca w/n	Ruben Hernández	16	1	174	125	333.50	9.68
6	Finca Villa Mercedes	Roger E. Mendoza	5	1	152	52	324.00	9.68
7	Finca w/n	Manuel Inestroza	12	1	180	176	316.50	8.80
8	Finca Doña Soledad	Soledad de Perdomo	6	1	113	35	331.50	8.80
9	Finca Texas	Pablo Toto	22	2	360	409	161.00	9.90
10	Finca la Escondida	Martín Quan	45	3	500	409	n/d	9.90
11	Finca Chaguite	Luis Aguilera	8	1	120	182	205.00	9.90
TOTAL OR AVERAGE			276	26	3,264	3,291	-	9.48

1) Concentrate feed only, alternate feeds not included.

w/n = Without name      n/d = Information not available

Source: Hog Improvement Program, Ministry of Agriculture, Comayagua, March, 1991.



V. CONCENTRATE AND ALTERNATE HOG FEEDS

There are three commercial feed mills in Honduras, which are: Alimentos Concentrados Nacionales, S.A. (ALCON) and Alimentos Concentrados Fafer (FAFER) located in San Pedro Sula and Compañía Hondureña de Alimentos, S.A. de C.V. (COHA) located in Tegucigalpa. Commercial feed mills manufacture concentrate feed for cattle, hogs, poultry, fishes and dogs. Over 60% of the output of feed mills is consumed by poultry. The share of hog feeds of the feed mills is estimated to be 15-20% only.

TABLE NO. 7

INSTALLED CAPACITY OF COMMERCIAL FEED MILLS

COMPANY	LOCATION	TOTAL CAPACITY	
		Tm./day	%
ALCON	San Pedro Sula	205	83.00
COHA	Tegucigalpa	28	11.33
FAFER	San Pedro Sula	14	5.67
TOTAL		247	100.00

Source: Livestock Department, Ministry of Agriculture, Tegucigalpa, D.C., Honduras, March, 1991.

In addition to the commercial concentrate feed mills there are around 15 smaller feed plants in the country, owned mostly by poultry and hog farmers or producer's cooperatives. Most of the output of these plants is used to feed the livestock of the owners, but several of them sell part of the production to other producer in their neighborhood. The daily production of these small feed mills is estimated to be around 100 Tm.

ALCON, the largest feed mill in Honduras, with approximately 83% of the commercial production of concentrate feed in the country, owned by Cargill Corporation of the U.S.A., is vertically integrated from the production of corn and soybean to the processing of hog and poultry. Corn and soybean is provided by independent farmers on contract term to ALCON, which provide contractors with inputs, technical assistance and financial support. Basic feed components like corn and soybean meal are also imported by ALCON on large scale and stored in their facilities.

There are around 30 hog farmers in the northern part of Honduras producing hogs under contract for Delicia, S.A., the largest porc processing plant in Honduras, of which Cargill Corporation is the major shareholder. ALCON provides concentrate feed, other inputs, technical assistance and financial support to hog farmers under contract with Delicia, S.A.

The main ingredient of concentrate feeds, corn, is also the most important basic grain for human consumption. During the decade of the eighties nation wide corn production persistently stayed behind demand, due to which feed mills have been competing for corn supply with human con-

sumption and often had to use imported corn. Local supply is still below global demand for corn.

With respect to the second major component of concentrate feed, soybean meal, until very recently most of the consumption of the concentrate feed industry has been satisfied through the importation of soybean meal, which in 1987 reached L.14,000,000,00. Since the early 1980's experiments have been conducted on limited commercial scale with the cultivation of soybean, sponsored by the Ministry of Agriculture, the Central American Bank of Development and other institutions. As far as yields and production costs are concerned the results have been satisfactory and the production of soybean on commercial scale has been increasing in Honduras since 1989.

Several other concentrate feed components are produced on limited scale in Honduras, among which the followings are the most important: blood, meat residue and boon meals of animal origin, corn gluten, by products of wheat and rice milling industries, african palm oil industry residues and molasses. Sorghum is being produced as secondary basic grain in several regions of the country and is frequently used in concentrate feeds.

Several alternate feed components are available in Honduras in limited volumes, among which the most important are the followings: Bananas and plantains (*Musa* sp.), yuca (*Manihot* sp.), yam (*Dioscorea* sp.), sweet potato (*Ipomea* sp.), milk processing plant byproducts and poultry tankage. Some of these alternate feed components are already used on limited scale by hog farmers. In 1986 two experiments have been conducted on the use of alternate feed for hogs, one at the Faculty of Agriculture of the Uni

versity of Honduras (CURLA) and the other at the Agricultural Research and Study Center (CATIE) in Turrialba, Costa Rica.

In the experiment of CURLA, conventional concentrate feed has been partially substituted with cassave, pumpkin and buttermilk. It has been concluded that partial substitution did not effect significantly the weight increase of hogs and that some cost reductions can be achieved by partial substitution of concentrate feed.

In the experiment of CATIE concentrate feed has been partially substituted by mulberrytree (*Morus* sp.) leaves, discarded banana (*Musa* sp.), sweet potato (*Ipomea* sp.) and yam (*Dioscorea* sp.). The results indicate that in most of the treatments with alternate feed component there was a significant decrease of the daily weight gain of hogs in proportion to the percentage of substituted concentrate feed. More information on these research works is presented in the following tables at the end of this chapter.

TABLE NO. 8

GRANTED NUTRIENT CONTENT OF DIFFERENT TYPES OF CONCENTRATE FEED FOR HOGS

TYPE OF FEED	PROTEIN MINIMUM %	FAT MINIMUM %	FIBER MAXIMUM %	E. M. K Cal./lb.	RECOMMENDED WEIGHT RANGE OF HOGS
Pregnancy	15.00	4.00	5.00	1,437	All pregnant sows
Iniciator	18.00	4.00	4.00	1,500	0 - 13.5 Kgs.
Grower I	18.00	5.00	5.00	1,437	13.6 - 36 Kgs.
Grower II	14.50	5.00	5.00	1,437	36.1 - 59 Kgs.
Finisher	14.00	5.00	5.00	1,437	59.1 - 100 Kgs.

Source: Compañía Hondureña de Alimentos, S.A. de C.V., (COHA). Tegucigalpa, Honduras, March, 1991.

TABLE NO. 9

AVERAGE LABORATORY ANALYSIS RESULTS OF DIFFERENT TYPES OF CONCENTRATE FEED FOR HOGS FROM THREE MANUFACTURERS

MANUFACTURER AND TYPE OF FEED	RAW PROTEIN %	NITROGEN %	ETHEREAL EXTRACT %	RAW FIBER %	HUMIDITY %	DRY MATTER %	NITROGEN FREE EXTRACT %
<u>Manufacturer A</u>							
Pregnancy Initiator	14.14	2.27	5.49	3.86	12.50	87.50	51.72
Grower	19.08	3.05	4.77	1.74	10.88	89.12	55.81
Finisher	14.94	2.39	6.09	1.79	11.56	88.44	59.82
	14.51	2.32	3.39	4.00	12.93	87.07	61.19
<u>Manufacturer B</u>							
Pregnancy Initiator	16.11	2.58	6.03	6.30	11.13	88.87	50.45
Grower	17.58	2.81	4.97	3.72	11.64	88.36	53.12
Finisher	16.36	2.62	6.73	7.67	10.40	89.60	47.55
	15.81	2.53	5.37	8.20	10.48	89.52	49.68
<u>Manufacturer C</u>							
Pregnancy Initiator	13.20	2.11	4.28	5.20	10.73	89.27	-
Grower	15.79	2.53	2.52	2.90	9.67	90.33	-
Finisher	15.82	2.53	3.91	2.74	10.80	89.20	-

Source: Ministry of Agriculture, San José Laboratories, Tegucigalpa, Honduras, March 1991.

TABLE NO. 10

AVERAGE LABORATORY ANALYSIS OF MINERAL CONTENT OF DIFFERENT TYPES OF CONCENTRATE FEED FOR HOGS FROM TWO MANUFACTURERS

MANUFACTURER AND TYPE OF FEED	ASHES	CALCIUM (Ca)	PHOSPHORUS (P)	MAGNESIUM (Mg)	IRON (Fe)	COPPER (Cu)	ZINC (Zn)
	gram/100 gram dry matter	gram/100 gram dry matter	milligram/kilogram dry matter	milligram/kilogram dry matter	milligram/kilogram dry matter	milligram/kilogram dry matter	milligram/kilogram dry matter
<u>Manufacturer A</u>							
Pregnancy Initiator	5.72	0.854	1.108	0.266	303.00	18.00	118.00
Grower	6.47	1.080	0.943	0.225	465.00	14.60	112.00
Finisher	5.35	0.905	0.786	0.234	286.00	15.60	109.00
	5.33	0.922	0.744	0.276	244.00	11.50	114.00
<u>Manufacturer B</u>							
Pregnancy Initiator	9.98	2.050	1.780	0.257	228.00	14.30	69.30
Grower	9.15	2.348	1.860	0.236	286.00	11.50	97.00
Finisher	11.00	2.370	2.120	0.304	357.00	8.70	78.30
	10.37	1.680	1.240	0.234	246.00	9.00	67.30

Source: Ministry of Agriculture, San Jose Laboratories, Tegucigalpa, Honduras, March 1991.

Ca = Calcium. P = Phosphorus. Mg = Magnesium. Fe = Iron.

Cu = Copper. Zn = Zinc.

TABLE NO. 11

INGREDIENTS USED IN CONCENTRATE FEED MANUFACTURING BY CCHA<sup>1)</sup> IN MARCH 1991

1. Initiator: for pigs from 10 day of age to 30 lbs.  
Corn; meat residue meal; soybean meal; whole milk; corn gluten, oil palm nut cake; vegetable oil; sugar cane molasses; calcium carbonate; bicalfos; salt; vitamins A, D3, E, K3, B12; Riboflavine; calcium pantofenale; I; Mn; Zn; Fe; Cu; Co; Se; niacin; lecithin; mecadox; methionine.
2. Grower I: for pigs from 30 to 80 lbs.. Corn; meat residue meal; soybean meal; corn gluten; wheat and rice byproduct; vegetable oil; sugar cane molasses; bicalfos; salt; vitamin A, D3, E, K3, B12; riboflavin; calcium carbonate; calcium pantotenate; niacin; lecithin; Mn; Zn; Fe; Cu; I; Co; Se; methionine.
3. Grower II: for pigs from 80 to 130 lbs.  
Corn; sorghum; meat residue meal; soybean meal; cotton seed meal; wheat and rice byproducts; oil palm nut cake; vegetable oil, sugar cane molasses; calcium carbonate; bicalfos; salt; vitamin A, D3, E, K3, B12, riboflavin; calcium pantotenate; niacin; lecithin; Zn; Mn; Fe; Cu; I; Co; Se; methionine.
4. Finisher: for pigs from 130 to 220 lbs.  
Corn; sorghum; meat residue meal; soybean meal; cotton seed meal; corn gluten; wheat and rice byproducts; oil palm nut cake; animal fat; sugar cane molasses; calcium carbonate; bicalfos; salt; vitamin A, D3, E, K3, B12; riboflavine; calcium pantotenato; niacin; lethicine; Mn; Zn; Fe; Cu; I; Co; Se; methionine.
5. Pregnancy: for pregnant sows.  
Corn, sorghum; meat residue meal; soybean meal; cotton seed meal; corn gluten; wheat and rice byproducts; oil palm nut cake; animal fat; sugar cane molasses; calcium carbonate; bicalfos; salt; vitamin A, D3, E, K3, B12; riboflavine; calcium pantotenate; niacin; lecithine; Mn; Zn; Fe; Cu; I; Co; Se; methionine.
6. Lactation: for lactating sows.  
Corn; sorghum; meat residue meal; soybean meal; cotton seed meal; corn gluten; wheat and rice byproducts; oil palm nut cake; animal fat; M-14; sugar cane molasses; calcium carbonate; bicalfos; salt; vitamin A, D3, E, K3, B12, Riboflavin; calcium pantotenate; niacin; Mn, Zn; Fe; Cu; I; Co; Se; IM-100, methionine.

1)Compañía Hondureña de Alimentos, S. A. de C. V.  
lbs. = pounds ( 460 gr. ).

Source: Information provided by the manager of the Company.



TABLE NO. 12  
FEEDING EXPERIMENT RESULTS OF PARTIAL SUBSTITUTION OF CONCENTRATE FEED WITH RIPE BANANA,  
(Musa sp.)

TREATMENT	1		2		3		4		5		STANDARD DEVIATION
	Concentrate feed provided <sup>1)</sup> %	Ripe banana provided <sup>2)</sup>	free	8	free	8	free	8	free	8	
Number of pigs	100	none	8	8	8	8	8	8	8	8	-
Average initial weight, Kg.	35.4	35.9	35.3	35.7	35.0	35.3	35.7	35.7	35.7	35.7	-
Average final weight, Kg.	91.1	95.0	94.8	93.3	94.8	93.3	93.3	93.3	98.8	98.8	-
Average daily weight increase, Kg.	0.838	0.757	0.791	0.643	0.791	0.643	0.643	0.643	0.583	0.583	0.027
Concentrate feed consumption, Kg./day/pig	3.0	2.3	2.1	1.8	2.1	1.8	1.8	1.8	1.5	1.5	0.040
Ripe banana consumption, Kg./day/pig	0.0	5.1	5.4	5.7	5.4	5.7	5.7	5.7	5.8	5.8	0.600
Concentrate feed D. M. consumption, Kg./day/pig	2.75	2.15	1.94	1.61	1.94	1.61	1.61	1.61	1.39	1.39	0.060
Ripe banana D. M. consumption, Kg./day/pig	0.0	1.10	1.20	1.27	1.10	1.20	1.27	1.27	1.31	1.31	0.120
Total dry matter consumption, Kg./day/pig	2.75	3.25	3.14	2.88	3.04	2.81	2.88	2.88	2.70	2.70	0.130
Conversion efficiency of dry matter <sup>5)</sup>	3.28	4.41	3.97	4.48	3.97	4.48	4.48	4.48	4.53	4.53	0.130
Conversion efficiency of C. F.	3.28	3.12	2.65	2.79	2.65	2.79	2.79	2.79	2.75	2.75	0.120
Consumption of raw protein, gr./Kg. of C. F.	480	409	379	333	409	379	333	333	286	286	-
C. F. saved/Kg. weight increase, Kg.	0.0	0.46	0.93	0.79	0.46	0.93	0.79	0.79	1.01	1.01	-
Ripe banana conversion efficiency <sup>4)</sup> Kg.	0.0	6.9	6.8	8.9	6.8	8.9	8.9	8.9	9.9	9.9	-
C. F. replacement by fresh banana, %	0.0	15.0	7.3	11.2	7.3	11.2	11.2	11.2	9.8	9.8	1.340
Carcass yield (warm), %	76.1	77.9	77.3	78.2	77.3	78.2	78.2	78.2	77.2	77.2	0.720

Hogs were Duroc and Yorkshire crossbreeds.

- 1) Pigs in treatment No. 1 received all the concentrate feed they could eat and the other treatments the percentage indicated of the daily consumption of treatment No. 1.
- 2) Treatment No. 2, 3, 4 and 5 received all the rip banana they could eat in addition to the concentrate feed ration.
- 3) Amount of dry matter (D. M.) required for one Kg. live weight increase.
- 4) Kgs. of banana needed to produce 1 Kg. live weight.
- 5) Kgs. of fresh banana needed to replace 1 Kg. of concentrate feed.

C. F. = Concentrate feed      D. M. = dry matter      Kg. = Kilogram  
gr. = gram

Source: Esnola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observation on the Use of Alternate Feeds for Hogs in Small Farms), CAFE, Turrialba, Costa Rica, 1986.

TABLE NO. 13  
FEEDING EXPERIMENT RESULTS OF PARTIAL SUBSTITUTION OF CONCENTRATE FEED WITH YAM (*Dioscorea* sp.)

TREATMENT	1	2	3	4	5
Concentrate feed <sup>1)</sup>	free	Restr.	Restr.	0	0
Protein supplement	0	0	0	Restr.	Restr.
Raw Yam <sup>2)</sup>	0	0	free	0	0
Cooked Yam <sup>2)</sup>	0	free	0	free	free
Number of hogs treated	4	4	4	4	4
Initial weight, Kg.	20.6	20.5	19.8	20.2	29.9
Final weight, Kg.	56.5	35.5	34.5	55.9	57.5
Daily weight increase, gr./h.	580	236	233	575	606
C. F. or P. S. consumption, Kg./d./h.	2.15	0.93	0.98	1.0	1.0
Daily Yam consumption, Kg./h.	0	1.58	1.48	3.46	3.49
Daily D. M. consumption, Kg./h.	1.96	1.29	1.36	1.87	1.89
D. M. conversion efficiency, %	3.37	5.47	5.84	3.25	3.25
Daily protein consumption, gr./h.	345	175	180	356	457
C. F. replacement by Yam <sup>4)</sup> , Kg.	0	n/d	n/d	3.05	2.80

Hogs were Duroc and Yorkshire crossbreeds.

- 1) Pigs in treatment No. 1 received all the concentrate feed they could eat and the other treatment restricted amounts, as indicated in the table.
- 2) Treatments No. 2, 3, 4, 5 received all the raw or cooked Yam they could eat in addition to the concentrate feed or protein supplement ration.
- 3) Kilograms of dry matter required to produce 1 kilogram of live weight.
- 4) Kilograms of Yam required to replace 1 kilogram of concentrate feed.

Restr. = restricted  
C. F. = concentrate feed  
D. M. = dry matter

Kg. = kilogram  
P. S. = Protein supplement  
n/d. = data not available

gr. = gram  
h. = hog

Source: Esnaola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.

TABLE NO. 14  
FEEDING EXPERIMENT RESULTS OF PARTIAL SUBSTITUTION OF CONCENTRATE FEED WITH RAW AND COOKED SWEET POTATO (*Ipomea sp.*)

TREATMENT	1	2	3	4	5	6
Concentrate feed provided <sup>1)</sup> (%)	100	80	60	40	60	40
Raw sweet potato <sup>2)</sup>	0	free	free	free	0	0
Cooked sweet potato <sup>2)</sup>	0	0	0	0	free	free
Initial weight of hogs, Kg.	20.8	17.2	19.5	18.3	22.7	23.2
Final weight of hogs, Kg.	97.9	72.8	68.6	63.5	89.0	72.5
Weight increase, gr./d./h.	648	467	421	380	557	413
C. F. consumption, Kg./d./h.	2.32	1.43	1.11	1.00	1.36	0.99
S. P. consumption, Kg./d./h.	0	1.15	1.34	1.07	2.04	2.24
Total D. M. consumption, Kg./d./h.	2.23	1.73	1.48	1.28	2.02	1.62
D. M. conversion <sup>3)</sup> , Kg.	3.44	3.70	3.52	3.37	3.62	5.42
Protein consumption, gr./d./h.	398	255	202	181	259	192
Raw protein content of D. M., %	17.8	14.7	13.6	14.1	12.8	11.8
C. F. saved, Kg.	-	0.52	0.95	0.95	1.14	1.19
C. F. replacement by S. P. <sup>4)</sup> , Kg.	-	4.7	3.4	3.0	3.8	4.6

Hogs were Duroc and Yorkshire crossbreeds.  
The experiment lasted 119 days.

- 1) Pigs in treatment No. 1 received all the concentrate feed they could eat and the other treatments the percentage indicated of the daily consumption of treatment No. 1.
- 2) Treatment 2 to 6 received all the Sweet Potato they could eat in addition to the concentrate feed ration.
- 3) Amount of dry matter required to produce 1 Kg. of live weight.
- 4) Amount of raw or cooked sweet potato needed to replace 1 Kg. of concentrate feed.

C. F. = Concentrate feed      S. P. = Sweet potato      d. = day  
D. M. = dry matter              Kg. = Kilogram              h. = hog  
gr. = gram

Source: Esnaola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.

TABLE NO. 15

FEEDING EXPERIMENT RESULTS WITH DIFFERENT AMOUNT OF RAW, CHOPPED SUGAR CANE (Saccharum sp.) OFFERED AS SOURCE OF ENERGY.

TREATMENT	Amount in relation to Treatment No. 1			
	1 free 100%	2 restr. 75%	3 restr. 50%	4 restr. 25%
Number of hogs	5	5	5	5
Initial weight, Kg.	26.5	26.1	26.5	26.0
Final weight, Kg.	91.3	80.7	79.2	60.8
Daily weight increase, gr./h.	441	371	358	237
Sugar cane offered, Kg./d./h.	10.1	7.4	5.3	2.5
Estimated S. C. consumption, Kg./d./h.	3.54	2.86	2.54	1.74
P. S. consumption, gr./d./h.	545	540	545	495
S. C. D. M. consumption, gr./d./h.	998	807	716	490
Total D. M. consumption, Kg./d./h.	1.490	1.290	1.230	0.936
Conversion efficiency, %	3.37	3.47	3.43	3.94

Hogs were Duroc and Yorkshire crossbreeds.

The experiment lasted 147 days.

1) Kilogram of sugar cane dry matter required to produce 1 kilogram live weight.

Kg. = Kilogram                      restr. = restricted  
 gr. = gram                          h. = hog  
 d. = day                              P. S. = Protein supplement  
 S. C. = Sugar cane dry matter      D. M. = dry matter

Source: Esnada, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms), CAYE, Turrialba, Costa Rica, 1986.

TABLE NO. 16  
FEEDING EXPERIMENT RESULTS OF SUGAR CANE (Saccharum sp.) AS SOURCE OF ENERGY, SUPPLEMENTED WITH RAW PROTEIN OF DIFFERENT SOURCES

TREATMENT	1	2	3	4	5	6
Concentrate feed <sup>1)</sup>	free	0	0	0	0	0
Protein Supplement	0	100% F. M.	100% S. B.	75% M. M. 25% S. B.	50% F. M. 50% S. B.	50% S. B. 50% M. M.
Number of hogs	6	6	6	6	6	6
Initial weight, Kg.	30.77	31.10	33.50	28.19	30.94	27.73
Final weight, Kg./h.	90.03	74.00	69.92	50.80	77.34	58.67
Daily weight increase, gr./h.	651	484	420	251	534	359
C. F. consumption, Kg./d./h.	2.59	0	0	0	0	0
S. C. offered daily, Kg./h.	0	9.23	9.23	9.23	9.23	9.23
S. C. consumed daily, Kg./h.	0	2.98	3.05	2.62	2.99	2.71
D. M. consumption, Kg./d./h.	0	0.84	0.85	0.73	0.84	0.76
P. S. consumption, gr./d./h.	0	537	576	638	573	602
R. P. consumption, gr./d./h.	362	322	505	280	322	280
D. M. consumption, Kg./d./h.	2.33	1.52	1.35	1.31	1.35	1.30
D. M. conversion, <sup>2)</sup> Kg./d./h.	3.58	2.74	3.22	5.32	2.52	3.62

The experiment lasted 91 days. Sugar cane was served raw and chopped. Hogs were Duroc and Yorkshire crossbreeds.

1) Pigs in treatment No. 1 received all the concentrate feed they could eat.

2) Kilogram of dry matter required to produce 1 kilogram of live weight.

F. M. = fish meal      M. M. = meat meal      S. C. = sugar cane  
 Kg. = kilogram      h. = hog      d. = day  
 C. F. = concentrate feed      D. M. = dry matter      P. S. = protein supplement  
 R. P. = raw protein      gr. = gram      S. B. = soybean cake

Source: Esnaola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternative Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.

TABLE NO. 17

FEEDING EXPERIMENT RESULTS WITH DIFFERENT COMBINATIONS OF FISH MEAL AND ERYTHRINA TREE (ERYTHRINA PEOPIGGIANA) LEAVES AS PARTIAL OR TOTAL PROTEIN SOURCE

TREATMENT	1	2	3	4
Fish Meal %	100	66	33	0
Erythrina tree leaves %	0	33	66	100
Number of hogs	6	6	6	6
Initial weight, Kg.	26.5	23.7	22.5	21.2
Final weight, Kg.	93.6	83.2	58.8	21.0
Weight increase, gr./d./h.	619	548	335	-2
Banana consumption, Kg./d./h.	8.0	7.1	6.1	3.0
E. T. L. consumption, gr./d./h.	0	135	125	114
F. M. consumption, gr./d./h.	506	334	156	0
Total D. M. consumption, Kg./d./h.	2.0	1.68	1.34	0.59
R. P. consumption, gr./d./h.	378	268	150	28
D. M. conversion efficiency, <sup>1)</sup> Kg.	3.20	3.07	4.0	0

Hogs were Duroc and Yorkshire crossbreeds.

1) Kilogram of dry matter required to produce 1 kilogram live weight.

Kg. = Kilogram  
 d. = day  
 E. T. L. = Erythrina tree leaves  
 D. M. = dry matter  
 gr. = gram  
 h. = hog  
 F. M. = Fish meal  
 R. P. = raw protein

Source: Esnaola, Marco et. al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms, CATIE, Turrialba, Costa Rica, 1986.

TABLE NO. 18

FEEDING EXPERIMENT RESULTS WITH GREEN BANANA (*Musa sp*) AS ENERGY SOURCE AND MULBERRY TREE (*Morus sp*) LEAVES AS PARTIAL OR TOTAL PROTEIN SOURCE

TREATMENT	1	2	3	4
Protein percentage supplied by mulberry tree leaves (%)	0	34	66	100
Number of hogs	6	6	6	6
Initial weight, Kg.	31.0	29.9	31.7	31.4
Final weight, Kg.	89.0	87.8	63.1	42.1
Daily weight increase, gr./h.	488	487	264	90
G. B. consumption, Kg./d./h.	7.4	7.0	3.3	2.2
M. T. L. consumption, Kg./d./h.	0	1.5	2.5	2.46
F. M. consumption, gr./d./h.	468	314	159	0
Total D.M. consumption, Kg./d./h.	1.94	1.99	1.44	1.08
D. M. conversion efficiency, <sup>1)</sup> Kg.	3.96	3.93	5.47	12.0
R. P. consumption, gr./d./h.	349	329	245	142

Hogs were Yorkshire and Landrace crossbreeds.

The experiment lasted 119 days.

<sup>1)</sup> Kilogram of dry matter required to produce 1 kilogram of live weight.

Kg. = kilogram

gr. = gram

h. = hog

d. = day

G.B. = green banana

M.T.L. = mulberry tree leaves

F.M. = fish meal

D.M. = dry matter

R.P. = raw protein

Source: Esnaola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.

TABLE NO. 19

FEEDING EXPERIMENT RESULTS WITH YAUTIA (XANTHOSOMA SAGITTIFOLIUM) AS ENERGY SOURCE AND MULBERRY TREE (Morus sp.) LEAVES AS PARTIAL OR TOTAL PROTEIN SOURCE

TREATMENT	1	2	3	4
Protein percentage supplied by mulberry tree leaves (%)	0	34	66	100
Number of hogs	6	6	6	6
Initial weight, Kg.	31.2	29.9	31.2	30.8
Final weight, Kg.	57.7	58.7	55.2	45.1
Daily weight increase, gr./h.	540	588	490	287
Cooked Yautia consumption, Kg./d./h.	7.3	6.5	6.99	6.92
F. M. consumption, gr./d./h.	250	290	150	0
M.T.L. consumption, gr./d./h.	0	460	820	750
Total D. M. consumption Kg./d./h.	1.90	1.88	1.97	1.81
D. M. conversion efficiency, Kg.	3.52	3.20	4.02	6.30
Protein consumption, <sup>1)</sup> gr./d./h.	311	341	281	187

Hogs were Duroc and Yorkshire crossbreeds.

The experiment lasted 49 days.

1) Kilogram of dry matter required to produce 1 kilogram of live weight.

Kg. = kilogram  
 h. = hog  
 F. M. = fish meal  
 D. M. = dry matter

gr. = grow  
 d. = day  
 M. T. L. = mulberry tree leaves

Source: Esnacla, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the use of Alternate Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.



TABLE NO. 20  
 FEEDING EXPERIMENT RESULTS WITH GREEN BANANA (Musa sp.) AS ENERGY SOURCE, SUPPLEMENTED WITH DIFFERENT COMBINATIONS OF BUTTERMILK AND SOYBEAN CAKE.

TREATMENT	1	2	3	4	5	6
Buttermilk	free	free	45% restr.	30% restr.	15% restr.	0 restr.
Soybean Cake	0	restr.	restr.	restr.	restr.	restr.
Number of hogs	6	6	6	6	6	6
Initial average weight, Kg.	16.0	16.0	16.0	16.0	16.0	16.0
Daily weight increase, gr./d./h.	385	520	512	475	481	480
Banana consumption, Kg./d./h.	2.70	2.37	5.19	5.92	5.77	6.05
Buttermilk consumption, lt./d./h.	15.8	17.1	6.8	4.0	2.2	0
S. C. consumption, gr./d./h.	0	184	384	432	469	510
Total D. M. consumption, Kg./d./h.	1.35	1.52	1.74	1.80	1.69	1.67
R. P. consumption, gr./d./h.	184	289	316	325	321	322
D. M. conversion, <sup>1)</sup> Kg.	3.50	2.92	3.38	3.79	3.52	3.47

Hogs were Duroc and Yorkshire crossbreeds.

1) Kilogram of dry matter required to produce 1 kilogram of live weight.

Kg. = kilogram  
 d. = day  
 lt. = liter  
 S.C. = soybean Cake  
 restr. = restricted  
 gr. = gram  
 h. = hog  
 D.M. = dry matter  
 R.P. = raw protein

Source : Esnola, Marco et al., Observaciones Preliminares sobre el Uso de Alimentos no Tradicionales en Cerdos en Fincas Pequeñas, (Preliminary Observations on the Use of Alternate Feeds for Hogs in Small Farms), CATIE, Turrialba, Costa Rica, 1986.

VI. PRODUCTION AND CONSUMPTION OF PROCESSED MEAT

Until the beginning of the decade of the seventies there was only one major pork processing plant in Honduras, Fabrica de Embutidos "EL MARRANITO", located in La Ceiba, on the Caribbean Coast of Honduras.

Before 1969, while the Central American Common Market was in force, most of the hams, sausages and other processed pork product consumed in Tegucigalpa and San Pedro Sula were imported from Costa Rica, Guatemala and El Salvador. The demand of smaller rural population centers was supplied mostly by local butchers, who worked on small scale artesan level.

Up to the end of the 1970's, when large scale african palm oil production began in Honduras and the road system was developed, the most important processed pork product was lard, used by the major part of the population for cooking. Hogs were valued according to the amount of lard they could yield and not for their meat. A large number of local butcher melted down the lard, prepared the traditional Honduran sausage known as "chorizo" and sold the craklings, which was a by product of the process of removing the lard of hog fat by frying. There are still some local butchers in small towns dedicated to this traditional pork processing activity.

After the break up of the Central American Common Market local investment in the pork processing industry became more attractive and one of the first major pork processing plants of Honduras, Agroindustrial Delikatessen, began to operate in the Zamorano Valley in 1970. Toward the end of this decade vegetable oil from Honduran african palm plantations displaced lard of the kitchen and hog production changed from fat type to meat type, which increased sausage, ham and other processed pork product consumption.

Most of the pork processing plants operating in Honduras have been established since the second half of the 1970's.

Presently the major pork processing plants are DELICIA and DELIKATESSEN with estimated market shares of 60% and 20% respectively of processed products sold in the major cities. Both enterprises are vertically integrated. DELICIA's main shareholder is Cargill Corporation who owns ALCON, S.A., the major concentrate feed mill of Honduras and control through contracts a large number of basic grain producers and hog farmers. Agroindustrial DELIKATESSEN operates its own feed mill, hog farm and processing plant in the Zamorano Valley and a distribution center of meat and processed products in Tegucigalpa.

DELICIA, S.A. distributes its products country wide in the major cities, while DELIKATESSEN supply the market of the central part of Honduras. EL MARRANITO supply retail stores in La Ceiba, other small cities on the Atlantic coast, San Pedro Sula and Tegucigalpa. The other major industrial pork processing plants (Table No. 21) distribute most of their production in the two major cities of Honduras, Tegucigalpa and San Pedro Sula.

Estimated production and consumption of ham, sausage and other processed products is presented on Tables No. 22 to 24. It is estimated that 22.6% of the processing industry output is ham, 66.8% sausage of all kind and 10.6% is made up of smoked products like bacon, pork chops, pork ribs, etc. The estimated production includes the output of several smaller industrial pork processing plants located in Tegucigalpa (Catalana, Bavaria, Manolo), San Pedro Sula (Bermejo and San Martin), Juticalpa (Ma-

TABLE NO. 21

LIST OF MAJOR MEAT PROCESSING PLANTS

NAME OF PLANT AND LOCATION	MARKET SHARE %
Embutidos Delicia, S.A. San Pedro Sula	60
Agroindustrial DELIKATESSEN Zamorano - Tegucigalpa	20
Fabrica de Embutidos EUROPEA Tegucigalpa	n/d
Fabrica de Embutidos EL MARRA- NITO La Ceiba	n/d
Fabrica de Embutidos GERMANOS Tegucigalpa	n/d

Source: Prepared by the consultant based on interviews.

Tegucigalpa, Honduras, March 1991.

TABLE NO. 22

GROSS VALUE OF THE OUTPUT OF THE MEAT PROCESSING INDUSTRY OF HONDURAS

YEAR	VALUE IN L.	RATE OF INCREASE %
1985	140,268,000	-
1986	154,206,000	10.0
1987	172,360,000	11.8
1988	217,793,000	26.4
1989	240,163,000	10.3

Source: Financial and Technical Feasibility Study of  
PROAGRI, S. A. de C. V., Tegucigalpa, Hondu-  
ras, March 1991.

TABLE NO. 23

ESTIMATED PRODUCTION OF DIFFERENT TYPES OF PROCESSED PORK PRODUCTS  
IN SELECTED YEARS.

TYPE OF PRODUCT	1980 TM	1985 TM	1988 TM	1989 TM	1990 TM
Ham	346.6	633.8	908.4	1,146.6	1,218.7
Sausage	870.8	1,592.4	2,282.3	2,881.2	3,062.0
Bacon and lard	162.7	297.3	426.1	537.8	571.6
Other products	153.7	281.0	402.7	508.4	540.4

Source: Estimated by the consultant based on information supplied by members of the industry and others on the composition of the Industry's output by types of products. Tegucigalpa, Honduras, March 1991.

TABLE NO. 24

PRESENTATION OF MOST POPULAR PRODUCTS OF THE MEAT PROCESSING INDUSTRY

PRODUCT	WEIGHT Kgs.	UNITE PER PACKAGE	SIZE CM.	DIAMETER CM.
Ham	3.6 - 5.5	1	-	-
Bologna Sausage	3.6	1	45	10
Hot dog	0.46	12	13	2
Salami	1.38	1	38	6
Chorizo	0.46	8	7	3

Source: Financial and Technical Feasibility Study of PROAGRI,  
S. A. de C. V., Tegucigalpa, Honduras, March. 1991.

TABLE NO. 25

PRODUCTION AND CONSUMPTION OF PROCESSED PORK PRODUCTS DURING  
SELECTED YEARS IN MAJOR CITIES OF HONDURAS

YEAR	PRODUCTION TM	IMPORTATION TM	EXPORTATION TM	CONSUMPTION <sup>1)</sup>	
				TOTAL TM	PER CAPITA Kg.
1980	1,533.8	43.9	-	1,577.7	1.69
1985	2,804.5	75.0	0.4	2,879.1	2.76
1988	4,019.5	232.6	-	4,252.1	3.45
1989	5,073.4	159.6	-	5,233.0	4.36
1990	5,392.4	n/d	n/d	5,392.4	4.14

1) According to recent studies processed pork products of industrial plants are consumed only in the major cities of Honduras by an estimated 70% of the population.

Source: Financial and Technical Feasibility Study of PROAGRI, S. A. de C. V. and estimates of the consultants. Tegucigalpa, Honduras, March 1991.



drid, Guayape and Embutidos Rico), Comayagua (Embutidos del Valle) and Olanchito (Embutidos Olanchanos). Most of these smaller industrial plants have their own retail outlet in the city where the plant is located and the major part of the production is sold there directly to the consumer and the remainder to local retailer.

There are at least several hundred of artesan homstyle sausage makers operating mostly with ordinary domestic kitchen equipment on micro scale. Most of them are owners of butcher stores, small and frequently primitive meal dispenser facilities or booths at public market places, where they sell their products raw or cooked directly to consumers. They usually prepare three traditional products, "chorizo" which is a chopped and seasoned raw meat sausage, cracklings and lard. Most of the meat used by these artesan micro enterprises is supplied by traditional pig keepers, who slaughter hogs illegally, outside of the authorized slaughterhouses and therefore there is high risk of cysticercus contamination.

It is estimated by official sources and members of the pork processing industry that the supply of processed pork products increased around 15% yearly during the decade of the eighties. This increase is due mainly to high urban population growth rate, improvement of communication between the main cities, development of hog farming, increasing investments in meat processing plants and more aggressive promotion of processed pork products.

The most popular products are "chorizo" type sausage, pressed and cooked ham, hot dog, bologna type sausage, cooked salami and smoked pork chops or ribs. Some of these products contain high percentage of corn gluten

and soybean meal due to which they can be offered at lower price than pure meat products. Better quality products, like country style smoked ham and cured salami are produced only by two or three of the meat processing plants in reduced volumes. According to members of the industry demand is low for better quality products, because the majority of the consumers cannot afford to pay the prices, which are in the range of L. 25.00 to L. 40.00/Kg.

According to several reports the pork processing industry utilizes 60% to 80% of its installed operating capacity due mainly to deficient management, incompatibility of the equipments and inadequate technology. It is estimated by members of the pork processing industry that supply is still lagging behind demand, inspite of the loss of purchasing power by the population in 1989-90, due to devaluation of the national currency.

A group of Honduran entrepreneurs plan to invest L.5,695,000.00 in an integrated hog production and meat processing project, which should be located in the Valley of Tamara, about 30 Km. from Tegucigalpa to the north. The hog farm is projected to operate with 300 sows and 15 boars and produce yearly 5,420 hogs for the plant with carcass weight of 320.3 TM. According to the planners, of the total carcass weight produced yearly 193.6 TM. should be sold as fresh meat and 126.9 TM. should be processed into sausages, hams and other products, which after incorporating fillings will result in 231 TM. of processed products. The projected output of processed products amount to 4% of the estimated national supply for 1991. This new enterprise has been named "Productos Agropecuarios Industrializados (PROAGRI), S. A. de C. V."

According to a study of the pork meat processing industry, per capita demand in 1975 was estimated at 0.72 Kg., which increased to 1.69 Kg. in 1980, to 2.76 Kg. in 1985 and to 4.14 Kg. for 1990. The average yearly per capita consumption increase amounted to 26.9% for the period of 1975 - 1980; to 12.7% for 1980 - 1985; and to 10% between 1985 and 1990. According to several studies, during the decades of 1970's and 1980's yearly per capita demand increased every year, which in the opinion of the consultant is due principally to the population shift from rural to urban areas at a rate of 3 - 4% yearly, which in turn prompted major changes in the habits of food consumption of a large proportion of the population. Furthermore the development of the road system during the last two decades combined with the expansion of the hog processing industry and aggressive promotion of the sale of processed pork products is changing the pattern of food consumption also in rural areas.

The largest meat processing plant, DELICIA, S.A. distribute country wide its products, of which the most popular types, like bologna sausage and hot dogs, can be found even in small road side stores. Rural electrification also contributed to the change of rural consumption pattern by facilitating the preservation of perishable food in refrigerators and freezers, which are presently common in many rural areas where such appliances were unknown twenty years ago.

Demand projections for 1991-95 indicates at least a yearly aggregate demand increase of 3% for processed pork products.

Per capita consumption depends on the purchasing power of the population. It is expected that recently implemented economic policies will led to

economic recovery, which should forestall further loss of purchasing power. It is reasonable to assume that per capita consumption will moderately increase during the first half of this decade.

Surveys of retail prices of processed pork products indicate that between 1983 and 1987 the average yearly increase was 5.87% and between 1987 and 1990 8.24%. Meat processing plants perform the distribution of their products to retail outlets. Their wholesale gross margin is around 20% and retailer earn also a gross margin of approximately 20%. Meat processors who sell their products directly to consumer obtain the gross margin of wholesaler and retailer. Often they sell at slightly lower prices than supermarkets and other retailers.

TABLE NO. 26

PROJECTED PRICE STRUCTURE OF PROAGRI FOR 1991

PRODUCT	UNITARY COSTS L./Kg.	WHOLESALE PRICE L./Kg.	RETAIL PRICE L./Kg.
Bologna Sausage	8.38	10.05	12.07
Popular Ham	9.09	10.91	13.09
Salami (uncured)	8.82	10.58	12.69
Hot dog	7.55	9.06	10.87
Chorizo (Sausage)	10.98	13.18	15.82
Copetin (Sausage)	10.43	12.52	15.03
Bacon	9.50	11.40	13.68
Smoked Ribs	11.55	13.86	16.63
Smoked Loin	15.60	18.72	22.46
Smoked Chops	11.55	13.86	16.63
Fresh Meat	10.85	11.92	14.30
Arithmetic Average	10.39	12.37	14.84

Source: Financial and Technical Feasibility Study of PROAGRI,  
S. A. de C. V., Tegucigalpa, Honduras, March 1991.

TABLE NO. 27

GROSS MARGIN OF MEAT PROCESSOR AND RETAILER

PRODUCT	PROCESSOR'S	MARGIN	RETAILER'S	MARGIN
	L./Kg.	%	L./Kg.	%
Bologna Sausage	1.67	19.93	2.02	20.00
Popular Ham	1.82	20.00	2.18	19.98
Salami (uncured)	1.76	19.95	2.11	19.94
Hot dog	1.51	20.00	1.81	19.98
Chorizo (sausage)	2.20	20.00	2.64	20.00
Copetin (sausage)	2.09	20.00	2.51	20.00
Bacon	1.90	20.00	2.28	20.00
Smoked Ribs	2.31	20.00	2.77	19.99
Smoked Loin	3.12	20.00	3.74	19.98
Smoked Chops	2.31	20.00	2.77	19.99
Fresh Meat	1.07	9.86	2.38	19.97
Arithmetic Average	-	19.06	-	19.98

Source: Prepared by the consultant on the basis of information of

Table No. 14 Tegucigalpa, Honduras, March 1991.

TABLE NO. 28

EVOLUTION OF RETAIL PRICES OF PROCESSED PORK PRODUCTS

PRODUCT	PRICE L./Kg.			INCREASE L.
	1983	1987	1990	
Popular Ham	7.15	8.80	11.37	4.22
Pressed Ham	14.28	15.40	16.26	1.98
Ham with Olives	8.34	10.12	12.91	4.57
Bavaria Ham	8.47	10.89	12.65	4.18
Salami (uncured)	7.70	11.68	13.97	6.27
Hot dog	4.69	6.38	8.69	4.00
Bologna Sausage	5.10	6.64	11.99	6.89
Copetin Sausage	8.80	10.12	11.55	2.75
Chorizo Sausage	7.15	8.47	10.98	3.88
Arithmetic Average	7.96	9.83	12.26	4.30
INCREASE %	-	23.49	24.72	-

Source: Financial and Technical Feasibility Study of PROAGRI, S.A.  
de C. V., Tegucigalpa, Honduras, March 1991.

TABLE NO. 29

PROJECTED DEMAND OF PROCESSED PORK PRODUCTS FOR 1991 - 1995

YEAR	DEMAND TM	INCREASE %
1991	5,554.2	-
1992	5,721.1	3
1993	5,892.7	3
1994	6,069.4	3
1995	6,251.8	3

Source: Financial and Technical Feasibility Study of  
PROAGRI, S. A. de C. V., Tegucigalpa, Hondu-  
ras, March 1991.



VII. INTERNATIONAL AND MULTINATIONAL CONTRIBUTIONS TO THE IMPROVEMENT OF HOG PRODUCTION

Probably U.S.A.I.D. was the first foreign development agency which contributed to hog improvement programs in Honduras during the 1950's and 1960's, with technical assistance and financial resources, in the frame of STICA, a bilateral agency between U.S.A.I.D. and the Honduran Government. STICA was probably the most successful agricultural development agency in Honduras, during which the agricultural extension service has been organized, several research centers have been established (C.N.A.G. in Comayagua and Santa Catalina in La Esperanza) and outstanding crop and livestock improvement programs have been performed, like the introduction of cantaloupes, charleston grey watermelons, Mexican and Dutch potato varieties among other crops and with respect to livestock Holstein, Brown Swiss and Charolais cattle and Duroc Jersey and Hampshire swines.

The successful diffusion of several improved crop varieties and livestock breeds as well as production technologies could be credited to the orientation of the program toward medium and large farmers. With a relatively small number of agricultural extension agents, around 35 in the second half of the 1960's and a modest yearly budget, which did not surpass three million Lempiras until the end of the decade of the sixties, STICA, later renamed DESARRURAL (Cooperative Service of Rural Development), a semi-autonomous dependency of the Ministry of Agriculture, introduced far-reaching technological improvements in the Agricultural Sector of Honduras and yield increases of crops and livestock.

Until the decade of the seventies hog farming was a rather extensive secondary activity even among medium and large farmers. Most of the nume-

rous pure and improved crossbreed pigs distributed from the breeding center of the Agricultural Station (C.N.A.G.) in Comayagua, later relocated to Nueva Aldea, near to Tegucigalpa, were left to roam and crossbreed with the local criollo stock, which has improved overtime to some extent local genetic material.

In the early 1980's the Government of the Netherlands has been conducting a financial assistance program for low income rural people, in the frame of which the establishment of several small hog farms (3-12 sows) has been financed in peasant cooperatives of the Aguan Valley. Several of these small hog farms have been implemented under the management of peasant's wives associations to provide women with more active roll in the rural economy. The majority of these projects bankrupted soon after the implementation, due mostly to deficient management and lack of technical assistance. It has been reported that many facilities are abandoned presently.

In 1982 FAO/PNUD and the Government of Honduras agreed to implement a bi lateral Program (HON/82/022) to Promote Hog Production. The Program has been financed by a contribution of U.S.\$115,000 by PNUD and L.150,000 by the Government of Honduras. FAO acted as the executing agency of the Program, which benefits were targeted toward the less favored low income rural population in order to improve their living conditions. The scope of the Programs included improvements of genetic characteristics, nutrition, management, processing and marketing of swine as well as training and financial assistance in a pilot area, to obtain better knowledge of local conditions, which should be used later in the implementation of projects in other regions of the country.

San Pedro Sula and the Comayagua areas were selected for the pilot project, in the frame of which 20 hog farmers have been provided with assistance, most of them members of National Association of Hog Farmers, which are medium to large producers. At the end of the Program improved nutrition and management practices have been reported.

The Chinese Mission has three hog experts assigned to the Livestock Division of the Ministry of Agriculture, who are stationed at the breeding centers of San Pedro Sula and Comayagua. They collaborate with technical personnel of the Hog Improvement Program in the management of the breeding centers as well as in the providing of technical assistance to hog farmers. In addition, the Chinese Government contribute approximately L.100,000 yearly to the budget of the Hog Improvement Program. Beneficiaries are mostly medium and large hog farmers, who constitute the wide majority of the clients of the breeding centers.

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\* Proagri, S.A. de C.V. PRODUCTOS AGROPECUARIOS INDUSTRIALIZADOS,  
SOCIEDAD ANONIMA DE CAPITAL VARIABLE

LIST OF ABBREVIATIONS

ALCON	= Alimentos Concentrados Nacionales, S.A.
Ca	= Calcium
CATIE	= Centro Agronómico Tropical de Investigación y Enseñanza
CM	= Centimeter
COHA	= Compañía Hondureña de Alimentos, S.A. de C.V.
COOPROCAL	= Cooperativa de Porcicultores de la Zona Central, Ltd.
Cu	= Copper
CURLA	= Centro Universitario Regional del Litoral Atlántico
C.V.	= Capital Variable
DELIKATESSEN	= Agroindustrial Delikatessen, S.A.
DELICIA	= Embutidos Delicia, S.A.
EL MARRANITO	= Fábrica de Embutidos El Marranito, S.A.
etc.	= Etcétera
FAFER	= Alimentos Concentrados Fafer, S.A.
Fe	= Iron
KG, Kgs	= Kilogramme (s)

L.	= Lempira (monetary unit of Honduras)
Mg	= Magnesium
MT	= Metric ton (1,000 Kgs)
N° or #	= Number
n/d	= no data available
P	= Phosphorus
PROAGRI	= Productos Agropecuarios Industrializados, S.A. de C.V.
S.A.	= Sociedad Anónima
sp.	= Specimen
S.R.N.	= Secretaría de Recursos Naturales (Ministry of Agriculture)
U.S.	= United States of America
Zn	= Zinc
%	= percent or percentage
/	= per







JICA