

AGRICULTURAL DEVELOPMENT PLAN  
FOR THE TERRITORY OF GUAM

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**Hafa Adai!**

The success of the Green Revolution represents a changing attitude among our people as we shift from being a totally consumptive society to an increasingly productive community. My intention in launching the Green Revolution was to reduce Guam's dependence on imported foods. The recently opened Public Market and the numerous roadside stands are examples of progress to date.

To insure the expansion of the island's agricultural industry, I am promoting the government's continuing involvement in the planning and programming of the Green Revolution. The Agricultural Development Plan establishes certain development guidelines directed toward meeting the goal of increased agricultural production. The document will assist us in our efforts towards self-sufficiency.

Si Yuus Pase,

  
RICARDO J. BORDALLO

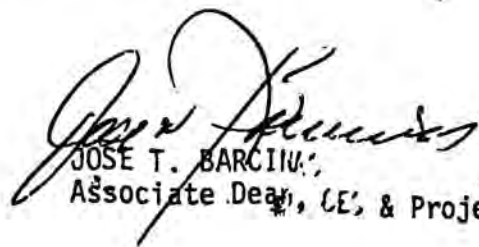
ACKNOWLEDGEMENT

This report, prepared for the Bureau of Planning through a special grant made by the Economic Development Administration, attempts to identify basic approaches toward a more definitive development of the Island's agriculture and/or any of its sectors.

While we have not attempted to identify solutions to every problem associated with the development of the industry, the recommendations contained herein were considered in relation to existing programs and resource potentials within this Territory.

The authors are deeply indebted to various individuals and entities whose support and cooperation made this report possible. Special acknowledgement is due Dr. R. Muniappan, Dr. Chin-Tian Lee, Dr. Milwant Sandhu, Mr. Antonio S. Quitugua, and Mr. Victor Artero for their invaluable suggestions. Special credit is also due Miss Elizabeth Flores for typing this report.

The College of Agriculture and Business hopes to continue participating in similar endeavors especially where implementation of this and related plans is concerned.

  
JOSE T. BARCILLA,  
Associate Dean, CE, & Project Leader

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# AGRICULTURAL DEVELOPMENT PLAN FOR THE TERRITORY OF GUAM

## I. INTRODUCTION

### A. ROLE OF AGRICULTURE IN THE ECONOMY

Guam's economic base is uncomfortably small. It is largely limited to the military, tourist and the construction industry. While there has been phenomenal growth in these three areas, other facets of the economy have either taken a backseat in the growth or have been grossly neglected.

Among those that have not had the benefit of the phenomenal growth is agriculture. Consequently, Guam imports almost all goods it consumes. With such dependency, and in the face of continued inflation, it would be highly desirable to diversify the economic base to include a viable agricultural industry.

Despite today's highly competitive demands for land uses, Guam still retains enough land that may be developed for farming. The island is also endowed with a climate suitable for a year-round agricultural operation.

Before World War II, the island of Guam was largely an agrarian society. Production of food was on a self-sustaining basis. Following the war, however, Guam saw a dramatic change in its economy and lifestyle. The island changed to a service-oriented society.

After World War II, Guam became an important U. S. military base. Much of its agricultural land was taken by the military and was converted into barracks and bases. High employment opportunities became available in the military, Government of Guam and private enterprises. As a result, the farmland was neglected and the island quickly changed from an agricultural to a service-based economy.

Another factor that considerably set back the development of the farming economy was the impact of Typhoons Karen and Olive in the early sixties. These typhoons practically wiped out the island's once-primary industry.

In recent times, there has been a resurgence of interest in the redevelopment of a viable agricultural industry. Increase in cultivated land and expansion of farm operations became evident throughout the island. Agricultural development programs became high priority objectives of the government. A Green Revolution Committee was formed to coordinate and put forth concerted effort of all Government of Guam endeavors relating to agriculture.



In 1976, Typhoon Pamela slowed down momentarily the momentum which began in 1974. Several months after Typhoon Pamela, however, the momentum became evident again.

In the 10-year period (1963-1972) following Typhoons Karen and Olive, business income increased five-fold from \$83 million to \$423 million. Resident personal income also rose from \$43 million in 1962 to \$166 million in 1972.

The value of locally produced agricultural products, on the other hand, has been increasing on the average of \$200,000 per year. In 1967, the value of farm products was \$1,633,080, increasing by \$937,460 in 1970. In 1974, the total value of local agricultural products was \$3,542,537.

Despite the steady upswing in domestic agricultural production, however, local producers supply only one-fourth of the total consumption for fresh fruits and vegetables, and in much lesser proportions for beef and poultry meat (Table 1).

Over the years, employment in agriculture remained at less than one percent of the total labor force employed. In terms of gross receipts, agriculture accounted for only \$1,043,000 of the total gross business receipts of \$607,704,000 in 1975.<sup>1</sup>

#### B. PURPOSE AND SCOPE

The Bureau of Planning has recently completed an Agricultural Growth Policy study for the territory. In the study, four growth options were mentioned as possible alternatives to hasten the development of agriculture and fishery on Guam, namely: field farming or conventional agriculture; hydroponic farming; mariculture; and livestock production. The study also discussed the potentials and constraints that need to be considered in developing agriculture and fishery<sup>es</sup>.

Development of plans, however, were beyond the scope of the study. This study (Agricultural Development Plan) is intended as a sequel to the Agricultural Growth Policy study conducted by the Bureau of Planning, with the objective of developing certain guidelines for Guam's agricultural development. Plans developed will be confined to field farming and livestock farming.

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<sup>1</sup>Economic Research Center, Department of Commerce, Statistical Abstract, 1975, Table 76, p. 75.

Table 1

LOCAL PRODUCTION, IMPORTS, AND CONSUMPTION OF  
MAJOR AGRICULTURAL PRODUCTS, GUAM  
FY 1972

COMMODITY	LOCAL PRODUCTION		IMPORTS		TOTAL CONSUMPTION	
	Dollars	%	Dollars	%	Dollars	%
Fruits and Vegetables	478,264	25	1,465,664	75	1,943,928	100
Beef	106,155	3	3,049,064	97	3,155,219	100
Pork	336,649	26	935,636	74	1,272,285	100
Poultry	72,848	8	877,086	92	949,934	100
Eggs	1,445,689	87	210,718	13	1,656,407	100
Fresh Fish	93,359	15	530,299	85	623,658	100
Total	2,532,964	26	7,068,467	74	9,601,431	100

\*Does not include imports for military use.

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

C. ORGANIZATION OF THE REPORT

Section II will present a brief status report on field farming and livestock farming. This will include a review of various support services and programs affecting these farm sectors. In Section III, certain development objectives will be presented within the context of potentials and constraints identified in the Agricultural Growth Policy study. Conclusion and recommendations will be given in Section IV.



## II. AGRICULTURAL GROWTH ELEMENTS

The recent Bureau of Planning study on "Agriculture Growth Policy" identified four alternative agricultural growth options which are expected to help reduce Guam's dependence upon imported agricultural products. These options are:

- A. Field farming or conventional agriculture;
- B. Hydroponic farming;
- C. Mariculture; and
- D. Livestock farming.

For purposes of this section, however, only field farming and livestock farming will be reviewed to the extent that available information would allow.

### A. FIELD FARMING

The cultivation and raising of food crops has been the mainstay of farming activity on Guam long before the inception of the now thriving poultry egg business.

Except for the years 1967 and 1971, the local production of fresh fruits and vegetables has steadily increased during the 10-year period ended 1975 (Table 2). The onslaught of Typhoon Pamela in 1976, however, caused serious damage and major disruption to this trend.

Field farming appears to have great potential for development. In 1972, the value of fruit and vegetable production was \$478,264 compared to \$1,465,664 in imports. The domestic markets (civilian and military), whose needs heavily depend on imports, offer a good argument for accelerated improvement in the production of fruits and vegetables.

An assessment made by the Department of Agriculture in 1974 on specific fresh produce requirements of local supermarkets, hotels, schools and the military sector indicate a potential demand for 18.5 million pounds per year (Table 3). In contrast, local production of these items in 1974 only represents 18 percent (volume-wise) of this demand.

As the tourist influx increases, this imbalance in local supply and demand can only aggravate already high consumer prices, and severely affect the buying power of local wage earners.

Production of fruits and vegetables in increasing quantities requires, in the short run, either expanded acreage or intensified use of land

under cultivation. In 1973, the Department of Agriculture reported a total of 1,389 acres of cultivated land. In the southern part of Guam alone, the villages of Yona, Talofoto, Inarajan, Merizo and Umatac have an estimated 10,600 acres of arable land, of which over 5,000 acres are available for agriculture.

While the agricultural potential is clearly evident, its development in relation to other land uses and socio-economic priorities can only flourish with adequate government and community support.

#### B. LIVESTOCK FARMING

This sub-sector of agriculture has been characterized by the steady decline in beef production, on one hand, and the rapid growth of the poultry egg industry on the other (Table 4). In between these extremes is the guarded optimism for an eventual development of a swine industry.

##### Pork

Despite a fairly steady increase in production, consumption of pork has been heavily dependent upon external sources. In 1971, imports amounted to 1,754,176 pounds (\$898,072) compared to 436,909 pounds (\$327,682) produced locally (Table 5). A number of proposals have been made for the establishment of slaughtering facilities in order to expand current production. It is estimated that the domestic pork output is made up of 90 percent roasting-size pigs and 10 percent slaughter type. The bulk of roasting-size pigs now being produced could be raised to full-size slaughter pigs for increased pork production.

##### Poultry

While egg production has already reached near self-sufficiency level, there is still much more to be desired in the way of increasing chicken meat production. Local production in 1971 was only 7 percent of the island imports for the same year, 2.3 million pounds (\$876,000). It has been proposed, time and again, that a poultry processing plant is needed to stimulate and expand production in this area. A processing plant will facilitate and encourage regular disposal of old unprofitable birds. It is estimated that 60 percent of the island's laying flock are replaceable and available for processing annually.

##### Cattle

Beef production has steadily declined all these years. On the other hand, imports increased tremendously from 1.1 million pounds in 1969 to 4.2 million pounds in 1972. Due to land constraint, there is much pessimism on the possibility of long-run improvement in this area.

Table 2

FRUITS AND VEGETABLES: TOTAL PRODUCTION AND VALUE  
FY 1966-FY 1975

FISCAL YEAR	Production (Pounds)	Value (Dollars)
1966	1,809,355	357,537
1967	1,435,319	266,642
1968	1,877,872	309,670
1969	2,230,493	404,919
1970	2,410,562	430,556
1971	1,819,924	354,973
1972	2,504,308	478,264
1973	3,129,453	622,672
1974	3,485,122	798,065
1975	3,750,400	937,600

Source: Department of Agriculture, Government of Guam.

Table 3  
FRUITS AND VEGETABLES: PRODUCTION AND MARKET REQUIREMENTS, 1974  
(In Pounds)

Commodity	Local Production	Market Requirements <u>1/</u>
<b>A. Fruits</b>		
Avocados	89,137	358,436
Bananas, cooking	110,143	227,240
Bananas, eating	301,383	701,740
Breadfruit	5,167	186,160
Lemons	20,606	655,200
Limes	20,022	166,140
Mangoes, Carabao	25,759	345,800
Mangoes, Saipan	86,437	153,400
Oranges	46,043	2,073,240
Papayas	118,524	366,392
Tangerines	77,506	515,580
Sub-total	900,727	5,749,328
<b>B. Vegetables &amp; Other Crops</b>		
Beans, K. W.	83,572	247,520
Beans, Yard	128,307	219,440
Beans, Wing	4,508	133,120
Bittermelon	146,566	280,000
Cabbage, Chinese	200,559	441,740
Cabbage, Head	27,984	1,410,864
Corn, field var.	66,940	481,000
Corn, Sweet	19,092	319,800
Cucumbers	139,754	874,796
Eggplant, long	352,572	315,692
Eggplant, round	8,930	219,700
Melon, Cantaloupe	169,239	721,656
Melon, Honeydew	2,827	829,036
Melon, Pepino	10,092	221,000
Okra	16,719	96,512
Onions, green	62,865	375,960
Peppers, hot	25,775	38,740
Peppers, bell	86,435	210,600
Radishes	36,589	81,640
Sweet Potatoes	92,951	359,580
Taro	89,745	347,360
Tomatoes	278,397	936,000
Watermelons	335,298	3,311,360
Yams	39,754	329,680
Sub-total	2,425,470	12,802,796
Total	3,326,197 <u>2/</u>	18,552,124

1/ Based on a 1974 Department of Agriculture survey of local super-markets, hotels, school cafeterias and the NSD.

2/ Does not include coconuts, guavas, squash and pumpkins. Source: Department of Agriculture, Government of Guam.

Table 4

POULTRY AND LIVESTOCK PRODUCTION  
FY 1966-FY 1975

FISCAL YEAR	Hogs (Head)	Goats (Head)	Cattle (Head)	Ducks (Number)	Chickens <u>1/</u> (Number)	Eggs (Dozens)
1966	5,500	823	6,146	533	54,150	720,000
1967	7,000	1,000	6,510	140	60,325	960,000
1968	7,600	950	7,000	200	72,000	1,056,000
1969	7,900	600	6,950	400	87,040	1,305,000
1970	8,750	1,050	5,800	540	130,000	2,150,000
1971	6,699	982	4,450	N/A	107,150	1,858,912
1972	8,325	897	4,112	N/A	120,776	2,065,270
1973	8,619	785	3,986	N/A	133,235	2,265,000
1974	10,463	537	2,771	3,324 <u>2/</u>	139,110	2,436,000
1975	11,726	492	2,502	N/A	142,537	2,498,620

1/ Layers only

2/ 1974 Census of Agriculture

N/A Not Available

Source: Department of Agriculture, Government of Guam.



### Support Services and Programs

Government assistance to agriculture has not been wanting. The Government of Guam is cognizant of the need for, and importance of, maintaining a certain level of agricultural well-being.

To this end, various government programs and services have been and are being offered to assist and provide incentives to farmers. These programs and services are presented briefly in the following sections.

#### Agriculture Land Lease

Two Government of Guam agencies presently handle the distribution of government lands on a lease basis. Under Public Law 9-117, the Department of Agriculture provides long-term lease of agricultural lands to bonafide individuals desiring to engage in commercial production of fruits, vegetables, ornamental plants, poultry and livestock. The lease may be obtained for a maximum term of 50 years, renewable every 10 years. Maximum size of lot available is 16 acres. As an incentive measure, the lessee is exempted from paying rent during the first five years. The 677-acre land lease project at Y. Sengsong, Dededo has 17 lessees.

#### Farm Loans

Presently, there are three potential sources of credit assistance for farmers: The Farmer's Small Loan Revolving Fund, the Agricultural Development Fund, and the Guam Development Fund. The first is a local fund (P. L. 9-121) which had a total loanable fund of \$250,000. Between 1969 and 1973, a total of 70 loans have been approved. About 90 percent of these loans are presently delinquent. This fund allows farmers and fishermen a maximum loan of \$10,000 at 2 percent interest. The Agricultural Development Fund administered by the Guam Economic Development Authority has \$100,000 in loanable funds at 3 percent annual interest.

The Guam Development Fund, also under GEDA, is a \$5 million federal fund, with \$1.5 million appropriated in fiscal year 1974 and \$3.5 million for the ensuing four years. Fifteen percent of this fund is allocated for agricultural loans.

#### Crop Insurance

This program, administered by GEDA, compensates farmers for the loss in farm capital due to natural disasters while a crop is being grown. Insurance coverage is limited to hired labor costs, land preparation, cost of fertilizers, insecticides, seeds and other expenses incidental to crop production up to the time of damage. Maximum liability for one policy under this program is \$5,000 for any qualified farmer.



A total of 17 crops were covered by this insurance program in 1973.

#### Marketing Revolving Fund

The marketing of agricultural products is a problem especially where synchronization of supply and demand is concerned. About three years ago, a legislation had been passed appropriating \$10,000 for the Department of Agriculture to purchase crops from farmers upon harvest and take the responsibility of selling the crops. However, the money was not released due to the absence of a program developed for this purpose.

To complement this program, a Crop Forecast and Market News Reporting service was jointly initiated by the Department of Agriculture and the Cooperative Extension Service, University of Guam. The responsibility was eventually turned over to the former agency which carried on the program for sometime until the activity was finally discontinued due to lack of manpower.

#### Farm Labor

One major factor that persistently worked against the development of commercially-oriented farm operations is the dearth of farm labor. To alleviate this problem, the Government of Guam (through the local Department of Labor) and the U. S. Immigration Office recently initiated the importation of alien farm labor. In 1974, total agricultural workers numbered 120 (40 Guam-hired and 80 aliens). Recent figures from the Department of Agriculture show that over 300 petitions have been initially processed by the agency but only less than 70 have been approved.

There is now a growing agitation to curtail the H-2 Labor program, and should this happen, the farm sector is likely to be adversely affected.

#### Low Water Rate

One other support program extended to local farmers is the provision of cheap water rates for various agricultural uses. Public Law 9-42 provides water subsidy to bonafide farmers at the nominal cost of 25-30¢ per 1,000 gallons.

As of 1975, the Department of Agriculture had processed 400 of these water applications. In view of the increasing number of requests for agricultural water, the agency had adopted a more rigid and careful evaluation of each and every application. It has been observed that some program recipients have violated the intents and purposes of Public Law 9-42.

### Seedling Production, Equipment Rental and Stud Service

The Department of Agriculture also extends other essential services to farmers including the production and sale of seedlings, rental of farm equipment, and animal breeding services--all of which are provided at nominal costs.

The Department, at the present time, has 4 tractors, 3 dozers and a spraying unit available for rental services. The limited number of equipment, however, could hardly keep pace with the demands for services.

The production of seedlings for sale to farmers is a major function of the Department. In FY 1977, a total of 400,000 seedlings were produced and sold to farmers and home gardeners. Although seedling production has substantially increased during the Pamela recovery period, the present supply often falls short of the increasing needs of farmers. A \$10,000 Plant Nursery Revolving Fund was recently allocated to the Department for the specific purpose of increasing the production of quality seedlings.

The number of breeding animals at the Department steadily went down even before the onslaught of Typhoon Pamela in 1976. As a combined result of rustling and disposal (sale) of old unproductive stocks, only 18 head of cattle now remain. Two of the few stud bulls that were being used for breeding services were recently taken by rustlers. Unless the breeding program in this area is discontinued, there is need for immediate replacement of lost stock.

In the swine program, 10 young boars of different breeds and 16 gilts are presently available for breeding purposes. A disaster-aid shipment of 102 young quality pigs was received by the Department from the U. S. mainland in June 1977 to augment the present stock.

### Farm Cooperatives and Organizations

Currently, the Territory of Guam has three farm cooperatives and two farm associations. These are the Guam Farmers Cooperative, the Malojloj Green Farm Cooperative, the Guam Farmers Union, Guam Hog Producers Association and the Marianas Poultry Association.

It is the established goal of these groups to serve not only their respective interests, but more importantly, their activities are aimed at providing a better and effective way of assembling and marketing their products especially where farm produce can be sold both to the public and to big buyers on contract basis. These organizations are also in a better bargaining position with respect to the acquisition of essential farm inputs such as fertilizers, insecticides, seeds, tools and equipment.

### III. DEVELOPMENT PLAN

The inception of a Green Revolution program in 1975 has generated renewed interest in the development of the island's once primary industry--agriculture.

By its very nature and purpose, the program represents a reorientation of governmental policy in economic development with the view of strengthening the "productive" as against the "consumptive" element in Guam's society, and to achieve greater self-sufficiency in the production of foodstuffs.

This reorientation on policy is, indeed, a step in the right direction in the light of Guam's heavy and continuing dependence on external food supplies.

As an initial effort toward this new policy direction, the Government of Guam allocated 1,500 acres of public lands for lease distribution to bonafide farmers under a special one-acre lease program. An additional 80 acres of military land at Radio Barrigada were also leased by the Federal Government to the Government of Guam for agricultural uses.

More recently, two studies were undertaken to pave the way for a more definitive planning of Guam's agricultural development. The Bureau of Planning, in its Agriculture Growth Policy study, came up with recommendations that may well serve as a guideline in determining the future course of agriculture based on industry potentials and constraints identified. A related study by the Guam Department of Commerce has determined the feasibility of building a modern public market where agricultural, arts and crafts, and other domestic products of Guam will be sold.

#### A. EVALUATION OF GROWTH ELEMENTS

##### Field Farming

The cultivation and raising of food crops has ~~been~~ proven successful for a score of island farmers. Even before the Spanish era, when agricultural technology was relatively absent, crops have been grown on a self-sustaining basis. The basic staples grown then were taro, yam and other tubers.

The advent of Spaniards on the island, however, witnessed the introduction of new crops including corn, rice, sweet potatoes, etc. All these were grown with considerable success under local conditions. During the American occupation and during all the years prior to and after World War II, a variety of new crops were additionally introduced, with some of them (watermelons, cucumbers, bell peppers, tomatoes,



### Farmer's Market

A temporary structure built at the Paseo de Susana (following Typhoon Pamela) is intended as an outlet for a variety of fresh produce, including cooked traditional foods and fresh fish.

Until a bigger and more permanent facility is established, this temporary structure will continue to serve the community at the size and volume of business it now operates. A study has just been completed to determine the feasibility of constructing a modern public market.

### Education and Research

In late 1972, the University of Guam obtained the "land grant university" status. The Cooperative Extension Service Program, an informal educational delivery system principally for rural areas, was initiated in 1973. Shortly afterward, a curriculum leading to the baccalaureate degree in agriculture was established.

An Agricultural Experiment Station was also established as part of the University's land grant program. Construction of agricultural laboratory facility at Inarajan was recently completed and is now in operation.

cabbages, etc.) generally developed for commercial-scale production. Although rice and other staples were produced in fairly sufficient quantities before the last World War, only copra was developed into a commercial export product. The industry, nevertheless, was completely abandoned following the war.

Field farming as it is seen today reflects a history of declining importance during the fifties and early sixties, and a slowly reviving industry during the seventies.

The contribution of this sector in the economic well-being of the Territory may be better judged by examining a number of factors that have important bearing on its future development.

Soil and Climate. Guam soils are generally derived from two sources--from volcanic rocks and from limestone formations. Soils in Northern Guam and portions of the southeastern side of the island are derived from limestone. It has been described as an extensive Lithosolic Latosol. This soil, although generally alkaline (average pH 7.60), is rich in hydrated oxides of iron and aluminum.

In Southern Guam, Regosols and Latosols are predominant on the volcanic rocks, generally acidic (average pH 4.89), and are impermeable as opposed to soils in the North which are very permeable, to water.

Compared limestone is  
 • The soils of Guam have one thing in common--the tremendous ability to fix phosphorus. Soil test results show values ranging from 1 to 2 ppm available phosphorus.

Fortunately for the island, chicken manure is in abundance and is being used by farmers. This should help in providing the micro-nutrient needs of crops.

The University of Guam Agricultural Experiment Station, which runs a modern Soil Testing Laboratory, subscribes to the principles of using soil test results as the basis for fertilizer recommendations. Soil test results, to be meaningful, need a lot of research data to back it up. Research staff of the soils laboratory are currently doing field and pot experiments, correlating results data for the purpose of forming a sound basis for fertilizer recommendations.

The soils of Guam can support farming with proper fertilization. A vigorous program to encourage farmers to have their soils tested has been initiated.

Efforts are presently being made to reclassify the soils of Guam to conform to the U. S. Soil Taxonomy System.

The island's total land mass of 212 square miles is blessed with a



tropical climate. Semi-annual monthly average rainfalls range from 12.90 inches during the rainy season (May-October) to 8.12 inches during the dry season (November-April). The months of August and October are usually the wettest months while February and March are usually the driest months. Average monthly temperatures range from 75 degrees Fahrenheit during the coolest months of late winter to the mid 80 degrees Fahrenheit in the summer and fall.

Land Resources. The development of a viable commercial agriculture on Guam has been frequently regarded as far-fetched in view of the increasing and tightening competition for various land uses. The increasing urbanization of Guam, thus, usually becomes a ready scapegoat.

Of greater implication, perhaps, is the existing pattern of land ownership and land tenure on Guam. It is estimated that of the 135,525 acres comprising the island Territory, about 35 percent is owned by the Federal Government; 45 percent is privately owned and 20 percent belongs to the Government of Guam. What seems significant, however, is the fact that most of the property acquired by the Federal Government are rich agricultural lands, much of which are now lying idle. ] wrom

Moreover, the strong family tie in the Chamorro culture has traditionally kept land ownership within the family circle. This has resulted in the ever-decreasing size of holdings among private land owners. Out of 10,038 private owners, 93.5 percent own property of 5 acres or less.<sup>2</sup>

Fruits and vegetables are presently being raised on an estimated 300 acres of land that are cropped 2-3 times a year.

Increased production may be effected by opening and developing new lands. Lands available for agricultural use in five villages of Southern Guam offer great potentials in terms of this objective (Table 6).

Effective implementation of the government's land lease program is also expected to contribute a great deal in increasing production. A Comprehensive Land Use Plan ~~is now in preparation which~~ includes agricultural districts totaling approximately 10,000 acres of prime agricultural land.<sup>3</sup>

Water Resources. Pending the development of surfacewater resources in Southern Guam, local farming will continue to depend on rainwater for

<sup>2</sup>Guam Bureau of Planning, Agriculture Growth Policy, Preliminary, 1977, p. 11.

<sup>3</sup>Bureau of Planning, Overall Economic Development Plan, June 1977, p. 92.



crop production. Although farmers have access to the use of domestic water supply (P. L. 9-42), it would not be economical <sup>a</sup> ~~nor feasible~~, in the long run, to draw irrigation water from the same source that serves the local population.

The Water lens in Northern Guam reportedly <sup>has</sup> ~~have~~ a maximum production capacity of 50 million gallons per day (mgd). At the current rate of pumpage (20.3 mgd), it is estimated that by the year 2,000, when Guam's population is projected to range from 200,000 to 250,000, Guam will have reached its maximum capacity for providing the water needs of its population<sup>s</sup>.

For this reason, the rivers in Southern Guam must be <sup>2</sup> ~~(harnessed)~~ to provide supplemental water supplies for commercial and industrial development, and primarily for agricultural uses. Proposed surfacewater development program<sup>s</sup> include<sup>s</sup> the construction of four reservoirs to impound water from the Talofofo River, Uga<sup>m</sup> River, Inarajan River, and the Umatac and La Sa Fua Rivers (Table 7).

Farm Labor. Agriculture on Guam, is greatly hampered by the shortage and/or difficulty of obtaining farm <sup>hands</sup> ~~hands~~. The shortage appears to be severe in both <sup>the</sup> unskilled and managerial aspects of labor for agriculture.

The importation of alien farm labor, which was initiated not too long ago, is presently being reviewed as to its impact on the local employment scene. It is argued that Guam residents must have priority over imported labor in the filling of locally available jobs.

One other way of alleviating the farm labor problem is by making land more obtainable by non-Guamanians, especially those who have the financial resources and expertise for successful agriculture. But just like labor importation, this approach is fraught with political considerations, which make it highly impractical.

The need for unskilled labor may be dispensed with somewhat by greater investment in farm equipment. However, the management skills and a reasonable amount of unskilled labor are absolute requirements no matter how advanced the technology of equipment may be.

It is important to stress, at this point, the role of education in attracting and preparing the youth for agricultural careers. Although enrollment in introductory agriculture has increased these past two years or so, the present curriculum offered by the University of Guam needs to be expanded to confer Bachelor's Degrees on specific agricultural courses. The introduction of basic agricultural instructions in secondary levels is also of primary importance. These processes should, in the long run, provide skilled manpower resources for agriculture's labor needs.



Table 5

## SELECTED COMMODITIES: PRODUCTION AND IMPORTS, FY 1968-FY 1974

I T E M	FISCAL YEAR	PRODUCTION		IMPORTS	
		Pounds	Dollars (U.S.)	Pounds	Dollars (U.S.)
FRUITS & VEGETABLES. .	1968	1,877,872	309,670	14,290,691	1,471,806
	1969	2,230,493	404,919	9,429,495	1,166,960
	1970	2,410,562	430,556	6,524,720*	1,235,686*
	1971	1,819,924	354,973	7,035,599*	1,529,444*
	1972	2,504,308	478,264	6,450,755*	1,465,664*
	1973	3,129,453	622,672	N/A	N/A
	1974	3,485,122	798,065	N/A	N/A
	. . . . .	1968	291,622	184,305	N/A
1969		289,539	187,042	1,145,273	796,542
1970		241,629	157,784	3,070,597	1,651,520
1971		185,388	124,581	3,391,099	2,458,594
1972		157,267	106,155	4,220,479	3,049,064
1973		141,370	94,817	N/A	N/A
1974		128,750	94,068	N/A	N/A
. . . . .		1968	536,600	402,450	N/A
	1969	560,900	420,675	1,005,909	466,023
	1970	411,800	308,850	1,640,852	912,304
	1971	436,909	327,682	1,754,176	898,072
	1972	449,464	336,649	1,671,808	935,636
	1973	538,965	404,323	N/A	N/A
	1974	741,300	563,200	N/A	N/A
	. . . . .	1968	108,000	38,880	N/A
1969		130,560	47,002	1,099,327	374,686
1970		195,000	70,200	2,249,238	968,316
1971		160,725	60,272	2,298,120	876,936
1972		194,780	72,848	2,370,809	877,086
1973		230,145	95,153	N/A	N/A
1974		244,200	104,300	N/A	N/A
. . . . .		1968	1,056,000	739,200	N/A
	1969	1,305,000	913,500	723,400	253,194
	1970	2,150,000	1,505,000	328,043	154,577
	1971	1,858,912	1,319,838	179,701	81,702
	1972	2,065,270	1,445,689	429,743	210,718
	1973	2,265,000	1,812,000	N/A	N/A
	1974	3,436,000	1,982,904	N/A	N/A
	. . . . .	1968	343,500	172,000	N/A
1969		326,498	163,250	303,683	92,213
1970		151,000	98,150	708,855	321,502
1971		170,577	110,875	472,737	210,709
1972		143,629	93,359	1,573,228	530,299
1973		183,000	118,950	N/A	N/A
1974		201,000	131,000	N/A	N/A

\*Does not include imports for military use, estimated at 5 million pounds a year.

n-Dozens

Not Available

TABLE 6

ARABLE LAND AVAILABLE FOR AGRICULTURE  
USE IN SOUTHERN GUAM

(ACRES)				
DISTRICT	RIVER BOTTOMS	COASTAL UPLANDS	INLAND PLATEAUS AND HILLS	TOTAL
Yona	200	-	1,042	1,242
Talofofu	360	225	1,185	1,770
Inarajan	410	345	810	1,565
Merizo	150	-	170	320
Umatac	62	-	192	254
TOTAL	1,182	570	3,399	5,151

Source: Bureau of Planning, Agriculture Growth Policy, Preliminary, 1977, p. 8.

TABLE 7

## SURFACEWATER RESOURCES IN SOUTHERN GUAM

RIVER	Area to be Irrigated (Est.)	Cost of Dam Construction (Est.)	Reservoir Storage Capacity (Est.)
	<u>Acres</u>	<u>Dollars</u>	<u>Gallons (million)</u>
Talofofu River	2,543	6,000,000	1,300
Ugam River	1,966	19,570,000	82
Inarajan River	2,012	2,500,000	600
Umatac and La Sa Fua Rivers	1,046	2,000,000	180
<b>TOTAL</b>	<b>7,567</b>	<b>30,070,000</b>	<b>2,162</b>

Source: Bureau of Planning, Overall Economic Development Plan, June 1977, p. 132.



Capital, Technology and Infrastructure. Planning for the development of agriculture must be formulated with due consideration of such important requisites as capital, technology and the provision of adequate infrastructures.

Implementation of any plans must first provide for adequate roads to make accessible fertile farm lands, markets, storage facilities, and irrigation systems.

At the present time, access roads in the southern part of the island are being studied. These include (a) the Inarajan to Quinene Road, (b) the Agfayan to Route 17A, and (c) the Agfayan to Route 2 roads. The construction of an asphalted coral road connecting Route 4 and Ija will enable farmers to have access to the University of Guam's proposed Agricultural Experiment Station. The total cost of constructing all four roads is estimated at \$4.3 million.<sup>4</sup>

Planning should also provide for farm credit and price incentives to orient subsistence farming to greater commercialization. Credit assistance is presently provided through the Farmer's Small Loan Revolving Fund, Agricultural Development Fund, and the Guam Development Fund. To a limited extent, price subsidy is also provided under the Marketing Revolving Fund. Increased capitalization of these various funds is necessary to meet the long-term needs of agricultural development projects.

If significant development is to be made, research programs on better crop varieties, insect and disease control, and better cultural practices must be placed in a high order of priority. Activities of the Agricultural Experiment Station and the Cooperative Extension Service are geared toward this objective.

Production and Marketing. The existing farm situation requires the synchronization of production and marketing activities.

Vegetable production on Guam is scattered throughout the island in small plots, oftentimes too small for efficient cultivation. Generally, plantings are erratic, with most farmers producing the same commodity at the same time with the least knowledge of, or information on, existing market conditions.

Most of the marketing of Guam's agricultural products is done in a primitive way. Grading or packaging is conspicuously absent. Little or no attention is paid to sizing or sorting. Most of the products are sold

<sup>4</sup>Bureau of Planning, Overall Economic Development Plan, June 1977, p. 98.



in bulk, packed in a jumble in whatever container may be handiest. In general, the customer is expected to buy what the farmer offers. The products offered appear to be of general good quality although there are wide variations in the degree of maturity.

Apparently, farmers have their own ideas of price. They generally feel that the market or customer should pay the price they ask. The fact that the offered price should bear some relationship to prices of similar products from other sources, including the United States, is evidently neither understood nor recognized. Meeting this kind of competition is something new to the local farmers. He has yet to grasp its meaning in terms of his producing or selling activities.

Most of the inadequacies of the existing marketing system are apparent in the pre-Pamela Farmers Market in Agana. Here, farmers displayed their products in small stalls. This was a retail market patronized mostly by housewives who desire to buy their produce as fresh as possible. The prices they paid were oftentimes higher than they would otherwise have to pay in the more progressive local food markets.

The farmers bring in a fairly good variety of produce, such as beans, eggplant, peppers, taro roots, yams, breadfruit, okra, bittermelon, watermelons, cantaloupes, bananas, avocados and papaya. Usually, the quantities brought in are small--a fact that is conditioned by the lack of storage facilities.

Those farmers who sell their produce in the Farmers Market apparently do so regularly and rely on it as their principal outlet. Other farmers sell their produce directly to retail stores, and these same farmers as well as others who are in the larger farmer category sell their products to the military, hotels, restaurants, school cafeterias, construction firms, and hospitals.

The armed services outlet on Guam provide the local farmers with a tremendous potential market for practically all the products that can be supplied, providing the quality is good and the price is reasonable. Unfortunately, however, only a small fraction of this particular demand is being met through limited marketing contracts with the local farmers.

A recent development is the increasing number of roadside stands that dot the major highways of Guam, especially in the northern part. These fruit and vegetable stands mostly cater to the needs of daily commuters. Some of these stands are operated by farmers, but a good number are run by individuals engaged in buying and selling.

There is great need for marketing education among the local farmers to develop, at least, a basic understanding of some of the more important elements of their trade. Closer working relationships between the farmers and their various customers would do much to improve the



situation and give each a better appreciation of the other's problem and needs. This would permit the establishment of a means of communication through which farmers could be kept informed of demands to be met and could plan their production accordingly, while the different market outlets could be kept fully advised of the availability of supplies in planning their purchases.

The present lack of communication partly explains the "feast and famine" cycle that characterizes Guam's agriculture.

There is also great need for improvements in the marketing structure to facilitate assembling, handling and selling of farm produce. Although there are now three farmer cooperatives in existence, their services are mainly confined to the needs of major retailers.

Competition for Commercial Crop Markets. Competition in the marketing of commercial fruits and vegetables presently comes from three major sources--the United States, Japan and the Trust Territory (Table 8). In 1971, imports from these areas comprised 47, 24 and 4 percent, respectively, of the estimated market supplies for the year.

This heavy dependence upon imports gives immediate rise to the need for planning and developing Guam's agriculture.

## B. STRATEGIC PLANS

Given the situation that Guam only produces roughly one-fourth of its present consumption of fruits and vegetables, and that importation of other important commodities will continue to remain high, it is imperative at this point to identify approaches that would help to bring about optimal development in this particular sector of agriculture (field farming).

### Field Farming

#### Production

The 1974 Census of Agriculture reported a total of 1,576 full-time and part-time farmers, with farms ranging from less than half acre to 50 acres in size. These farmers were engaged in the production of over 30 different types of fruits and vegetables, and about 10 different types of poultry and livestock.

Although Guam has been lagging behind in the production of food-stuffs, there are crops that have shown great potentials for increased production, given the necessary support for growth and expansion (Table 9).

Such crops as cucumbers, watermelons, yard beans, and eggplants are

TABLE 8

FRUITS & VEGETABLES: IMPORTS, BY SOURCE  
FY 1970 AND FY 1971

SOURCE	1 9 7 0		1 9 7 1	
	Pounds	Dollars	Pounds	Dollars
UNITED STATES	3,744,000	659,157	4,139,314	844,144
JAPAN	1,558,355	430,183	2,111,598	591,247
HONGKONG	25,883	7,250	4,693	4,717
PHILIPPINES	21,019	5,199	10,205	2,589
AUSTRALIA	281,097	20,839	4,441	970
TRUST TERRITORY	554,981	65,515	319,336	43,670
OTHER COUNTRIES	339,385	47,543	446,012	42,107
T O T A L	6,524,720	1,235,686	7,035,599	1,529,444
	<u>P E R C E N T</u>			
UNITED STATES	57.38	53.34	58.83	55.19
JAPAN	23.88	34.81	30.01	38.66
HONGKONG	0.40	0.59	0.07	0.31
PHILIPPINES	0.32	0.42	0.15	0.17
AUSTRALIA	4.31	1.69	0.06	0.06
TRUST TERRITORY	8.51	5.30	4.54	2.86
OTHER COUNTRIES	5.20	3.85	6.34	2.75
T O T A L	100.00	100.00	100.00	100.00



26  
Table 9

CROPS RECOMMENDED FOR EXPANDED CULTIVATION

DISTRICTS AND CROPS	1974 PRODUCTION		1974 Market Requirements 1/	1983 TARGET 6/	
	Acres (Trees)	Pounds		Area	Production
			Pounds	Acres	Pounds
A. NORTH					
Beans, K. W.	20.4	83,572	248,000	67.0	340,000
Radish	21.1	36,589	82,000	29.8	112,300
Sweet Potatoes	33.2	92,951	360,000	59.0	493,000
Tomatoes	112.2	278,397	936,000	223.7	1,281,900
Taro (Hawaiian)	2/	2/	3/	153.5	237,000
B. SOUTH					
Bittermelon	48.4	146,566	280,000	65.3	383,500
Cantaloupes	67.9	169,239	722,000	108.7	986,000
Taro (wetland)	2/	2/	3/	51.7	232,800
Papayas	(1,087)	118,524	366,000	(3,825)	501,000
Pineapples	0.5	272	24,234 4/	3.3	33,000
Zucchini	N/A	N/A	56,000 5/	37.0	68,500
Squash					
C. NORTH & SOUTH					
Avocados	(928)	89,137	358,000	(2,900)	490,300
Bananas, eating	68.0	301,383	702,000	115.0	960,000
Cabbage, Chinese	79.0	200,559	442,000	107.7	602,500
Cabbage, Head	10.8	27,984	1,411,000	97.3	1,931,000
Corn	29.1	66,940	481,000	177.4	660,000
Onions, green	31.7	62,865	376,000	122.0	515,000
Bell Peppers	39.6	86,435	211,000	76.2	288,000

1/ From a 1974 DOA survey of supermarkets, hotels, school cafeterias, including the Naval Supply Depot and Andersen AFB's Commissary store. Estimate includes quantities imported and those produced locally. The estimate, however, does not include undetermined amounts of local produce normally allowed for farm home consumption, barter or giveaways.

2/ Totals for both types of taro: 32.6 acres and 89,745 pounds.

3/ Total for both types, 347,500 pounds.

4/ Based on 1975 fresh pineapple shipments from neighboring islands and other foreign countries.

5/ Estimated on the basis of a current (1977) marketing contract between the NSD and the local farmers.

6/ The target assumes production levels necessary to meet the estimated per capita market requirement in 1974. This would require cultivation of additional lands over and above the 1974 harvest acreage.



not included in the concern list because, thus far, these are the items that have more than demonstrated their suitability and productive capacity under local conditions.

Commodities like apples, white potatoes, bulb onion and grapes are also of least concern because of the opposite condition--they are not suited to the local environment. Consumption of these foodstuffs, therefore, will continue to depend upon imports.

It seems clear, at this juncture, that the development of field farming will have to be focused on those crops listed in Table 9.

It is the consensus of the authors that any appreciable stride toward the attainment of the 5-year production target for these individual crops (see Appendix B) would have to depend, a great deal, on the following:

Acreage Expansion. Opening or development of additional farm lands over and above the existing acreage is of immediate priority. There are 70 vegetable farmers on Guam who are, at present, operating individually 5 or more acres of land. Identification of these additional lands should be initiated as early as 1978. A possible site might be the development of the Ija, Inarajan area.

Production Concentration. The 5-year production goal is geared toward the cultivation of specific crops in districts or villages where they are most suited. The major areas of production during the Plan Period (1979-1983) should be as indicated in Table 9.

Education and Research. The activities of the Cooperative Extension Service and the Agricultural Experiment Station of the University of Guam should be intensified in order to keep the local farmers abreast of the latest trends in farming. This means more trained personnel to assist the farmers; better seed varieties; improved farm management; more effective control of insects and diseases, etc.

Farm Labor and Capital. The projected increase in production would require proportionate increase in manpower resources and credit assistance available for such a long-term program.

To this end, importation of farm labor under the H-2 program should be continued until such time that the local labor market could supply the needs of the industry.

While farm financing should be made available in larger amounts than is now possible, credit assistance should be gradually shifted from supporting subsistence operations to promoting commercial ventures that offer greater economic contribution to the agricultural industry. The Farmer's Small Loan Revolving Fund has not been of much help in this respect.



Statistical Information. Adequate and timely statistical information provides an important basis for determining the magnitude of agricultural activity as well as the trends of development in agriculture. The information presently collected leaves much to be desired as data being gathered are based mostly on observations and estimates made by the Department of Agriculture.

The College of Agriculture's Extension and Research staffs should play a bigger role in collecting and disseminating vital information that make direct contribution to the production and marketing decisions of farmers.

Attention in this regard should be focused on production statistics of leading commodities being produced; inputs; land under use; size and distribution of farm plots; and volume and allocation of production loans.

Seedling Production and Equipment Services. As more lands are developed and utilized for crop production, the Department of Agriculture needs to increase its seedling output and provide more farm equipment for rental services than are now available. A possible alternative in meeting increased seedling and farm equipment demands is the encouragement (through incentive programs) of private firms entering into seedling production and/or equipment service enterprises.

Improved Crop Varieties. In 1976, the Guam Agricultural Experiment Station started screening crop varieties that are adaptable to the climatic and cultural conditions of Guam. Thirty-three (33) varieties of Chinese Cabbage and 9 varieties of eggplants were tested. Research in this area should be expanded to include all vegetable crops grown on Guam.

Land Preserves. Although not much additional land would be required during the Plan Period (1979-1983), it is necessary for the Government to secure and protect arable lands that have been identified and determined as potential resource for future agricultural uses.

The land districted for non-agricultural uses by the Comprehensive Land Use Plan is sufficient to preclude widespread development pressures on agricultural lands until the population doubles. There will be an excess of land available for agriculture for at least two decades.<sup>5</sup>

Infrastructure. The provision of vegetable processing plant and storage facilities may be contemplated as early as 1981, but implementation must take place until and after its feasibility has been determined.

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<sup>5</sup>Bureau of Planning, Overall Economic Development Plan, June 1977, p. 92.



### Marketing

The present distribution and marketing system for local fresh produce is aptly described as chaotic. During a certain time of the year, Guam experiences a bumper crop of tomatoes, cucumbers, bittermelons and eggplants. Yet, local retailers import the same commodities from the Marianas, Japan and the United States causing the market for vegetables to collapse.

Also, there is no grading for vegetables. Farmers mix the good and the bad. No standard weights and standard containers are used. This is another reason why retailers depend on imported products which are well graded and packed.

In order for the farmers to garner an increasing proportion of the market now filled by imports, the following approaches are submitted for consideration:

Access to Services. The Cooperative Extension Service of the College of Agriculture should set up at least 3 or 4 field offices in strategic villages where farmers could meet with Extension Agents to discuss and solve their production and marketing problems. The Cooperative Extension Service should have a marketing specialist to conduct educational programs.

• Crop Forecasting and Market Reporting Program. The program which has been initiated, but discontinued lately, must be revived as soon as feasible. This responsibility should be transferred from the Department of Agriculture to the Cooperative Extension Service, University of Guam.

Grading and Packaging. Standards for grades and packaging should be set up by the CES and DOA during the early part of the Plan Period, at least, for a few selected commodities such as tomatoes, cucumbers, eggplants and bell peppers. Grades for other crops will be developed later. Accordingly, an educational program on grades should be conducted by the CES and DOA. In order to be effective, a law similar to the Guam Shell Egg Law must be passed for vegetable grade and packaging standards.

Farm Cooperatives. The three existing farmer organizations (Guam Farmers Cooperative Association, Malojloj Green Farm Cooperative and the Guam Farmers Union) should improve their facilities in order to handle more island produce. Grading and packing facilities, refrigeration, storage, loading and unloading facilities must be adequately provided.

Marketing Contracts. Regardless of whether they are members of cooperatives or not, local farmers should be encouraged and assisted in drawing marketing arrangements with various domestic outlets. This will insure not only ready markets for their produce but this would also



aid the local retailers in adjusting or coordinating their purchases, if any, of imported fresh produce.

A central marketing facility where farmers pool and sell their products has been suggested, time and again. This, however, has yet to be studied. The proliferation of roadside vegetable stands throughout the island tends to weaken the rationale behind the idea of a central marketing facility.

### Livestock Farming

#### Swine Production

Past records indicate that while Guam annually imports 2-1/2 million pounds of pork (Table 10), about 1064<sup>6</sup> local swine producers are producing approximately 500,000<sup>7</sup> pounds via home slaughter.

There are conflicting reports as to numbers of hogs and pigs on farms. The 1974 census shows a potential at 9,900 hogs and pigs while the Statistical Abstract shows 11,700 head of hogs. This same census indicates that there are a minimum of 1,000 or more farmers who raise hogs on their farms.

At the present time, there is an organization called the Guam Hog Producers with a membership of 40, who have banded together for the furtherance and improvement of swine production. These producers own approximately 600 head of breeding females, including 10 head of imported purebred hogs. They have developed their own feed imports (at considerable savings) and are presently developing plans for the building of a slaughterhouse.

To assume that Guam farmers could produce the 2-1/2 million pounds of pork is within the realm of possibility, but its feasibility is something that has yet to be determined.

Limiting Factors. There are stumbling blocks that stand in the way of developing a viable swine industry. It is not that they cannot be overcome, but their magnitude is such that it will need complete cooperation between all parties involved such as, Government of Guam, financial institutions, and farmers. The factors listed are all important and are not listed in order of priority as they are all of high priority.

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<sup>6</sup>1974 U. S. Census of Agriculture.

<sup>7</sup>1975 Statistical Abstract, Economic Research Center, Department of Commerce, Government of Guam.

PORK CONSUMPTION  
1970-1974 AND 1979-1983

(In Pounds)

FISCAL YEAR	Production	Imports	Consumption
1970	411,800 <sup>1</sup>	1,640,852 <sup>1</sup>	2,052,652 <sup>1</sup>
1971	436,909 <sup>1</sup>	1,754,176 <sup>1</sup>	2,191,085 <sup>1</sup>
1972	449,464 <sup>1</sup>	1,671,808 <sup>1</sup>	2,121,272 <sup>1</sup>
1973	538,965 <sup>1</sup>	N/A	
1974	741,300 <sup>1</sup>	N/A	
1979	1,320,500	2,388,030	3,708,530
1980	1,889,500	1,944,890	3,834,390
1981	2,458,400	1,507,120	3,965,520
1982	2,708,400	1,394,140	4,102,540
1983	2,958,800	1,286,650	4,245,450

<sup>1</sup>Actual. All other figures are estimated or projected.

N/A Not available.

NOTE: Total consumption for 1970-1983 are projected at 31 pounds per capita and at 3.4 percent annual increase in population (1974=100,000).



Slaughter Facilities. Without slaughter facilities, there is very little chance that the swine industry on Guam will exceed its present output of approximately 850,000 pounds of home slaughter pork. Such a facility need not be elaborate, but one that is functional and can meet the estimated slaughter potential and USDA standards. From preliminary plans being developed by the Guam Hog Producers Association, it is estimated such a plant would cost approximately \$150,000, excluding land.

One of the questions invariably asked: Are there enough hogs on the island to warrant the building of a slaughter facility? The direct answer would have to be no. However, a Fall 1977 survey of 92 hog farmers conducted by an agricultural class at the College of Agriculture and Business indicates that all of the farmers surveyed would expand their operation, facilities and number of breeding animals if a slaughterhouse facility is built.

Financing. Like any other business enterprise, financing for the establishment of a viable swine industry is of necessity. A major concern to any swine farmer is the provision for adequate capital investment, equipment and supplies for the first year of operation. Most agricultural enterprise had failed because of the lack of financing. The principal and the interest repayment schedule for swine production loans must be such that the enterprise would realize adequate returns.

A description of current loan programs available to hog producers follows:

- a. Guam Economic Development Authority has made 2 loans for swine production with an average loan value of \$15,000 and appears to be the more ready source of financing on the island.
- b. The Guam Department of Agriculture has made 9 loans for swine production at an average of \$6,700. This loan program, however, needs additional funding.
- c. The Farmers Home Administration (FHA) has made several loans under an emergency measure granted after Typhoon Pamela which has given a considerable boost to agriculture, particularly to swine production.

A sustained effort should be made by all interested parties in securing means by which FHA would be able to grant loans for agriculture other than just disaster loans.

Quality Breeding Stock. In order to provide efficient management and quality production, the swine producer must have a constant supply of top quality breeding stock, especially boars. Continuous effort must be made toward maintaining the "best" breeding animals and affording a continuous supply of them. These quality animals are needed to supply



large, fast gaining litters that are efficient in growth and feed usage.

The Department of Agriculture is basically charged with this responsibility. Over 100 head of quality hogs were recently imported for sale to bonafide swine raisers. Every effort should be made to see that the Department continue to fulfill this obligation.

The College of Agriculture, through its experiment station, should eventually be able to help meet part of this obligation. Additional education meetings and training sessions should be conducted to aid the farmer in the selection of quality breeding stock.

Off-Island Influence on Market. The cost of production is relatively fixed on Guam, especially the cost of feed, facilities, breeding stock and labor. Off-island imports, especially those from the mainland USA, are more variable in price. Whenever the cost of production are lowered, particularly feed, this is immediately reflected in the unit price of imported pork, which is much lower than the local production cost. Farmers should have access to a continuous educational program on cost analysis in order to become competitive.

Cost of Feed. Feed contributes approximately 60% to the cost of producing a pound of pork. Feed is presently being manufactured on island but the ingredients are being imported. Thus, feed costs remain high. Local sources of feed must either be developed or researched to replace part of the imported ingredients. Research projects on type, kind and cost of feeds adaptable to Guam should be initiated. Any such studies that may be undertaken should include impact analysis of cheaper feed imports.

Environmental Impact. As more swine units are developed and with increasing human population, Guam could experience air pollution problems similar to Hawaii, where livestock farmers have either quit or had to relocate at great expense. The Government of Guam should set aside agricultural tracts or areas where some air pollution in the form of odors could be expected. These tracts should be located so as to avoid water lens pollution. Review of methods and techniques of odor and fecal waste management should be conducted.

Technical Feasibility. The local swine producers do have the basic knowledge of how to produce swine, but further education would have to be done concerning efficiency of production, especially on the cost-benefit aspects of their enterprise.

The basic structure for production is on island in the form of farms, facilities and breeding stock except that all would need upgrading.

If a slaughterhouse were built, management would have to be imported



during the first year, to provide the efficiency needed during the early growth years.

Economic Feasibility. As previously indicated, there is market on island for 2-1/2 million pounds of pork for the civilian market, which could be expanded into the military, both through the commissary and the mess halls.

Granted that Guam must import feeds which add a great deal to costs, one major advantage would be the freshness of the locally produced pork.

One factor which could limit the economical growth of the pork industry on Guam would be the high feed costs on Guam in the face of "cheap" pork imports.

Growth Impact. There would be an increased demand for water as the industry develops. Based on the Department of Agriculture census of swine on island, it can be safely assumed that 11,700 head of hogs could use 12,811,500 gallons of water per year. In order to produce the 2-1/2 million pounds of pork consumed, Guam would need an additional 4,050 head of butchers, which would consume approximately 2,345,700 gallons of water per year.

Some increase in power consumption could be expected, but at present, there is no method by which this amount could be estimated.

Land will be of importance, although this would not be as critical as water. All of the hogs needed to supply the additional pork could easily be produced on 25 hectares of land. This does not include land for feed production, which could demand as much as 3,600 hectares if all of the feeds were produced on island.

#### Organization

A joint committee consisting of representatives from the Department of Agriculture, Department of Commerce, Territorial Planning, Department of Public Health, Department of Land Management, Guam Economic Development Authority, local Farmers Co-op Marketing Associations, Guam Environmental Protection Agency and the College of Agriculture and Business should be formed. This group would be formed to overcome such roadblocks as:

- a. Financing
- b. Land use
- c. Environmental impacts
- d. Zoning

All swine producers should be united in a loose form cooperative association for the following potential benefits:

- a. Purchase of breeding stock and development of pure breeding herds.
- b. Cooperative marketing of live animals.
- c. Cooperative slaughter and sale of slaughter products.
- d. Cooperative feed management and purchase.

This group should determine the time frame for development as they are the ones who will eventually assume responsibility over the success and future of this industry.

#### Goat Production

Of the domesticated animals, the goat is probably the easiest one to raise. It can thrive even on submarginal lands. For best results, however, it is preferred that goats be reared on good pastures. A nanny (adult female goat) can have two litters per year at an average of two kids per delivery. Goats are not only prolific but are also resistant to disease. These animals may be raised either for meat or milk. Most farmers, however, raise goats for meat. Milk goats are quite difficult to raise because unlike the beef type, these animals cannot grow on pastures alone. They need feed supplementation.

Goat meat is particularly popular among the Filipino groups on the island. Even at a relatively high price of \$1.50-\$1.75 per pound, the demand for chevon (goat meat) remains consistently high, and in fact, on the increase.

The steadily declining goat population is partly indicative of the extent of this demand. The Guam Department of Agriculture reported that there were as many as 3,268 goats on the island in 1965 compared to 537 that was recorded in 1974.

If this enterprise is to meet the estimated present consumption needs of 700,000 pounds per year, a crash development program would be required to produce 10,769 head of goats at the average dressed weight of 65 pounds. This does not include an estimated 2,950 head of breeding stock that have to be retained in order to sustain the current demand.

#### Duck Farming

A number of people on Guam have long been raising ducks in small flocks. These ducks were raised mainly as a source of supplementary food and income for the family. Since there had not been much market



for ducks, farmers did not have the interest to raise more than satisfying their needs.

In recent times, however, the demands for live ducks all too suddenly became noticed. The presence of Vietnamese people in the community purportedly gave rise to this situation. Apparently, duck is a delicacy. Thus, in two years, the prices of adult hens and drakes dramatically increased from \$2.00 to as much as \$6.00 a piece.

Like chickens, ducks are generally classified as meat type and egg type. Both types are being raised by farmers on the island. A commercial duck farmer in Maina, with 2,500 layers, is presently engaged in the production of "baluts" or embryonated eggs. This farm has two incubators with a capacity of about 2,000 eggs. Eggs are gathered, washed and sorted out daily before they are incubated for 14 days. Infertile eggs, including those with slightly cracked shells or irregular shapes, are processed and sold in the market as salted eggs. Baluts and salted eggs are considered a delicacy among the Filipinos. Balut eggs are retailed at 75-85¢ a piece and the salted ones are sold at 50-60¢ each.

The 1974 Census of Guam Agriculture reported a total of 272 duck farms with a total population of 3,324. Recent estimates, based on farm visits conducted, placed the current duck population at 7,000. This includes 2,000 that were imported during the past two years.

Duck egg production in the form of "baluts" and salted eggs is presently estimated at 83,300 dozens per year. More than 80 percent of these are consumed by the local Filipino community.

In view of the growing interest in this new venture, and in order to provide the basic guidelines necessary to further the development of this industry, a more detailed study on its various aspects is deemed a priority consideration.

#### Broiler and Fryer Production

Guam's population consumes up to 2 million pounds of imported broilers and fryers per year.

Due to the success gained by the egg industry in recent years, it has also been the consensus among many of the Government of Guam leaders that Guam farmers could make this (broiler) a viable local industry. This may be a rightful assumption if only the quantities and the obviously low retail price of imported poultry meat are taken into account. There are, however, limiting factors that have hindered development plans in this regard, namely: cost of feed, cost of production other than feed, slaughter and processing facilities and competition from imports.



A question invariably asked is: Why can't imported feed be used similar to what is done in pork and egg production? From experiments conducted at the Department of Agriculture, approximately 8.5 pounds of feed are needed to produce 3-4 pounds of dressed bird. At the present cost of feed, this would mean 54¢ per pound of meat which (not considering other costs such as housing, labor, equipment, utilities and processing) is already higher than the average retail price of imported broiler or fryer.

If there were some ways and means by which Guam farmers could start producing corn or grain sorghum in quantities, then broiler or fryer production may be given a second look.

It is the consensus of the authors that it is not feasible at the present time to competitively produce broilers or fryers on Guam.

#### Roasting Chickens

Although no experimental work has been done, there is a possibility that roasting chicken production could be a success. Under this program, less expensive commercial feed could be used. There is a demand for this type of poultry meat but, again, the major limiting factor would be a processing plant.

#### Stewing Hens

There is a demand for stewing hens, and local farmers can meet a portion of this demand. There are approximately 100,000 stewing hens produced each year by local fresh egg producers. The present method of disposal, however, creates an inefficiency (slow sales of live birds) which lend to an increase in the price of fresh eggs. As in any of the poultry meat enterprises, a processing plant is one of the major limiting factors.

#### Poultry Processing Plant

It is granted that any type of poultry processing plant could be a costly service to offer, but considering its advantages over a manual type operation, a processing plant is needed. It does not have to be a fully-automated plant, but could be a table-top-type operation which would still comply with federal poultry meat processing specifications.

A poultry processing plant is necessary because the present method of disposing live birds is slow and inefficient. The government should take the initiative in putting up a pilot project as poultry producers are apparently not in a position to assume the responsibility, at the present time. The reasons are:

1. Producers have already made so much investments in existing

facilities that they no longer have enough capital for other major investments;

2. Management efficiency will be adversely affected as producers' time and effort would be dissipated between the farm and the plant;

3. A producer-owned processing facility could create semi-monopoly by not purchasing or processing birds from non-participating producers; and,

4. Other industries such as broiler and fryer production may not be developed as plant owners would not be interested in building up competition against the stewing hen market.



#### IV. CONCLUSION AND RECOMMENDATIONS

##### A. FIELD FARMING

The foregoing argues for the further development of local agriculture, primarily in Field Farming, where some farmers have and are experiencing success. The development of this sector is not only dictated by the need to cut down Guam's heavy dependence upon imports but more importantly, there is a need to strengthen the "productive" as against the "consumptive" element in Guam's economic development.

The potential for development in Field Farming is supported by the availability of lands needed for expansion. Also, water is not likely to be a constraint, at least, during the Plan Period (1979-1983) when crops recommended for expansion (Table 9) would be grown in districts where soil conditions are expected to have greater impact.

However, there are problem areas that must be resolved, and to which the following recommendations are addressed:

##### 1. Agricultural Credit

The Department of Agriculture must seek additional funding from the Guam Legislature to augment the \$250,000 originally allocated for the Farmers Small Loan Revolving Fund. The amount is too uneconomical to satisfy even the needs of small farmers. In order to protect the fund, however, farmers must invest in the Farmers Small Revolving Fund about 3-5 percent of each and every loan approved. This is to insure not only the perpetuity of the fund but in the long run the fund will eventually belong to the farmers themselves.

It is also recommended that the loaning policy of the Guam Economic Development Authority be reviewed. Their criteria in granting loans for agriculture is not clearly understood. The Crop Insurance program of GEDA likewise needs to be evaluated. Records reveal that not too many farmers are taking advantage of the program.

##### 2. Agricultural Land Lease Program

The Government's Land Use Permit Scheme (short-term) should be discouraged in favor of the long-term lease program (P. L. 9-117). It has been observed that short-term lease lots either remain idle or are being used by the lessees for Sunday picnics. The long-term lease program is the only way by which farmers could guarantee themselves of the returns for any investments made.

##### 3. Irrigation Water

The Northern Region of Guam can be very productive during the rainy



season. Due to the highly porous character of the soil, drainage is not a problem since water easily goes through the soil. During the dry periods, however, farming in northern Guam becomes a problem due to the lack of irrigation water.

An irrigation facility has to be established in order for the producers to continue planting during the dry period. The government must also subsidize the agricultural water rate, similar to the one the state of Hawaii is giving their farmers (very low water rate).

The Southern Region of Guam becomes a problem during the rainy season due to excess water and poor drainage. However, the district can become very productive during the dry period because of the availability of sufficient moisture in the soil.

The low land areas in the South need to be drained to insure continuity of planting.

A good irrigation design is needed during the dry season in order to utilize the free surfacewater that is available in the Southern region. At the present, very little of this water is currently tapped because of the absence of irrigation facilities.

The government, in cooperation with private agencies, must develop agricultural roads in this low land areas in order to open the various prime lands currently lying idle. These areas include Talofof, Umatac, Merizo, etc. Good agricultural roads are a must in order for farmers to have access to production and marketing of products.

One way in which the government can raise revenue toward developing an irrigation system is to tax agricultural imports (penny a pound). Several states in the U. S. mainland are raising funds through this system of import tax.

#### 4. Farm Labor

One of the major stumbling blocks in developing agriculture in the Territory is the non-availability of local farm workers. The attitude of local people toward farm jobs is rather negative. As a consequence, commercial farmers, such as two of the island's largest poultry producers and swine producers, have to import farm workers from the Philippines, Japan and Korea.

Farm labor is still going to be a major problem for the farmers unless the local government, in cooperation with federal officials, get together to iron out the various problems facing the importation of farm workers.

Another aspect in the farm labor situation is the fact that farmers



have to compete for the same manpower that are being drawn to other industries such as hotels, private business firms and both local government and federal agencies. In other words, it is almost next to impossible to entice local people to work in the farm as long as attractive job opportunities still exist within the various sectors of the economic community.

It is recommended that either the Government of Guam or some private business firm enter into a contract with foreign countries such as the Philippines, Taiwan, Korea, etc. to assemble farm workers of different skills in Guam to act as a pool whereby local farmers can get workers either monthly or annually. Federal sanction in this regard would have to be secured.

#### 5. Development of Farm Roads

At present, there are large tracts of government land as well as private land that are considered prime agricultural lands but which are lying idle because there is no access to the property. There are few that are partially developed. However, farmers are rather reluctant to intensify their cultivation because of the difficulties involved when it is time for harvesting and transporting the products to market. A vast tract of land areas in the central part and southern part of Guam can be opened and be put into production in a relatively short time if the needed roads are built. The majority of this tract of land is highly desirable for production of crops such as bananas (valley area is ideal because of the protection it provides against typhoon), pineapple and taro. In addition, many of these valley areas are blessed with rivers which flow out to the ocean. Production during the dry period is excellent because of the availability of irrigation water.

The government should be financially involved in the development of farm roads. At present, very little has been done because farmers are currently being charged for this type of development. Farm roads may be built by the government provided the private land owners would assume the responsibility of maintaining such facilities.

In addition, the government can probably grant a 10-20 year tax deferment on such land areas given road access provided that private land owners will sign an agreement that once farm roads are built, their land must be cultivated, and put into production.

Another alternative is the establishment of a Farm Road Development Fund to provide some financing to farmers over a long period. The fund should provide not only low interest rate but also low repayment schedule.

Or, the government, through the Public Works, should defray the costs of the road development and then make an assessment to all the people that



will be benefited by such facilities. This is very similar to the sewer system concept where one makes a monthly payment for the facility installed. Again, this type of program calls for financial sacrifices on the part of the farmers.

#### 6. Vegetable Processing Plant

A study should be conducted to determine the feasibility of constructing a vegetable processing facility where surplus fresh produce may be converted into pickles and other processed products. This is one way to extend the supply period for certain products, particularly those that are grown only seasonally.

#### 7. Farmers' Cooperatives

A comprehensive analysis of the three existing farm cooperatives and their potentials seems necessary as a preliminary step to encouraging the formation of similar organizations in the future. The present cooperatives need to be strengthened, and the aspects needed to be thoroughly examined include membership structure, the range of existing functions, additional services that they could provide, and the adequacy of existing facilities.

#### 8. Coordination of Production and Marketing

The present agricultural situation on Guam is characterized by the serious lack of communication between the producers and market outlets as to the extent of supply and demand for local fresh fruits and vegetables.

The College of Agriculture should revive and expand the Crop Forecast and Market News Reporting service to provide the basic information needed by both the producers and the local merchants. An updated Planting Calendar is also necessary to guide farmers in their activities.

#### 9. Identification of Farm Lands

In order to provide guidance for effective planning, a comprehensive mapping and identification of existing and potential farm lands should be made. The document should indicate major crops grown in various districts or farms.

#### 10. Equipment Services

The Department of Agriculture, thus far, has not been able to provide the necessary equipment services to farmers, either due to inadequate equipment or ineffective administration of this program, or both.

It is recommended that these services be phased out from the Department,



and turned over to private management. Non-profit cooperative associations or some of the local private equipment companies now performing similar services may assume this responsibility, with the Government of Guam providing financial support to these private entities, at least, for the initial period.

#### 11. Federal Agencies

The various support and service programs now available to local farmers need to be augmented through the extension of certain federal programs to Guam. The Government of Guam should find ways and means to have the following federal agencies extend their jurisdiction to the Territory:

- a. Production Credit Associations
- b. Farmers Cooperative Banks
- c. Commodity Credit Associations
- d. Federal Land Banks
- e. Federal Crop Insurance
- f. Farmers Home Administration (Presently, the local office of this federal agency only extends emergency loans designed for Typhoon Pamela rehabilitative projects).

#### 12. Price Support

A number of traditional crops that were grown in abundance in pre-war period are fast waning out of the foodshelves. Although demand for these commodities is high, not much is being produced.

The government should establish a price support program to encourage farmers to grow more of these crops. These crops include taro, ginger, sweet potatoes, cassava, yams, papayas, guavas, bananas, avocados, limes and lemons.

Since most of these crops are harvested only annually in limited quantities, and if increased production is thus desired, a price subsidy would be needed to support these commodities, at least, during their brief period of abundance.

#### 13. Keeping Prime Agricultural Lands for Farming

There is an urgent need for the Government of Guam to protect prime agricultural lands from being lost continually to commercial ventures, such as housing development and other related activities.

The Executive and the Legislative branches of the government should get together and initiate measures whereby owners of prime agricultural lands would be encouraged to keep such lands under agricultural production.

Currently, the Government of Guam is providing incentives to new industries established in the Territory in the form of tax rebate. Similar incentives should be given to land owners who develop and keep their prime agricultural lands in production.

The measure should emphasize that such incentives will be provided for as long as the lands are continually kept in production. Otherwise, higher taxes should be imposed upon the property. The rationale behind this proposal is to encourage the development of prime agricultural lands that have been and are still lying idle.

#### 14. Farm Disaster Aid

The development of Guam agriculture has been and will continue to be hampered by natural disasters such as typhoons, floods and drought.

In view of these hazards that farming is exposed to, and in order to provide farmers ready assistance whenever any such disasters occur, the government should develop a program whereby emergency agricultural loans would be made available to farmers at low interest rate. Assistance may also be extended in the form of rewriting and/or granting moratorium on existing loan obligations.

The program may be funded through legislation, and the money deposited with a banking institution to earn interest. Once the Director of Agriculture declares that the farming industry is on a state of disaster, this money would be withdrawn, and all agencies (DOA, GEDA, FHA, SBA, etc.) that may be designated to oversee the program would be mobilized to extend the necessary assistance to farmers.

The destruction and tremendous losses suffered by the industry from Typhoons Karen, Olive and Pamela suggest the need for such a program.

#### 15. Quarantine Program

The development of field farming depends, in large measure, on how well crops are protected against pest and disease infestation.

The Oriental fruit fly has been a major pest of many vegetable and fruit crops on Guam. It was only recently that Guam was freed of this menace. However, the presence of another pest (Melon fly) on the island is causing so much concern that Guam is not allowed to export its fruit and vegetable products. The banana industry is also faced with the threat of being wiped out if nothing is done to arrest the banana Bunchy Top disease.



To insure the protection of island crops against the hazards of potential and existing pests and diseases, it is recommended that a) increased budgetary support (both local and federal) be obtained for the Territory's plant quarantine program; b) the local quarantine staff be expanded and upgraded; c) Government of Guam should request for the assignment to Guam of federal quarantine officers from USDA's Animal and Plant Health Inspection Service (APHIS) to assist the local quarantine personnel; and d) federal assistance (APHIS) should be secured to help Guam in the eradication or control of the Melon Fly and the Bunchy Top disease.

#### B. LIVESTOCK FARMING

Findings suggest that Livestock Farming on Guam would have to contend with such major constraints as input costs, water requirements, and to a considerable extent, land.

Aside from the now thriving egg industry, the potential of Livestock Farming lies in swine raising. Recent trends in production attest to this interesting possibility. However, planning for a viable livestock industry has yet to be founded on firm grounds.

Recommendations in this regard are as follows:

1. A feasibility study should be made to determine the economics of an expanded livestock enterprise.
2. While swine and broiler production hold some promise for optimum growth, current production has yet to be much improved to warrant the establishment of slaughtering and poultry processing facilities.
3. Goat raising has also a great potential. An in-depth study is needed to determine its viability. In the meanwhile, efforts should be made by authorities concerned to protect the local farmers from rampant (though unreported) rustling incidents.
4. There is a need to promote a budding industry--duck raising (for baluts). It is submitted that a thorough study be made to determine the economic contribution of this sector.



APPENDIX A

SELECTED CROPS: Past Trends in Production

K. W. BEANS PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	11.5	36,646	-	-
1972	21.9	91,728	90.4	150.3
1973	18.1	75,044	(17.4)	(18.2)
1974	20.4	83,572	12.7	11.4
1975	21.2	89,932	3.9	7.6
ANNUAL	18.6	75,384	22.4	38.0

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

RADISH\* PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	14.6	16,794	-	-
1972	5.0	7,380	(65.8)	(56.1)
1973	24.5	34,913	390.0	373.1
1974	22.1	36,589	(9.8)	4.8
1975	23.7	35,094	7.2	(4.1)
ANNUAL	18.0	26,154	80.4	79.4

\*Mostly the red round type.

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

SWEET POTATO PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	22.6	48,931	-	-
1972	25.8	70,340	14.2	43.8
1973	30.6	83,465	18.6	18.7
1974	33.2	92,951	8.5	11.4
1975	35.0	99,024	5.4	6.5
ANNUAL	29.4	78,942	11.7	20.1

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

TOMATO PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	31.9	52,983	-	-
1972	43.7	100,346	37.0	89.4
1973	110.9	249,986	153.8	149.1
1974	112.2	278,397	1.2	11.4
1975	117.6	299,583	4.8	7.6
ANNUAL	83.3	196,259	49.2	64.4

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.



BITTERMELON PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	7.4	16,842	-	-
1972	9.9	29,479	33.8	75.0
1973	44.9	131,609	353.5	346.5
1974	48.4	146,566	7.8	11.4
1975	51.1	157,720	5.6	7.6
ANNUAL	32.3	96,443	100.2	110.1

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

TARO\* PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	30.5	110,684	-	-
1972	41.9	110,023	37.4	(0.6)
1973	30.4	80,586	(27.4)	(26.8)
1974	32.6	89,745	7.2	11.4
1975	34.5	96,575	5.8	7.6
ANNUAL	33.9	97,523	5.8	(2.1)

\*Includes the wetland and Hawaiian varieties.

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

CANTALOUPE PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	33.7	48,637	-	-
1972	51.7	99,271	52.8	104.1
1973	82.4	151,968	60.0	53.1
1974	67.9	169,239	(17.6)	11.4
1975	70.3	176,118	3.5	4.1
ANNUAL	61.2	129,051	24.7	43.2

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

PAPAYA PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	TREES	POUNDS	TREES	PRODUCTION
1971	553	39,769	-	-
1972	856	76,192	54.8	91.6
1973	1,216	108,224	42.1	42.0
1974	1,087	118,524	(10.6)	9.5
1975	1,156	112,543	6.3	3.4
ANNUAL	975	93,050	23.2	36.6

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.



AVOCADO PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	TREES	POUNDS	TREES	PRODUCTION
1971	121	8,637	-	-
1972	744	69,180	514.9	700.9
1973	870	80,040	16.9	15.7
1974	928	89,137	6.7	11.4
1975	1,049	105,920	13.0	18.8
ANNUAL	742	70,583	137.9	186.7

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

BANANA\* PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	58.5	202,946	-	-
1972	62.3	276,650	6.5	36.3
1973	59.8	258,953	(4.0)	(6.4)
1974	68.0	301,383	13.7	16.4
1975	75.5	339,944	11.0	12.8
ANNUAL	64.8	275,975	6.8	14.8

\*Eating type.

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

CHINESE CABBAGE PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	15.2	27,309	-	-
1972	17.4	41,292	14.4	51.2
1973	76.7	180,092	340.8	336.1
1974	79.0	200,559	3.0	11.4
1975	81.4	215,822	3.0	7.6
ANNUAL	53.9	133,015	90.3	101.6

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

HEAD CABBAGE PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	10.3	19,851	-	-
1972	8.9	21,155	(13.6)	6.6
1973	10.1	25,128	13.5	18.8
1974	10.8	27,984	6.9	11.4
1975	8.1	20,114	(25.0)	(28.1)
ANNUAL	9.6	22,846	(4.6)	2.2

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.



CORN\* PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	25.0	44,443	-	-
1972	22.9	51,144	(8.4)	15.1
1973	26.9	60,109	17.5	17.5
1974	29.1	66,940	8.2	11.4
1975	29.9	72,034	2.7	7.6
ANNUAL	26.8	58,934	5.0	12.9

\*Field Corn

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

GREEN ONION PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	19.2	31,642	-	-
1972	23.1	49,307	20.3	55.8
1973	27.1	56,450	17.3	14.5
1974	31.7	62,865	17.0	11.3
1975	33.2	67,649	4.7	7.6
ANNUAL	26.9	53,583	14.8	22.3

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.

BELL PEPPER PRODUCTION  
FY 1971-FY 1975

YEAR	HARVESTED		% INCREASE (DECREASE)	
	ACRES	POUNDS	ACRES	PRODUCTION
1971	21.5	25,014	-	-
1972	21.2	52,684	(1.4)	110.6
1973	31.1	74,920	46.7	42.2
1974	39.6	86,435	27.3	15.4
1975	41.8	93,369	5.6	8.0
ANNUAL	31.0	66,484	19.5	44.0

SOURCE: Compiled from data supplied by the Department of Agriculture, Government of Guam.



APPENDIX B

SELECTED CROPS: Production Targets, 1979-1983

BUREAU OF PLANNING  
GOVERNMENT OF GUAM  
P.O. BOX 2950  
AGANA, GUAM 96910

BANANA(eating): ACREAGE AND PRODUCTION TARGETS, FY1979-FY1983

<u>Year</u>	<u>Area Planted</u>	<u>Production</u>
	(Acres)	(Pounds)
1974	68.0*	301,383
1979	106.5	839,800
1980	108.5	868,300
1981	110.6	898,000
1982	112.8	929,000
1983	115.0	960,000
Annual Growth(%)	2.0	3.4

\* Harvested acres.

Assumptions

- Production target is based on a 3.4 percent annual increase in population (1974=100,00) and is projected at 7.0 pounds per capita requirement.
- Acreage target includes the use of existing farms (68 acres) plus the development of 47 additional acres.
- Yields are held at constant rates, as follows:  
Existing farms, 4,432 pounds per acre.  
New farm lands, 14,000 pounds per acre.

All acreage figures are given in total effective crop area.



CANTALOUPE: ACREAGE AND PRODUCTION TRAGETS FY1979-FY1983

Year	Area Planted (Acres)	Population (Pounds)
1974	67.9*	169,239
1979	102.6	863,700
1980	104.1	893,100
1981	105.6	923,600
1982	107.2	955,500
1983	108.7	986,000
Annual Growth	1.5	3.3

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,00) and is projected at 7.22 pounds per capita requirement.

--Acreage target includes the use of existing farms (67.9 acres) plus the development of 40.8 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,492 pounds per acre.

New farm lands, 20,000 pounds per acre.

All acreage figures are given in total effective crop area.

TOMATO: Acreage and Production Targets, FY1979-FY1983

YEAR	AREA PLANTED	PRODUCTION
	(Acres)	(Pounds)
1974	112.2*	278,397
1979	205.7	1,119,700
1980	209.9	1,157,700
1981	214.3	1,197,400
1982	218.9	1,238,700
1983	223.7	1,281,900
Annual Growth (%)	2.1	3.4

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 9.36 pounds per capita requirement.

--Acreage target includes the use of existing farms (112.2 acres) plus the development of 111.5 additional acres.

-- Yields are held at constant rates, as follows:

Existing farms, 2,481 pounds per acre.

New farm lands, 9,000 pounds per acre.

All acreage figures are given in total effective crop area.



BITTERMELON: Acreage and production targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u>	<u>PRODUCTION</u>
	(Acres)	(Pounds)
1974	48.4*	146,566
1979	61.9	335,000
1980	62.7	346,500
1981	63.5	358,200
1982	64.4	370,600
1983	65.3	383,500
Annual Growth (%)	1.4	3.5

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 2.8 pounds per capita requirement.

--Acreage target includes the use of existing farms (48.8 acres) plus the development of 16.9 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 3,028 pounds per acre.

New farm lands, 14,000 pounds per acre.

All acreage figures are given in total effective crop area.

TARO (Wetland): Acreage and Production Targets, FY1979-FY1983

YEAR	AREA PLANTED (Acres)	PRODUCTION (Pounds)
1974	16.3*	44,873*
1979	52.3	207,000
1980	53.9	214,000
1981	55.5	221,300
1982	57.2	229,000
1983	59.0	237,000
Annual Growth (%)	3.1	3.5

\* Estimates.

Assumptions

- Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 1.73 pounds per capita requirements.
  - Acreage target includes the use of existing farms (16.3 acres) plus the development of 42.7 additional acres.
  - Yields are held at constant rates, as follows:
    - Existing farms, 2,753 pounds per acre.
    - New farm lands, 4,500 pounds per acre.
- All acreage figures are presented in total effective crop area.

TARO (Hawaiian): Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	16.3*	44,872*
1979	132.1	207,000
1980	137.0	214,000
1981	142.3	221,300
1982	147.8	229,000
1983	153.5	237,000
Annual Growth (%)	3.8	3.5

\* Estimates.

Assumptions:

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 1.73 pounds per capita requirement.

--Acreage target includes the use of existing farms (16.3 acres) plus the development of 137.2 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,753 lbs./acre

New farm lands, 1,400 lbs./acre.

All acreage figures are presented in total effective crop area.



SWEET POTATO: Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	33.2*	92,951
1979	55.0	430,700
1980	55.9	445,300
1981	56.9	460,500
1982	57.9	476,500
1983	59.0	493,000
Annual Growth (%)	1.8	3.5

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,00) and is projected at 3.6 pounds per capita requirement.

--Acreage target includes the use of existing farms (33.2 acres) plus the development of 25.8 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,800 pounds per acre.

New farm lands, 15,500 pounds per acre.

All acreage figures are presented in total effective crop area.

RADISH: Acreage and Production Targets, FY1979-FY1983

YEAR	AREA PLANTED (Acres)	PRODUCTION (Pounds)
1974	21.1*	36,589
1979	28.2	98,100
1980	28.6	101,500
1981	29.0	105,000
1982	29.4	108,500
1983	29.8	112,300
Annual Growth (%)	1.4	3.4

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 0.82 pound per capita requirement.

--Acreage target includes the use of existing farms (21.1 acres) plus 8.7 additional acres to be developed.

--Yields are held at constant rates, as follows:

Existing farms, 1,734 pounds per acre.

New farm lands, 8,712 pounds per acre.

All acreage figures are presented in total effective crop area.

K. W. BEANS: Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	20.4*	83,572
1979	59.5	296,700
1980	61.0	306,800
1981	62.9	317,300
1982	64.9	328,200
1983	67.0	340,000
Annual Growth (%)	3.0	3.5

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 2.48 pounds per capita requirement.

--Acreage target includes the use of existing farms (20.4 acres) plus the development of 46.6 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 4,097 pounds per acre.

New farm lands, 5,500 pounds per acre.

All acreage figures are presented in total effective crop area.



CHINESE CABBAGE: Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	79.0*	200,559
1979	102.4	528,800
1980	103.7	546,700
1981	105.1	565,400
1982	106.5	585,000
1983	107.7	602,500
Annual Growth (%)	1.3	3.3

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 4.42 pounds per capita requirement.

--Acreage target includes the use of existing farms (79 acres) plus the development of 28.7 additional acres.

--Yields are held at constant rates, as follows:  
Existing farms, 2,539 pounds per acre.  
New farm lands, 14,000 pounds per acre.

All acreage figures are given in total effective crop area.

HEAD CABBAGE: Acreage and Production Targets, FY1979-FY1983

YEAR	AREA PLANTED (Acres)	PRODUCTION (Pounds)
1974	10.8*	27,984
1979	86.2	1,686,800
1980	88.8	1,744,000
1981	91.5	1,803,700
1982	94.3	1,866,000
1983	97.3	1,931,000
Annual Growth (%)	3.0	3.5

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 14.1 pounds per capita requirement.

--Acreage target includes the use of existing farms (10.8 acres) plus the development of 86.5 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,591 pounds per acre.

New farm lands, 22,000 pounds per acre.

All acreage figures are given in total effective crop area.

CORN: Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	29.1*	66,940
1979	156.2	575,500
1980	161.1	595,000
1981	166.2	615,300
1982	171.5	636,600
1983	177.4	660,000
Annual Growth (%)	3.2	3.5

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 4.81 pounds per capita requirement.

--Acreage target includes the use of existing farms (29.1 acres) plus the development of 148.3 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,300 pounds per acre.

New farm lands, 4,000 pounds per acre.

All acreage figures are given in total effective crop area.



GREEN ONIONS: Acreage and Production Targets, FY1979-FY1983

<u>YEAR</u>	<u>AREA PLANTED</u> (Acres)	<u>PRODUCTION</u> (Pounds)
1974	31.7*	62,865
1979	109.1	449,800
1980	112.0	465,100
1981	115.3	481,000
1982	118.7	498,000
1983	122.0	515,000
Annual Growth (%)	2.8	3.4

\* Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 3.76 pounds per capita requirement.

--Acreage target includes the use of existing farms (31.7 acres) plus the development of 90.3 additional acres.

--Yields are held at constant rates, as follows:  
Existing farms, 1,983 pounds per acre.  
New farm lands, 5,000 pounds per acre.

All acreage figures are given in total effective crop area.

BELL PEPPERS: Acreage and Production Targets, FY1979-FY1983

YEAR	AREA PLANTED (Acres)	PRODUCTION (Pounds)
1974	39.6*	86,435
1979	69.8	252,500
1980	71.3	261,000
1981	73.0	270,000
1982	74.6	279,200
1983	76.2	288,000
Annual Growth (%)	2.2	3.3

\*Harvested acres.

Assumptions

--Production target is based on a 3.4 percent annual increase in population (1974=100,000) and is projected at 2.11 pounds per capita requirement.

--Acreage target includes the use of existing farms (39.6 acres) plus the development of 36.6 additional acres.

--Yields are held at constant rates, as follows:

Existing farms, 2,183 pounds per acre.

New farm lands, 5,500 pounds per acre.

All acreage figures are given in total effective crop area.

APPENDIX C  
Livestock Production



NUMBER OF BUTCHER HOGS NEEDED  
TO SUPPLY 2-1/2 MILLION POUNDS PORK

1. 2-1/2 million pounds of pork
2. Average slaughter weight per pig equals 175 pounds
3. Average dressing weight at 175 pounds is 65%

or

$175\# \times 65\% = 114\#$  of edible pork carcass

$2,500,000\# \div 114\# = 21,900$  head of butcher hogs

NUMBER OF SOWS AND BOARS NEEDED  
TO SUPPLY 21,900 HEAD OF BUTCHERS

1. Average herd will have a farrowing rate of 1.65
2. Average number pigs from each litter that will survive to market weight is 7

or

$21,900 \text{ head} \div (1.65 \times 7) = 1,896$  breeding sows 20% of sows need to be replaced each yr. (baren sows, crippled, age, etc.)

$1,896 \times 20\% = 379$  gilts for replacement

also 38 replacement boars will be needed for breeding

$418 \div 11.55 = 36$  additional sows

or

1,896 sows or gilts and 418 replacement gilts and boars or 2,314 sows needed.

RAISING MARKET WEIGHT HOGS  
50 SOW OPERATION

INVESTMENT

<u>I/</u>	1. Land	-0-
	2. Buildings	
	A. Farrowing barn and nursery	\$ 19,440
	B. Sow holding	15,360
	C. Finishing barn	30,600
	3. Feeders, water, and farrowing crates	15,000
	4. Truck	3,500
	5. Scales and Misc. equipment	1,500
	6. Breeding stock	
	A. Sows 50 @ \$300	15,000
	B. Boars 3 @ \$600	1,800
	Total Investment	\$102,200

CASH EXPENSES

	1. Feed	
	A. Starter 9,184 lbs. @ 14¢	\$ 1,286
	B. Grower 198,112 lbs. @ 13¢	25,755
	C. Finisher 147,288 lbs. @ 12¢	17,674
	D. Sow, Boar Replacement 121,500 lbs. @ 13¢	15,795
<u>II/</u>	2. Labor	
	30 hours per sow/year x \$2.35/hr.	3,525
<u>III/</u>	3. Return to management	4,940

4. Taxes and insurance	\$ 1,000
5. Utilities	1,800
6. Vet expenses, wormer, etc.	800
<u>IV/</u> 7. Repairs, maintenance, etc.	4,270
<u>V/</u> 8. Interest on investment	6,643
9. Replacement boar	600
Total Cash Expenses	<u>\$ 84,088</u>
 <u>INCOME</u>	
646 butchers = 107,000# @ 90¢/lb.	96,300
10 sows = 4,000 @ 60¢/lb.	2,400
1 boar = 400 @ 25¢/lb.	100
Gross Income	<u>\$ 98,800</u>
 <u>DEPRECIATION</u>	
Buildings \$65,400 - 20 years	3,270
Equipment \$20,000 - 10 years	2,000
Total Depreciation	<u>\$ 5,270</u>
Total Cash and Depreciation Expenses	\$ 89,358
Total Income	98,800
Less Cash and Depreciation Expense	<u>89,358</u>
Net Income	\$ 9,442
Interest Paid	\$ 6,643
Return to capital only	16,085
Return per dollar invested %	15.8%



OWN OPERATOR RECEIVES

Salary	\$ 3,525
Return to management	4,940
Return to capital	<u>16,085</u>
TOTAL	\$ 24,550

This operation is based on 50 sows farrowing 1.75 times per year and weaning 7.5 pigs per litter.

I/ Land - No land cost was figured in, as it is assumed that the farmer would already own his land or have a long-term Government of Guam lease.

II/ Labor - the 30 hours per sow includes labor for the market weight hogs or lechon using mechanical feeding devices.

III/ Return to management is the amount that would normally be spent if management were hired. The usual rate paid for management is 5% of gross sales.

IV/ Repairs, maintenance, etc. 5% of original investment in buildings and equipment.

V/ Interest on investment - Building equipment and breeding herd total investment at 6.5%

LECHON OR TURNING PIG PRODUCTION  
50 SOW OPERATION

INVESTMENT

<u>I/</u> 1. Land	-0-
2. Buildings	
A. Farrowing barn and nursery	\$25,440
B. Sow holding	15,360
3. Feeders, waters and farrowing crates	11,500
4. Truck	3,500
5. Scales and misc. equipment	1,500
6. Breeding stock	
A. Sows 50 @ \$300	15,000
B. Boars 3 @ \$600	1,800
	\$74,100
Total Investment	\$74,100

CASH EXPENSES

1. Feed	
A. Starter 9,184 lbs. @ 14¢	\$ 1,286
B. Grower 62,976 @ 13¢	8,200
C. Swine, Boar Replacement 121,500 @ 13¢	15,795
<u>II/</u> 2. Labor	
30 hrs. per sow/year x \$2.35/hr.	3,525
<u>III/</u> 3. Return to management	2,660
4. Taxes and insurance	1,000
5. Utilities	1,800

6. Vet expenses, wormer, etc.	\$ 800
<u>IV/</u> 7. Repairs, maintenance, etc.	2,040
<u>V/</u> 8. Interest on investment	4,820
9. Replacement Boar	600
	<hr/>
Total Cash Expenses	\$42,526

INCOME

646 weanlings Ave. 60# @ \$75.00/head	\$48,450
10 sows = 4,000# @ 60¢/lb.	2,400
1 boar 400# @ 25¢/lb.	100
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Gross Income	\$50,950

DEPRECIATION

Buildings \$40,800 ÷ 20 yrs.	\$ 2,040
Equipment \$11,500 ÷ 7 yrs.	1,645
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Total Depreciation	\$ 3,685
Total Cash and Depreciation Expenses	\$ 46,211
Total Income	50,950
Less Cash and Depreciation Expenses	46,211
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Net Income	\$ 4,739

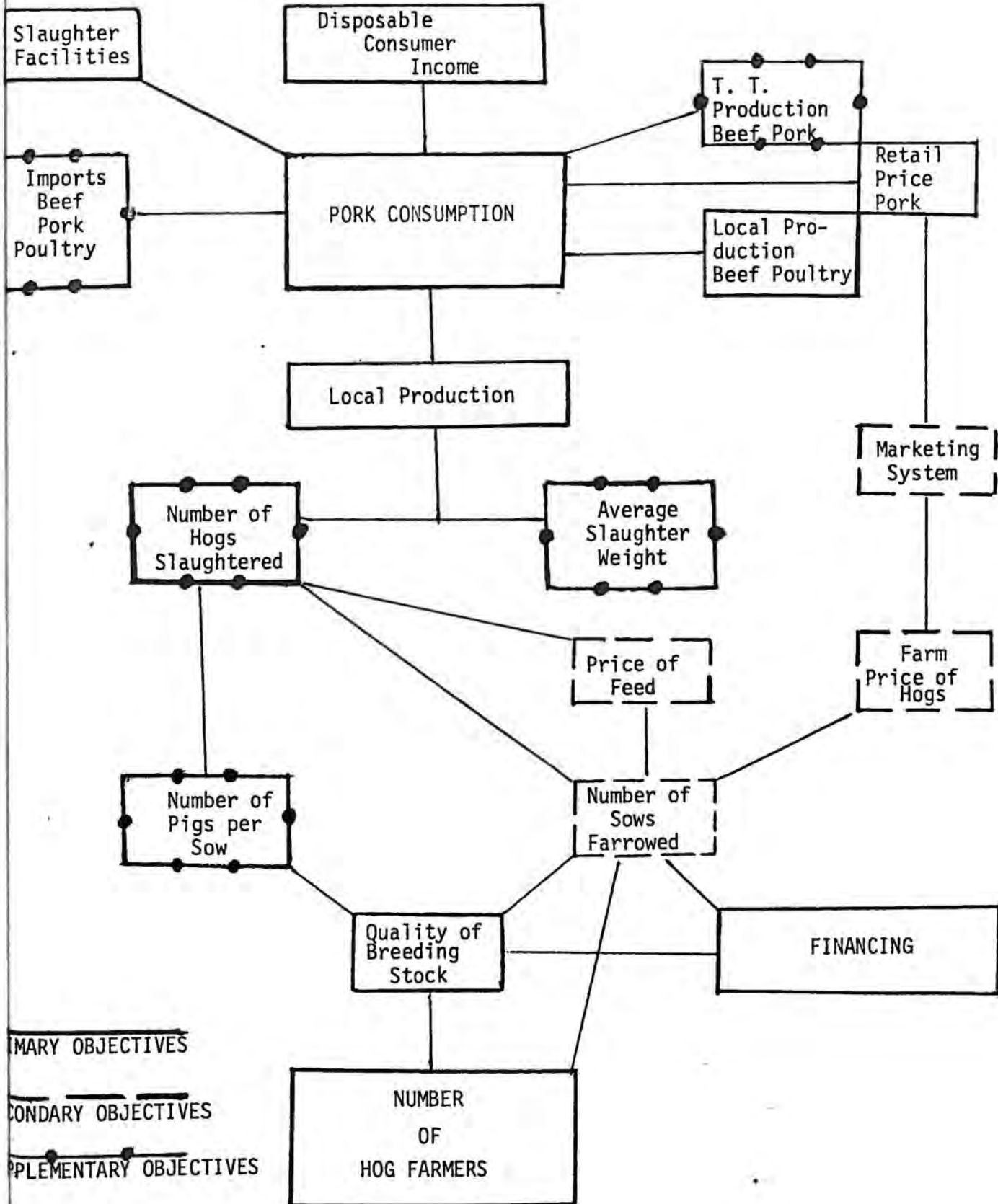
Interest paid	\$ 4,820
Return to capital	9,559
Return per dollar invested	12.9%



OWNER OPERATOR RECEIVES

Salary	\$ 3,525
Return to management	2,660
Return to capital	<u>9,559</u>
TOTAL	\$ 15,744

### FACTORS AFFECTING PORK PRODUCTION AND CONSUMPTION ON GUAM



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