AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

PROJECT CLASSIFICATION

A. PRIMARY: Food production and nutrition — AE10-0000-G750

B. SECONDARY: Agricultural economics--Thailand

TITLE AND SUBTITLE

Southeast Asian corn commodity systems; the Thailand corn commodity system

AUTHOR(S)

(100) Drilon, J. D. (101) SEARCA; Harvard Univ. Business School

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1976	216p.	ARC TH338.17351.S272

REFERENCE ORGANIZATION NAME AND ADDRESS

Harvard

SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

(SEARCA-Harvard Project 928-B)

ABSTRACT

CONTROL NUMBER

PN-AAG-659

11. PRICE OF DOCUMENT

DESCRIPTORS

Size
Agribusiness
Systema analysis
Production
Technological change
Marketing
Exports
Thailand

13. PROJECT NUMBER

931093600

14. CONTRACT NUMBER

AID/csd-3153 GTS

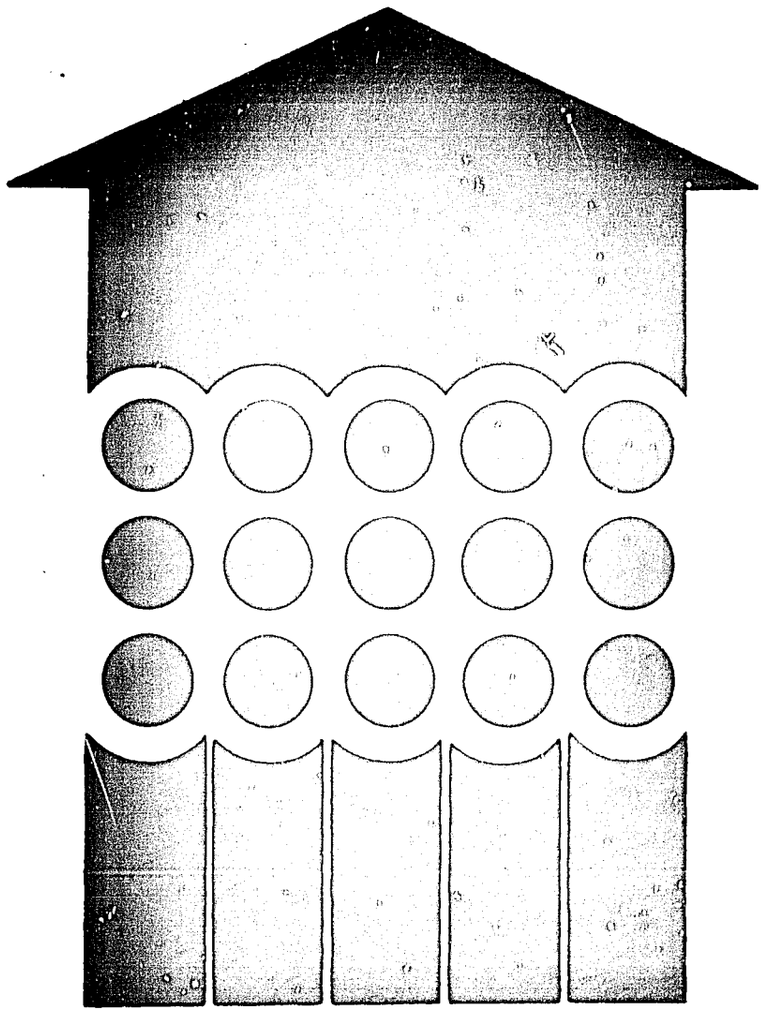
15. TYPE OF DOCUMENT

AID-1 (4-74)

TH
232.17351
S727

IN-AAG-659
①

HARVARD-SEARCA Project 928-B
SOUTHEAST ASIAN CORN COMMODITY SYSTEMS



THE THAILAND CORN COMMODITY SYSTEM

SEARCA-HARVARD PROJECT 928-B
Southeast Asian Corn Commodity Systems

Project Director:

J. D. Drilon Jr.

Deputy Director:

Gil F. Saguiguit, Sr.

Chief, Executive Staff:

Geronimo M. Collado

Philippines	Thailand	Indonesia
G. M. Collado (Coordinator)	Sopin Tongpan (Coordinator)	Rusli Hakim (Coordinator)
Manuel M. Arreola	Phaitoon Hathamart	Hidajat Nataatmadja
Luis C. Ranit	Somsak Priebprom	A. Soeharjo
Donato Antiporta	Winich Werayangkool	Sjarifudin Baharsjah
Gil C. Saguiguit, Jr.	Sutat Sriwatanapongse	
Domingo E. Cigaral		
Myrna S. Corpus		
Corazon M. Felismino		

Counterpart Agribusiness Team
(Project 928-B, Harvard Business School)

Ray A. Goldberg
Project Director

James E. Austin
Richard McGinity
Richard Gartrell
Leonard Wilson
David Cole
Ernette Au

TABLE OF CONTENTS

Chapter		Page
I.	A Socio-Economic Profile of Thailand	1 - 3
II.	The Corn Industry of Thailand	4 - 17
III.	Agricultural Inputs	18 - 29
IV.	Corn Production and Productivity	30 - 36
V.	Assembly, Storage and Transport Network	37 - 50
VI.	Processing for Feeds	51 - 76
VII.	Marketing and Export	77 - 113
VIII.	Corn Utilization and Nutritional Dimension	114 - 130b
IX.	Government Developmental Programs	131 - 145
X.	Agribusiness Education and Research	146 - 205
XI.	Bibliography	206 - 207

CHAPTER I. A SOCIO-ECONOMIC PROFILE OF THAILAND

Brief History

Thailand is a kingdom about the size of France, located in the heart of the tropical Southeast Asian mainland populated by some 39 million people. The people of Thailand are Mongoloid but heavily influenced by Hindu culture.

Thailand's public administration has been characterized by a highly centralized government. In the past, the country was ruled by monarchy which was ended by the revolution in June 1932 after which the present form of constitutional monarchy came to being. After 1932, several coup d'etat took place but the system of administration had virtually remained unchanged. Until 1932, Thailand was divided for administrative purposes into large regional areas known as monthons (circles) and administered by a lord-lieutenant or high commissioner appointed by the crown. The 1932 revolution abolished the monthons and made the changwat (province) the primary administrative division. There are now 71 changwats. The changwat is divided into amphurs (district) and each amphur is further divided into tambons (township). Each tambon is further divided into mubans (village).

The topography of Thailand is characterized by (1) folded mountains, which are in the southeastward continuation of the Himalayan System; (2) flat alluvial plains which are intersected by winding rivers and irrigation canals which are flooded during the

rainy season; (3) undulating country sides; and (4) sandy beaches, mangrove swamps, irregular coastlines, and numerous islands.

Climate and rainfall

In general, Thailand has a tropical monsoon climate, with clearly defined wet and dry seasons. There is little variation in temperature throughout the year. Broadly speaking, Thailand has a rainy season from May to October, a cool dry season from November to February and a hot dry season from March to May, except in the south where there is no pronounced dry season. Two types of climates are recognized: that of the tropical rain forest and that of the tropical savana.

Natural Resources

Agriculture dominates the major part of land utilization. About 26 million acres are planted to food crops, raw materials for a number of important industries, and export products which account for more than 80% of foreign exchange earnings. About 62% of cultivated land is planted to rice.

Water resources, mainly rivers, are increasingly brought into use by dam constructions for the purpose of irrigation and hydro-electricity.

The Thai Economy

The Thai economy is dominated by agriculture. However, the agricultural share of the value of GDP is decreasing. Among the various crops, rice, rubber, kenaf, maize, cassava, sugarcane, cotton and groundnut were major income contributors from which GDP originated. Other major economic sectors contributing to the growth of GDP were wholesale and retail trade, manufacturing services, transportation and communication, construction, public administration and defense, ownership of dwelling, banking, insurance and real estate, mining and electricity and water supply. Among these, manufacturing, electricity and water supply registered the highest rate of growth in 1963 to 1967.

Table 1

Agriculture's Contribution to GDP in Percentage, Thailand, 1960-73

Year	Agriculture (Millions of Baht)	GDP (Millions of Baht)	$\frac{\text{Agr.}}{\text{GDP}} \times 100\%$
1960	21,463.3	53,984.0	39.75%
1961	23,111.4	58,970.0	39.19%
1962	23,688.7	63,793.0	37.13%
1963	24,564.3	68,078.6	36.08%
1964	25,007.9	74,667.3	33.49%
1965	29,382.9	84,303.0	34.85%
1966	37,005.9	101,374.7	36.50%
1967	35,143.1	108,224.3	32.47%
1968	36,962.1	117,306.7	31.50%
1969	41,675.1	130,612.7	31.90%
1970	38,786.0	135,939.0	28.53%
1971	41,457.0	145,340.0	28.52%
1972	48,551.0	160,162.0	30.31%
1973	57,410.0	187,681.0	30.58%

Source: Office of the National Economic Development Board, Bangkok, Thailand, National Income of Thailand, (various editions).

CHAPTER II. THE CORN INDUSTRY OF THAILAND

Background

Corn is an important source of foreign exchange earnings to Thailand. Corn as a food crop was already popular in the 17th century. However, corn consumption by most people, is mainly as a snack in the form of "roasted ears" while traveling. Very small unfertilized cobs, called "baby corn" is also an ingredient in a few dishes.

Commercial varieties of corn grown in Thailand at present were originally brought into Thailand in 1920 by Prince Sithiporn Kridakara, who was at that time the Director General of the Department of Agriculture.

Research on corn was started in 1951 by the Department of Agriculture in cooperation with the United States Operation Mission to Thailand (USOM/Thailand). In that year, "Tequisate Golden Yellow" was brought to Thailand and later became known as "Guatemalan Variety." This is partly because when the crop was introduced, the farmers were taught modern cultural operations.

Four fundamental aspects of the corn industry in Thailand affect the organization of the industry and how it operates. These are as follows.

1. Farmers basically sell their produce keeping only a portion of their production to use as seed in the following season.
2. Corn farmers cultivate larger farm areas than the average farmer in Thailand. Corn farmers also have relatively larger production quantities to sell.
3. Corn is a relatively new crop in Thailand. With regard to production, it means that farmers are not culturally or socially bound to specific practices because they are "traditional." With regard to marketing, it means that there is no traditional marketing system for corn. HOwever, as will be discussed later, corn was quickly picked up as a trade commodity by the rice marketing institutions. Since these were geared to operate competitively in an export situation, the system could hardly be called "traditional."
4. Ninety percent of the corn is exported. Since the Bangkok port is basically the only large scale export facility in Thailand, most of the corn has to go to Bangkok.

Climatic and Soil Characteristics

The climate in the corn belt of Thailand is classified as "medium rainfall monsoon," Appendix Figure A. Rain normally falls at least

13 days a month starting from May to October which spans the rainy season. The temperature of the region varies between a daily average of 23°-26°C in March and April, 16°-20°C in cooler months and 36°-38°C in hotter months. There is less variation in temperature than rainfall from year to year. The meteorological data is given in Appendix Figure B.1 - B.5.

The soils of the corn region are complex and locally variable, although they are fertile. Most of the soils consist of clays and loams which are moderately drained to well drained having a high limestone content well suited for the production of corn.

Almost all farmers use Guatemalan yellow flint (PBS) variety released by the Ministry of Agriculture in the late 1950s and early 1960s. This corn variety has been improved continuously and its yield level is considerably high.

Few corn varieties ,namely ,Thai DMR#6 and Thai Composite #1 from the National Corn Program have been released but the areas planted to these varieties are still small. These varieties have higher yield and better downy mildew resistance than Guatemala PB5.

Virtually all the land is tractor plowed at least once before planting. Very few farmers use hand hoes or animal plows for plowing and seeding. Few farmers use tractor for planting. Row planting is not commonly practiced.

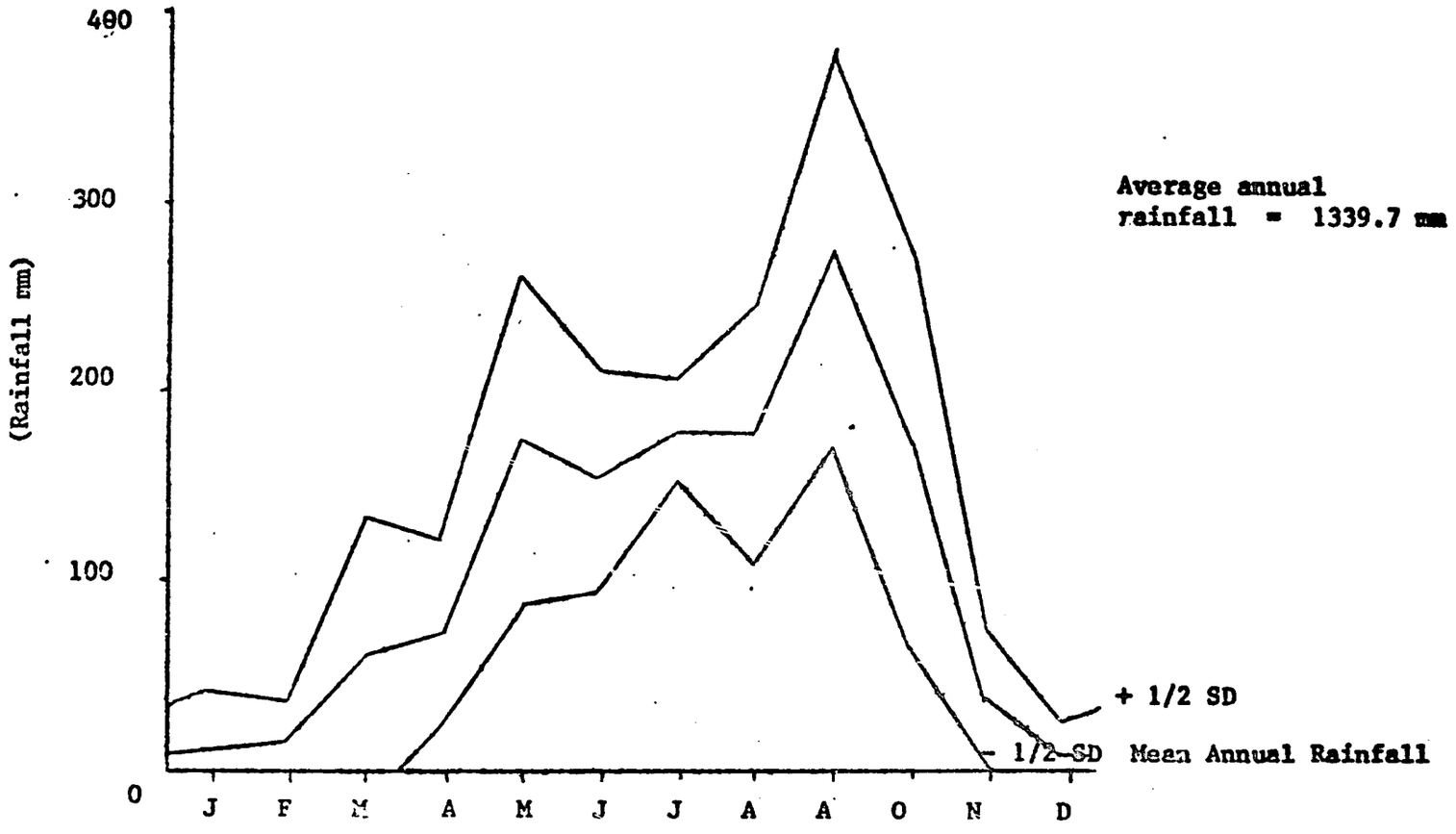
After germination, thinning is not commonly practiced. There is negligible amount of fertilizer, herbicide and insecticide application among farmers. In case of severe insect damage, especially the Patanga locust (Patanga succineta Linn), the government has to take action in spraying.

It is difficult to use machines for harvest since corn is not normally planted in rows. The farmers use the hand-picking method even though it is not effective. The ears are picked and de-husked and then collected in the bag for threshing.

Corn is normally threshed by the corn buyers. They can request for a machine thresher attached to a tractor or truck to be sent to the farm. The corn is purchased right after threshing. It is the buyer's job to deliver the corn seed to their drying floor or storage. The corn seeds are normally kept in air tight containers without any fungicide and insecticide seed treatment.

Appendix Figure A

The Seasonal Distribution of Rainfall and the Annual Variation in Lopburi, 1951-1971



Source: Meteorological Department

Appendix Table 1

Rainfall in the Central Highlands, Thailand, 1966-1970

Month	1966		1967		1968		1969		1970		Mean Average		Rainfall Intensity
	No. of days	Millimetres	No. of days	Millimetres	No. of days	Millimetres	No. of days	Millimetres	No. of days	Millimetres	No. of days	Millimetres	Amount of rainfall/ rainy day
January	5	165.0	6	3.8	1	T	1	1.1	1	0.7	2.8	34.1	12.2
February	4	13.6	1	T	5	178.0	0	0	3	0.3	2.6	38.4	14.8
March	1	7.3	1	T	6	49.1	2	66.3	6	66.4	3.2	37.8	11.8
April	5	23.9	10	163.8	10	102.6	7	32.2	9	88.7	8.2	82.2	10.0
May	19	354.6	16	175.9	15	171.2	14	135.6	16	157.9	16.0	199.0	12.4
June	12	136.2	14	74.6	18	196.0	19	176.0	20	208.5	16.6	158.3	9.5
July	16	97.6	21	274.3	21	110.7	20	152.4	17	131.5	19.0	153.3	8.1
August	21	268.9	23	117.8	20	81.5	17	92.1	26	170.6	21.4	146.2	6.8
September	19	227.4	25	225.9	24	140.5	20	252.6	21	206.8	21.8	210.6	9.7
October	14	361.2	9	85.5	17	125.5	14	218.2	18	232.2	14.4	204.5	14.2
November	3	24.0	4	47.4	2	1.4	3	23.9	4	6.1	3.2	20.6	6.4
December	3	37.9	0	0	0	0	0	0	4	9.3	1.8	9.4	5.2
Annual total (mm)	124	1,717.6	130	1,169.0	139	1,156.5	117	1,150.4	145	1,279.0	131	1,294.4	9.9
Annual total (inches)		68"		46"		46"		45"		50"		51"	0.4"

Source: Meteorological Station, Cotton Development Centre, Takfar.

Appendix Table 2

Maximum and Minimum Monthly Temperature in the Central Highlands, Thailand, 1967-1970

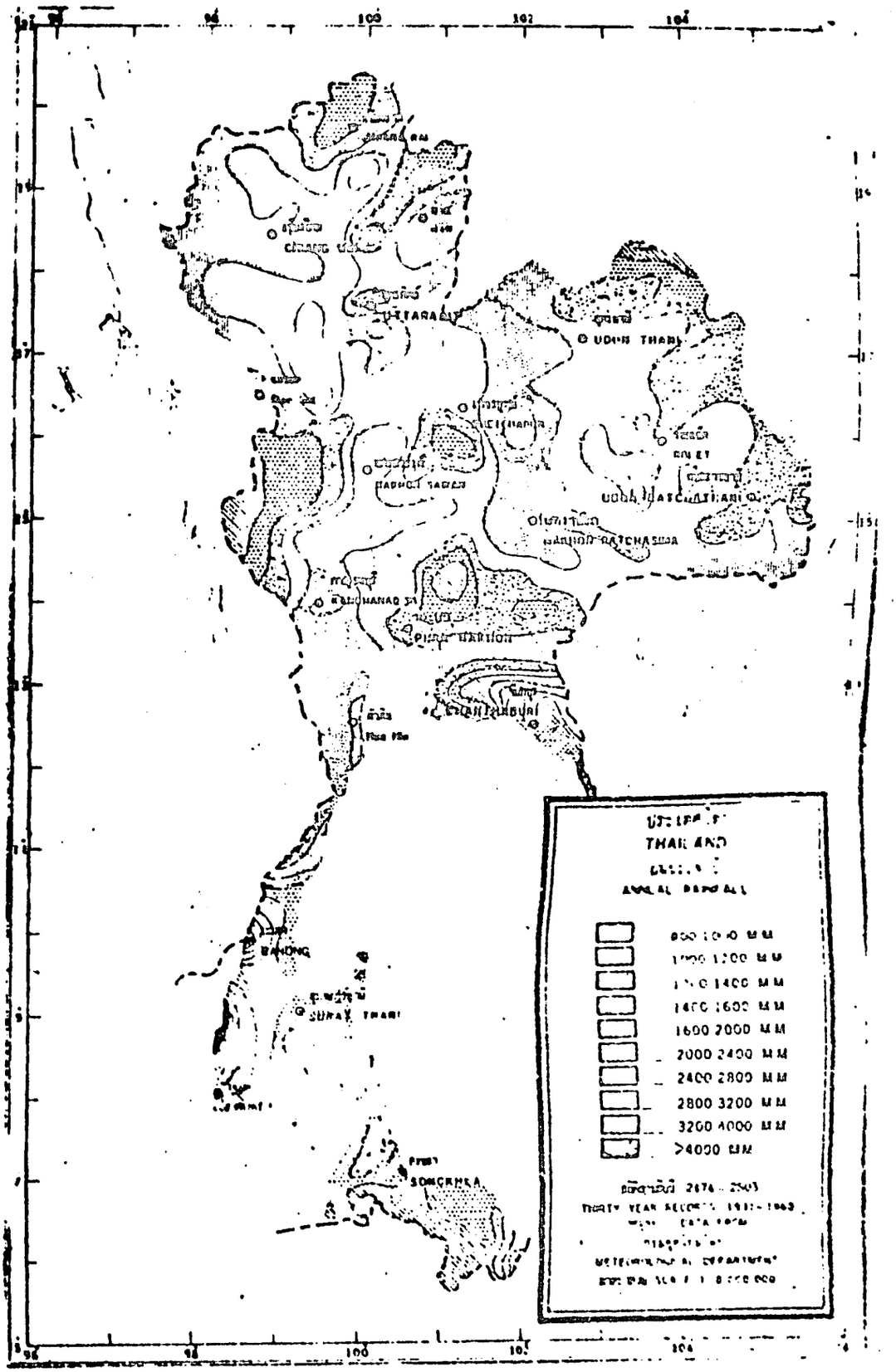
Month	Temperature °C (1967)				Temperature °C (1968)			
	Mean Maximum	Mean Minimum	Monthly Mean	Duration of Sunshine (Hrs)	Mean Maximum	Mean Minimum	Monthly Mean	Duration of Sunshine (Hrs)
January	29.7	21.7	25.7	6.8	29.6	15.9	22.8	9.7
February	32.6	20.6	26.6	8.2	34.3	21.0	27.7	9.6
March	33.5	21.7	27.6	8.5	33.3	22.0	27.7	8.7
April	37.7	25.3	31.5	9.5	35.4	23.7	29.6	8.3
May	32.6	23.8	28.0	6.3	31.7	23.3	27.5	5.5
June	32.9	23.9	28.4	4.8	32.2	23.2	27.7	6.8
July	34.2	24.0	29.1	8.0	32.1	23.4	27.8	5.4
August	32.8	23.8	28.3	4.7	32.3	23.4	27.9	4.9
September	32.0	24.4	27.7	4.8	32.6	23.6	28.1	6.3
October	30.4	23.3	27.3	5.0	31.9	23.0	27.5	7.1
November	32.3	21.3	26.8	8.6	33.3	21.2	27.3	9.5
December	29.9	20.0	25.0	9.0	33.8	19.2	26.6	9.4

Appendix Table 2 (continued)

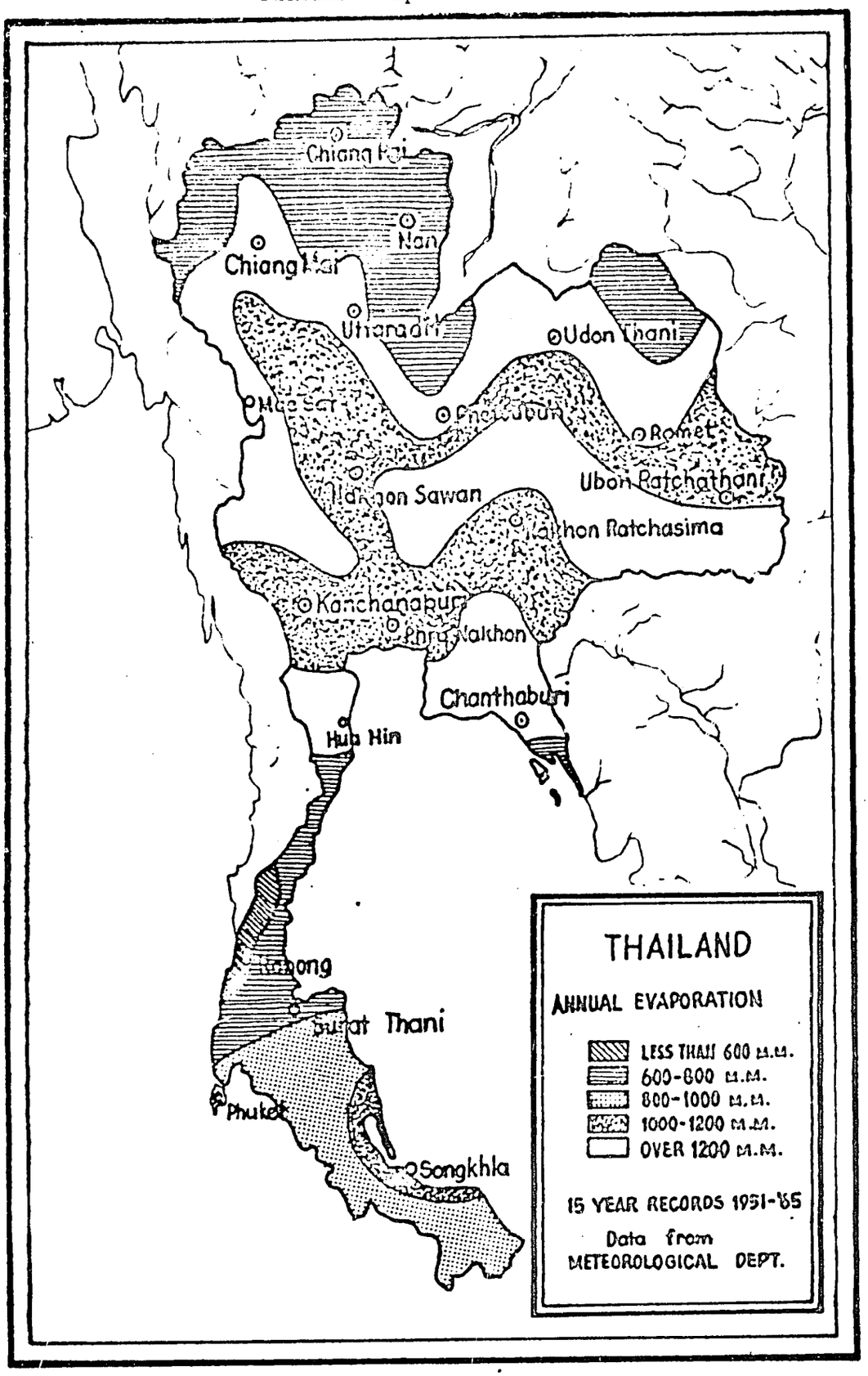
Month	Temperature °C (1969)				Temperature °C (1970)			
	Mean Maximum	Mean Minimum	Monthly Mean	Duration of Sunshine (Hrs)	Mean Maximum	Mean Minimum	Monthly Mean	Duration of Sunshine (Hrs)
January	32.5	19.3	25.8	7.1	31.4	19.1	25.3	7.5
February	31.8	19.1	25.4	9.0	33.1	19.7	26.4	7.7
March	36.4	24.5	30.4	9.0	36.5	24.7	30.6	9.3
April	35.6	23.5	29.1	8.1	34.3	24.2	29.3	7.2
May	35.7	24.2	30.0	7.5	35.5	25.2	30.4	8.4
June	33.5	24.6	28.1	N/A	33.2	24.4	28.9	6.9
July	31.2	23.7	27.5	4.0	31.9	23.8	29.9	6.7
August	32.4	23.6	28.0	4.9	30.9	23.7	27.5	3.6
September	31.3	23.5	27.4	6.3	31.5	24.0	27.8	4.2
October	30.8	23.3	27.1	4.9	31.5	22.9	27.2	7.4
November	29.5	21.8	25.7	6.2	29.4	19.2	24.3	8.7
December	28.5	15.9	23.3	9.8	29.3	22.4	25.9	2.5

Source: Meteorological Station, Takfar
Meteorological Office,
Office of the Prime Minister

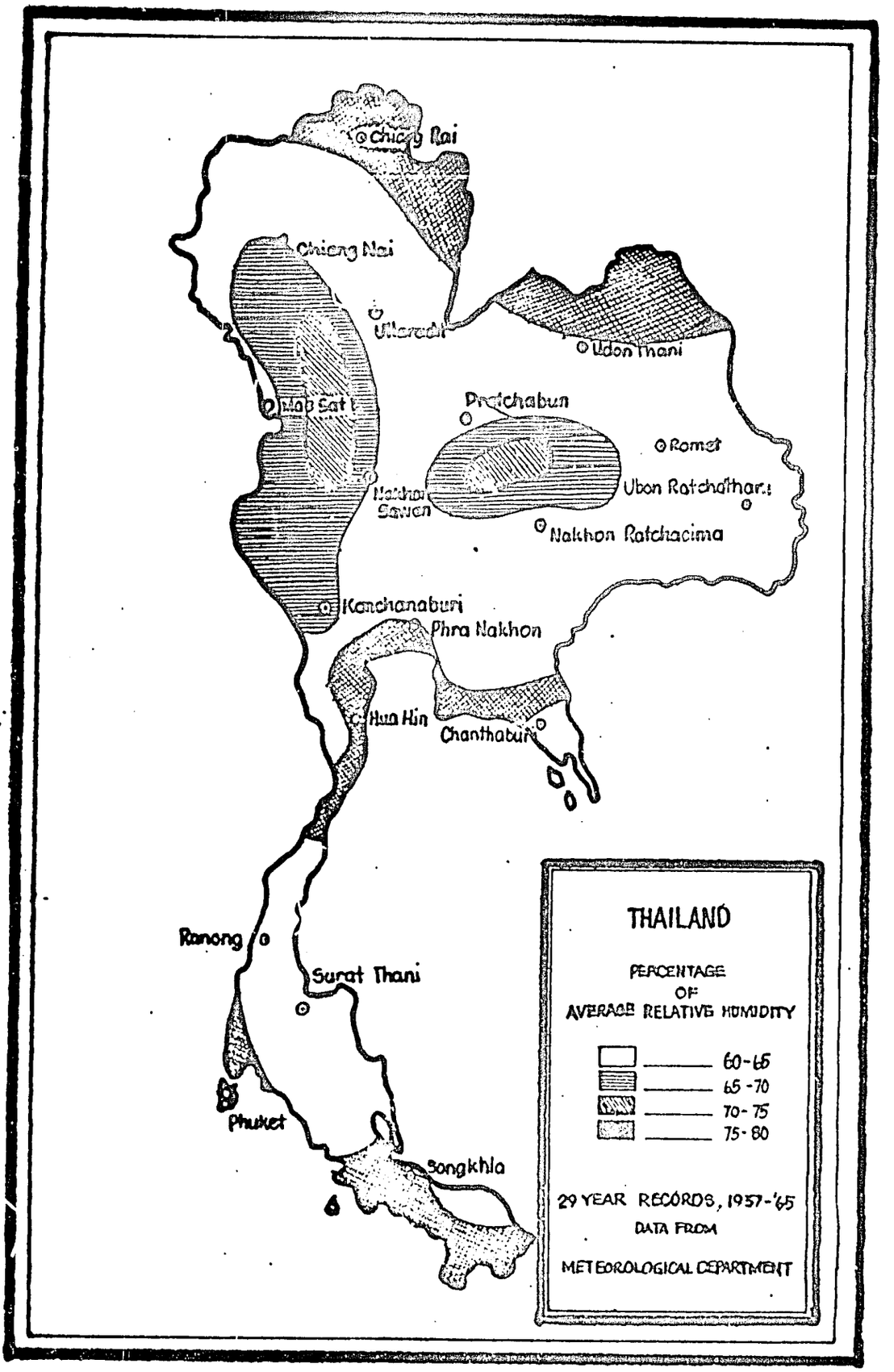
Appendix Figure B.1
Annual Rainfall Chart



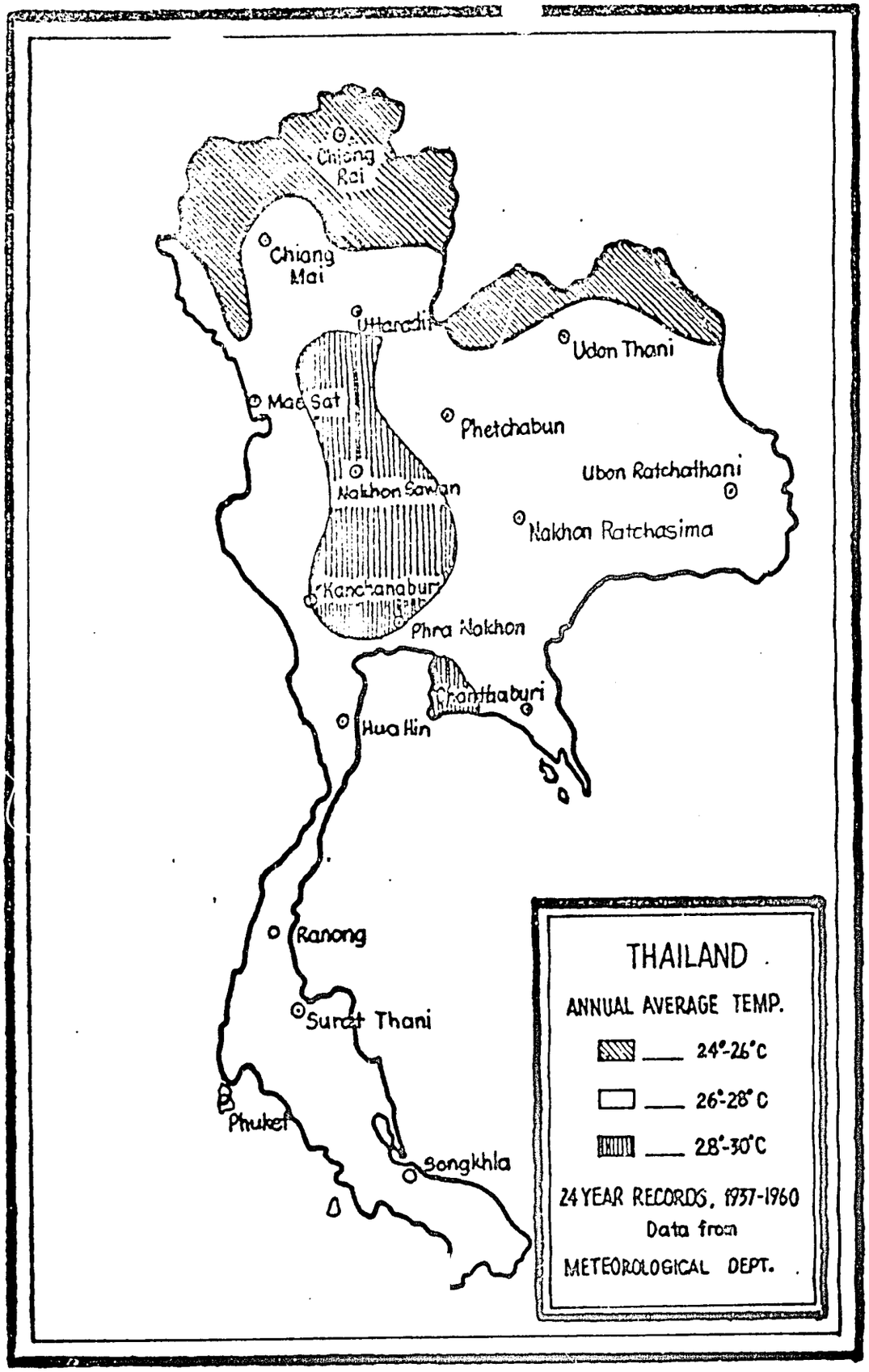
Appendix Figure B.2
Annual Evaporation Chart



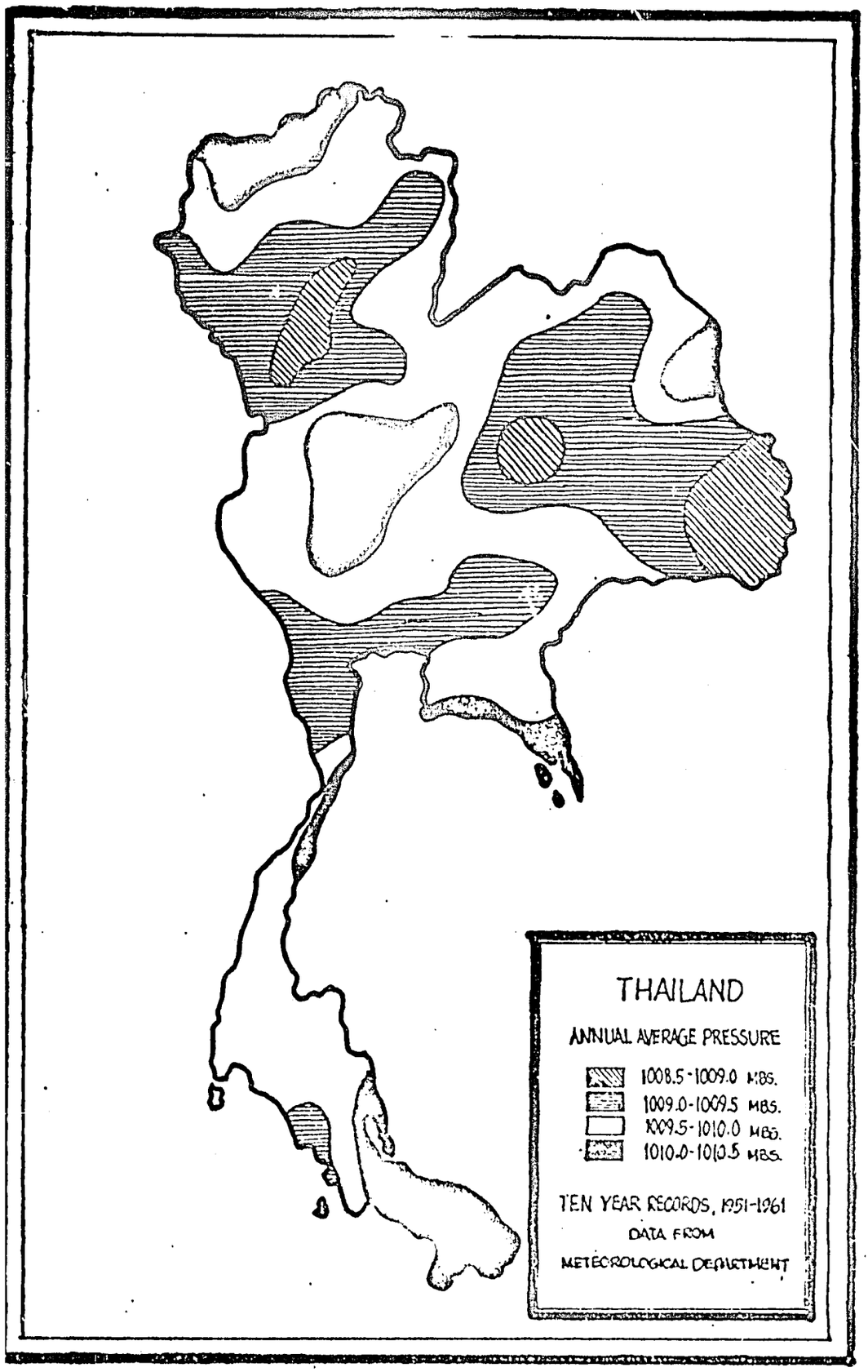
Appendix Figure B. 3
Average Relative Humidity Chart



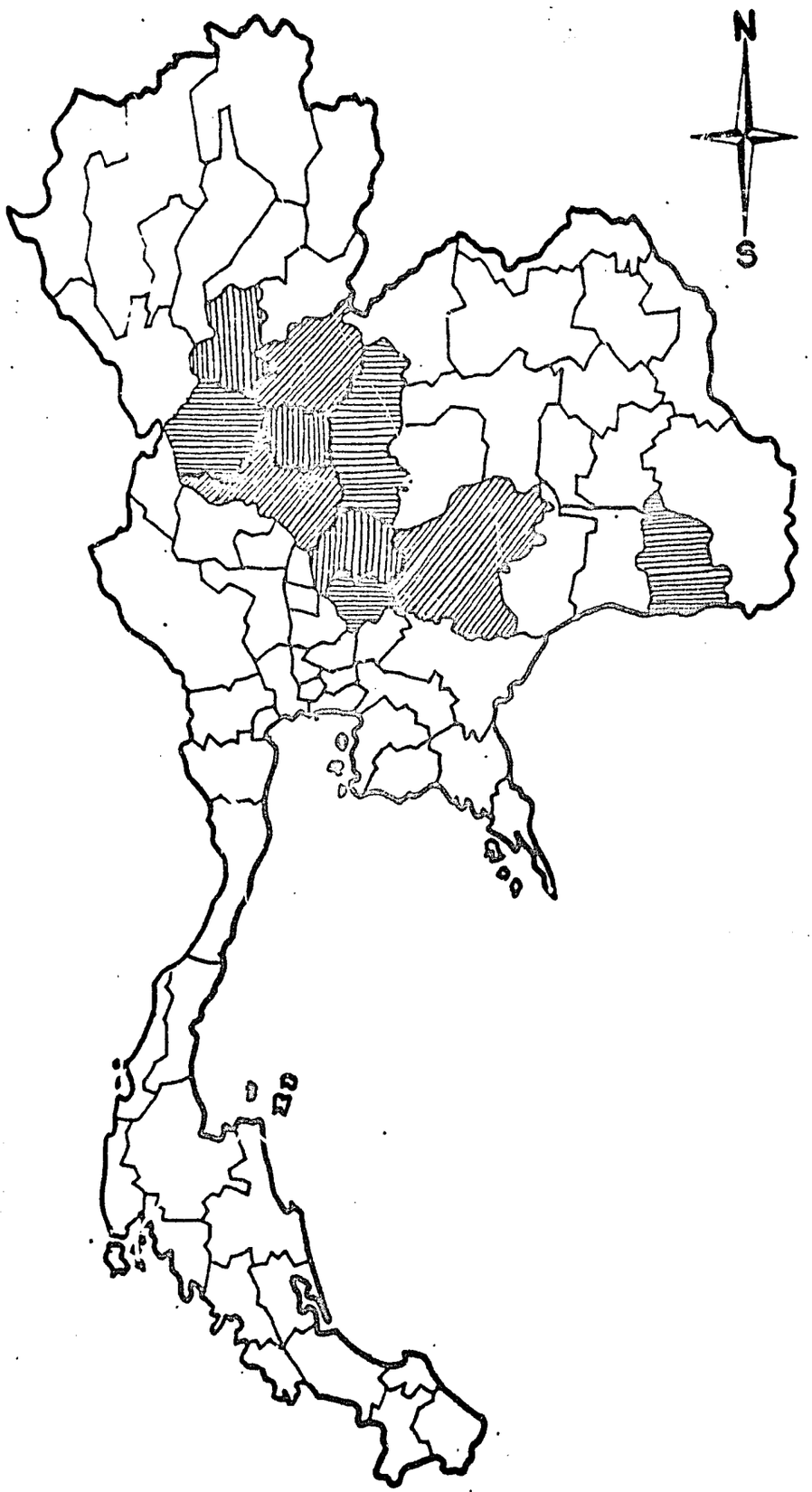
Appendix Figure B.4
Annual Average Temperature Chart



Appendix Figure B.5
Annual Average Pressure Chart



THE CORN-BELT AREA OF THAILAND



CHAPTER III. AGRICULTURAL INPUTS

A. Agricultural Machinery and Equipment

The purchase and use of tractors in Thailand during the past years has been increasing at a significant rate. From a total number of 234 tractors in 1957, there are now more than 35,000 units, Table 2.

The rapid expansion of tractor use resulted in the establishment of many small manufacturing workshops which sell spare parts of tractors, tractor attachments, special wheel equipment for tractors, simple two-wheel tractors, simple four-wheel tractors and power driven puddling machines.

Most of these workshops developed from a mechanic or automotive repair enterprise and do not have design facilities. The basic design of some machines had been obtained by copying the imported machine, changing bit parts in order to satisfy the customers, fitting the modified model to local conditions in Thailand and at the same time meeting the low purchasing power of Thai farmers. However, the manufactured implements, namely, the low-lift irrigation pumps (Debriddhi pumps), two-wheel tractors and some other implements, were built following the designs which, in turn, were developed by the Department of Agriculture, Tables 3 and 4.

At present, there are approximately 100 small scale manufacturing workshops, mostly in the Central Plain Region. In addition, there are 12 medium size workshops which produce 150 walking tractors a year.

Table 2

Thailand Import of Tractors During the Year 1963-1972

Year	Units	Baht
1963	2,247	194,227,197
1964	3,864	283,660,136
1965	5,200	322,419,302
1966	4,577	408,317,430
1967	5,698	567,607,388
1968	5,104	477,713,352
1969	3,631	326,738,986
1970	2,305	314,075,716
1971	2,662	359,272,414
1972	1,809	289,074,652

Note: Approximately Baht 20.0 = $1

Source: Thailand Custom Department

Table 3

U.S. Exports of Small Engines to Thailand

	1966		1967		1968		1969 (Jan.-August)	
	Units	$	Units	$	Units	$	Units	$
Gasoline engines, n.e.c., 6 brake hp and under	20,833	762,642	17,848	697,664	33,948	1,181,070	11,850	372,204
Gasoline engines, n.e.c., over 6, not over 10b hp	12,293	739,348	30,445	1,270,939	25,088	1,174,025	9,811	553,722
Gasoline engines, n.e.c., over 10, not over 50b hp	222	36,739	429	62,532	135	21,923	135	22,422
Total -	33,348	1,538,739	48,732	2,031,135	59,171	2,377,018	21,796	948,348

Note: Approximately Baht 20.00 = $1.00

Source: U.S. Department of Commerce - FT 410 Reports

Table 3 (continued)

Japan Export Internal Combustion Engines, other than Aircraft to Thailand

	1966		1967		1968	
	Units	(1000)¥	Units	(1000)¥	Units	(1000)¥
Internal combustion gasoline engines for land, with a rating not more than 30 hp	14,272	233,549	15,572	290,866	17,631	318,627
Internal combustion diesel engines for land, with a rating not more than 30 hp	17,040	747,406	25,237	1,064,604	38,138	1,670,642
Internal combustion engines for land, with a rating not more than 30 hp n.e.c.	1,952	45,825	242	5,035	320	9,687
Total -	33,264	1,026,780	41,051	1,360,505	56,085	1,998,956

Note: Baht 0.06 = ¥1

Source: Japan Export Statistics, Ministry of Finance, Japan

Table 4

Thailand Imports of Small Internal Combustion Engines, Diesel & Semi-diesel Engines

	Year	U.S.A. Units	U.S.A. (1000)	Japan Units	Japan (1000)	U.K. Units	U.K. (1000)	W. Germany Units	W. Germany (1000)	Austria Units	Austria (1000)	Others Units	Others (1000)
Internal combustion, piston engines, n.e.s.	1966	25,372	28,614	11,468	11,363	511	8,741	1,447	2,638	5,565	8,584	564	1,555
	1967	38,093	38,627	17,096	21,274	359	5,213	1,525	3,551	384	1,673	540	2,931
	1968	38,466	34,548	26,225	26,453	996	5,913	2,122	3,898	8,768	17,108	2,698	4,687
	1969 (January-June)	19,767	15,702	11,339	12,378	555	4,522	1,312	2,296	1,550	2,967	1,300	2,231
Diesel and semi-diesel engines	1966	1,934	20,434	21,563	79,836	3,446	34,844	1,437	21,273	255	3,418	1,332	9,721
	1967	587	6,621	28,385	92,356	11,996	39,965	608	10,632	77	1,888	6,236	15,707
	1968	405	10,935	37,640	105,477	3,751	38,878	825	17,360	460	1,744	1,748	9,343
	1969 (January-June)	428	2,210	17,722	49,643	4,037	23,303	756	12,936	57	811	1,965	10,132
Parts of internal combustion piston engines, n.e.s.	1966	288	23,181	943	43,044	308	17,089	188	16,583	8	671	208	12,598
	1967	365	29,964	1,052	54,818	362	20,970	258	24,817	6	572	289	19,808
	1968	756	34,008	2,240	89,406	351	22,721	382	29,024	9	3,499	371	20,829
	1969 (January-June)	116	13,166	940	51,005	152	10,909	188	16,808	3	287	223	10,739
Parts of diesel and semi-diesel engines, n.e.s.	1966	35	4,944	58	3,490	36	3,205	29	3,750	0.1	1.6	14	602
	1967	37	4,669	204	8,595	57	4,422	47	4,448	0.2	11	20	1,052
	1968	43	4,978	46	2,794	42	3,446	29	3,325	-	-	26	1,610
	1969 (January-June)	15	1,467	32	1,942	21	1,138	9	1,494	-	-	5	380
		(Metric Ton)											

Note: Total figure in terms of units and price are not included in this table as in the original table.
1969 figures (January-June) are obtained from Port of Bangkok only, provincial ports are not included.

Source: Thailand Custom Department

B. Agricultural Machineries

Mechanization of agriculture in Thailand has been directed primarily to improve and modernize rice farming. The development of farm mechanization in Thailand has been brought about by the presence of upland areas that have to be cleared, new technology and increase in irrigated areas.

Custom farm services are the primary users of tractors which provide an alternative labor force to majority of the farmers especially when there is shortage of farm labor and draft animals during peak farming season. Farmers prefer to hire tractor service because the tractor is faster and provides better quality of tillage, Table 5.

Tractors are widely used for land preparation in the production of corn, sorghum, cotton, sugarcane, soybean and broadcasting rice field. About 86% of the tractor's working time is spent in tilling operation.

The growth of farm of farm mechanization is limited by the small size of land holdings, shortage of available capital, low prices of agricultural products and lack of qualified people.

C. Agricultural Credit and Financial Support for the Corn Industry

The gradual change of Thailand's rural economy from self-sufficiency to a commercial system has significantly affected the

Table 5

Custom from Service Charges by Region in Thailand

Regions	Types of Services (Baht/Rai) Plowing Service Charges 3-4 Disc	7 Disc	Rotovator	Shelling (Corn) (Baht/Tang)	Threshing (Paddy) (Baht/Tang)
1	N.A.	15-20	N.A.	-	-
2	25-30	13-20	N.A.	N.A.	0.20-0.25
3	20-25	15-20	N.A.	N.A.	0.15
4	30-35	20-25	N.A.	N.A.	N.A.
5.	25-35	15-25	40-60	15	0.30
6	30-35	15-20	N.A.	50	0.25
7	20-35	15-25	N.A.	N.A.	N.A.
8	25-40	20-25	N.A.	N.A.	N.A.
9	20-30	15-20	N.A.	N.A.	N.A.
10	30-35	20-30	30-40	-	-
Average	25-33	16-23	30-60	15-50	0.25

Note: 1 Tang = 20 Litres

1 Rai = 0.4 Acre

Source: Thailand Farm Mechanization

credit needs of the farmers. Since economic conditions have forced them to grow more crops for commercial purposes, they must invest a higher capital in their farms. Consequently, there is a need to provide credit for these farmers.

Different sources of loans are available to Thai farmers which may be classified into two distinct categories, institutional and non-institutional. Institutional sources include agricultural cooperative societies, various government agencies, and commercial banks; non-institutional sources include local stores, merchants, landlords, private money-lenders, relatives and neighbors. Table 6 shows the supply of credit by source and region of Thailand as of 1965. In the Central Plain, commercial lenders are the chief sources of credit. In other regions, relatives are the predominant lenders. Farmers turn to relatives and friends who charge more than the credit institutions but less than commercial lenders. When opportunities to obtain funds from other sources are exhausted, farmers seek loans from local stores, merchants and landlords.

The total amount of funds supplied by all of these sources has not been adequate for the needs of farmers. Improvement of credit facilities through the reorganization of credit cooperatives and the establishment of the Bank for Agriculture and Agricultural Cooperative can only partially solve this problem.

The launching of Thailand's scientific agriculture program requires the use of large quantities of input purchased from the non-agricultural sector. A shortage of rural credit can constrain farmers from using recommended inputs. This concern has prompted credit programs, agricultural banks, cooperative societies, and other related institutions to provide short-term loans for purchasing farm requisites.

Originally, the aim of the Thai government in providing credit to farmers through various credit cooperative societies was to relieve poor farmers from the burden of their debts. However, the government has recently reoriented its agricultural credit program toward achieving another goal - that of the expansion of agricultural output as a whole. This is the most likely goal in a majority of developing countries in an attempt to make credit available more amply to farmers.

The most fundamental problem of the agricultural credit system in Thailand has been the exorbitant rate of interest as shown in Table 6. Farmers are obliged to deliver their crops to these middlemen who charge exorbitant rates of interest ranging from 50 to 75%, or 30 to 45 kilograms of corn per 100 bahts of loan. Local price of corn was about 1.66 baht per kilogram in 1973.

The middlemen usually own and manage business enterprises in various crop producing areas. Most farmers depend on the middlemen for all of their needs. Many farmers have no money left after delivering their products to the middlemen in repayment for their loans after each

Table 6

Monthly Interest Rates by Region and Type of Lender, Thailand, 1965

Type of Lender	Central Plain	North	Northeast	South	Mean for all areas
Relative	1.7	2.6	1.8	1.1	1.8
Neighbor	2.4	3.3	3.3	2.3	2.6
Commercial Lender	2.3	4.8	4.3	2.0	2.9
Local store	2.7	5.4	6.2	2.7	3.5
Crop buyer	2.4	4.7	3.9	1.3	2.9
Landlord	3.8	-	1.8	-	3.5
Money lender	2.1	5.0	7.3	3.6	3.3
Others	1.6	3.4	7.0	2.2	2.5
Institutional Lender	0.8	0.8	0.8	0.8	0.8
Credit Cooperative	0.8	0.8	0.8	0.8	0.8
Other Government Agencies	0.8	0.8	0.8	0.8	0.8
Commercial Bank	-	-	-	-	-
Weighted Average Rate	2.2	3.3	2.7	1.5	2.4

Source: Thisyamondol, P., Arromdee, V., and Long, M. F., Agricultural Credit in Thailand, Theory, Data and Policy, Bulletin of Kasetsart University, Bangkok, Thailand, 1965.

harvest time. Due to an inadequate amount of loan granted by local agricultural cooperatives and banks, together with a rather complicated procedure in processing loans from these official sources, the services of local middlemen are still important to farmers.

Much has to be done to make credit more available to farmers in Thailand. The root of the problem at present is the inadequacy of statistical information on agricultural credit and the amount of funds needed in agriculture. Efforts should be exerted to accurately determine the total need for agricultural investment.

D. Financial Support for the Industry

The shortage of financial credit for the agricultural sector of Thailand has retarded the ability of farmers to expand their farming business operations. So far as the corn industry is concerned, there has been no active credit policy designed to finance the growth of this industry in any special way.

As of December 31, 1970, the total agricultural credit extended to Thai farmers from institutional sources amounted to 1,357 million bahts. Of this amount, about 1,209 million bahts was supplied by the Bank for Agriculture and Agricultural Cooperatives, 123 million bahts by the Bangkok Bank, and 25 million bahts by other commercial banks. This amount could meet only 10 to 15% of the farmers' total credit needs.[1/]

1/ The National Economic Development Board, The Third National Economic and Social Development Plan, 1972-1976, Government of Thailand, p. 262.

Most of the credit available in commercial banks and other private unorganized credit sources consist of production loans. These must be repaid after the harvesting season or at the end of the year. A long-term loan for land improvement programs or investment in agricultural equipment is scarcely available to farmers. However, the government is interested in the establishment of a financial institution which will finance farmers' long-term investment with a low rate of interest.

To a large extent, the lack of sufficient production credit limits the ability and opportunity of farmers to use fertilizers, insecticides and herbicides.

CHAPTER IV. CORN PRODUCTION AND PRODUCTIVITY

A. Production

A.1 Trends in Production

Prior to 1947, corn output was less than 10,000 metric tons per year, but it increased remarkably afterwards. Corn production rose to 25,700 metric tons in 1949 and reached 186,300 metric tons in 1958. Corn export boomed in 1958 due to a considerable increase in Japanese importation of corn from Thailand. Corn production responsively rose to 317,200 metric tons in 1959, thus marking the year as one of tremendous change in the corn history of Thailand. Production sharply increased and continued to rise until it reached the record of 2,300 metric tons in 1971, a ninety-fold increase in corn output during the 25-year period as shown in Table 7.

During the past 20 years, 1952-1972, the area planted to corn rose tremendously from 44,960 hectares in 1952 to 96,960 hectares in 1957, and sharply rose to 199,840 hectares in 1959 in response to an export boom in 1958. A boom in both production and hectarage consequently began in 1959. Corn hectarage reached the peak of 1,018,832 hectares in 1971, as shown in Table 8.

Table 7

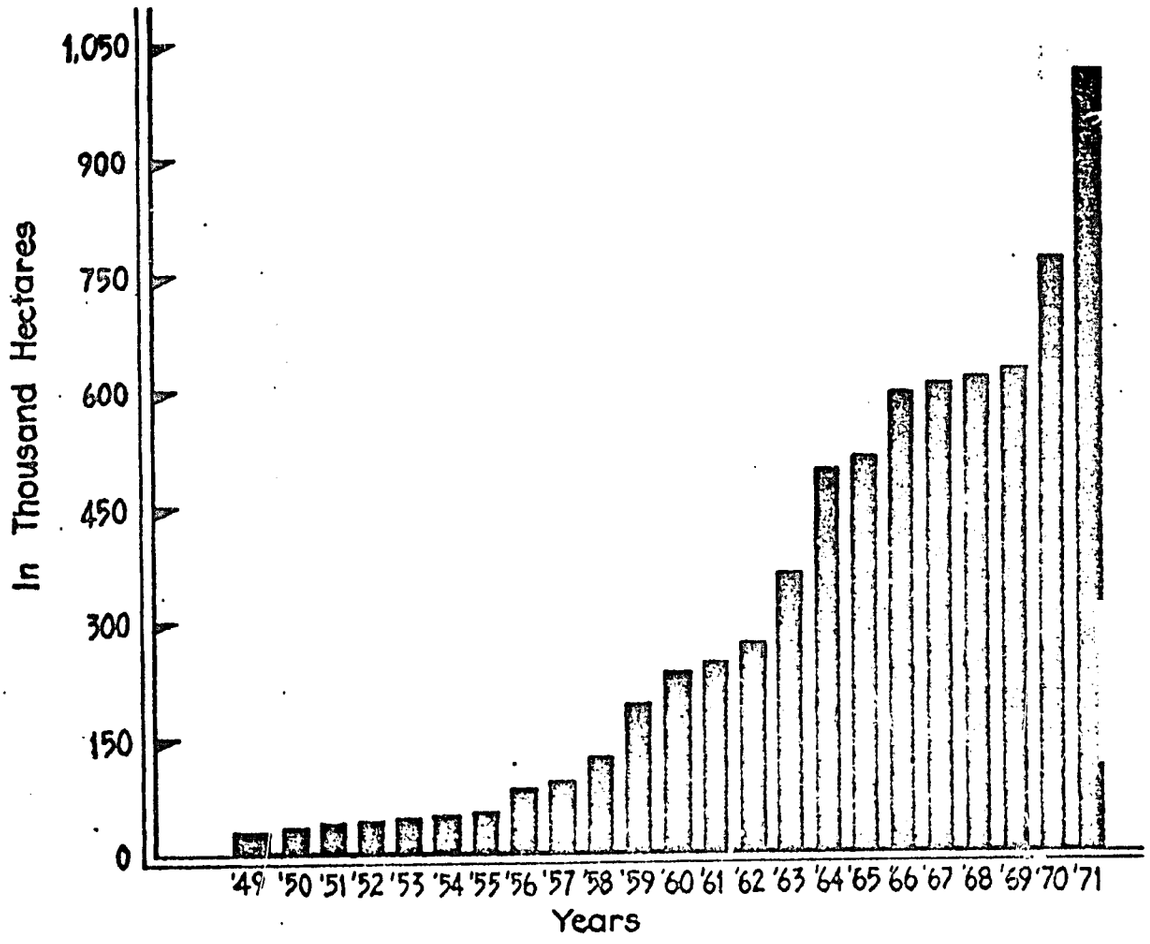
Corn Production in Thailand, 1949-1972

Year	Area Planted (hectares)	Production (metric tons)	Yield Per Hectare* (kilograms)
1949	34,880	25,700	736.8
1950	36,160	26,900	743.9
1951	41,440	41,700	1,006.3
1952	44,960	44,800	996.4
1953	47,680	51,100	1,071.7
1954	52,960	62,300	1,186.4
1955	55,520	67,500	1,215.8
1956	82,240	114,800	1,395.9
1957	96,960	136,800	1,410.9
1958	126,720	186,300	1,470.2
1959	199,840	317,200	1,587.3
1960	285,600	543,900	1,904.4
1961	306,560	598,300	1,951.7
1962	327,680	664,979	2,029.4
1963	417,840	858,021	2,053.5
1964	551,854	935,125	1,694.5
1965	576,861	1,021,286	1,770.4
1966	653,362	1,122,399	1,717.9
1967	662,080	1,314,900	1,986.0
1968	670,880	1,507,500	2,247.0
1969	679,680	1,700,000	2,501.1
1970	828,800	1,938,200	2,338.5
1971	1,018,832	2,300,000	2,257.5

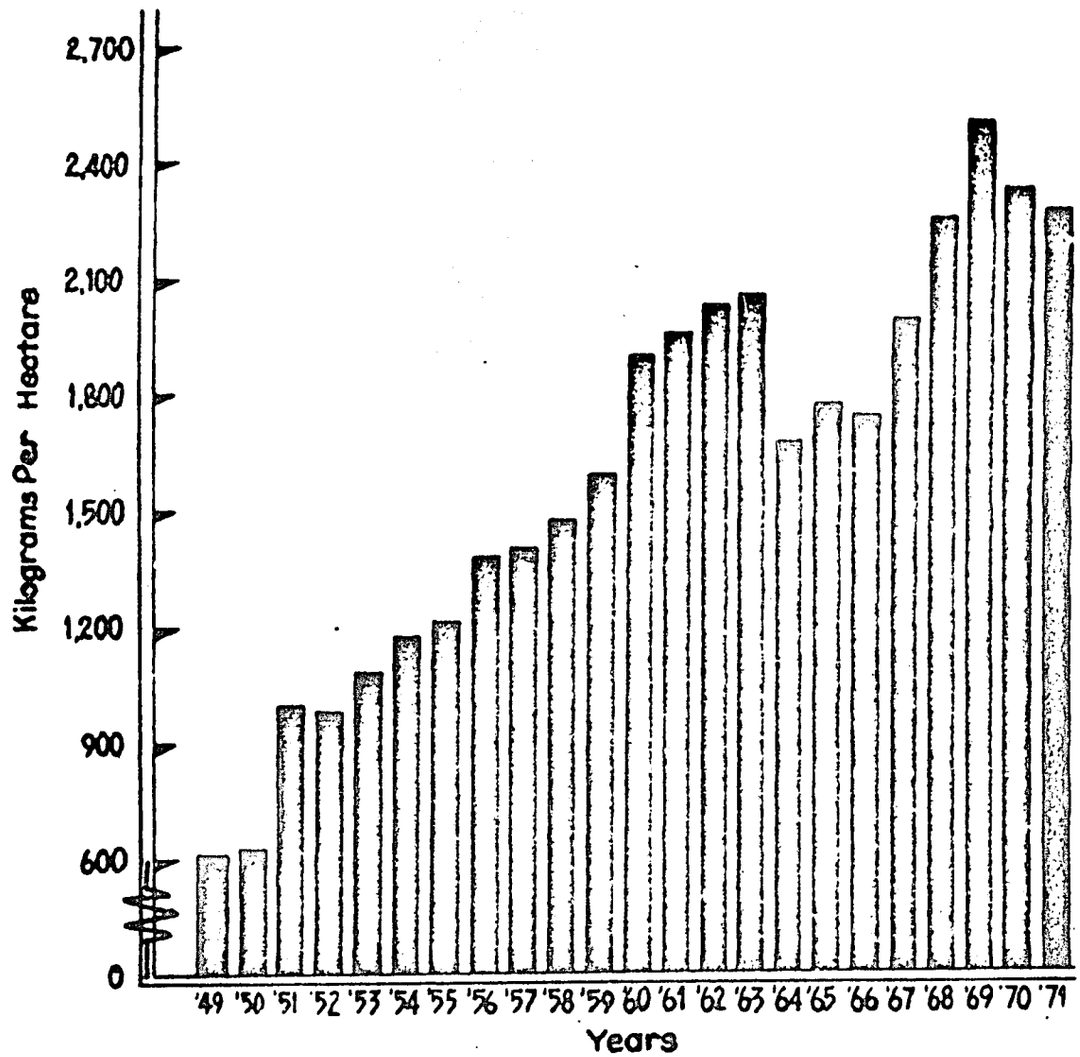
*Computed from area planted

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives

Corn Planted Area in Thailand, 1949-1972



Corn Production Per Hectare in Thailand.
1949 - 1972



Total Corn Production in Thailand, 1949-1972

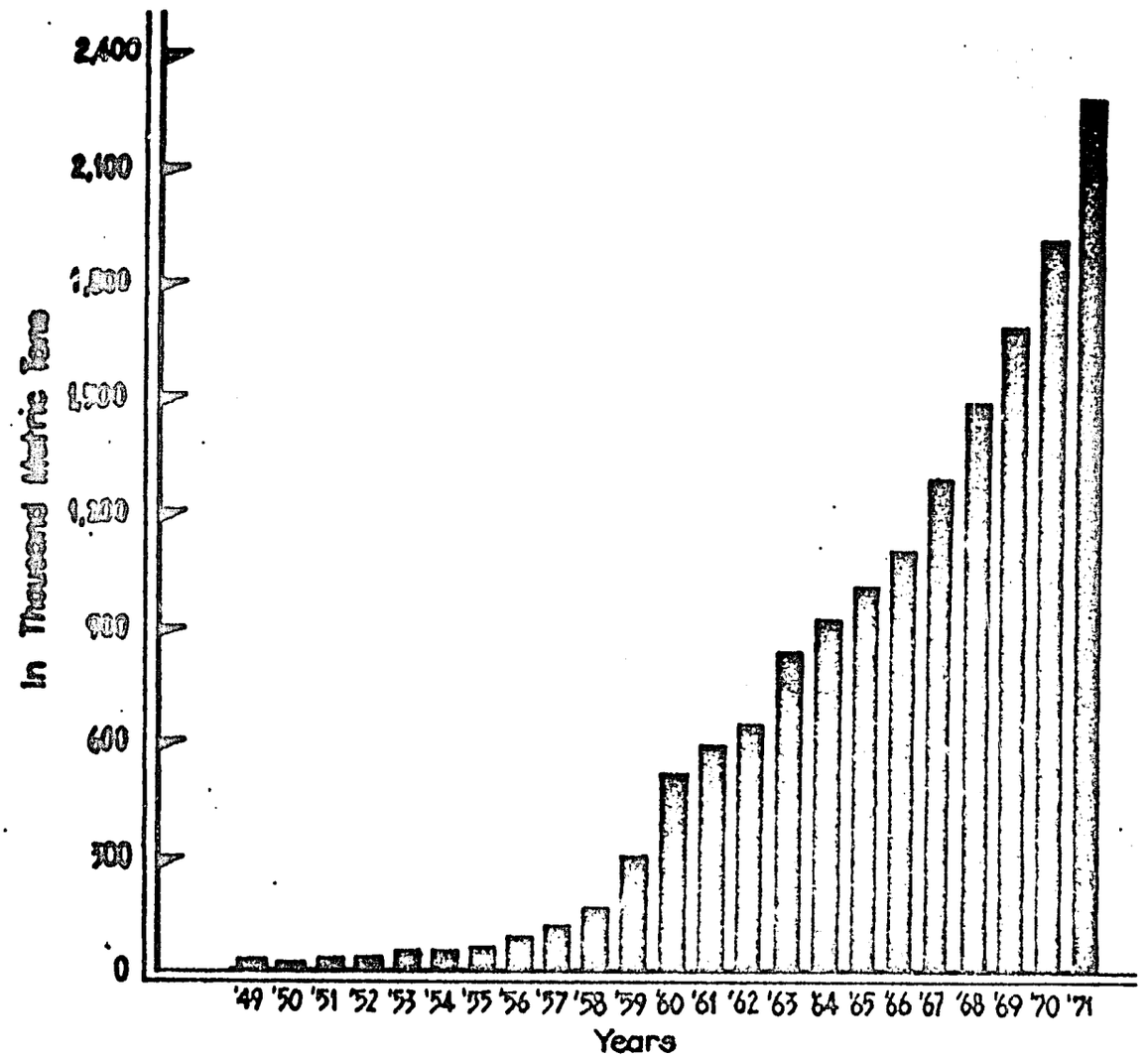


Table 8

Projected Corn Production in Thailand
1972-1980

Year	Production (In thousand metric tons)
1972	1833.0
1973	1929.3
1974	2025.6
1975	2121.9
1976	2218.2
1977	2314.5
1978	2410.8
1979	2507.1
1980	2603.4

Formula Used

$$\hat{P} = \alpha' + \gamma' t$$

$$\alpha' = \bar{P}$$

$$\gamma' = \frac{\Sigma Pt}{\Sigma t^2}$$

Where:

$\hat{P}$ = Estimated Production

P = Production

$\bar{P}$ = Average Production

t = Time

A.2 Cultural Management

Corn can be grown in any upland area in Thailand where the amount of rainfall is adequate for the requirements of the crops. Most corn farmers grow corn in May and June and harvest the crop in September and October. A smaller second crop is planted right after the first crop is harvested in December and January. Only a small number of farmers grow corn during the second season because it rains heavily making it difficult to use machinery in the field. Furthermore, excessive moisture during the season promotes susceptibility to various kinds of diseases which results in low yield. Corn matures in 90 to 110 days in Thailand.

For the last few decades, an increase in national corn input from less than 10,000 metric tons per year to 2,300,000 metric tons per year in 1971 was mainly due to a tremendous rise in corn hectarage. The aggregate yield in 1971 was 2,257.5 kilograms per hectare, but local yields in Petchaboon and Srisaket provinces were 3,312.04 and 3,437.50 kilograms, respectively, as indicated in Table 9. However, it is expected that hectarage expansion in corn production is nearing its saturation point. At present, new land can no longer be opened up for crop cultivation inasmuch as existing virgin lands lie mostly within a strictly national reservation area. The time has come for Thailand to raise yield capacity per hectare by adopting modern cultural practices.

Table 9

Output, Hectarage, Yields of Corn Production in Cornbelt Area of Thailand, 1971

Provinces	Hectarage		Output		Yield
	Area Planted (Hectares)	Percent of Total	Production (m.t.)	Percent of Total	Kg/Ha
1. Lopburi	206,400	20.26	439,250	19.10	2,128.15
2. Nakhonsawan	185,600	18.22	319,000	13.87	1,718.75
3. Nakhonrajasima	118,800	11.60	275,000	11.96	2,314.84
4. Petchaboon	108,800	10.68	360,350	15.67	3,312.04
5. Saraburi	89,568	8.79	230,000	10.00	2,567.88
6. Sukhothai	57,920	5.68	108,000	4.70	1,864.64
7. Phitsanulok	38,736	3.80	72,600	3.15	2,031.25
8. Kamphaengphet	36,160	3.55	73,450	3.19	2,031.25
9. Phichit	25,136	2.47	56,500	2.46	2,247.77
10. Srisaket	20,800	2.04	71,500	3.10	3,437.50
11. The rest of provinces	131,552	12.91	294,350	12.80	2,237.52
Total	1,018,832	100.00	2,300,000	100.00	2,257.49*

*Country's average yield in 1971.

B. Major Production Regions

The corn belt of Thailand covers 10 main provinces, mostly located in Central Thailand, namely, Lopburi, Nakhonsawan, Saraburi, Pichit, Nakhonrajsima, Sukhothai, Phitsanulok, Kamphaengphet, and Srisaket. Lopburi which is the largest corn area of the country, which planted 206,400 hectares or about 20% of the total corn hectarage in Thailand in 1971, Table 9.

C Farm Cost Structure

Table 10 shows the farm cost structure in corn production in 1973. Most corn farmers do not apply fertilizer, herbicide, and insecticide in their farms. They apply a very small amount of chemicals as protection from insects during the storing period. Usually, farmers do not buy seeds for planting but keep their best ears of corn for this purpose. Therefore, the material cost of seeds per hectare amounts to only 51.32 bahts or 5.78% of the total variable cost. Labor cost accounts for 836.83 bahts per hectare or 94.22% of the total variable cost of 888.15 bahts per hectare. Total corn income per hectare is 2,973.56 bahts while total variable cost amounts to 888.15 bahts. This leaves 2,085.41 bahts of net corn income per hectare. The last column of Table 10 shows costs and returns per farm.

Table 10

Cost and Return of Corn Production, Thailand, 1973
Pakchong-Lopburi

Item	Cost Per Hectare	Cost Per Metric Ton
Material Cost		
Seed	48.63	27.00
Fertilizer	-	-
Chemicals	2.69	1.00
Labor Cost		
Plowing	231.63	129.00
Planting	142.19	79.00
Weeding	284.94	145.00
Harvesting	116.69	64.00
Shelling	61.38	34.00
Total variable cost	888.15	479.00
Total production (kgs)	1,786.69	-
Total income	2,973.56	1,661.00
Net income	2,085.41	1,182.00

Ill, May 1974

CHAPTER V. ASSEMBLY, STORAGE AND TRANSPORT NETWORK

A. Assembly

Corn assembly is conducted by traders at three different levels of market, namely, rural grower's markets, assembly central markets, and terminal market.

A.1 Rural Grower's Markets

This is the first market level which assembles corn grain directly from the growers. Thereafter, rural grower's markets sell corn to either assembly central markets or terminal markets in Bangkok. They are located within the corn producing areas. Traders who assemble corn at this level are classified into four groups.

1) Rural merchant

He buys corn directly from growers at his business place or at farm gates, and sells his assembled grain to other merchants. A rural merchant also extends agricultural credit to numerous growers who, in turn, deliver their produce to him as payment at harvest time.

2) Commission agent

He buys corn directly from growers or other local traders. He locates and assembles the grain demanded at the upper

price limit set by their principals. He usually receives a commission from the value of the corn purchased. He is free to reduce the commission and offer growers a higher price which is a frequent practice among regular suppliers. The commission agent encounters certain quality risks. Since the principals set the upper price limit for both low and high quality of grain, the commission agent depends ultimately on the quality of the grain purchased. The commission agent also extends agricultural credit to growers.

3) Hawker merchant

At harvest time, the hawker merchant travels to various local grower's markets and buys corn from growers and local traders. He does not extend any credit to growers. His main function is to assemble the harvested corn grain, and usually sell the produce immediately after purchasing or after a short period of storage.

4) Local agricultural cooperatives

The cooperatives assemble the corn grains of their members and deliver the produce to the cooperative Marketing and Purchasing Federation of Thailand Ltd. in Bangkok. However, some local agricultural cooperatives sell their assembled grain to other large scale independent merchants in the assembly wholesale markets or at the terminal market in Bangkok.

A.2 Assembly Central Markets

The corn marketing channel has been recently dominated by an up-country central assembly market at Tha Rua, which is along the Pasak river in Saraburi province, over 100 kilometers from Bangkok. The rise in importance of Tha Rua has been due mainly to its location and the progressive activities of marketing firms located here.

The Tha Rua market is serviced by hard surfaced road, railway, and river barge facilities. River barge is the cheapest form of transportation in Thailand. The Pasak river is navigable up to Tha Rua all year round. The Pasak flows into the Chao Phya river, the main water transport route of the Kingdom, at Ayuthia. Tha Rua lies between the major corn production areas of the Central Highlands and the export facilities at Bangkok, so it was logical for an assembly market to develop here.

Corn is loaded into the barges by means of a "chute", which is a device by which bulk or bagged corn can be loaded by gravity from the river bank to the barges on the river below. The first chute appeared in Tha Rua in the early 1960's. The market got a big boost in 1967 when an international company, Calabrian (Thailand, Ltd.)constructed storage and drying facilities at Tha Rua. Due to a number of factors, the company became bankrupt shortly thereafter, and the facilities were taken over by a commercial bank which was one of the company's creditors.

The bank subsequently leased the facility of Continental Overseas Ltd., a wholly owned subsidiary of one of the world's five largest corn trading multinational corporations.

The growth of Tha Rua assembly market has been due primarily to its locational advantage relative to the rapid expansion of corn production. The Continental operation however, through its buying practices, has had an important effect on the conduct of the market, which in turn has stimulated the growth of the market. Continental does not buy directly but, instead, manages storage and shipping facilities for corn brought there by brokers and subsequently sold to Continental in Bangkok. As essential feature of Continental's operations is the use of scales and moisture testers and posted prices. Previously, corn was bought by the bags and a buyer had to exercise his own judgement as to the nature and degree of damage, moisture content and other factors determining price which was arrived at by bargaining.

During the first year of operation, Continental was the only facility which was selling on the basis of weight, moisture and posted prices. During the second year, the two largest private traders at the market also installed truck scales and moisture testers. By 1974, all other traders at Tha Rua had adopted these measures.

During the 1974 crop season 14 chutes were operating in the Tha Rua market. Of 7 trucks scales operating, 6 were owned by individual firms. The seventh scale is owned by a group of businessmen who weigh trucks for a fee.

The volume of corn which passes through the Tha Rua market is not known precisely, but is estimated to vary between 40 and 60% of all corn exported from Thailand or from 800,000 to 1.2 million tons per year. Corn arrives at Tha Rua mainly by truck, although a small amount comes by rail. All corn leaving Tha Rua goes by river barge to Bangkok. The trucks average 12 metric tons of corn each. The largest daily volume recorded was 436 trucks or over 5,000 tons. Tha Rua market is active in August and September following harvest of the first crop and reaches its peak of activity in November and December. The market is nearly closed in May and July.

A.3 Terminal Market

Bangkok is considered the terminal market of corn in Thailand. Corn grain from either rural grower's markets or assembly central markets flow to large scale merchants in Bangkok. Merchants operating their business in the terminal market are classified as follows.

1) Wholesale merchants

They buy corn grains from rural merchants, assembly merchants, commission agents, and brokers of both rural and central markets. They assemble a very large quantity of corn and sell them to exporters and feed millers. They own very large warehouses as well as silos in Bangkok, and extend "revolving credits" to their suppliers in rural and central markets.

2) Brokers

The brokers assemble corn grain in their name for exporters or feed millers. They receive a commission for their services. Generally, brokers have no storage facilities and their main function is to provide the supplies.

3) Exporters

The exporters buy corn grain from wholesale merchants and brokers in Bangkok. Many of them send their representatives to buy corn at various assembly central markets. If the demand for corn is large in the overseas markets, these exporters may send their representatives to assemble corn grains directly from the rural grower's markets. They also extend "revolving credits" to their regular suppliers. Exporters own large and modern storage facilities.

4) Cooperative Marketing and Purchasing Federation of Thailand Ltd. (CMPF)

The CMPF is an exporter of corn in the terminal market, Bangkok. It intends to directly purchase corn from local agricultural cooperatives, which are members of the cooperative. Conceptually, the CMPF could greatly help to improve the corn marketing system, since corn marketing through the cooperative channels is the more direct way of moving corn from grower members of local cooperatives to CMPF which is the exporter. However, CMPF has had difficulties in getting started.

B. Storage

B.1 Storage Methods and Facilities

The quality of corn grain can only be maintained through good storage at various levels of marketing. At the farm level, most farmer-growers completely lack storage facilities. Consequently, they are compelled to sell their corn immediately after harvesting. Some growers own poor storage facilities. The types of storage facilities in both rural and central markets are much different depending upon the financial status and volume of business of individual traders. Due to the high cost of construction materials, some merchants build cheap storage facilities, such as a large shelter without any wall. When it rains, they cover the sacks of corn kept under the shelter with a very large plastic sheet. However, these merchants store corn in this manner for only a short period of time while waiting for shipment to central markets of Bangkok. Many large independent merchants build strong storage facilities. They will store the grain for future marketing at better prices. However, these storage facilities are not really good for storing corn because most of them are built with poor ventilation. From a study[1/] on corn storage, it was found that

---

1/ Tavil Paonil, "Market Structure of Corn in Thailand," 1971, (Unpublished M.S. Thesis, Department of Agricultural Economics, Kasetsart University), Bangkok, Thailand, p. 83.

56% of merchants trading in both rural and central markets own good storage facilities. The rest do not have any storage facilities and keep their sacks of corn in an open concrete area, covering them with plastic sheets when it rains. The corn is temporarily kept in this manner and moved quickly when trucks are available.

Storage facilities of big traders in assembly central markets and terminal market are of standard quality. All grain traders own large storage units because of their large volume of business and good financial positions. Most corn exporters build their warehouses along the bank of the Chao Phya River for shipping convenience.

Lack of good storage facilities at the farm and rural grower's market levels is one of the main corn marketing problems in Thailand. This leads to quality deterioration of Thai corn, which is not desirable in the marketing system. This problem may be partly resolved with government aid.

B.2 Existing Storage Capacity

The average storage capacity of each godown belonging to traders in rural and central markets is about 3,951 sacks of corn, or approximately 400 metric tons, which is considered quite small. However, for large independent merchants in central and

terminal markets, the average storage capacity for each godown is about 34,434 metric tons.[2/] These storage facilities are meant for all crops handled by traders.

Big silo storage facilities are few in Thailand. The defunct Calabrian (Thailand) Company Ltd. built a silo and flat storage with a capacity of 65,000 metric tons at Tha Rua, the main up-country corn assembling center of Thailand. This company also built smaller silos of about 3,000 metric tons capacity in about 10 different places. In the terminal market at Bangkok, there are presently three private silo companies namely, Bangkok Silo Company Ltd., Siam Silo Company Ltd., and United Silo Company Ltd. These three silos have a total storage capacity of 120,000 tons and a total drying capacity of 10,000 metric tons per day.[3/]

The mixture content of newly harvested corn is high. Hence, during harvest time, the demand for silo drying services cannot be met by all the silo companies. However, if the storage facilities at the farm rural and central market levels had been good, and if growers and merchants at different marketing levels had stored and marketed corn evenly throughout the year, the existing silo drying capacity in Bangkok would have been sufficient. However, the flow of corn into Bangkok is uneven and this causes a serious

---

2/ Ibid., p. 37.

3/ Preecha Tanprasert, "Corn", Fifteen Year Anniversary Report, The Thai Maize and Produce Traders Association, Bangkok, 1972, p. 49.

problem in corn marketing. The silo authorities and representatives of the Thai Maize and Produce Traders Association had met to discuss this problem, but the best solution has not yet been found. One of the main contitions of corn trading contracts between Thailand and Japan and between Thailand and Taiwan is that the shipments of corn from Thailand must be obtained from silo storage facilities. This places Thailand in a disadvantageous position. If Thai exporters could supply corn of the right quality, it is likely that the importer's requirements of corn to be stored and shipped from silos sill be removed. The attempt of each exporter to utilize silo services all at the same time has caused a severe set-back to the corn marketing system. This resolution of the problem is left largely to the corn exporters. Theoretically, the existing silo drying capacity in the country can meet all the needs of exporters under normal conditions. With a drying capacity of 10,000 metric tons per day, the existing three silo companies can accommodate and service over 3 million metric tons of corn per year. This capacity is far above the annual volume of corn export of 2 million metric tons. A proper adjustment in trading contracts and shipment schedules may greatly improve the corn marketing system, particularly on storage system.

C. Transport Network

C.1 Methods of Transporting Corn

At the farm level, corn transportation is inconvenient, slow and costly. This is mainly due to the inefficient feeder road system in rural areas. In transporting corn from the farms to the main road, farmers still use bullock carts because when it rains, other means of transportation, such as trucks and tractors with trailers, cannot pass soft and muddy feeder roads. On clear and dry days, small trucks and tractors with trailers can go right to the farms. Transporting corn to the main road becomes possible when the trader's big trucks are visiting to transport the corn to their godowns. Sometimes, small trucks and tractors are used to transport corn from the farms to the trader's business places or godowns. In the wet season, transportation of corn from farm to trader's business places become expensive and cumbersome because shipments have to be done in two steps. Firstly, corn has to be transported to the main road by a bullock cart or a tractor with trailer. This is a time-consuming task and costly if a tractor is used. Secondly, the unloading and loading which is done twice at the main road and at trader's warehouses entail additional expense. In the dry season, wherein big trucks can freely operate, the transportation cost is much lower.

Corn transportation from rural grower's markets to assembly central markets, or the terminal market in Bangkok is rapid and effective because of better national highways. Trucks with loading capacities of 10 to 20 metric tons are used to transport corn at this level. This cuts down transportation cost and costs from loss of weight.

The most important up-country corn center is located at Tha Rua. This is the largest assembly central market. Due to the availability of water way transportation, corn from Tha Rua to Bangkok is totally transported in barges. The cost of water transport is much cheaper than by trucks since the loading capacity of the barge is much higher.

C.2 Corn Transport Routes and Transportation Cost

Corn reaches Bangkok by road, rail or water routes. Corn from main producing areas as Lopburi, Saraburi, Uthaitani, Nakhonsawan, and Pitsanulok can be transported by any of the three routes. However, most traders use the water route system since it is the cheapest. However, during the dry season, when the level of water in the rivers is low and barges cannot be conveniently used, traders use the road routes. Rail route is the least efficient and inconvenient means of transporting corn because of its slowness and complicated procedure.

Corn from such provinces as Petchaboon, Sukhothai and Kamphaengphet is transported to Bangkok by trucks only. Though rail transport is available, traders do not choose this route.

In transporting corn from northeastern producing areas, such as Nakhonrajasima and Srisaket which are 256 and 586 kilometers from Bangkok, respectively, only road and rail routes are available. Srisaket is the only corn producing area where road transportation is poor. Instead corn is transported by rail. However highways are being constructed in the area. Transport of corn may be diverted from rail route to road route in the very near future as road conditions improve.

The distance from corn producing areas to utilization centers or Bangkok vary from 100 kilometers to over 500. kilometers as shown in Table 11. The table also shows the corn transportation costs from producing areas to silos in Bangkok in 1972. It can be seen that water routes have the least cost in shipping corn from such main areas as Lopburi, Saraburi, and Nakhonsawan to Bangkok.

The proportion of corn arriving at Bangkok by each method of transportation is not known exactly. The corn coming from Tha Rua is transported by barge, which amounts to at least 40% of the total transported volume. Other barge loading facilities are known to exist at Chainat, Nakorn Sawan, Phayukakiri, and Tapan

in Pichit province. A reasonable estimate would be 2% loss by rail, 20 to 30% by truck, and 70 to 80% by barge.

Table 11

tances and Transportation Costs form Corn Producing Areas to Silos in Bangkok, 1972

es	By Rail		By Road		By Barge	
	Distance (Km)	Cost ฿/ton	Distance (Km)	Cost ฿/ton	Distance (Km)	Cost ฿/Ton
buri	133	43.50	153	70	170	30
buri	113	40.50	108	40	170	30
onsawan	246	59.50	237	80	323	35-40
chaboon	-	-	351	80	-	4/
hothai	487	95.50	438	110	-	-
phaeng-phet	-	-	358	90	-	-
anulok	389	80.50	492	110	461	-
honra-asima	264	62.50	256	70	-	-
saket	515	97.50	586	-	-	-

Dr. Sirirak Chantarangsu, "Corn Transportation," The Daily Trade News, Special Issue, March 1, 1972, Ministry of Commerce, p. 38.

---

pplicable

CHAPTER VI. PROCESSING FOR FEEDS

A. Production

The growth of the feed milling industry in Thailand has been slow. Statistically, the demand for corn by domestic feed millers in Thailand rose from about 130,000 metric tons in 1968 to 230,000 metric tons in 1973 or 15% increase per annum.

A recent study conducted by the Department of Commercial Economics, Ministry of Commerce, reported that the production of mixed feed by the five largest feed millers in Thailand totalled 88,387 metric tons in 1970, 161,804 metric tons in 1971, and 206,450 metric tons in 1972. The figures in 1973 were unlikely to change noticeably from figures in 1972 because the millers suffered high prices on main ingredients, such as rice bran, broken rice, corn, soybean, and fishmeal.

Although statistics on livestock population are not available, it has been roughly estimated that if all commercial poultry and pig farms in Thailand utilize mixed feed, the domestic demand for animal feed will reach about 3.5 million metric tons per year. The existing production capacity of all the feed mills in Thailand is about 779,350 metric tons per year which is only 21% of the total estimated requirement. However, most of the feed mills have not yet produced at maximum capacity.

The animal feed industry in Thailand receives financial incentives from the Board of Investment. At the end of 1973, there were 34 feed mills in Thailand, most of which were small mills. Of these, eight mills received financial incentives from the Board, four of which have already started operation. The total capacity of these eight feed mills is about 539,000 metric tons per year or about 69.16% of the total production capacity of all mills.

Five other large feed mills which did not receive any incentive from the Board had a total production capacity of about 180,350 metric tons per year, which is about 23.14% of the total production capacity of all mills. The rest are small mills with a combined production capacity of about 60,000 metric tons per year, which is about 7.70% of the total production capacity of all mills, Table 12.

The Board of Investment grants investment incentives to mills whose funding requirement is not less than two million bahts, (US$100,000) excluding the cost of land and operating funds.

Table 12

Production Capacity of Feed Mills in Thailand

Mills	Production Capacity (Metric Tons/ Year)	%
1. Received aid from Board (8 mills)1/	539,000	69.16
2. Do not receive aid from the Board (5 large mills)2/	180,350	23.14
3. Small mills2/	60,000	7.70
Total	779,350	100.00

1/ Board of Investment, Thailand

2/ Department of Commercial Economics, Ministry of Commerce

B. Ready-mixed Animal Feed

B.1 Production

Ready-mixed animal feed is produced from local and imported raw materials. Among local raw materials used are fishmeal, soyabean waste, rice bran, and bran waste, broken rice, maize, sorghum, and other ingredients such as "krathin" (genus leucaena) foliage, powdered bones, crushed oyster shell, salt and sugar.

Imported raw material ingredients consist of different kinds of vitamins, mineral salt, tallow and skimmed milk. The use of these raw materials in the production of animal feed varies with the feed formula used for raising fowls, swine, cattle, fish and horses.

Presently, there are 33 feed mills operating throughout the country. Five large mills have a combined production capacity of about 26,000 tons monthly, whereas the remaining 28 small mills produce about 9,000 tons per month, to make a total of about 35,000 tons monthly or an aggregate of 420,000 tons annually.

A list of the large mills and their actual production in 1972 is shown below.

	Production Tons	Percentage of Total Production
Charoen Pokabhan Industry Co., Ltd.	73,500	27.6
Sri Thai Livestock Co., Ltd.	45,000	16.9
Inter-Industrial Trade Co., Ltd.	38,350	14.4
Betagro Co., Ltd.	36,000	13.5
Ralston Purina (Thailand) Co., Ltd.	13,600	5.1
Total production of five plants	206,450	77.6
Others	60,000	22.4
GRAND TOTAL	266,450	100.0

These mills are not operating at full capacity because of low domestic demands. About 40% of the animal raisers mix their own animal feed. Thus, local animal feed millers have to seek more outlets overseas. In 1972, the supply of raw materials for the production of ready-mixed animal feed became scarce

in the country as well as overseas and, as a consequence, animal feed prices increased.

The growth in the local production of animal feed during the past few years has been increasing at an average of 35% annually. Past production of existing feed mills is shown below.

(Quantity:Ton)

	1970	1971	1972	1973*
Charoen Pokabhan Industry Co., Ltd.	28,000	57,000	73,500	14,500
Sri Thai Livestock Co., Ltd.	30,000	37,000	45,000	7,800
Inter-Industrial Trade Co., Ltd.	30,000	36,000	38,350	10,400
Betagro Co., Ltd.	-	24,000	36,000	10,000
Ralston Purina (Thailand) Co., Ltd.	387	7,804	13,600	3,080
Total	88,387	161,804	206,450	45,780
Others**	21,000	38,000	60,000	11,000
GRAND TOTAL	109,387	199,804	266,450	56,780

Sources: Commodities Research Unit, Business Economics Department

*Estimated figures during period January-March 1973
**Estimated figures

B.2 Rations of Mixture

The production of both ready-mixed animal feed concentrate mixed with other ingredients as rice bran, maize, and broken rice is set at a concentrate ratio of 30% and other materials

at 70%. The concentrate is composed mainly of fishmeal and bean waste, and a maximum of 1% of feed supplement of vitamins and mineral salt.

The volume of raw materials required for the production of animal feed in the country is shown below.

(Quantity: Tons/Year)

Ingredients	Demand of 5 Major Feed Plants 3/	Demand Country-wide 4/
Fishmeal	45,790	60,000
Soyabean waste	38,200	40,000
Other bean waste	21,100	23,000
Rice bran	-	1,000,000
Rice bran waste	36,400	36,400
Broken rice	24,640	2,000,000
Coconut waste	7,300	9,000
Maize	43,600	180,000
Sorghum	3,000	10,000
Others	250	-

3/ Commodities Research Unit, Commercial Economic Department

4/ Estimated from the requirements of 5 major feed plants and all small plants, and also surveys on feed use at raisers' level.

B.3 Production and Distribution

The quantity of locally produced animal feed is about equal to that of consumption, since animal feed cannot be stored over a long period due to nutrient and quality deterioration.

The production and distribution of animal feed by the five major feed plants are as follows.

Year	Sales (tons/year)	Production (tons/year)	%
1970	88,243	88,387	99.8
1971	156,809	161,804	96.9
1972	180,904	206,450	87.6

The above figures do not include the sales receipts of smaller producers which are estimated at about 20% of total country sales.

From the above table, it will be noted that the five major feed plants produced as much as 87.6% of total production particularly Charoen Pokaphan Industry Company Ltd. which produced 27.6% of the total production in 1972.
animal feed sold by these companies is believed to influence animal feed prices in the local markets.

B.4 Export

Thailand's exports of animal feed and ingredients in 1971 and 1972 are shown below.

Year	Export Value (In Million Baht) Mixed Animal Feed	Ingredients	Total
1971	1.695	71.500	73.195
1972	0.655	138.300	138.955

Ingredients:

	(Value: Million Baht)	
	1971	1972
Fishmeal	50.2	92.3
Rice bran	-	30.5
Coconut waste	9.8	10.8
Groundnut waste	8.7	4.4
Soyabean waste	2.8	0.3
Total	71.5	138.3

Source: Customs Department

Animal feed concentrates which are exported in pellet form comprise mainly of fishmeal and beanwaste. Charoen Pokaphan Company Ltd. exported such concentrates to Hongkong at 1,000 tons monthly, to Borneo and Sarawak at about 200 tons monthly from October-November 1972 at an FOB Bangkok price of about 3,000 baht per ton.

Export of mixed animal feed by the five major feed plants as reported by them is shown below.

	(Unit: ton)		
	1970	1971	1972
Charoen Pokaphan Industry Co., Ltd.	116	2,913	9,409
Betagro Company Ltd.	-	-	4,500
Inter-Industrial Trade Co., Ltd.	-	-	3,200
Sri Thai Livestock Co., Ltd.	-	2,000	5,000
Ralston Purina (Thailand) Co., Ltd.	-	-	417

B.5 Import of Feed Ingredients

During 1971, imports of animal feed ingredients was valued at 35.05 million baht as compared with 62.13 million baht in 1972, or an increase of 77%.

The largest amount of ingredients imported consist of sweetened forage and other preparations used in animal feeding (Code 2307). In 1971 1,662 tons of forage was imported at a value of 19.45 million baht as compared with 3,184 tons valued at 31.69 million baht imported in 1972. This represents an increase of 92% in volume and 63% in value.

Besides the imported feed ingredients, other ingredients imported in 1971 and 1972 are as follows.

	1971	1972	Increase
Groundnut waste	1.91	10.17	4.3 folds
Soyabean waste	1.29	3.16	1.5 folds
Other seed waste from which oil has been extracted	0.51	11.53	22 folds

Source: Customs Department

Statistics indicated that imports on fishmeal mainly from South Africa in 1954 amounted to 353.6 tons which was valued at 1.78 million baht. In 1972 the importation of 452.9 tons was valued at 2.09 million baht, representing an increase of 28% in volume and 17% in value. Several other ingredients

used in producing animal feed are also imported in small quantities with a total value of about 2.5 million baht in 1972.

The imported animal feed classified by type and value are shown below.

Type	(Value: million baht) 1971	1972	%
Code 2307 animal feed to be mixed with chemical products	19.45	31.69	63
Code 2304 seed waste and other wastes	3.71	25.36	597
Code 2301 fishmeal	1.78	2.09	17
Other ingredients	10.09	2.49	-75
Total	35.03	62.13	

C. Fishmeal Production of Thailand

C.1 Production

Presently, there are about 70 fishmeal plants operating in the country. Additional plants are being established to increase the industry's production capacities.

The production figures used were those of 1972. During 1971, production was estimated at 60,000 tons equivalent to only 50% of the 1972 production.

Fishmeal is produced mainly from scrap fish comprised of various kinds of small fish, small crustaceans, mollusks and other species caught along with the more economically valuable marine species.

Province	Number of Plants	Production (tons) Monthly	Annually
Trang	4	1,530	18,360
Songkhla	6	1,520	18,240
Satun	4	1,110	13,320
Pattani	2	540	5,400
Nakhon Si Thammarat	10	1,350	16,200
Phuket	4	1,050	12,600
Ranong	2	625	7,500
Surat Thani	2	100	1,200
Chumphon	12	975	11,700
Samut Sakhon	14	980	11,760
Rayong	3	230	2,760
Trat	7	48	576
Total	70	9,968	119,616

Source: Fishery Association of Thailand

Fishery statistics of the Fisheries Department indicate a rising volume of marine fish caught amounting to 1.47 million tons in 1971. It is estimated that about 1.6 million tons of fish was obtained in 1972. Songkhla Sea Fishery Station conducted a research on scrap fish in 1968 and found that scrap fish accounted for 53.9% of the total fish catch in that year. In 1969, scrap fish production dropped to 50.4% and in 1970 went up again to 56.2%. Fish catch is likely to increase in the following years. Fishermen have resorted to increasing the use of trawling nets with small mesh to catch all sizes of fish, unlike in the past when fishermen usually discarded scrap fish.

It is estimated that about 600,000 tons of scrap fish was caught in 1972 which is procured in fishmeal plants and other plants producing animal feed supply, poultry and fresh-water fish farms.

In the production of 1 kilogram of fishmeal, 5 kilograms of scrap fish is used. Based on 600,000 tons of scrap fish, production of fishmeal in 1972 could be about 120,000 tons.

C.2 Production Cost

The Fishery Association of Thailand has estimated production cost of 1 kilogram of fishmeal as follows.

1. The production cost of fishmeal in the southern provinces of Thailand starting from Ranong province downwards is estimated as follows.

a. Cost of scrap fish, 5 kg at 0.60 baht	3.00 baht
b. Production expenses	0.49 baht
c. Administrative expenses	0.36 baht
d. Transportation to Bangkok	0.25 baht
Total	4.10 baht

2. Production cost of fishmeal in central provinces

a. Cost of scrap fish, 5 kg at 0.80 baht	4.00 baht
b. Production expenses	0.49 baht
c. Administrative expenses	0.36 baht
Total	4.85 baht

The price of scrap fish is higher in the central regions than in the southern provinces due to the added transportation cost. Furthermore, fishermen in the south who are indebted to fishmeal plants sell the scrap fish at lower prices than in the central provinces.

C.3 Fishmeal prices

Fishmeal prices offered by the five major animal feed plants are as follows.

	(Baht per kilogram)			
	Average 1971	Average 1972	Average early 1973	Average Mid April 1973
Charoen Pokaphan Industry Co., Ltd.	3.27	3.75	5.30	3.80-3.95
Betagro Co., Ltd.	3.10	3.50	5.50	3.80-3.95
Inter-Industrial Trade Co., Itd.	3.00	4.75	5.25	3.80-3.95
Sri Thai Livestock Co., Ltd.	3.20	3.40	5.20	3.80-3.95
Ralston Purina (Thailand) Co., Ltd.	3.40	4.25	5.23	3.80-3.95

Fishmeal prices depend largely on its protein content. Peruvian fishmeal has as much as 65% protein content and it is in great demand in the world market. On the other hand, Thai fishmeal has about 50-60% protein content or lower.

The export price of Thai fishmeal to Singapore prior to the imposition of the export control was $720 per ton C & F, or about 6,000 baht per ton. In contrast, the local market price of fishmeal was 5,200 to 5,500 baht per metric ton.

The main causes for high prices of fishmeal before the export control are as follows.

1. In early 1973, the Peruvian government banned the fishing of demersal fish for 3 months, resulting in a substantial reduction of fish catch and consequently the export of

scrap fish. Since Peru is the world's biggest exporter of fishmeal, the shortage spread around the world. At the same time, shortage in the supply of maize and soyabean contributed also to the higher price of fishmeal and animal feed in the world market.

2. Large quantities of fishmeal had been exported by Thailand in response to overseas demands because countries which formerly bought fishmeal from Peru , such as Taiwan, Japan, Singapore and Malaysia turned to Thailand for fishmeal supply. Songkhla and Trang provinces did some brisk business in exporting fishmeal to Malaysia and Singapore directly. It appeared also that some maize exporters turned to exporting fishmeal since they were exempted from both export duty and business taxes.

4 Export and Import

1. Export

In 1970, 18,339 tons of fishmeal valued at 50.2 million baht was exported as compared with 27,153 tons (an increase of 84%) which was exported in 1971. Major markets of fishmeal were Singapore, Taiwan, Philippines, Japan, Sri Lanka and Malaysia.

2. Import

In 1971, 354 tons of fishmeal valued at 1.8 million baht was imported into the country. In 1972, 453 tons

(an increase of 28%) valued at 2.1 million baht (an increase of 16.7%)of fishmeal was imported mainly from South Africa, Singapore and the United States due to lower cost in the world market.

D. Bean Meals

There are several kinds of bean meals used in animal feeding. The most significant meals are yellow soyabean meal, black soyabean meal and groundnut meal. However, the most popular is the yellow soyabean meal. Actually, their feed values are about the same. Groundnut and black soyabean meals are less popular due to problems of storage and aflatoxin contamination. The supply of black soyabean meal is also irregular and blackens the color of animal feed in the production process.

Nevertheless, these bean meals can be used as substitutes for each other in animal feeding. Bean meals sold in the market must contain at least 44% protein, not over 13% moisture and not more than 3% sand mixture.

D.1 Production

Yellow soyabean meal and black soyabean are used by modern oil extracting plants such as Vivatana Industry Company Limited (VICL). Groundnut as a source of oil is not an economical source of oil because it is more expensive than soyabean by almost 100 baht per picul. Besides, the soyabean meal has a higher price than the groundnut meal.

The VICL plant is capable of turning out about 4,500 tons of seed oil monthly from kapok seeds, cotton seeds, yellow soyabean, black soyabean, and rice bran to some extent. Other major oil extracting plants are Seri Industry Company Limited with a production of about 900 tons per month and Nakorn Chaisri Company Limited with monthly production of about 600 tons. There are about 15 other small plants with a monthly production of 150 to 300 tons each. These small plants use yellow soyabean, black soyabean and groundnut as main raw materials.

The use of these raw materials depends largely on the harvesting periods of these crops. Supplies of yellow soyabean and black soyabean usually reach the markets during November to February from Sukhothai, Nakhon Sawan and neighboring provinces. During May to July, supplies come from Chiang Mai and nearby provinces.

At present, supplies of yellow soyabean and black soyabean to Bangkok and nearby provinces amount to about 25,000 to 35,000 tons of estimated total production of 50,000 to 60,000 tons. About 10,000 to 15,000 tons is channeled to oil extracting plants. After undergoing the oil extraction process, about 8,300 to 12,000 tons in the form of meal is recovered. About 50% of the meal is produced by VICL.

During the period November 1972 to February 1973, soyabean cropping in Sukhothai, Nakhon Sawan and nearby provinces produced record high harvests of yellow soyabean and black soyabean. However,

this was the result of rice farmers switching over to soyabean during July-August after the drought had occurred which damaged their rice crops.

D.2 Domestic protein consumption

Protein in animal feed is mainly derived from fishmeal, black soyabean meal and groundnut. Nonetheless, their availability is dependent on the yields of the following crops.

November-February and May-July	-	supplies of yellow soyabean meal and black soyabean meal
May-October	-	supplies of groundnut meal
From February onwards	-	supplies of fishmeal

If every year, between 12,000 and 15,000 tons of yellow soyabean is channeled to oil extracting plants, the production of soyabean meals would be sufficient for domestic consumption at about 13,000 to 16,000 tons per annum.

The animal feed industry is growing at an annual rate of 30 to 35%. On the other hand, demand for yellow soyabean meal and black soyabean meal is estimated to be increasing at the rate of 3,000 to 4,000 tons yearly. It is estimated that the input of oil extracting plants must reach 15,000 to 18,000 tons of beans annually in order to produce 13,000 to 16,000 tons of meals.

D.3 Export and Import

According to Customs statistics, the export of yellow soyabean meal dropped from 4,724 tons in 1970 to 1,208 tons in 1971.

and further to only 129 tons in 1972. There was negligible import of yellow soyabean meal in 1970, 316 tons was imported in 1971 and 714 tons in 1972. On the other hand, 6,290 tons of soyabean was exported in 1970, 6,200 tons in 1971, and 7,222 tons in 1972.

The import and export of yellow soyabean meal are exempted from duty. However, enterprises are required to pay a business tax of 2% on exports and 7% on imports.

D.4 Prices

Domestic and export prices of yellow soyabean meal are as follows.

		(Baht per Kilogram) Domestic Price	Export Price
1970 average		2.60	2.24
1971		2.60	2.32
1972	January	2.90	small export
	June	3.40	small export
	December	3.60	small export
1973			
	January	4.00	4.80
	February	4.10	5.80
	March	5.00	6.15
	April	4.40-4.80	No export

The price of black soyabean meal is lower than the yellow soyabean meal by about 50 s tang per kilogram.

Source: Commercial Economic Department, Ministry of Commerce, Thailand

E. Feed Processing Methods

The method of feed processing starts from (1) drying and dehydrating all raw materials, namely rice bran.

broken rice, corn, peanut waste, soybean waste, blackbean waste, copra waste, fishmeal, prawn shells, salt, and sugar waste, and then separating all foreign materials from such ingredients, (2) grinding each dried ingredient and storing them separately, (3) weighing all by-product materials mentioned above, fishmeal, minerals, vitamins, antibiotic, and other premixes with an automatic weighing machine, and mixing all of them in the mixer, (4) weighing other main ingredients according to the formula, and (5) mixing ingredients in (3) and (4) together. After the second mixing indicated in (5), the finished products will be processed and pressed into small pellets. These feedmix pellets are sacked and kept ready for marketing. The millers sell part of their feedmix in the form of feed concentrate. In this case, broken rice is used in mixing. When feeding, livestock raisers have to mix the concentrate with broken rice according to their formula.

F. Problems of Feed Milling Industry

The most important problem confronting the feed milling industry at present is the rising price of raw materials. In 1973, the feed mix price rose noticeably due to shortage of some input raw materials. This has caused many livestock raisers to stop their business. The most critical raw materials were soybean and fishmeal. Soybean is considered an important oil

seed in Thailand. The domestic demand of the vegetable oil extracting factories for soybean is rather high. After having extracted oil, the soybean waste is either sold to feed millers or exported. Due to the rising price of raw materials of feed millers, the government had stopped the exportation of soybean waste and fishmeal since March 16, 1973 in order to alleviate the feed mix price crisis. This measure was not as effective as it should be in solving the problem. Later on, the vegetable oil extracting factories complained that they had accumulated a large quantity of soybean waste due to the small domestic demand of the feed milling industry. Consequently, they had lost major portions of their export incomes. However, the main reason why these factories could not dispose all of their soybean meal was perhaps due to the high price of their products. The price of soybean meal for January 1973 before the export ban instituted on March 16, 1973 was 4.30 bahts per kilogram. After prohibiting soybean meal export, the price as of July 1973 rose to 7.80 bahts per kilogram.[1/]

Fishmeal is also a major raw material ingredient in feed mixing. The ban on fishmeal importation was more complicated than that of the soybean waste. The prohibition of fishmeal export on March 16, 1973 led to violent reactions and complaints from the fishmeal factories.

1/ Unpublished report, Agricultural Section, Bank of Thailand

According to the study conducted by the Department of Commercial Economics, Ministry of Commerce, the domestic demand for fishmeal is only 60,000 metric tons a year, while the production of fishmeal is about 120,000 metric tons a year. Therefore, the surplus of 60,000 metric tons must be sold off to overseas channels. The prohibition of fishmeal export was, thus, detrimental to the fishmeal industry. Later on, there arose a serious conflict between the fishmeal industry and the feed milling industry on the price of fishmeal.

Apart from the problems of obtaining soybean waste and fishmeals the feed millers also encountered problems in the rising price of rice bran and broken rice during 1973. The overall increase of input prices at present has led to an increase in the feed mix price of all main feed millers. It was reported that at the beginning of 1973, the feed mix price was 23 to 27% higher than that at the beginning of 1972.[2/]

F. Feed Marketing

It is apparent that the production of livestock in Thailand is beginning to move toward commercialization, as seen from the increasing use of feed concentrate and finished feed mix among the farmer raisers. As the population rapidly grows at a rate

---

2/ Sommai Panyatorn and Pramuan Chaopetr, Ibid., p. 29

of 3.2% per annum and the corresponding increase in income, the demand for various kinds of meat products rises proportionately. The increasing demand for meat has greatly encouraged the expansion and commercialization of the overall livestock industry within the country. The increase in technical know-how of farmers is quite notable at present as a result of the extension effort of the government and existing feed millers. This apparent increase in the farmers' knowledge of modern farming techniques was the prime factor leading to the commercialization of their farms. In addition, the promotional campaign of the feed millers and their efforts to increase their market share has greatly contributed to the development of the livestock industry in this country. Marketing competition among feed millers is quite keen. As feed mix prices are closely set, the ability of feed millers to market their products will almost wholely depend on the ability of their own sales representatives to market their products in the local areas. The level of percentage discounts given to sale representatives will greatly help feed millers in gaining their respective market shares.

Due to the keen competition among feed millers in the domestic feed market, most feed millers at present are building their own marketing patterns as follows.

1. They move their business toward a high degree of vertical integration.

2. They establish their own stock breeding farms by importing good breeding stocks from foreign sources.
3. They form their own farmers' groups to absorb their breeding stock.
4. The farmer-raisers operate their businesses under a close technical supervision of the feed millers, including the availability of free veterinary services, and animal medicines on credit from the feed millers.
5. At the marketing age of animals, the feed millers totally buy the animals from farmer-raisers and carry the rest of all marketing responsibility.

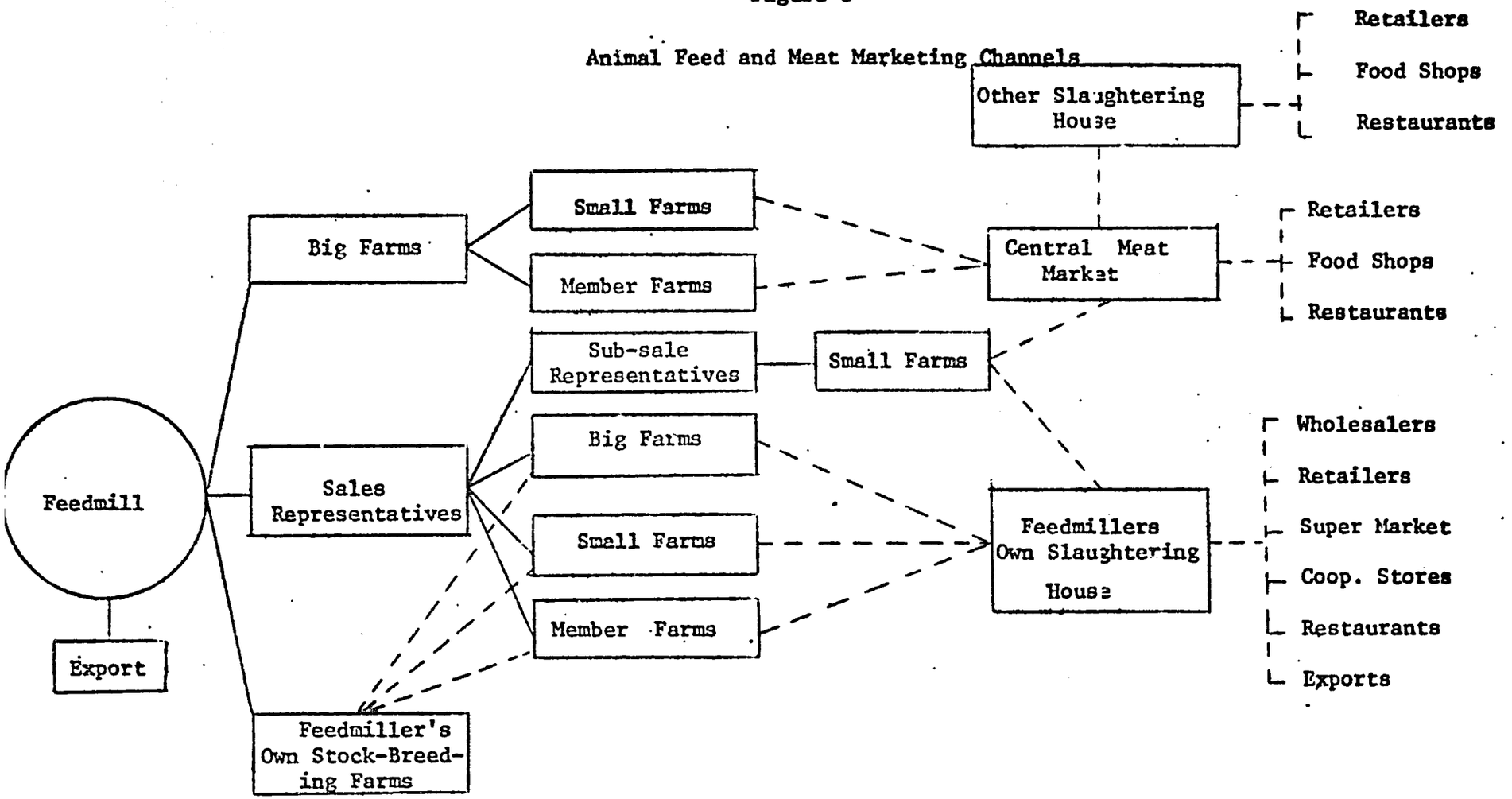
The feed millers deliver the animals to their own slaughtering houses, process, and sell final meat products to consumer markets or otherwise export these meat products. The animal feed and meat marketing channel is shown in Figure C. Usually, most livestock raisers are confronted with marketing problems and low prices for their products. The establishment of the feed millers' own marketing patterns as mentioned above greatly adds more stability to the livestock-raising occupation of farmer-raisers.

H. Outlook

Commercialization in the livestock-raising industry is really needed in Thailand. Due to a rapidly increasing population, the

Figure C

Animal Feed and Meat Marketing Channels



_____ Animal Feed Marketing Channel

- - - - - - - - Animal Stock and Meat Marketing Channel

Source: Sommai Panyatorn and Pramuan Chaopetr, "Feedmilling Industry", Monthly Bulletin, Vol. XIV, No. 3, March, 1974, Bank of Thailand, p. 34

demand for meat is also increasing accordingly. The shortage of meat supply causes consumers to pay a very high price for all kinds of meat. Every family desires to eat more meat but the high price relative to their low income have caused them to divert their food consumption to other foods. A commercialization in livestock raising will certainly lead to a higher level of meat supply within the country. As a livestock industry becomes more commercialized, the demand for feed concentrate and finished feed mix will inevitably rise, hence, the feed milling industry will expand. At present, the annual demand for animal feed mix exhibits an increasing trend and is expected to rise noticeably in the near future. This will in turn cause an increase in the domestic utilization of corn. The major ingredients of feed mix in Thailand are corn, rice bran, and broken rice. Sorghum is occasionally used by the millers. The degree of these input substitutions is greatly dependent upon the prevailing relative prices and availability of supplies.

At present, it can be said that the expansion of the feed milling industry in Thailand is not as rapid as in some countries. One reason for this is that most livestock raisers still use their own traditional feed for their livestocks. However, the increasing number of good foreign animal breeding stocks among farmer raisers will inevitably lead them to utilize more feed mix since new livestock breeds need a higher quality of feed which cannot be traditionally produced by farmers without technical

knowhow. A feed mix concentrate will be increasingly needed by the farmer-raisers. This will undoubtedly cause a sizable expansion in the feed milling industry. However, feed mill production capacities are limited. As mentioned earlier, the existing production capacity of all the feed mills in Thailand at present is equivalent to only about 21% of the total estimated potential demand. If all livestock raisers begin to utilize feed mix, a shortage of supply will certainly occur. The feed milling industry cannot be expanded as rapidly as it should be to meet the increasing domestic demand. There is also a high degree of instability in the supply of raw materials which confronts the feed millers. Furthermore, feed millers have to compete with foreign buyers in buying raw materials as soybean waste and fishmeal. The price of these raw materials is likely to fluctuate along with the export price. This causes a great problem to feed millers in stabilizing feed mix prices within the country.

The solution to the problem of livestock feed production is really complex. The most affected group is the poor consumer who presently buys meat at such a high price. Most often, they have to forego a high percentage of their meat consumption. The high price of livestock feed greatly hinders the development of the livestock industry of Thailand. The problem is still left to the government to find the best solution. This may be in the form of better incentives to the feed milling industry on one hand and the livestock industry on the other hand.

CHAPTER VII. MARKETING AND EXPORT

A. Domestic Marketing Practice for Corn

A.1 Distribution and Marketing Chains in the Industry

Thailand's corn industry is chiefly an export economy. Most of the corn goes to overseas markets. The Thais are not corn eaters. Rice is still the main diet of the people. Apart from the domestic utilization of corn by the feedmilling industry, corn is not domestically processed for human food consumption within the country.

Most corn is rapidly moved out of the producing area after each harvesting time. Farmers sell their corn to rural merchants, wholesalers, landlords, and local agricultural cooperatives. Some of these local assemblers of corn grain store their collected grain for future marketing at a better price. Due to the lack of adequate storage facilities, most of these local assemblers immediately sell the grain either to corn assembly central markets located at Ayuthaya, Lopburi, and Saraburi, to Bangkok brokers, or to feedmillers in Bangkok and nearby provinces.

Most corn grain flows through the assembly central markets, exporters' buying representatives, provincial wholesalers and brokers. Thereafter, the grain is sold directly to corn exporters. These exporters store the grain in their own godowns located along the bank of the Chao Phya River while awaiting shipment to overseas

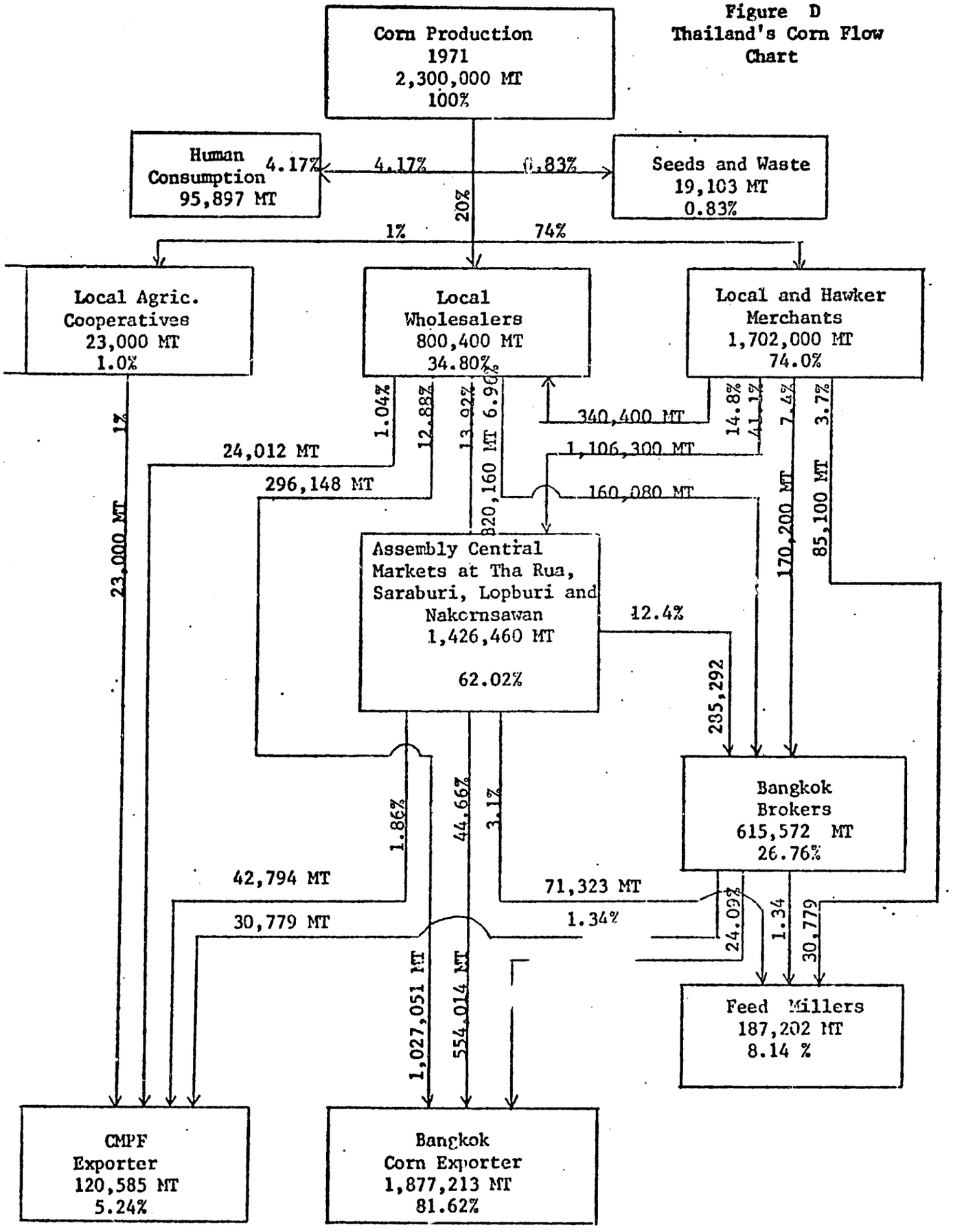
markets. As to the quantity of corn delivered to local agricultural cooperatives, the grain is directly sold to the Cooperative Marketing and Purchasing Federation of Thailand Ltd. (CMPF) in Bangkok. The CMPF is also a corn exporter having a direct marketing contract with the importing cooperative in Japan. A relatively small quantity of corn is absorbed by feedmillers. A study on corn marketing revealed that during the period of June 1968 to May 1969, about 97.74% of corn grain from various producing areas went to exporters and only 2.26% was absorbed by domestic feedmillers.[1/] The corn marketing channel is illustrated in Figure D, showing Bangkok as the main and terminal corn market in Thailand.

A.2 The Corn Price Movement

Tables 13 to 15 show various time series of corn prices in Thailand. For the past 10 years, the average wholesale price of corn in Bangkok was about 1,110.92 bahts per metric ton. Corn prices almost remained unchanged during this period of time although the general price level of all commodity had considerably gone up in the last decade. This implies that real corn prices somewhat exhibit a declining trend. However, the price spread shown in Table 15 indicated some movement during the recent years, but not really significant.

1/ Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, A Study on Marketing and Prices of Agricultural Products in the Upper Chao Phya Basin, Thailand, 1969, p. 59

Figure D
Thailand's Corn Flow Chart



Description of Thailand's Corn Flow Chart

It is estimated that seed and domestic human consumption takes about 5% of production. The balance of 95% flows through local agricultural cooperatives (1%), local wholesalers (20%), and local and hawker merchants (74%). From local assemblers, about 60% of corn flows through the Assembly Central Markets located at Tha Rua. Approximately 40% of corn flows through this market. When the corn reaches Bangkok, it flows through Bangkok brokers (26%), feed millers (10%), and the rest of the bulk of corn goes to Bangkok exporters (80%) and only about 5% of total corn production is exported through the Cooperative Marketing and Purchasing Federation Ltd. (CMPF). The figures in each box represent the percentage shares of production in the marketing channels.

An attempt was also made to estimate in detail the percentage flow of corn from each marketing agency level. These percentages presented indicate the flow direction of 100% collected grain for each marketing agency.

Table 13

Monthly Wholesale Prices of Corn in Bangkok, 1962-1971

Bahts/metric ton

Year	January	February	March	April	May	June	July	August	September	October	November	December	Average
1962	1,096.17	1,140.33	1,090.83	1,028.33	1,117.67	1,027.75	933.33	907.17	933.33	916.67	903.67	909.00	1,001.17
1963	1,077.67	1,120.17	1,046.50	1,028.00	1,132.17	1,119.17	1,103.17	1,090.00	947.00	974.17	1,011.67	1,042.83	1,057.67
1964	1,033.83	941.17	889.83	1,010.00	1,097.50	1,148.33	1,096.00	1,066.67	996.17	1,002.00	1,045.67	1,153.33	1,040.00
1965	1,245.00	1,377.00	1,315.50	1,372.50	1,548.17	1,511.33	1,191.17	996.83	952.67	975.00	971.17	1,000.33	1,204.67
1966	1,206.17	1,182.50	1,115.83	1,108.33	1,155.83	1,056.00	1,063.83	1,051.67	1,119.33	1,090.00	1,124.67	1,252.50	1,131.83
1967	1,187.50	1,130.33	1,147.83	1,274.17	1,351.83	1,315.83	1,298.33	1,145.17	1,048.17	1,050.83	1,060.00	1,046.83	1,170.17
1968	986.17	969.67	1,014.67	1,068.83	1,063.67	1,039.17	988.67	913.50	847.00	835.17	951.17	1,059.00	978.00
1969	1,153.50	1,166.83	1,106.33	1,125.00	1,222.17	1,345.50	1,072.83	985.33	969.83	988.67	1,086.17	1,011.50	1,102.67
1970	1,134.50	1,031.83	1,193.00	1,243.33	1,299.17	1,235.00	1,225.50	1,282.67	1,323.17	1,284.50	1,232.33	1,205.83	1,224.17
1971	1,280.33	1,344.67	1,319.17	1,384.17	1,501.83	1,479.33	1,258.67	1,019.50	947.67	901.33	981.83	979.67	1,199.83
1972													1,140.00

Source: The Thai Maize and Produce Traders Association, Bangkok, Thailand

Table 14

Five-Year Monthly Average of Prices Received by Farmers and Wholesale Prices in Bangkok, and Corresponding Indexes, Thailand, 1967-1971

(Bahts/kilogram)

Months	Farmers' prices		Wholesale prices	
	5-year average	Index	5-year average	Index
January	0.77	95	1.15	102
February	0.72	89	1.16	103
March	0.81	100	1.16	103
April	0.83	102	1.22	08
May	0.83	102	1.27	12
June	0.89	110	1.27	12
July	0.83	102	1.18	04
August	0.77	95	1.05	93
September	0.80	99	1.01	89
October	0.79	98	1.01	89
November	0.82	101	1.04	92
December	0.83	102	1.06	94
Average	0.81	100	1.13	100

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

Table 15

Price Received by Farmers, Wholesale Prices in Bangkok, and Price Spread, for Corn in Thailand, 1967-1971

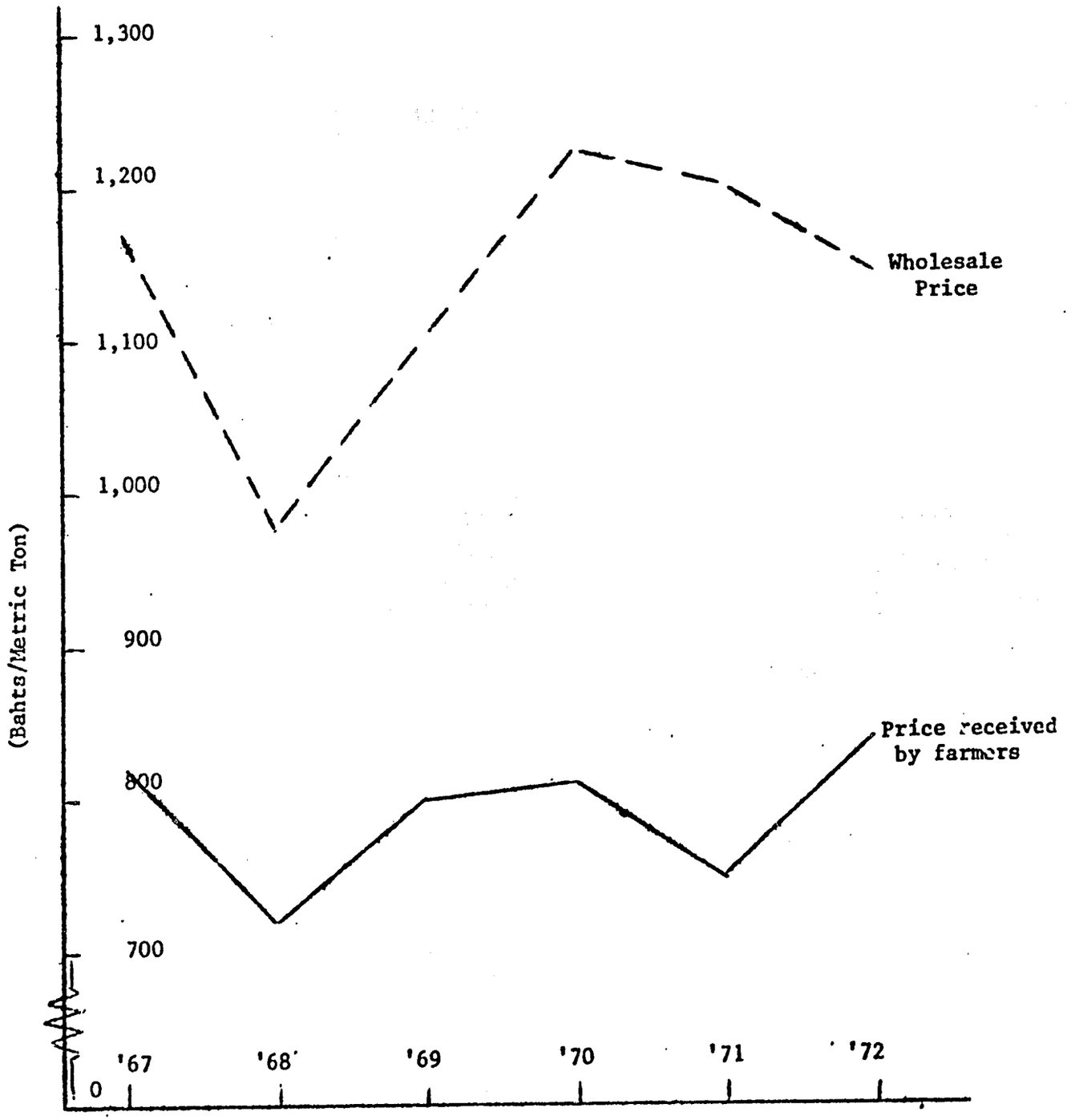
(Bahts/metric ton)

Year	Price received by farmers	Wholesale price in Bangkok	Price spread
1967	820	1,170	350
1968	720	978	258
1969	800	1,103	303
1970	810	1,224	414
1971	750	1,200	450
1972	840	1,144	304

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

Figure F

Price Received by Farmers and Wholesale Prices in Bangkok
1967-1971



Looking at the corn price received by farmers in Table 14, it can be said that farmers' prices were still low compared to wholesale prices. An increase in the efficiency of corn marketing may lead to a narrower price spread.

Domestic corn price is determined by the condition of demand and supply. It greatly depicts a seasonal variation. During the harvesting season in September and October, the price is usually low because of a great volume of corn flowing from the farms into the marketing channels. The price will gradually rise in the following months until it reaches a maximum in May and June when the grain stock inventory is obviously low, Table 14.

A.3 Corn Marketing Problem

There are three basic problems in marketing corn grains.

a) Low farmers' price

The price factor is the most important incentives for farmers to grow more corn. Due to a heavy debt obligation, farmers are forced to sell their corn to merchant creditors to pay their debts at a time when the price is at the lowest.

The farmers never benefit from a higher corn price in later months. When Corn price is high, the grain has already been moved out of their farms into the hands of merchants or other assemblers along the channels, who always reap the full benefit of rising prices.

b) Inefficient marketing strategy of farmers.

Most corn farmers run their farming business almost independently, particularly in the marketing of their products. An individual corn farmer produces a great quantity of corn each season, and individually sells his product to the local merchants of his choice. Under this marketing system, he is likely to be in a disadvantageous position to merchants in terms of pricing, because he alone has no bargaining power. Corn farmers rarely market their products collectively except for a small number of farmers belonging to local agricultural cooperatives. Farmers in many areas form themselves into local Farmers' Groups which are under the direction of the Ministry of Agriculture and Cooperatives. Due to lack of appropriate leadership within each group, they again fail to reap full benefits from the collective marketing of their products.

c) Lack of storage facilities

Apart from the need for farmers to market their corn immediately after harvesting to clear their debts, most farmers also have to sell their corn due to lack of proper storage facilities to store their corn. Many farmers do not even have any barn to keep the grain.

Due to a large volume of corn purchased by local assemblers, they also lack adequate storage space to store the grain before selling to either brokers in Bangkok or to assembly central markets. Very often, the trucks and barges have to wait for a few days to unload the grain because the silos and godowns of exporters are filled.

A.4 Government Policies on Corn Marketing

To improve the corn marketing system, the government has introduced the following measures.

a) Setting up of local corn growers' groups

The Ministry of Agriculture and Cooperatives has assisted corn growers in forming cooperative societies in order that they may gain the benefit of collective action in production and marketing.

b) Improvement of corn marketing by means of cooperative system

The policy is to strengthen the capacity and the capability of existing agricultural marketing cooperatives and set up new ones to handle the marketing of corn for its members. These local cooperatives will deliver the corn grain to the Cooperative Marketing and Purchasing Federations of Thailand Ltd. in Bangkok for exportation.

c) Building up silos and storage facilities

The lack of silos and storage facilities at the local level is one of the main corn marketing problems which force the growers to sell their corn at low prices during the harvesting period. Furthermore, existing farm storage facilities are not properly equipped to store grain in good condition for future marketing. The government through the Ministry of Commerce and in cooperation with the Department of Cooperative Promotion, is inaugurating a silo and storage project for corn. This policy will considerably increase the efficiency of corn marketing in Thailand.

B. The Corn Export Market

B.1 Trend in Corn Export

Before 1958, annual corn export volume was less than 100,000 metric tons. The export volume rose drastically from 162,914 metric tons in 1958 to 767,485 metric tons in 1963. This sharply increased to 1,146,932 metric tons in 1964 and reached a record of 1,885,683 metric tons in 1971. The keen promotion of the overall corn growing industry as set out in the policy of the First and Second Five-Year Economic and Social Development Plans during 1960-1966 and 1967-1971, coupled with the tremendous increase in demand of the export markets, has resulted in the boom of corn production and export, as shown in Table 16.

Table 16

Volume and Value of Corn Export, Thailand, 1950-1971, FOB, Bangkok

Year	Corn		Cornmeal		Total		Average Price
	Metric Tons	Millions of Bahts	Metric Tons	Millions of Bahts	Metric Tons	Millions of Bahts	฿/M ton
1950	12,630	10.5	-	-	12,630	10.5	831
1951	22,562	21.3	-	-	22,562	21.3	944
1952	25,162	27.9	-	-	25,162	27.9	1,109
1953	34,711	47.0	-	-	34,711	47.0	1,354
1954	36,976	56.1	-	-	36,976	56.1	1,517
1955	68,186	80.0	-	-	68,186	80.0	1,173
1956	81,490	96.1	-	-	81,490	96.1	1,179
1957	64,337	74.4	-	-	64,337	74.4	1,156
1958	162,914	182.7	-	-	162,914	182.7	1,121
1959	236,781	249.5	1,648	1.8	238,429	251.3	1,054
1960	514,745	550.7	2,633	2.8	517,378	553.5	1,070
1961	567,236	597.3	1,980	2.1	569,216	599.4	1,053
1962	472,405	502.2	11,723	13.6	484,128	515.8	1,065
1963	744,046	828.2	23,439	28.8	767,485	857.0	1,117
1964	1,115,041	1,335.6	31,891	41.7	1,146,932	1,387.3	1,209
1965	804,380	967.6	26,973	34.9	831,353	1,002.5	1,206
1966	1,218,537	1,519.9	43,019	56.5	1,261,556	1,576.4	1,249
1967	1,090,762	1,355.4	55,219	75.6	1,145,981	1,431.0	1,249
1968	1,480,841	1,556.1	77,357	90.9	1,558,198	1,647.0	1,057
1969	1,476,105	1,674.4	68,709	92.5	1,544,814	1,766.9	1,144
1970	1,371,474	1,859.9	76,481	112.2	1,447,955	1,969.1	1,360
1971	1,806,035	2,185.7	79,648	100.0	1,874,461	2,285.7	1,212

Source: Department of Customs

From 1961 to 1971, corn export prices fluctuated in a narrow range of 1,053 to 1,360 bahts per metric ton. An increase in the corn export volume together with quite stable export prices led to a considerable increase in export earnings of 599.4 million bahts in 1961 to 2,285.7 million bahts in 1971. This made corn as the second largest export earning crop after rice in 1971. Export earnings for rice in 1971 was 2,909 million bahts.

Corn is exported from Thailand in two major forms, corn grain and cornmeal. Cornmeal was first exported in 1959, totalling 1,648 metric tons valued at 1.8 million bahts. Export of cornmeal rose steadily and reached 79,648 metric tons in 1971, valued at 100 million bahts. Major importers of Thai cornmeal are Singapore, Hongkong and Malaysia.

The world market share of Thai corn was 5.1% in 1970, making Thailand the fourth largest corn exporter in that year after the United States, Argentina, and France. In 1970, the total volume of world corn export was 30,509,500 metric tons, of which 47.2% was exported from the United States, 17.2% from Argentina, 8.0% from France, 5.1% from Thailand, 3.9% from South Africa, and 18.6% from the rest of the world as shown in Table 17.

Major Thai corn importers are Japan, Taiwan, Singapore, Hongkong and Malaysia. These countries annually import at least 90% of the total volume of Thailand's corn export. For example,

Table 17

Percentage Distribution of Corn Export of World Leading Exporters, 1966-1970

Countries	1966	1967	1968	1969	1970
United States	61.1	47.6	52.4	52.3	47.2
Argentina	14.7	15.9	10.1	15.0	17.2
France	5.1	6.3	5.7	8.1	8.0
Thailand	4.8	4.0	5.2	5.5	5.1
Union of South Africa	0.2	7.4	10.4	2.8	3.9
Others	14.1	18.8	16.3	16.3	18.6

Source: Calculated from FAO Trade Yearbook, 1970

in 1971, Thailand exported 1,885,683 metric tons of corn of which 925,277 metric tons or 49.1% was sold to Japan, 322,098 metric tons (17.1%) to Taiwan, 169,513 metric tons (9.0%) to Singapore, 156,002 metric tons (8.3%) to Hongkong, 91,618 metric tons (4.9%) to Malaysia, and 221,175 metric tons (11.6%) sold to the rest of the world, as shown in Tables 18 and 19.

Japan is the largest importer of Thai corn. Corn trade between Thailand and Japan first began in 1951. In this year, Thailand exported 4,867 metric tons of corn to Japan. The volume of corn trade with Japan rapidly increased. In 1960, up to 79.4% of total Thai corn export went to Japan. The

Table 18

Volume of Corn Export[2/] by Destinations, Thailand, 1957-1973

(Metric tons)

Year	Hongkong	Singa-pore	Malay-sia	Kuwait	Japan	Taiwan	Others	Total
1957	2,925	9,586	15,432	-	36,393	-	1	64,337
1958	3,879	14,880	14,471	-	129,683	-	1	162,914
1959	10,170	18,384	20,587	-	189,185	-	103	238,429
1960	11,327	35,601	24,865	-	441,046	2,052	50	514,941
1961	57,245	82,498	31,560	-	338,346	719	54,697	569,131
1962	104,300	97,551	50,596	-	229,686	-	1,995	484,128
1963	113,253	88,702	61,629	-	453,414	9,911	40,576	767,485
1964	111,325	88,063	64,883	-	844,936	9,573	28,152	1,146,932
1965	85,099	96,518	62,701	140	559,749	8,990	18,156	831,353
1966	80,597	165,676	82,515	1,525	826,289	57,116	47,838	1,261,556
1967	85,614	131,639	87,642	7,070	670,797	143,993	19,226	1,145,981
1968	140,378	186,826	135,903	10,525	666,272	395,475	22,819	1,558,198
1969	144,841	188,456	132,553	9,323	486,686	450,498	142,458	1,554,815
1970	112,078	109,706	92,798	16,802	649,903	447,299	19,369	1,447,955
1971	143,780	169,513	92,806	15,278	925,277	322,098	204,709	1,873,461
1972	119,978	225,959	107,962	9,665	842,204	502,775	35,076	1,843,619
1973	142,264	172,759	121,781	12,656	490,380	311,247	143,553	1,394,643

2/ Including cornmeal.

Source: Department of Customs

Figure G

Volume of Corn Export by Destinations, Thailand
1957-1973

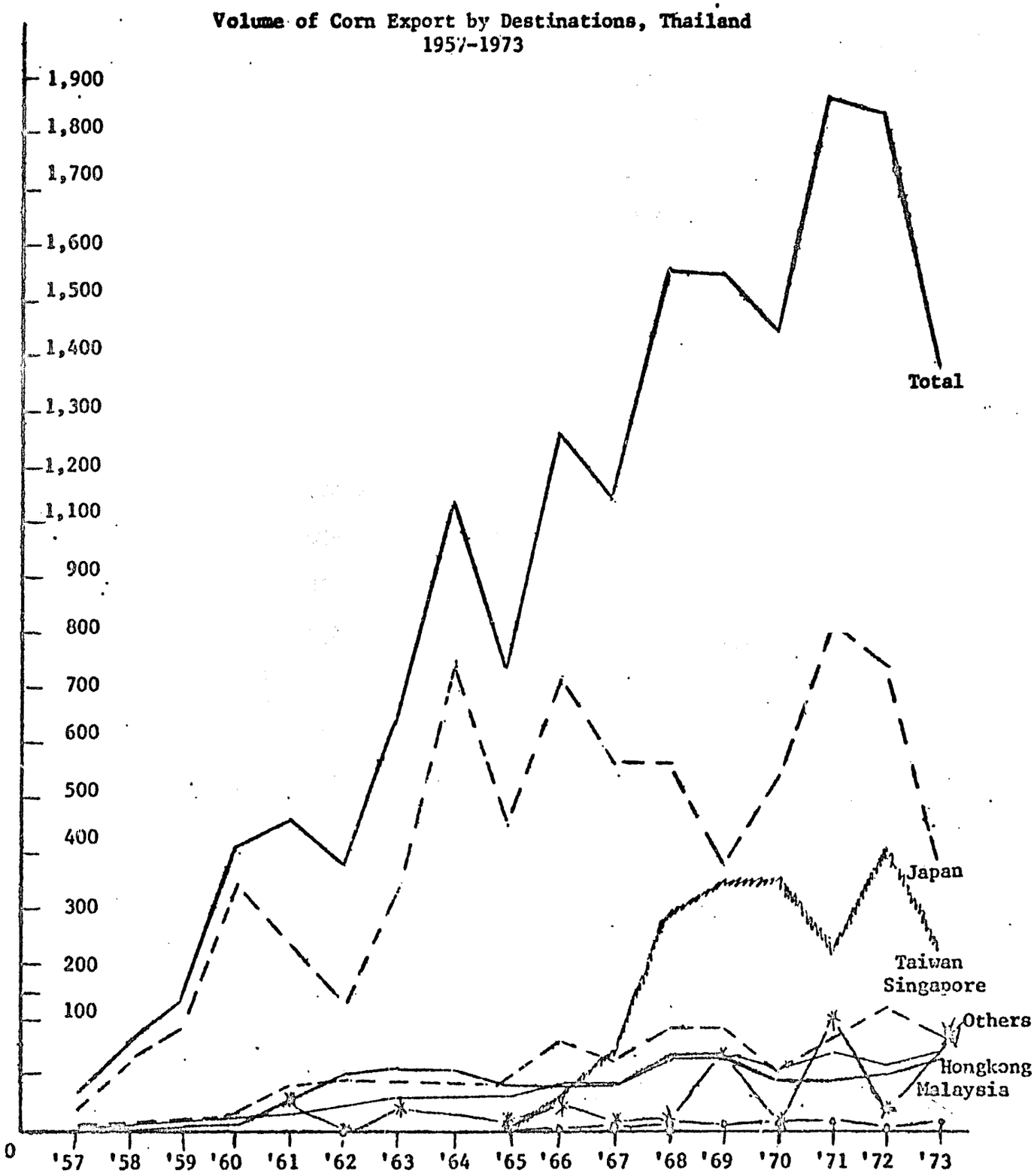


Table 19

Percentage Distribution of Corn Export by Destinations, Thailand, 1959-1973

Year	Hongkong	Singapore	Malaysia	Japan	Taiwan	Others	Total
1957	4.5	14.9	24.0	56.6	-	-	100.0
1958	2.4	9.1	8.9	79.6	-	-	100.0
1959	4.3	7.7	3.5	79.3	-	5.2	100.0
1960	2.2	7.1	2.6	79.4	0.4	8.3	100.0
1961	7.9	14.5	2.5	59.4	0.1	15.6	100.0
1962	21.5	20.1	5.8	47.4	-	5.2	100.0
1963	14.8	11.6	6.0	59.1	1.3	7.2	100.0
1964	9.7	7.6	4.0	73.7	0.8	4.1	100.0
1965	10.2	11.6	7.0	67.3	1.1	2.8	100.0
1966	6.4	13.1	6.4	65.5	4.5	4.1	100.0
1967	7.5	11.5	7.5	58.5	12.6	2.4	100.0
1968	9.0	12.0	8.5	42.8	25.6	2.3	100.0
1969	9.4	12.2	8.3	31.5	29.2	9.4	100.0
1970	7.7	7.6	6.3	44.9	30.9	2.6	100.0
1971	8.3	9.0	4.9	49.1	17.1	11.6	100.0
1972	6.5	12.3	5.9	45.7	27.3	3.3	100.0
1973	10.2	12.4	8.7	35.2	22.3	11.2	100.0

Source: Calculated from Table 12

importance of Japan as Thailand's major corn importer has declined in recent years as Taiwan, Singapore, Hongkong, and Malaysia has increasingly absorbed Thai corn. The percentage of Thai corn exported to Japan greatly declined from 79.3% in 1960 to 31.5% in 1969. This went up again to 49.1% in 1971, and then declined to 35.2% in 1973. However, Japan is still considered as the largest importer of corn from Thailand.

Other markets are located in the Middle East such as Iran and Kuwait. Occasional importers of Thai corn are U.S.S.R. and the Philippines.

Some of the trade agreement provisions between Thailand and Japan are shown in Appendix 3.

B.2 Corn Export Volume and Revenue Vs. Other Prime Export Commodities

Rice, rubber, corn, tin, tapioca products, jute and kenaf are the major export-earning commodities of Thailand. In 1973, earnings from these commodities accounted for 56.39% of the total export revenue of the nation. Of these principal exports, corn has shown a very bright potential in the export economy. Its growth export revenue reached the highest record of 2,936 million bahts in 1973 accounting for 9.2% of the total export revenue in

this year. However, rice still occupies the first place in Thailand's export economy except in 1973 where the domestic shortage of rice caused the volume of its export to fall drastically from 2,112,114 metric tons in 1972 to 847,870 metric tons in 1973. As a consequence, earnings dropped from 4,437 million bahts in 1972 to 3,601 million bahts in 1973. Rubber export earning was the largest in 1973 for Thailand at 4,557 million bahts which was the highest record in the rubber industry's history. Total volume and value of Thailand's principal exports are shown in Table 20.

B.3 Potential in the Export Market

Due to a slow growth of domestic corn utilization, the industry must continue to depend on its export markets. Table 21 shows the corn export volume and level of domestic utilization from 1968 to 1971. The volume of corn absorbed by the domestic feed industry has been very low at 151,421 metric tons in 1968, 168,256 metric tons in 1969, 188,451 metric tons in 1970, and 220,896 metric tons in 1971 as compared to the corresponding volume of total corn exports ; 1,558,199 metric tons in 1968, 1,554,815 metric tons in 1969, 1,447,955 metric tons in 1970 and 1,873,461 metric tons in 1971.

Table 20

Total Quantity and Value of Principal Exports, Thailand, 1957-1973

Year	Rice		Rubber		Tin[1/]		Corn		Tapioca products	
	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht
1957	1,570,237	3,622	134,833	1,406	18,396	531	64,337	74	98,775	138
1958	1,132,930	2,968	135,508	1,326	9,096	255	162,914	183	151,626	192
1959	1,091,671	2,575	174,404	2,336	13,737	434	238,429	252	194,648	224
1960	1,202,772	2,570	169,655	2,579	17,114	537	514,941	551	269,733	288
1961	1,575,998	3,598	184,598	2,130	18,104	617	569,131	599	443,302	446
1962	1,271,023	3,240	194,180	2,111	19,841	685	484,128	516	400,788	423
1963	1,417,673	3,424	186,887	1,903	22,003	741	767,485	857	427,443	439
1964	1,896,258	4,389	216,993	2,060	22,339	961	1,146,932	1,388	738,859	653
1965	1,895,223	4,334	210,854	1,999	20,503	1,166	831,353	1,004	719,442	676
1966	1,507,550	4,001	202,535	1,861	18,898	1,316	1,261,556	1,577	688,603	644
1967	1,482,272	4,653	211,118	1,574	27,107	1,822	1,145,981	1,431	781,32[illegible]	725
1968	1,068,185	3,775	252,220	1,816	24,017	1,510	1,558,198	1,647	888,854	772
1969	1,023,064	2,945	276,381	2,664	23,431	1,631	1,554,815	1,767	975,091	876
1970	1,063,616	2,516	275,610	2,232	22,246	1,618	1,447,955	1,969	1,326,865	1,223
1971	1,576,142	2,909	307,871	1,905	21,873	1,569	1,873,461	2,286	1,123,034	1,240
1972	2,112,114	4,437	317,695	1,862	21,840	2,664	1,843,619	1,085	1,311,038	1,547
1973	847,870	3,601	390,714	4,557	22,346	2,019	1,394,643	2,936	1,813,099	2,506

Table 20 (continued)

Year	Jute & Kenaf		Shrimp		Tobacco Leaves		Sugar		Mung beans	
	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht
1957	14,580	46	7	-	6,728	100	3,541	6	10,452	33
1958	27,587	70	39	-	5,781	85	82	-	7,222	24
1959	37,317	88	198	1	1,235	16	450	1	15,400	37
1960	61,769	230	942	3	1,696	21	5,723	8	23,033	48
1961	143,477	626	889	3	1,136	12	1,537	3	26,447	60
1962	237,898	579	1,279	9	2,628	31	43,019	46	21,025	62
1963	125,753	358	2,053	46	3,782	41	52,823	122	20,685	59
1964	162,095	495	3,414	69	6,147	79	48,903	211	33,375	84
1965	316,986	1,102	4,880	109	6,046	89	83,834	100	50,688	118
1966	473,269	1,614	7,882	191	7,880	115	54,858	82	55,291	131
1967	317,094	866	8,829	259	8,562	147	15,013	37	46,897	122
1968	289,478	674	7,290	278	10,375	199	52	-	46,700	132
1969	255,978	780	8,133	270	8,532	149	16,102	47	76,771	215
1970	257,663	719	6,421	224	10,785	197	56,248	94	89,818	255
1971	271,676	935	5,593	247	13,158	236	174,571	382	85,596	255
1972	255,093	1,087	6,725	340	18,160	284	407,501	1,264	88,316	277
1973	263,850	1,052	114,790	798	16,339	307	254,239	1,067	96,524	374

Table 20 (continued)

Year	Fluorite		Sorghum		Cements		Teak		Others	Total
	Metric tons	Millions of baht	Metric tons	Millions of baht	Metric tons	Millions of baht	Cubic metres	Millions of baht	Millions of baht	Millions of baht
1957					15,463	10	75,747	262	1,312	7,540
1958					13,742	10	72,554	239	1,095	6,447
1959					17,726	12	73,253	244	1,339	7,560
1960	922				24,719	11	100,925	356	1,412	8,614
1961	5,131	3			156,924	51	64,528	252	1,597	9,997
1962	6,962	3			179,486	63	39,753	170	1,601	9,529
1963	15,875	7			143,631	55	32,215	137	1,487	9,676
1964	38,666	16	13,146	13	102,371	36	40,490	179	1,706	12,339
1965	46,993	20	54,004	61	105,655	41	45,233	201	1,921	12,941
1966	73,670	30	102,668	113	45,423	17	49,459	243	2,164	14,099
1967	125,752	56	93,145	108	32,987	17	35,716	194	2,154	14,166
1968	204,871	116	54,017	56	34,705	19	29,446	169	2,516	13,679
1969	157,962	158	57,299	62	95,491	38	29,003	166	2,954	14,722
1970	349,257	222	79,507	103	150,677	83	28,763	156	3,161	14,772
1971	335,774	311	131,483	157	237,601	90	37,594	183	4,576	17,281
1972	274,450	222	131,055	138	736,572	218	40,303	208	6,858	22,491
1973	275,428	225	173,888	240	883,552	303	51,743	425	11,718	32,283

1/ Figures for tin exports during 1957-1964 and parts of the exports during 1965-1967 were the concentrates. Since 1968 they consist wholly of tin metal.

Source: Department of Customs, Ministry of Finance, Thailand

Table 21

Corn Export Volume and Level of Domestic Utilization, 1968-1971

(Metric tons)

Corn	1968	1969	1970	1971
Volume of export	1,558,199	1,554,815	1,447,955	1,873,461
Volume of Domestic Utilization	164,000	181,000	204,000	240,000
Seed	12,579	12,744	15,549	19,104
Feed industry and others	151,421	168,256	188,451	220,896

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand

The government through the Ministry of Commerce has maintained the following policies to improve the export potential of Thai corn export markets.

1) Study the demand for corn in various export markets

2) Study foreign price movement for corn

3) Strengthen existing export markets for corn as we are finding new ones

4) Improve grade and standardization of corn

5) Control and regulate corn export so as to maintain efficiency in the marketing system

These policies were written in the "Acceleration of Corn Production and Marketing Program, 1972-1976"[3/] as part of the Third Five-Year National Economic and Social Development Plan for 1972-1976 in relation to the corn industry.

If overseas markets can be definitely secured and widened to absorb all the Thai corn, the rapid expansion of corn production is deemed attainable. At present, corn is produced without the application of fertilizer, pesticides or herbicides. The full and appropriate application of these inputs will cause a great increase in corn output and yield. Technically speaking, it is feasible to increase corn output and yield in Thailand. However, marketing the bulk of increased corn output will pose another problem. The program for accelerating corn production and marketing in Thailand is presented in Appendix 4.

[3/] Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Acceleration of Corn Production and Marketing Program, 1972-1976, Agricultural Economic Document No. 55, 1972, p.26.

Appendix 3

(Excerpts from)

AGREEMENT ON MAIZE TRADE BETWEEN THAILAND AND JAPAN FOR 1969/70 SEASON*

It is mutually agreed that the maize trade between Thailand and Japan for the crop year 1969/70 be conducted under the following terms and conditions:

1. Validity of Agreement:

   The agreement shall be valid from the date of its signing to June 30, 1970.

2. Quantity:

   The target of maize to be sold to Japan during the 1969/70 season shall be 600,000 metric tons. However, the Japan Feed Trade Association (JFTA) undertakes to purchase whatever quantity of maize offered by the Board of Trade of Thailand (BOT), subject to the following conditions:

   1) The quantity for October shipment is definitely fixed at 90,000 metric tons.

   2) The quantities for November shipment and onwards shall be fixed along the following lines:

      a. The BOT shall advise the JFTA of the tentative quantity of each shipment 75 days before the

---

*Reproduced from the text of the complete agreement as printed in (9).

commencement of the shipment period involved, while the definitive quantity shall be determined by mutual consent, of both BOT and JFTA within the allowance of 10% more or less of the tentative quantity 60 days before the commencement of the shipment period involved.

b) The tentative quantity to be advised and the definitive quantity to be determined in accordance with 2) shall be within the range of 130,000 metric tons maximum and 60,000 metric tons minimum in respect of each shipment period. In the event of of the tentative quantity of any one shipment period falling below the minimum of 60,000 metric tons, it is mutually agreed that the agreement shall be automatically terminated as from the shipment involved.

3. Contracts between buyers and sellers:

As soon as the quantity for any particular shipment has been agreed upon, the BOT shall furnish the JFTA with a list of registered exporters, who have received export allocations from the Thai competent authorities. Members of the JFTA shall be at liberty to enter into contract with

any of the registered exporters listed within the limit of the export allocation of each exporter within the limit of the export allocation of each exporter within 10 days following receipt of the said list. The JFTA shall furnish the BOT with the details of such contracts within 5 days following the expiration of the said 10-day period.

In the event members of the JFTA are unable to conclude contracts with Thai exporters up to the quantity agreed upon, the JFTA shall immediately inform the BOT of such shortfalls and the BOT shall furnish the JFTA with a list of alternative exporters with whom members of the JFTA are able to conclude contracts in order to cover the shortfalls within 5 official working days from the date of receipt of such notice.

Following receipt of this list, members of the JFTA shall conclude contracts with such Thai exporters within 5 official working days and submit details of such contracts to the BOT.

4. Price Selecting Procedure:

The price of Thai maize shall be based on the price of U.S. Corn No. 2 Yellow and shall be fixed 30 days before the commencement of each shipment period.

The average of three Chicago futures closing quotations (for nearest contract) during a period of 30 days, holidays

included, before the price fixing days shall be used. One price shall be fixed and two prices shall be selected by JFTA.

The fixed price shall be the quotation on the day at the middle of the price selection period, while the other two prices shall be selected from the quotations on the days which shall be at least four Chicago business days apart from each other and also from the day of the fixed price.

In fixing FOB Premium, the average of three premiums on the same days on which the Chicago futures quotations are fixed and selected shall be used. Such Premium shall be the average of quotations made by the 4 companies, namely, Bunge Far East Agencies, Continental Overseas Corporation, Louis Dreyfus & Co., (Overseas) Ltd., and Tradax (Japan) Ltd.

5. Pricing Formula:

The formula of calculation shall be as follows:

1) The average Chicago Futures for U.S. Corn No. 2 Yellow (calculated on the above basis).

Plus 2) Average FOB Premium for U.S. Corn No. 2 Yellow (calculated on the basis as stated above).

3) Freight from the Gulf Ports of the United States to Japan at prevailing rate at the time of price-fixing (Method of calculation is stipulated in a Note of Understanding).

Less	4)	Freight from Bangkok to Japan at prevailing rate at the time of price-fixing in accordance with the attached Note of Understanding.
	5)	Allowance for shortage of weight of 0.588%
	6)	Loading charges US$0.28 per metric ton
	7)	Inspection fees US$0.30 per metric ton
Plus	8)	Gunny bag US$2.00 per metric ton
Equal	9)	FOB Bangkok unstowed in bag price per metric ton of Thai maize

6. Alternative Price:

In the event of unforeseen circumstances, such as dock strikes in the US Gulf area, war, civil commotion, etc. which make the shipment of U.S. corn to Japan impossible for approximately one month and cause the Chicago Futures to cease reflecting realistic international corn prices, BOT and JFTA shall agree to negotiate for an Alternative Price to replace the Formula Price based on Chicago Futures.

The right to invoke the application of the Alternative Price shall be vested in the BOT but the BOT must exercise this right not less than 60 days before the commencement of the applicable shipment period. Within a five-day period following the invocation of the Alternative Price, the JFTA shall have the right to reduce the quantity irrespective of the 10% tolerance on the pre-advised quantity. However, in no case shall the final quantity after such reduction be less than 60,000 tons.

7. Export Procedure:

While this agreement is in force, the Department of Foreign Trade shall, at the request of BOT, issue export permits covering maize to be exported to Japan only to exporters designated by BOT who have concluded contracts under this agreement with members of JFTA.

At the request of BOT, the Department of Foreign Trade shall not issue export permits to designate Thai maize exporters who have, directly or indirectly, agreed to sell or have sold maize to members of JFTA at prices other than agreed upon by JFTA and BOT.

8. Breach of Contract:

In the event of an exporter committing a breach of contract such as, default or nonfulfillment of contract, delay-delivery, etc. which cause damage to the Japanese importer, and the claim against such damage made by the Japanese importer was ignored by the exporter, then the Japanese importer through the JFTA shall submit the claim together with the supporting written evidence of such default to the BOT.

Upon receipt of sufficient evidence of such default from the JFTA, the BOT will assume responsibility and bring pressure to bear on the said exporter. BOT shall be held responsible for such damage within the limit of the terms and condition specified in the JTA 63 form.

In the case of an importer (member of JFTA) committing a breach of contract such as not opening a letter of credit within the specified time limit or sending ships to load the cargo as scheduled, and refusing to pay the compensation caused to the exporter, the JFTA shall likewise be responsible for such breach of contract. Such claims shall, however, be submitted to the JFTA through the BOT together with the supporting written evidence of such default.

9. Other terms and conditions:

Other terms and conditions of contract to be concluded between the designated Thai maize exporters and the member of JFTA shall be in accordance with JFTA 63.

10. Enforcement of the Agreement:

The enforcement of this Agreement is subject to the approval of the Ministry of Economic Affairs of the Government of Thailand and the Ministry of International Trade and Industry of the Government of Japan.

(Signed in Bangkok on August 6, 1969 by the President of the Board of Trade of Thailand and by the Chairman of the Japan Feed Trade Association.)

Appendix 4

Corn Production and Marketing Scheme

STEPS OF WORK

Job	Direction of Movement	Job Description	Responsible Agent	Beginning Year	Completing Year
a	1 - 2	Construct and improve transportation network sufficient to ship corn from producing areas to markets	Ministry of Communications	1972	1972
b	3 - 4	Expand activities (as well as establishing new ones) of agricultural experiment stations so as to be able to improve and multiply high-yield varieties of corn; to conduct a necessary research on corn	Department of Technical Agriculture, Ministry of Agriculture and Cooperatives	1972	1972
c	4 - 5	Conduct an agricultural economic survey of members of chosen farmer's groups so as to study their basic economic status	Division of Agricultural Economics. Ministry of Agriculture and Cooperatives	1973	1973
d	4 - 6	Establish cooperative societies among corn growers and supervise their operation toward the right direction	Department of Cooperative Promotion, Ministry of Agriculture and Cooperatives	1973	1973

Appendix 4 (continued)

		Establish farmer's groups among corn growers and supervise their operation as necessarily	Department of Agricultural Extension, Ministry of Agriculture and Cooperatives	
e	4 - 7	Produce corn seeds and multiply such that it will meet a demand from members of both cooperatives and farmer's groups	Department of Technical Agriculture, Ministry of Agriculture and Cooperatives	1973	1973
f	5 - 8	Study on economics of corn production and marketing	Division of Agricultural Economics, Ministry of Agriculture and Cooperatives	1973	1973
g	6 - 8	Extend agricultural credit to cooperative members or members of farmer's groups	Bank for Agriculture and Agricultural Cooperatives (or other commercial banks)	1972	1972
h	7 - 8	Increase all technological promotion effort among cooperative members and members of farmer's groups as to new farming techniques, and to provide more farm requisites of them	Department of Agricultural Extension, Ministry of Agriculture and Cooperatives	1972	1972
i	2 - 9	Facilitate transportation services as well as regulating and controlling of transportation rate	Ministry of Communications	1973	1973

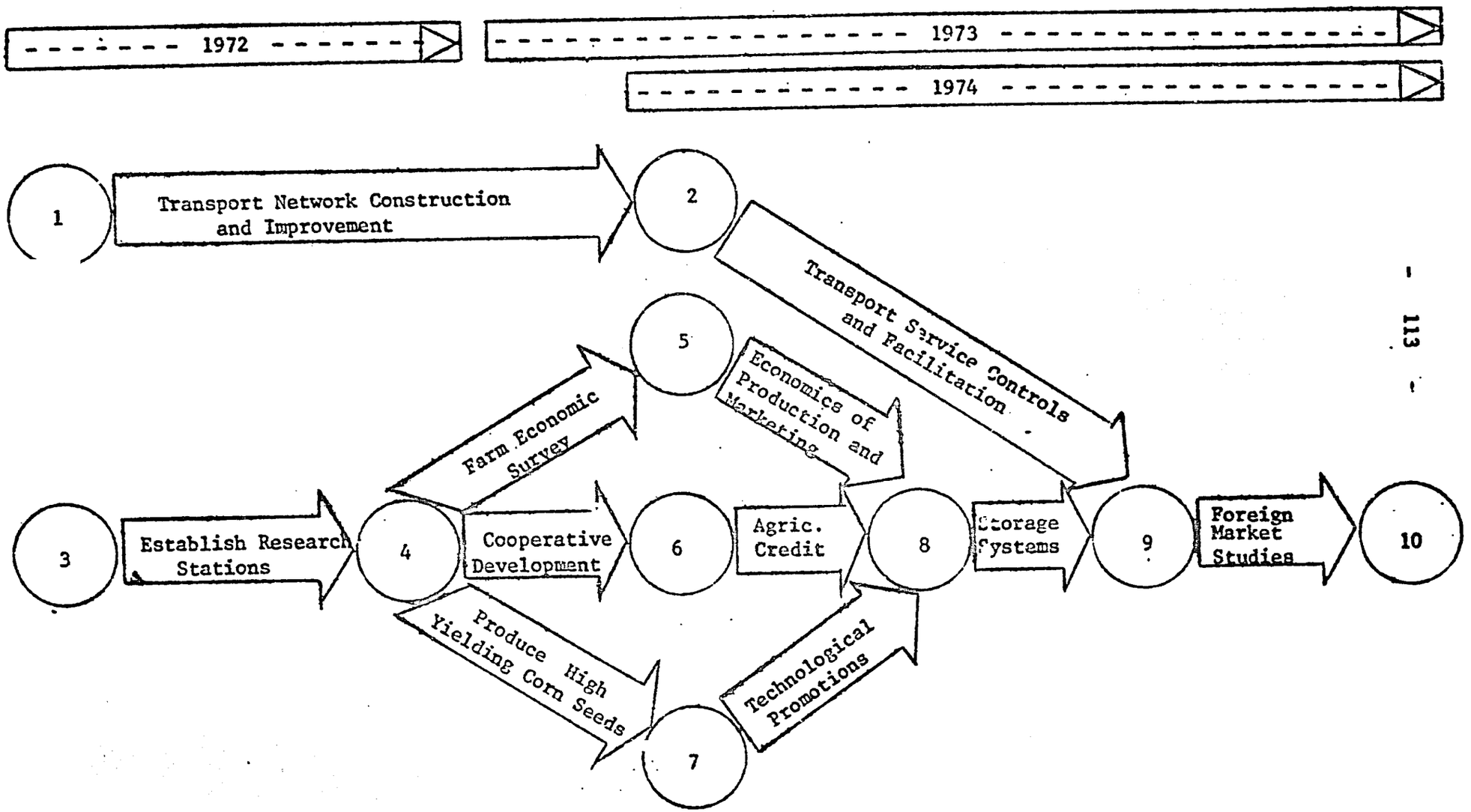
Appendix 4 (continued)

j	8 - 9	Construct silos and warehouses within cooperative system to facilitate and strengthen the corn marketing of cooperatives and farmer's groups	Department of Cooperative Promotion, and the Warehouse Bureau of Thailand	1973
k	9 - 10	1) study foreign demand		
		2) study foreign price movement	Ministry of Commerce	
		3) expand overseas markets		
		4) Regulate and control export		

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, "Acceleration of Corn Production and Marketing Program", 1972-1976, Agricultural Statistics Document No. 55, 1973, pp. 29-33.

Appendix Figure H

Program for the Acceleration of Cron Production
and Marketing in Thailand
1972-1976



CHAPTER VIII. CORN UTILIZATION AND NUTRITIONAL DIMENSION

A. Background on Corn Utilization Pattern

The Thai people prefer corn as dessert, not as a carbohydrate staple. Very small proportion of corn is domestically consumed in forms of roasted or boiled fresh sweet corn ears, glutinous corn as well as field corn. Baby ear corn used as a vegetable is also popular for local consumption. Due to the small quantity of corn directly consumed by the Thai people, statistical records on domestic human consumption of corn as food is not available.

Apart from a small quantity for direct human consumption, corn is domestically utilized as seeds and animal feeds. The demand for seeds varies directly with the area planted each year. The seeding rate is about 18.75 kilograms per hectare. For instance, a 1,018,832 hectares of area planted in 1971, would require a seed volume of 19.103 metric tons. As to the quantity absorbed by the domestic feed industry, it is unfortunate that an official statistical record is not available for study. However, the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives estimated the domestic utilization of corn for 1967 to 1971 as shown in Table 22. Column 2 in the Table includes the small quantity of human consumption. It can be seen that the domestic utilization of corn in Thailand

is small relative to its production and export. The total domestic utilization of corn is only about 10% of the total production, the rest of which goes to export markets. Though the demand for domestic feed is rather low at present, it is highly expected that the future demand will definitely and steadily rise as the domestic livestock industry is being permanently promoted by the government. Furthermore, the growth rate of the domestic livestock industry is being accelerated by feed millers through promotional efforts to widen feed markets.

Table 22

Domestic Utilization of Corn, Thailand, 1967-1971

(Metric Tons)

Year	Seeds	Domestic Feed Industry and Human Consumption	Total
	(1)	(2)	(3)
1967	12,414	127,568	140,000
1968	12,579	151,421	164,000
1969	12,744	168,256	181,000
1970	15,540	188,460	204,000
1971	19,103	221,897	241,000

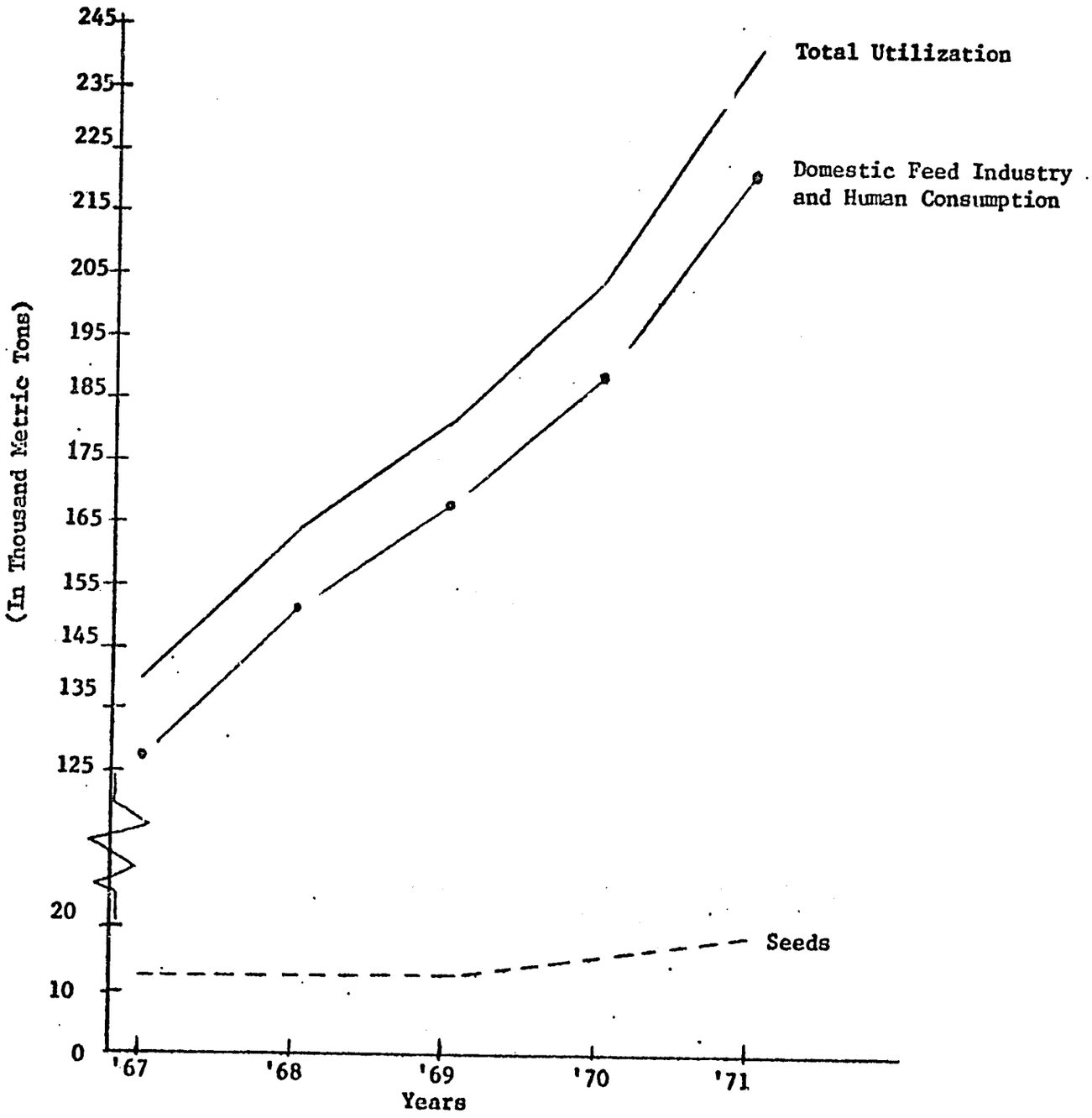
Sources: Column 1 - Computed from area planted using the seeding rate of 18.75 kilograms per hectare

Column 2 - = Column 3 - Column 1

Column 3 - Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Acceleration of Production and Marketing Program, 1972-1976, Agricultural Economics Document, No. 55, 1972

Figure I

Domestic Utilization of Corn, Thailand, 1967-1971



B. Nutritional Aspects of Corn

In 1966, the average per capita income of Thailand was about $120 or $10 per month.[1/] The Thais spent 50% of their income of $5 per month for food. Of this $5, $2 was spent for rice consumption (400 gm/day or 12 kg/month) and other $3 for other food commodities. Protein from rice alone is inadequate, hence, the need to augment protein intake from other sources using the $3 left. It is clear that they cannot spend this amount for protein food from animals since the price of meat is valued at $1.25/kg. The cheapest source of protein is legumes. However, it is difficult to convince the people to consume soymilk and soymeat.

In Thailand where rice is a staple food, the protein calorie ratio is somewhat low (8.7% compared to 11.12% in developed countries).[2/] This is due to the low protein content of rice. However, the low protein-calorie ratio will mostly affect the young population in which more protein of high quality is essential for optimal growth. On the other hand, the quality of the rice-based Thai diet is more or less satisfactory for adults because of a relatively balanced amino acid content of rice protein.

1/ Report on Protein Food Promotion, November 22-December 1, 1970. The Institute of Food Research and Product Development, Kasetsart University

2/ Ibid

A research is now being conducted by the National Corn Improvement Program to produce a high yield and high protein corn variety. The product must not only provide a source of improved animal feed, but also the beginning of corn utilization for human food for Thailand. However, as mentioned before, the Thai eating habit tends to make it difficult to popularize the use of corn and corn products.

C. Nutrition Problems in Thailand[3/]

Thailand, with her 39 million people and 3.2% population growth rate, is expected to reach 70 million by the year 2,000.

Meeting the nutritional needs of the people not only involves production of sufficient food but also adequate means for its storage, processing and distribution to people of all income levels. Food balance sheets serve as excellent guides for agricultural production, but mean consumption values fail to consider the marked differences in distribution and consumption, particularly of more expensive foods. High protein foods of animal origin are consumed disproportionally by people with higher income. In Thailand, the average annual per capita income is about $120. About half of this is spent for food. The limited purchasing power of the people restricts the amount of available high protein.

Emphasis has been given to the problem of food production although little progress is being made in the development of improved methods of food processing and distribution in the country. The lack of a well developed food industry inhibits the development and application of workable approaches to overcome malnutrition. Many inexpensive nutrients, minerals and vitamins, can be added directly to food products which are centrally milled or processed and widely consumed by population segments most vulnerable to malnutrition. From an agricultural point of view, emphasis on the production of sufficient amounts of energy sources and protein foods to provide the needs of the country, apart from export considerations must be pursued.

In Thailand, the protein malnutrition problem appears to be confined largely to infants, pre-school children and pregnant or lactating women. Protein malnutrition in young children frequently follow intercurrent diseases as intestinal parasitic infestations and diarrheas. Other nutritional problems, include deficiencies of thiamin, riboflavin, vitamin A, iodine and calcium. Anemia was also widespread as based on the findings of the International Center for National Nutrition and Development. See Appendix 5 for the details of the ICNND study.

3/ Excerpts from C. E. Combs, Report on Protein Food Promotion Seminar, November 22-December 1, 1970. The Institute of Food Research and Development, Kasetsart University.

The Protein Problem

Protein intake, usually adequate for adults, is often inadequate for children. Protein malnutrition existed among 1 to 2-year old children in the form of typical kwashiorkor. Considering the eating habits of rural Thais, food other than rice are usually shared by all members of the family. Ordinarily, no extra protein is provided for children. This practice is based on the assumption that children can obtain their nutrient needs from the same diet consumed by adults.

Table 23 shows the protein requirement based on the WHO Technical Report, No. 301 (1965) for different ages when protein is supplied by breast milk, rice or the average Thai diet. When infants are weaned from the breast, rice appears to provide most of their protein up to age 2. After that, they are more likely to obtain more protein from side dishes in the form of animal or pulse protein.

Limited food intake studies with children indicated that the 1 to 5 years old child consumes no more than 1.1 to 1.2 grams of protein from rice per kilogram of body weight. Rice alone supplies approximately one-half to two-thirds of the protein needs of the child after weaning to age 2 1/2. The lack of a suitable transitional food for infants after weaning and the lack of awareness of the need to provide more protein to the rapidly

Table 23

Protein Requirement As Influenced by Age and Protein Quality

Age	Breast Milk	Rice (NPU 57)	Thai Diet (NPU 64)
	Gram Protein/Kg Body Weight		
0 - 3 months	2.3	-	-
3 - 6 months	1.8	-	-
6 - 9 months	1.5	2.64 4/	2.35
9 - 12 months	1.2	2.10	1.86
1 - 3 years	-	1.86	1.65
4 - 6 years	-	1.70	1.52
7 - 9 years	-	1.60	1.44
10 - 12 years	-	1.50	1.35
13 - 15 years	-	1.47	1.30
16 - 19 years	-	1.35	1.20
20 years and over Pregnant women	-	1.25	1.10
20 years and over Lactating women	-	1.47	1.30
20 years and over	-	1.80	1.60

4/ Food intake studies reveal that the 1 - 5 years old child consumes no more than 1.1 - 1.2 grams of protein from rice per kg of body weight.

growing child aggravates protein malnutrition in pre-school children.

The protein requirement of pregnant and lactating women also increases during such periods. An additional supply of 6 gm of reference protein is required per day during the last six months of pregnancy. After birth, an additional requirement of 15 gm is needed to support lactation in nursing mothers.

Diet short in calories result in some protein diverted to provide energy instead of being used for growth and repair of body tissues. Energy intakes are frequently limited among young children after weaning. Breast milk contains approximately 50% of its calories as fat while the conventional diet to which the child is transferred to generally contains no more than 25% of its calories as fat. This marked drop in the proportion of fat calories in the diet immediately after weaning makes it difficult for the child to consume an adequate intake of calories to maximize protein efficiency utilization. Under these conditions, protein quality is less important than protein quantity since amino acids are not likely to be metabolized for energy purposes in any appreciable quantity. Rice based diets have a reasonably good protein quality. Rice itself is reasonably good with an NPU of 57 although it has a low level of protein as a percent of calories.

Based on its quality index, the Thai diet has been shown to have a net digestible protein calorie content of 5.3%. This is entirely satisfactory for adults but inadequate for children. It appears clear that the protein problem with the Thai diet is one of insufficient protein quantity rather than protein quality.

Another example of the marked differences in requirements are in essential amino acids as supplied by proteins for infants, young children and adults. Such values show the differences in needs for amino acids in relation to energy content of the diet and to differences in protein requirements.

D. Government Programs and Goals in Nutrition

D.1 Protein Supplementation for the Target Group

One measure to cope with the protein problem is to increase, by supplementation, the protein calorie ratio in the child's diet up to the level of 13-15%. Such an increase cannot be expected to occur automatically as a result of increased income, although the protein calorie ratio is expected to reach an equilibrium at 11-12%. However, the traditional eating pattern of the people where food other than rice is usually shared by members of the family from a common dish does not allow for extra protein to be given to the vulnerable younger age group.

It is considered necessary that supplementary feeding be established for the vulnerable groups consisting of the pre-school child, the infant and school child in that order of priority.

D.2 Promotion of Protein Food Production at Local Level

In a traditional society, the majority of food consumed is produced by the family. For this type of society, it is essential to support protein food production at a local level. Priority is given to protein of animal origin followed by pulses because the quantity required to serve the target group is limited. On the other hand, pulses are not commonly used in Thai foods. The promotion program should also aim at raising the income level of the producer for incentive purposes.

D.3 Protein Food Development

The development of cheap protein foods should be seriously explored. Cheap sources of protein are mostly vegetable in origin. Utilization of such protein would also help to alleviate the need for a higher production of animal protein to satisfy the demand of increasing population. For this type of program to last, the source of protein to be utilized should be produced in adequate quantity and sold at a relatively stable price.

D.4 Research on High-Protein Rice Varieties

In a country with a rice-based diet such as Thailand, one of the limiting amino acids, as lysine in cereal protein, is generally not a constraint to the protein quality. Even though the importance between the first few amino acids in these diets have not been fully studied, it could still be recommended that high protein and high yielding rice varieties should be the object of rice research, should be given serious consideration.

D.5 Protein Food Development Project

The joint project for protein food developments has been conducted by the Institute of Food Research and Product Development, Kasetsart University and the Department of Health, Ministry of Public Health. The Institute of Food Research and Product Development is responsible for producing foods suited for Thai diet with high nutritional value and low cost. These food products are then tested on children by the Department of Health.

Appendix Table 5.1

The ICNND Nutrition Survey

The ICNND Nutrition Survey examined 2,389 civilians as well as military personnel in five (5) different provinces. Food consumption studies were done on 93 families (513 people) at these locations. Biochemical determinations were done on blood and urine samples to evaluate nutritional status. Food analysis of food and food mixtures based on actual diets consumed were also performed.

The average daily per capita consumption of foods based on the survey are shown in Appendix Table 5.1.

Appendix Table 5.1

Average Daily Per Capita Consumption of Foods by Thai Civilians (ICNND Survey)

	Grams
Rice (48% home-pounded)	440
Meat and Fish (fresh fish, 24 gm; fermented fish, 11 gm; dried fish, 5 gm; frog, 5 gm; shrimp, 2 gm; chicken, 7 gm; beef, 8 gm; other, 2 gm)	64
Eggs	4
Vegetables (cabbage, 14 gm; string beans, 8 gm; bamboo shoots, 7 gm; sweet potato, 6 gm; cucumber, 5 gm)	82
Fruits	6
Fats and Oils	1.4
Coconut Products	18
Soybean Products	0.9

Rice provided 70%, by weight, of the food consumed and 87% of the calories. Rice, meat, fish and vegetables represented 93% of the total food consumed and 95% of the calories.

The intakes of various nutrients is summarized in Appendix Table 5.2 by various provinces.

Appendix Table 5.2

Nutrient Intakes Per Person Per Day for Thai Civilians
(ICNND Survey)

Observation	Province					All
	Songkhla	Chiengmai	Lopburi	Udorn	Ubol	Combined
No. of families	23	19	11	20	20	93
No. of persons	107	96	60	127	123	513
Calories	1772	1660	1474	1837	1962	1770
Total protein, gm	54	47	39	45	48	47
Animal protein, gm 1/	24	10	18	12	14	15
Protein, gm/kg body weight 2/	1.7	1.5	1.2	1.4	1.5	1.5
Carbohydrates, gm	299	343	298	396	421	357
Fat, gm	41	12	14	9	10	17
Calcium, mg	102	371	143	342	311	266
Phosphorous, mg 1/	715	612	580	653	692	658
Iron, mg	24	27	19	26	18	23
Vitamin A, I.U. 1/	696	4160	2760	926	855	1781
Thiamine, mg 3/	0.33	0.52	0.36	0.40	0.45	0.42
Thiamine, mg/1000 cal.	0.19	0.31	0.24	0.22	0.23	0.24
Riboflavin, mg 3/	0.41	0.76	0.52	0.42	0.40	0.50
Riboflavin, mg/1000 cal.	0.23	0.46	0.35	0.23	0.20	0.28
Niacin, mg 3/	8.6	8.7	8.2	10.5	12.3	9.8
Vitamin C	23	34	29	23	23	26

1/ Calculated values; others based on direct analysis

2/ Based on mean weight of 31.8 kg

3/ Corrected for cooking losses

The data were obtained by direct chemical analyses of food composites based on the actual consumption by families, except for the values given for animal protein, phosphorous and vitamin A which were based on calculations. The average caloric intake was 1770 per person per day, or approximately 100 calories below the calculated requirement for civilians of 1871 calories. The average protein intake was 47.2 gm per person per day, 31% of which came from animal products. The total protein in the diet averaged 10.8% of the calories consumed and supplied an average of from 1.2 to 1.7 gm of protein per kg of body weight. The intake of thiamine and riboflavin was consistently low at all locations. Average intake of vitamin A was low in four of the 5 locations. Calcium intakes were distinctly marginal while mean niacin and vitamin C intakes were satisfactory.

The proportion of nutrients supplied by major food groups is shown in Appendix Table 5.3.

Appendix Table 5.3

Major Food Sources of Individual Nutrients 1/
Among the Thai Civilians - Percent Means for all Groups Combined

	Percent Contribution to Total Diet					
	Rice	Meat	Eggs	Vegetables	Fruits	Miscellaneous
Total diet (by weight)	70	10	0.6	13	1	4
Calories	87	5.8	0.4	1.9	0.3	3.9
Protein	65	29	1.2	2.8	- 2/	2.0
Calcium	24	57	1.0	14.0	-	3.9
Phosphorous	62	28	1.1	5.0	-	3.0
Iron	58	21	1.4	12.2	-	6.4
Vitamin A	-	5	4.4	84.0	2.0	4.7
Thiamine	82	5	1.0	10.0	-	3.0
Riboflavin	55	20	3.5	17.3	-	3.5
Niacin	69	22	-	8.2	-	1.0
Vitamin C	3	-	-	83.5	12.2	1.6

1/ As calculated from standard food tables

2/ Percent less than 1.0

Appendix Table 5.3 illustrates again the marked significance of rice, meat and vegetables in the diet.

Biochemical findings listed in Table 20 show a high prevalence of anemia as shown by low hemoglobin levels. A very high percentage of the samples showed low urinary riboflavin levels. Low thiamine excretion in the urine and low vitamin A levels in the blood serum also supported the low dietary intake data. Serum albumin levels were low in pregnant and lactating women and in children under 15 years of age.

Appendix Table 5.4

Biochemical Findings Among the Thai Civilians
(ICNND Survey)

	Males		NPNL 1/		Females Pregnant	Females Lactating
	15	15+	15	15+	15+	15+
Blood						
Hemoglobin						
% def.	52	20	66	70	100	68
% low	96	60	95	100	100	89
Serum Albumin						
% low	40	17	37	22	89	32
Serum Vitamin A						
% def.	4	-	11	2	11	-
% low	75	17	58	27	67	39
Serum Vitamin C						
% low	3	3	6	-	-	7
Urine						
Thiamine						
% def.	5	38	7	28	20	24
% low	23	71	24	47	40	71
Riboflavin						
% def.	26	59	27	58	75	50
% low	83	95	79	93	88	86
N-Methylnicotinamide						
% low	-	4	4	5	-	10
Minimum No. of samples	27	64	38	40	5-9	20

1/ Non-pregnant, non-lactating

Appendix Figure J
NUTRITION PROBLEMS OF THAILAND
(ICNND REPORT)

Figure 1

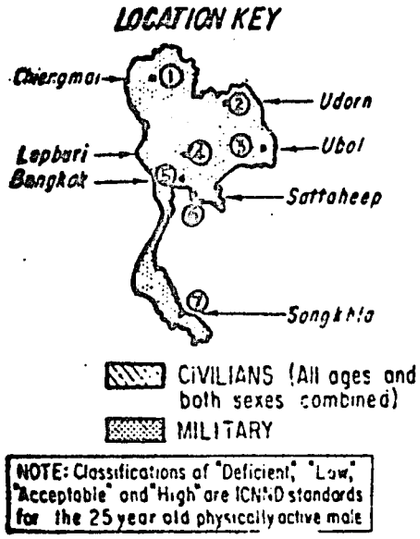


Figure 2

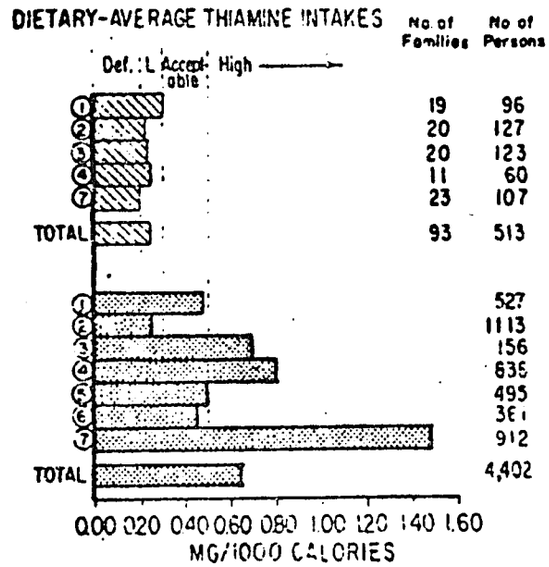


Figure 3

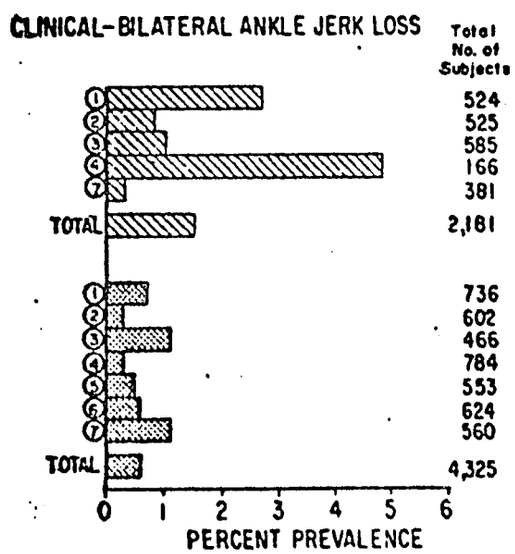
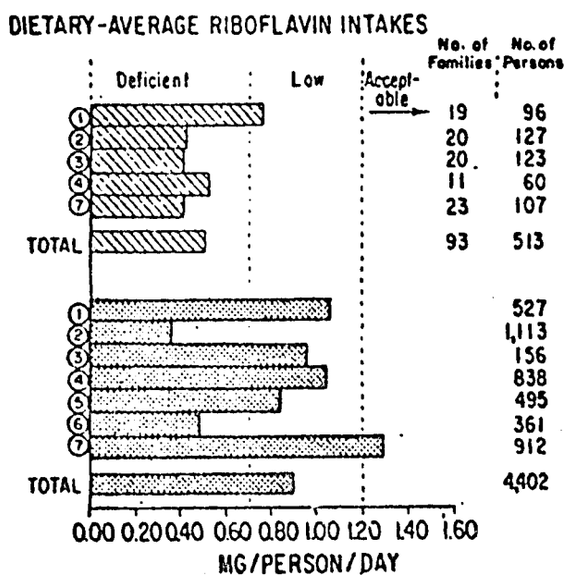


Figure 4



Appendix Figure J
(Continuation)

Figure 5

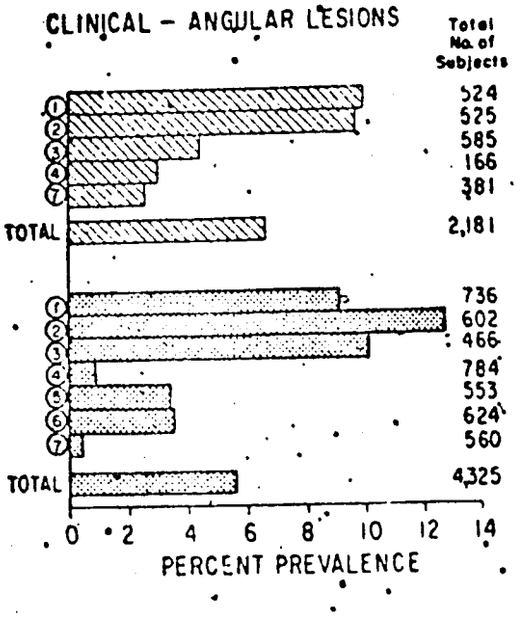
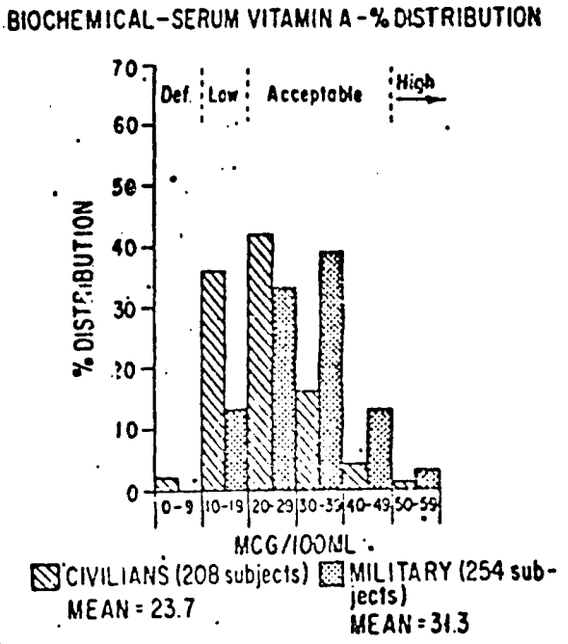
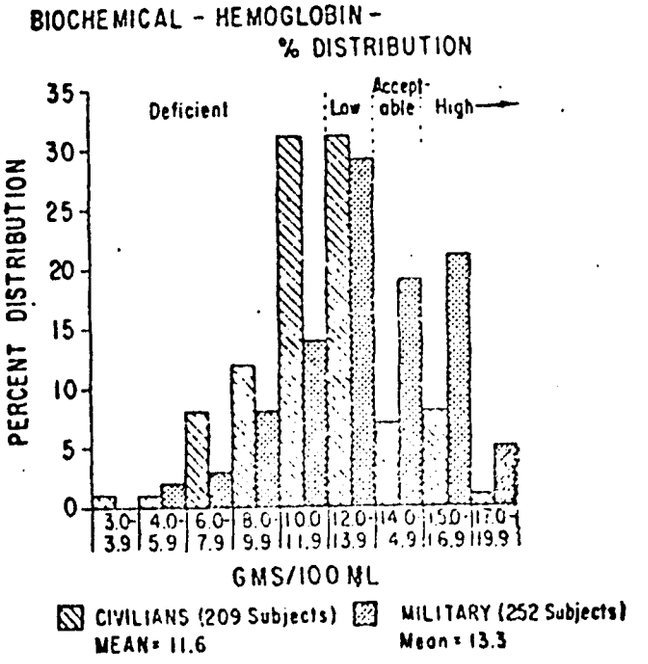


Figure 6

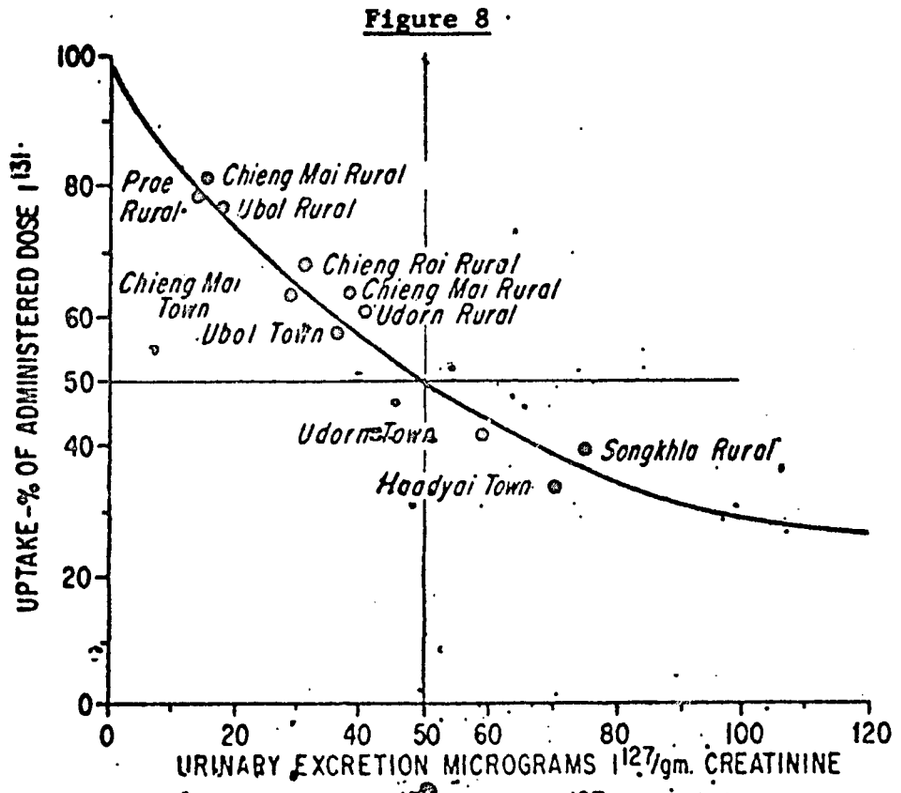


Minerals

Figure 7



Appendix Figure J
(Continuation)



The Relationship of Means I^{131} Uptake to I^{127} Excretion in Thai School Girls in Various Areas of the Country.

CHAPTER IX. GOVERNMENT DEVELOPMENTAL PROGRAMS

A. Agricultural Development Programs and Policies

The government has launched the Third Five-Year National Economic and Social Development Plan, 1972-1976. In connection with the development of the agricultural sector, the plan has set a target growth rate of at least 5.1% per annum. The target is much higher in contrast to the previous plan of 4.1% growth rate during the Second Five-Year Plan, 1967 to 1971. The Third Five-Year Plan heavily emphasize increasing overall agricultural yield, and qualities of products in harmony with foreign demand. This aims to raise export quality levels and particularly support the domestic utilization of agricultural products both for human consumption and agro-industrial processing.

To meet increasing domestic demand, raise export levels and earn more foreign exchange, the Thai government must not only accelerate production but also the marketing of some commodities. Export expansion will help improve the prevailing balance of payment problem of Thailand's international trade. To achieve this objective, special programs have been developed not only to increase production but also improve the marketing potential of corn, soybean, silk, coconut, prawn and cattle. In addition, cotton, tobacco and coffee are to be included in the program.

The program includes the following features:

1. To plan for the proper utilization of new areas for the production of promotional crops
2. To promote modern farming technology through farmers' institutions
3. To extend more agricultural credit to farmers at a minimum rate of interest
4. To assist farmers in marketing their products in cooperation with private traders
5. To encourage the private sector in the handling of agricultural marketing and the establishment of agro-industries

In addition to the enforcement of the intensified crop program, the government has also established programs on 1) agricultural research, 2) agricultural extension, 3) fisheries, 4) livestock, 5) forestry, 6) land development, 7) farmers' institutions, 8) irrigation, 9) agricultural credit, 10) price support program, and 11) agricultural marketing.

B. The National Corn Development Program

The coordinated program for corn development in Thailand was established in 1961 with the cooperation of the Rockefeller Foundation, the United States Operations Mission (USOM) to Thailand, Kasetsart University and the Department of Agriculture, Ministry of Agriculture and Cooperatives. The research activities started in 1962

and the University of Hawaii team also joined the program during this period.

A new strain of Guatemala corn was bred and yielded at least 10% higher than the parent variety. A number of new germplasms was introduced and tested. This led to the establishment of the National Corn and Sorghum Research Program in 1956. At about the same time the Agricultural Program of the Rockefeller Foundation moved its headquarters from India to Thailand. This Inter-Asian Corn Program played an important role in the development of the National Corn and Sorghum Research Center at Pakchong, Nakhonrajasima. The center has provided all facilities for the growth of corn research and production in Thailand.

Since the establishment of the National Corn Improvement Program, closer cooperation has been achieved among the government agencies involved. Kasetsart University has been carrying out all the basic research work while the Department of Agriculture is responsible for applied research. The Department of Extension also joins in the expansion phase. All these activities are partly supported by the Rockefeller Foundation in terms of technical staff assistance and equipment.

B.1 Research Function

The National Corn and Sorghum Research Center conducts research, training and extension activities. It has 10 research Projects.

1. Breeding and Genetics for the Improvement of Yield and Quality of Corn

A series of yield trials was conducted to evaluate the performance of improved varieties developed in Thailand and observe the performance of tropical hybrids and genetic materials from other countries. Extensive yield testing of short-stored materials developed at CIMMYT was also conducted.

Attempts to improve grain yield, standability, downy mildew resistance and plant height were made in various populations with major emphasis on downy mildew resistance. Philippines DMR 1 and DMR2 were used as sources of resistance which were crossed with elite germplasms and outstanding varieties. Advanced crosses and backcrosses of the downy mildew resistant populations were evaluated and tested for yield varieties. Cooperative efforts in developing resistant varieties were continued with the breeding programs of the Philippines, Taiwan and Indonesia.

The protein quality program concentrated on crosses between the modified hard endosperm opaque-2 grain type downy mildew resistant. Modified opaque-2 varieties from the foreign programs were also evaluated for adaptation and grain yield. Selection for stabilizing the modified hard endosperm opaque-2 phenotype was continued in varying populations.

2. Sorghum Breeding

Yield testing of promising TSS (Thai Sorghum Selection) lines from the breeding program was made in order to identify the elite lines. These TSS lines came from the final groups of the selected families of the original 600 crosses. Some of these TSS lines which largely have yellow endosperm are promising in agronomic characters as well as nutritional quality. Some US hybrids were also tested.

3. Crop Production and Soil Management Practices for Improving of Corn and Sorghum

Improved materials from corn and sorghum breeding programs have been tested in terms of cultural practices, such as row spacing, population studies and interplant competition with legumes.

4. Soil Fertility Research and Soil Surveys

Fertilizer response of many corn and sorghum varieties have been studied. Attempt has also been made to improve soil fertility through the appropriate use of fertilizer. The results of soil surveys made mostly in the corn areas help to identify the limiting soil factors.

5. Corn and Sorghum Diseases

Attempts have been made to identify important corn and sorghum diseases. Control measures against these diseases have been carried out. Inoculation techniques for some diseases

are developed to investigate the nature of the diseases and help breeders in screening for disease resistance.

6. Corn and Sorghum Insects

Surveys on the extent of insect pests infestation for corn and sorghum have been made. Insecticide trials have been conducted to identify the most effective and economic formulations. The resistance of selected varieties to some insects are determined under natural and artificial infestation. Mass rearing techniques are developed to maintain adequate insect cultures for artificial infestation.

7. Economic Studies

Cost and return of corn and sorghum production have been conducted at the experiment stations and in the farmer's fields. This is to find the most efficient production package for the farmers.

8. Animal Feeding Experiments

Many varieties of corn and sorghum have been tested to determine their nutritional value over animal feeding. New varieties such as high lysine, opaque-2 corn and yellow endosperm sorghum have been found to contain high nutritive value.

9. Quality Laboratory Testing

Corn varieties or lines, especially opaque-2, are regularly analyzed to identify the lines with high quantity and quality protein. Therefore, besides grain yield, grain quality is also emphasized for both corn and sorghum in efforts to develop new varieties.

10. Farm Management Research

This project develops and maintains the farm land for experimental work. It includes farm machinery, land leveling and preparation, irrigation and the overall management with the assistance of the Department of Agriculture. Regional testing and farm demonstrations on corn and sorghum are conducted by this group.

B.2 Training Function

The second function of the National Corn and Sorghum Research Center is training. The training activities aim to upgrade the ability of research and extension workers involved with corn and sorghum production programs. Since the center also serves as the Inter-Asian Corn Center, an average of 30 trainees from the Asian neighboring countries have been trained each year. The Thai trainees either come from Kasetsart University, the Department of Agriculture or the Department of Extension.

B.3 Extension Function

The third activity of the center is extension. The center has no direct responsibility in this activity but it trains the extension workers who carry information back to their respective working areas. The center provides information on request.

There are other government agencies besides Kasetsart University and the Ministry of Agriculture which are indirectly involved in the promotion of corn development programs. The Department of Public Welfare, Ministry of Interior, through the Land-Self Help

Settlement Division has prompted corn production program in many areas. The Department of Vocational Education, Ministry of Education, through the Colleges of Agriculture has helped to spread the new production technology.

C. The Role of the Board of Investments of Thailand and Its Investment Incentives

The Board of Investment of Thailand does not grant any financial aid to any industry, but it offers "investment incentives" to numerous industries, including feed millers, flour processors, and cattle (buffalo, cow, and beef) raisers under the following conditions.

1. Feed millers and flour processors who apply for promotion in terms of investment incentives from the Board of Investment must have a capital investment which is not less than two million bahts excluding the cost of land and working capital.
2. Cattle raisers (buffalo, cow, and beef raisers) who apply for promotion in terms of investment incentives from the Board of Investment must have a capital investment of not less than one million baht, excluding the cost of land and working capital. However, the Board will not offer investment incentives to "beef raisers" whose capital investment requirements are at least five million bahts or

above, excluding the cost of land and working capital.

The Board will grant investment incentives to each successful applicant. All applicants are given basic promotion in terms of "Tax Reduction and Exemptions." However, special incentives may be granted to each qualified applicant depending upon the degree to which the firms, millers, processors, or livestock raisers will contribute to the national income and productivity mostly in terms of income and employment generation.

D. Agricultural Extension

D.1 Institution Engaged in Agricultural Extension

1. Agricultural extension is undertaken by a department of the Ministry of Agriculture in cooperation with the Department of Agriculture, the Livestock Department, and the Fishery Department. The Department of Agricultural Extension was formed by the consolidation of the extension divisions of the Rice and Agricultural Departments in October 1, 1968.

The principal aims of the department are as follows.

a) Through extension, to provide farmers the latest agricultural knowledge and techniques from extension and research efforts

b) To mobilize natural resources and disseminate knowledge from government and private agencies, and pass this on to farmers to improve their farming operation

D.2 Extension Activities

1. New knowledge and experience in agriculture are relayed to farmers to increase their farm income through the observance of farm management, pest control, crop rotation, irrigation systems, nutrition, home management, marketing and mechanization. These new techniques will help farmers in managing their farms and improve their economic and social status.

2. Training programs are organized for farmers, leaders, and rural youth to increase efficiency, leadership potential, scientific knowledge, and encourage them to work cooperatively through farmers' organizations and rural youth clubs.

3. Research results are disseminated through demonstrations, group meetings, farm visits, and the use of mass media.

4. Coordinated teams are organized to promote projects planned by government and private agencies related to the development of farmers and agriculture such as rural development, cooperative work, industry and sanitation. The proficiency of extension personnel is also improved to enable them to cope with their responsibilities.

D.3 Extension, Teaching and Research Activities of Staff Member

1. The extension staff serves as advisors and distributes new knowledge in farming practices to farmers. The methods are adapted to suit the needs of farmers in each particular

situation. Training activities must give all extension staff the opportunity to reach the highest possible level of professional improvement. In addition, mobile training units staffed with specialists and extension personnel, audio-visual and agricultural equipment visit farmers to provide information and agricultural assistance.

2. Farm problems are solved by extension workers working cooperatively with research workers from various institutions. Cooperative exchange of ideas, introduction of new scientific methods, discussions, and experiments will aid in solving farmer problems.

3. Concentrated efforts on extension activities and research programs will mainly be conducted by other institutions. Research results will be passed on to the farmer through the Extension Department.

D.4 Public Service Activities

1. Radio Programs

The extension department also produces agricultural radio programs, broadcasting 6 1/2 hours daily, reaching at least 51 provinces in Thailand. Program content includes information on technical findings, agricultural practices, marketing news and entertainment.

2. Short Courses

Five 7-day training meetings for farmer club representatives are conducted at selected locations in each region. Farmer

clubs select and send to the appropriate course one representative who has never attended the course. Training includes exposure to new cultural techniques, recommendations for new crops, improved seed and fertilizer application, marketing information and extension department policies.

The 10-day National Farmers Club Conference is held annually and attended by 500 delegates, selected by the Farmers Clubs. Selections are made on the basis of one delegate for every seven clubs per province. The conference agenda includes election of National Officers and Board of Directors.

The short course on pest control considers the needs of the particular area where the course is held. Selected farmers participate in training sessions held at Crop Pest Control Units in the provinces. Farmer leaders have an opportunity to solve their problems together, sharing and developing ideas about new methods of applying pesticides, use and care of spray and dusting equipment, and learning about new species of insects and types of diseases.

3. Newspapers and Magazines

Research results, agricultural information, and news of all kinds of activities are also conveyed to the farmers through the publication and distribution of technical

bulletins, leaflets, magazines, and bulletins. In addition, technical movies, slides and film strips are produced for training meetings and village visits.

4. Youth Activities

One of the principal responsibilities of the department is to encourage youth activities in agriculture. The 4-H Club program was established in 1953 under the extension division of the Department of Agriculture. With the new institutional set-up, it was transferred to the Department of Agricultural Extension in October, 1968. The 4-H sub-division, attached to the Information and Training Division, is responsible for executing and supervising 4-H activities. Volunteer leaders, who are willing to help in guiding youth activities are part of the professional staff. More than 80% of the volunteer leaders are school teachers. The youth groups carry out one or more projects of their own selection. These projects are part of their activities and reports on them may be presented to the national 4-H Club meeting.

5. Extension Personnel

	Special Grade	First Grade	Second Grade	Third Grade	Fourth Grade	Un-graded Workers	Total
1. Administrative Officers	2	13	69	177	330	-	597
2. Provincial Extension Officers	-	22	139	124	114	-	339
3. District Extension Officers	-	-	13	229	655	-	967

4. Regional Extension Officers	1	1	33	84	13	-	131
5. Pest Control Unit Officers	-	-	19	56	148	-	223
6. Clerks, Drivers, Laborers, etc.	-	-	-	-	-	-	282

6. Financial

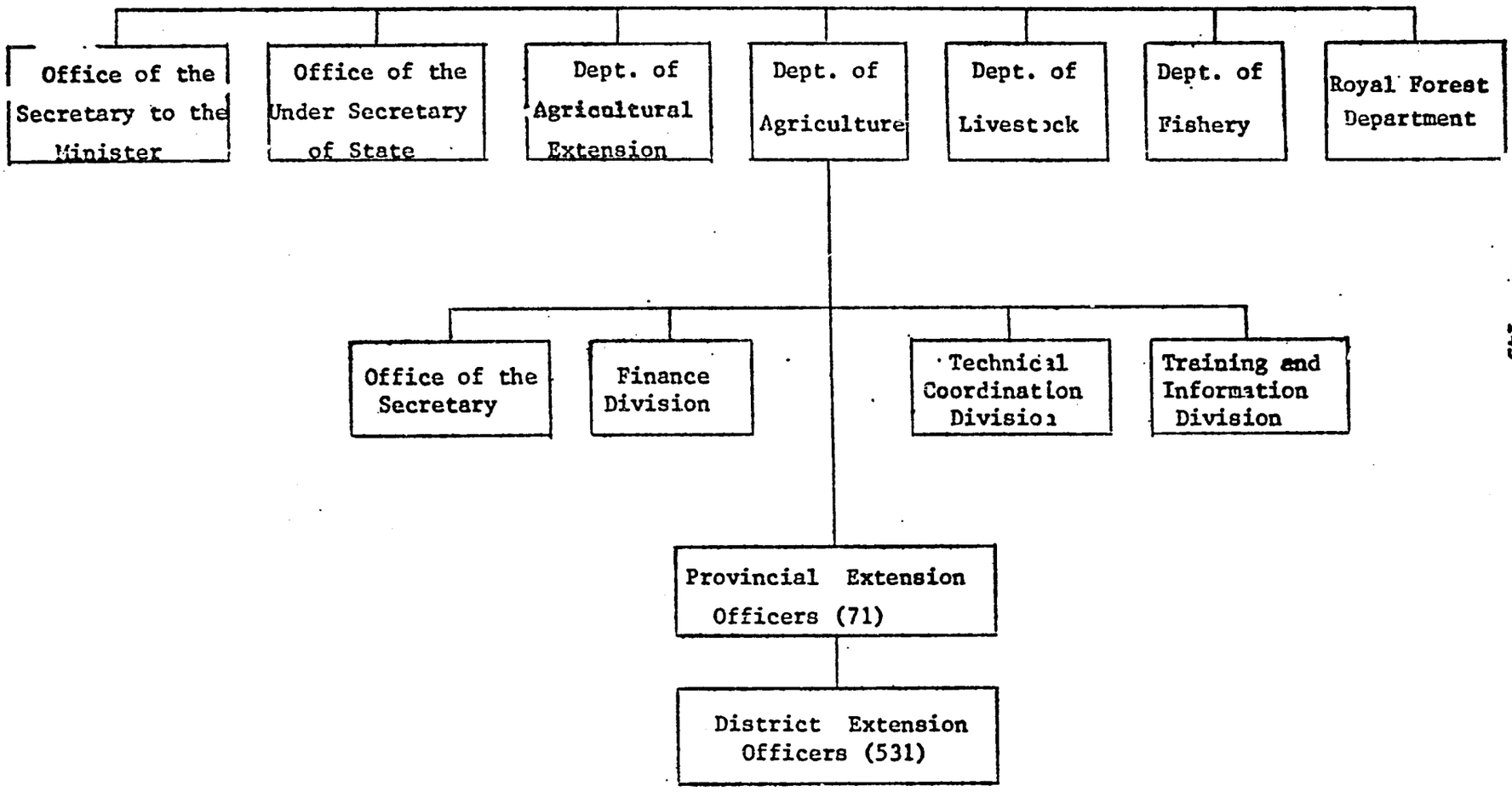
The administrative work, including salaries, is financed by the government. Additional assistance comes from USOM (USAID) in the form of commodity support, participant training, technical assistance and counterpart funds.

USOM, other cooperating countries and agencies support the program in the form of academic training towards master's degrees in specialized fields, on-the-job training and study tours for training officers, farmers, farmer leaders and officers. Farmer and farmer leader training is in the form of short study tours to other countries to observe farmer activities and their organizations. Other foreign agencies also provide the department occasional assistance by granting funds for study tours under the Colombo Plan, Fulbright, and other special fund sources.

Appendix Figure K

ORGANIZATION CHART

Ministry of Agriculture



CHAPTER X. AGRIBUSINESS EDUCATION AND RESEARCH

A. Education in General

The national education system which has been in effect since 1960, provides an educational ladder of 12 or 13 years. Elementary education consists of 7 years and children are encouraged to stay in school until they are at least 15 years of age. They may leave school after finishing the highest grade offered in their local elementary schools which is still only up to grade 4 in many localities. Secondary education in the academic or general stream takes 5 years in the academic or general stream, while the vocational stream takes six (6) years. Most students leave school at the end of grade 10 or grade 12 (academic stream) or grade 13 (vocational stream).

The Ministry of Education is responsible for all elementary and secondary schools, plus teacher training and technical colleges. Universities are state-owned and responsible to the State University Bureau. All educational policies are implemented and coordinated by the National Education Council.

Administration of the school system is carried out by a number of government agencies as well as the Ministry of Education.

Many departments within various ministries operate their own pre-service, in-service training schools and trade schools.

Some, such as the military academies of the Ministry of Defense, attain the degree granting status. Others, as the staff colleges, give post-graduate training to military officers. Within the Ministry of Agriculture, there are pre-service schools operated by the Departments of Agriculture, Rice, Forestry, and Livestock Development.

The administration of the education system rests mainly upon two national authorities; the Ministry of Education and the Office of the Prime Minister, the responsibilities of which have been mentioned. A relationship exists between the universities, the National Education Council (NEC), the National Economic Development Board (NEDB), the University Civil Service Commission (UCSC) and the Office of the Prime Minister, Appendix Figure L.

The chief advisory bodies for education are the NEC and Khuru Sapha. The NEC functions as a coordinating body of the national education system, while the Khuru Sapha, a semi-governmental association of teachers, has a strong voice on the education policy and administration through the Ministry of Education.

Another body, the University Development Commission (UDC) is relatively new, and may play an increasingly important role in the joint graduate school program. It aims to serve as a coordinator to maximize the use of well trained personnel and other resources of various universities into a concerted graduate program.

The contribution of the private sector to the school system is important. Private foundations and religious groups have been active in lower educational levels. Their activities are supervised and regulated by the Private School Division of the Department of Secondary Education. In general, it may be noted that the private schools are also helping the state strongly in the pre-school and secondary levels where education is not compulsory. Vocational and technical education is now an open educational area for private sector participation. Presently, there are a few vocational and technical schools in operation, but there have been no common standards laid down by the Government until the recent enactment of a legislation for private colleges.

Supervision of the school system is assigned principally to a network of education officers who are responsible directly to the Ministry of Education. Their main task is to oversee the overall functions of established schools under the jurisdiction of the Ministry. The Ministry also provides an academic supervisory group consisting of teaching experts in different fields. These supervisory units evaluate the teaching methods and curricula, recommend and implement any possible improvements, and carry out special in-service training for teachers.

Another type of supervision is carried out by the NEC, which coordinates the policy and programs of all universities as well

as the general education system and authorizes any proposed academic establishments and changes. In addition, the Council also reviews the educational budget.

Education planning is a cooperative effort of various agencies coordinated by the NEC. There are planning units attached to each university, and to the Ministry of Education. These units undertake the preliminary work of educational planning, to be reviewed through proper channels and incorporated into the national plan by the NEC, NEDB and Budget Bureau.

B. University Level Agricultural Education in Thailand

At present, Thailand has three universities which offer a Bachelor's degree in agriculture. Kasetsart is the oldest which was formed in 1942 by combining the government training schools for agriculture and forestry. Khon Kaen and Chiangmai Universities were started in the late 1950's to early 1960's and have Faculties of Agriculture. Only Kasetsart offers Master's degrees in agriculture. In Thailand, only Kasetsart has a separate Department of Agricultural Economics and is the only university offering Bachelor's and Master's degrees in Agricultural Economics.

B.1 Faculty of Economics and Business Administration of Kasetsart University

The Agricultural Economics department at Kasetsart is one of six departments in the Faculty of Economics and Business

Administration. The other departments are Economics, Business Administration, Accounting, Cooperatives and Marketing. The Faculty has a professional staff of 90 persons, of whom 71 are currently at the University and 19 are abroad for further training.

The number of graduates in Agricultural Economics is about 90 to 100 Bachelor's and 10 to 15 Master's degree holders per year. Although not administratively connected to the Faculty of Agriculture, the Department of Agricultural Economics maintains close working relationships with it since the Bachelor's degree curriculum includes a number of courses in technical agriculture.

C. Plan for Implementation of an Agribusiness Program at Kasetsart University

C.1 Introduction

The Departments of Business Administration and Agricultural Economics are jointly preparing to initiate an agribusiness program in the university. At present, Thailand has no formal university programs in agribusiness in spite of the high national priority placed on this field.

The need for agribusiness education, training, and research is being felt by both departments. The present undergraduate program in Agricultural Economics is heavily oriented to farm

management and farm production. In the past, graduates were mainly employed by the government for various production programs. But each year, an increasing number of B.Sc. graduates are employed by agribusiness firms and supportive firms such as commercial banks. Various firms have been increasingly requesting the Department for prospective employees, which the Department cannot fill. It is estimated that there are 30 to 50 job openings per year for agribusiness graduates. Agricultural economics graduates who have gone to work for private firms have indicated that they lacked adequate background in accounting, business management and commodity analysis. Likewise, graduates of the Department of Business Administration have, in the past, worked primarily for government agencies. This department also feels the pressure to produce graduates who have adequate training and practical experience to meet the requirements of the private sector.

The two departments are capable of including an agribusiness component to their program. The 28 persons currently on or committed to join the Department of Agricultural Economics includes five (5) with Ph.D's, seven (7) more currently in or about to start Ph.D programs, eleven (11) with Master's degree, and two (2) currently taking their Master's programs.

The Department of Agricultural Economics pursues two types of research. The first consists of research conducted by staff members and a list of thesis publications.

The second type involves Master's thesis research which are supervised by members of the Department. The Department of Business Administration has, in the past joined, cooperated with the Agricultural Economics department on larger research projects.

C.2 Objectives of the Program

The overall objective of the program is to meet the increasing demand of public agencies and private entrepreneurs who need more trained employees with the proper knowledge. The specific objectives of the program are:

1) To improve the overall ability of graduates under the present curricula to integrate principles and theory, once employed after graduation by business firms in agriculture.

2) To increase the confidence of these students in their ability to apply what they have learned in solving practical management problems in agricultural business firms.

The major emphasis of the program is the creation of an agribusiness oriented minor program which can be offered as an option for majors in Agricultural Economics and Business Administration. It is necessary to retain both of the present types of graduate majors since they are currently needed in Thailand.

Both majors contain elements essential for a good agribusiness program.

As experience is gained, the program will continually be evaluated on how well it meets the needs of the students and their future employers. For example, the need for a special major, rather than a minor, at the Bachelor's level, or the need for a Master's program in agribusiness, will be re-examined. The second aspect to be looked at is, whether or not students in other departments in other faculties such as agronomy and agricultural engineering could benefit from taking selected agribusiness courses as electives or pursuing the program as a minor field of study.

It is also recognized that special non-degree training such as seminars and workshops for executives and middle and lower management levels, will be integrated to the program from the beginning.

C.3 Coursework

The present curricula for Business Administration and Agricultural Economics majors consist of roughly 45% basic natural and social sciences and 55% professional courses. The basic natural and social science course requirements are quite similar for both Business Administration and Agricultural Economics. It is only in the professional courses that the student becomes specialized in their respective major fields.

The professional category consists of about two-thirds general professional and one-third special professional courses, as shown in Table 24.

What must be done in the new program is to assemble some of the existing courses into a set of special professional agribusiness courses. Thirteen such courses equivalent to 41 units are listed in Table 25. All these courses are currently approved and listed in the Kasetsart University catalogue. Present majors in Agricultural Economics take about 15 of the 41 units while the Business Administration majors take over 30 of the 41 units.

The next task therefore is to decide which courses in the 85 units of professional courses in the current curricula can be substituted for courses in the set of 41 units which are not being taken. The curricula for both majors permit a sufficient number of enough elective courses.

The staff of both departments envision four "streams" of orientation in Agricultural Economics and Business Administration.

1) Agricultural Economics major with regular (farm production management) orientation

2) Agricultural Economics major with agribusiness orientation

3) Business Administration major with agribusiness orientation

4) Business Administration major with regular (general business orientation)

Table 24

Content of Professional Curricula for Business Administration and Agricultural Economics Bachelor's Degree Majors

Subject Matter	Bus Adm	Ag Econ
Business Administration	39	-
Agricultural Economics	-	42
Law	12	a/
Accounting	12	3
Economics	12	12
Marketing	3	-
Electives	7	7
Statistics	b/	6
Cooperatives	-	3
Agriculture	-	12
	85 credits	85 credits

a/ Three credits of law (Law III) are included in Social Science.

b/ Six credits of statistics (Stat 101 and 412) are included in Basic Science.

Table 25

Courses That Would Comprise an Agribusiness Option at Kasetsart University

	Course No.	Course Title	Credits	Equivalent Course in U.P. Agribusiness program[a]
1.	Acct 111	Principles of Accounting	4	(Acct1)
2.	Acct 211	Principles of Accounting	4	(Acct 1)
3.	Acct 301	Managerial Accounting	4	(Mgt 115)
4.	Law 111	Business Law	3	(Mgt 160)
5.	Ag Econ 331 or Mktg 111	Introduction to Agricultural Marketing / Principles of Marketing	3	
6.	Mktg 415	Marketing Management	3	(Mgt 170)
7.	BA 111	Principles of Management	3	(Mgt 101)
8.	BA 411	Production Management	3	(Mgt 105)
9.	Ba 331	Business Finance	3	(Mgt 141)
10.	BA 413	Business Policy	3	(Mgt 190)
11.	BA 414	Quantitative Analysis	3	(Mgt 181)
12.	Ag Econ 371	Introduction to Agribusiness	3	
13.	Ag Econ 472	Agribusiness Management	3	
			41 credits	

[a] Bachelor of Science in Agribusiness, a joint program by the College of Agriculture and Business Administration, University of the Philippines.

The proposal is illustrated in Appendix Figure M. Agricultural Economics majors who choose the agribusiness option in Business Administration would take some general professional courses to increase their knowledge of business and to prepare them for professional agribusiness courses. Likewise, Business Administration majors choosing the agribusiness option could take some general professional courses in Agricultural Economics to increase their knowledge of Agricultural Economics.

Acquisition of books and establishment of a library is also a high priority. A list of books are being obtained from other programs in the United States and Asia. Since agribusiness is basically an integrated area of inquiry, the number of books available on the subject is relatively small.

More emphasis will be placed on acquiring case materials. One delaying factor with regard to cases is the lack of experience among the staff in developing and using case materials. This can be alleviated through visiting staff, seminars and workshops, and shorttern staff training abroad. But the main burden is the language barrier among the Thai staff, because cases are prepared in the language of the business firms being studied.

C.4 Seminars and Workshops

Starting in the early stages of the program, seminars will be undertaken involving persons from government agencies and the private sector who are potential employers of graduates of the

program. These seminars will keep participants informed about the program, provide feedback on how to improve the program, and generate support for the program. Participants will include representatives from chambers of commerce, trade associations, and government agencies.

A second type of seminar will revolve around cases prepared by the Kasetsart University staff. The envisioned participants will involve managers and supervisors from firms in the same business sector analyzed in the case. This type of seminar will give the staff experience in preparing and using cases which may also be used for undergraduate courses, and to increase the clientele of the program including persons and institutions that support the program and employ its graduates.

A third type of session will involve workshops or short courses which will be conducted on specific topics at the request of the clientele. These are sometimes referred to as extra mural, extension, or continuing education workshops which usually involve middle and lower level management personnel as participants. The Department of Business Administration has already started this type of activity last year which were participated in by firms from local industrial areas.

A fourth type of workshop will deal with in-service training and upgrading of staff capability among the various departments involved. Outside consultants and experts, such as those from

the University of the Philippines, will be asked to come and lead such sessions.

In summary, the seminars and workshops are expected to attain the following:

1) Increase the employment opportunities for graduates

2) Increase the number of firms willing to provide practical training

3) Give the staff more experience thereby improving their teaching ability

4) Add to the stock of teaching materials

5) Increase the support of the clientele for the program, and be of real value to the agribusiness sector

C.5 Practical Training

Practical training for students will be offered to familiarize them with on the activities of a particular business firm and to understand how it operates. Experience in agricultural economics has shown that, given a solid academic background, the key to producing graduates who are able to do well in their chosen occupation lies in the practical training and experience they have had in that line of work.

It is planned that the students will spend four to eight weeks actually working in an operating firm performing tasks assigned by the manager.

Contact with business firms and developing a group of firms which are willing to take in trainees and provide the kind of training desired is crucial and will require considerable staff

time. Initially, enrollment in the undergraduate agribusiness program may have to be limited to match the number of firms which will agree to provide training.

C.6 Staff Development

Staff development is an essential prerequisite of the program. A staff member of agricultural economics entered the MAB (Masters in Agricultural Business) program at the University of the Philippines in October, 1973, and is expected to return to Kasetsart University in June, 1975. Three new Bachelor's degree graduates have been recruited and sent to the University of the Philippines for graduate training. A graduate of the Master's program in Economics at Thammasat University is a candidate for a scholarship to go abroad to study for a Doctoral degree in agribusiness.

The addition of new staff members is also planned. Three more new Bachelor's graduates in 1975 may be sent to the UP for MAB degrees and return to join the Kasetsart University staff in about January 1977. Out of the six sent to UP, at least 2 or 3 are hoped to have the potential to go abroad again for doctoral work.

Meanwhile, both departments will be alert for persons already trained in agribusiness or supporting fields who may wish to join the staff.

With regard to present staff members who are competent in their disciplines but lacking in experience in agribusiness, every effort will be made to provide them with opportunities for non-degree training and encouragement for self-improvement.

Development of present staff will have to be handled on person to person basis. Several possibilities which have been discovered are as follows: First, the International Management Institute at Harvard should be investigated. It conducts a 6 to 12 week session each summer. Second, the Indian Institute of Management alternatives include: (1) Agricultural Management Program for executives, development administrators, and teachers for 3 weeks which starts in September; (2) Special teacher development program which can be made by individual arrangement; (3) Two-year Agricultural Management Program. Third, University of the Philippines possibilities would be by special arrangement, and could vary from three (3) weeks to one trimester. This would consist primarily of special work with the instructor of the course or courses which the Kasetsart University staff member is teaching or will teach.

The assistance of visiting staff will be important during the initial phases of the program. The objectives of having visiting staff would be to assist in developing and revising course content, preparation of teaching materials, and in-service training for staff.

Possibilities of obtaining visiting staff from the University of the Philippines has yet to be explored. This would involve one visiting staff for a period of one or two semesters or several individuals for several weeks.

Table 26

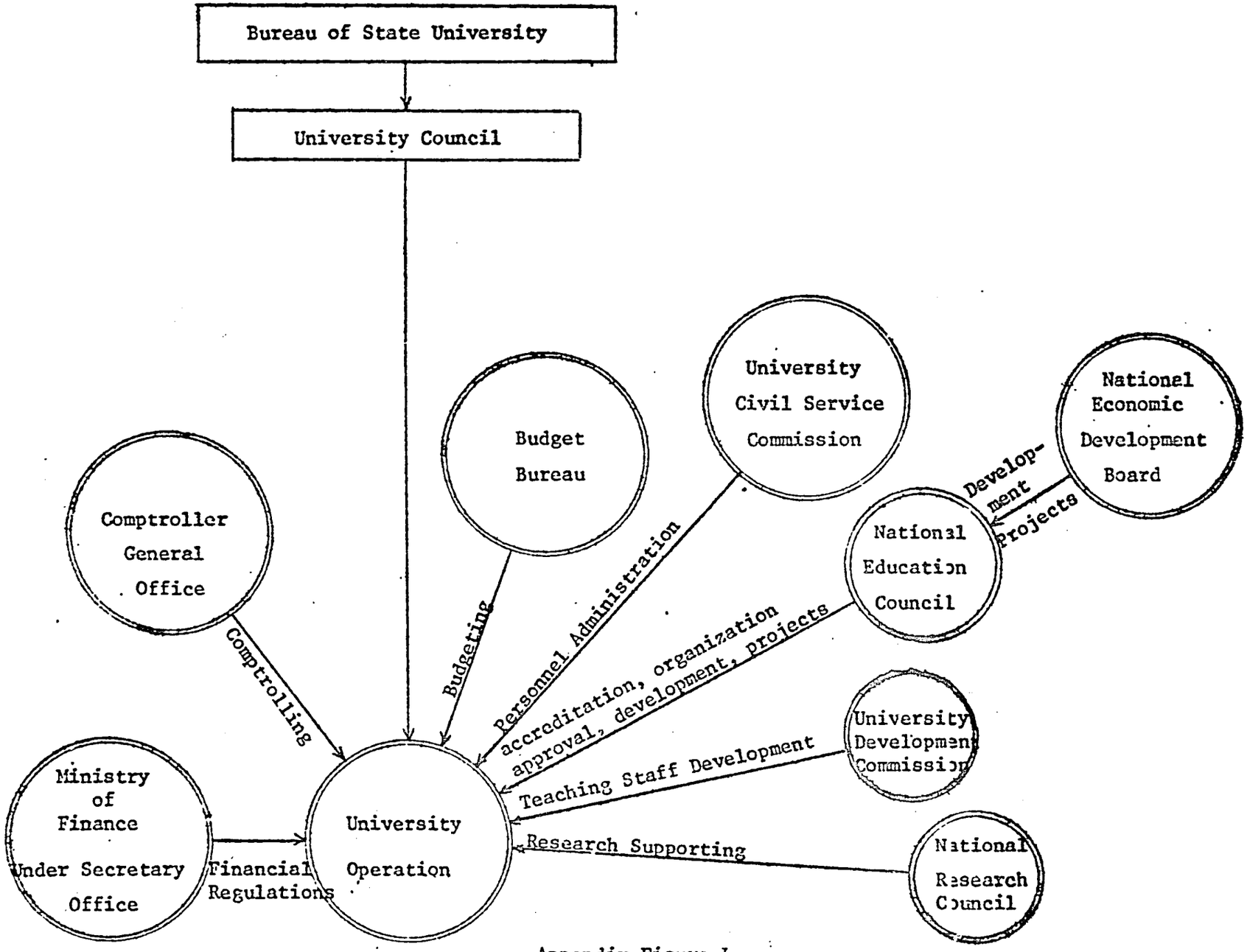
Suggested Time Table for Development of Agribusiness Program at Kasetsart University

Time Period	Staff Development	Others
Mid part of 1974	first 3 candidates to MAB program at UP	Overall plan prepared Dr. Sopin and Mrs. Sriroon to visit UP Agribusiness Program
Later part of 1974	2 staff abroad for non-degree training	Dr. Desai arrives - Plan courses and curriculum
Mid part of 1975	Mr. Somkit returns - second 3 candidates to MAB, 2 staff abroad for non-degree training	Start teaching of basic courses to third year, student - start seminars and workshops
Later part of 1975		Start research and student training
First part of 1975	First 3 MAB candidates return	
Mid part of 1976		start teaching special courses to fourth year student
First part of 1977	Second 3 MAB candidates return	First group of agri-business minor students graduate
Mid part of 1977	First MAB to DBA in US	

Latter part of 1977	-
First part of 1978	-
Mid part of 1978	Second MAB to DBA in US
Later part of 1978	Mr. Boonjit returns with Ph.D

Appendix 6 presents a list of Kasetsart University staff in Agricultural Economics and their educational qualifications.

Appendix 7 provides additional information of agricultural colleges and universities in Thailand.

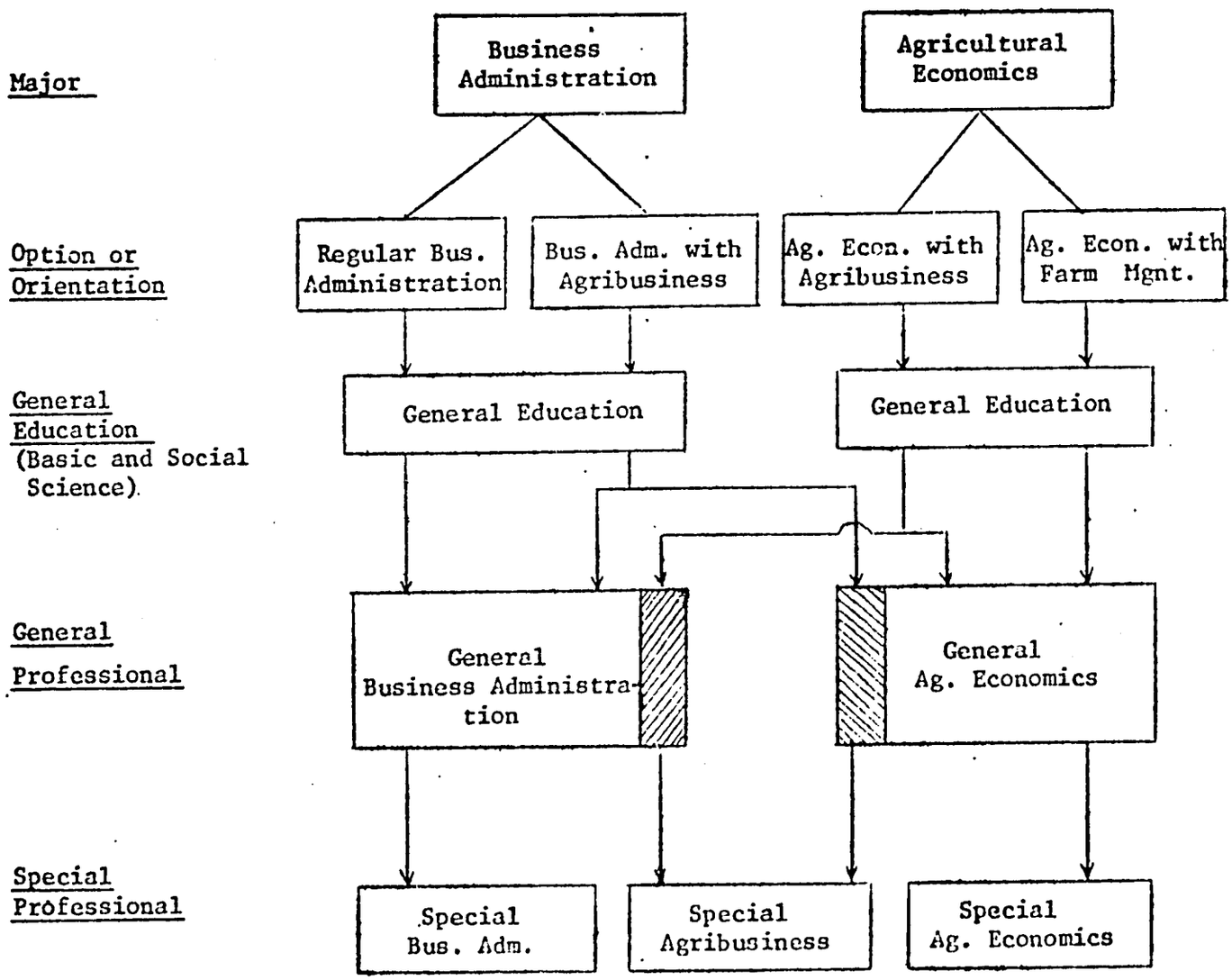


Appendix Figure L

The University relationship with regulatory and planning agencies

Appendix Figure M

Schematic diagram of how Business Administration major take some general agricultural economics courses and how agricultural Economics majors take some general business administration courses before both proceed to take special agribusiness courses.



Note: Shaded area in General Business Administration section represents courses that Ag. Economics major would take, and vice versa.

Appendix 6

Kasetsart University, Bangkok
Department of Agricultural Economics
List of Staff with Education Qualifications

	Name	Bachelor's Degree	Master's Degree or Other Advanced Training Beyond Bachelor's Degree	Ph.D.	Other Advanced Training Beyond M.S.	Area of Specialization
1.	Mr. Arb Nakajud[1/]	TU-LL.B. '51	Oregon St. '57		11/	Farm Mgt./Production Economics, Agricultural Development
2.	Dr. Sopin Tongpan[2/]	KU-Econ Coop '57 (H)	Oregon St. '63	Ohio St. '68		Prices
3.	Dr. Kamphol Adulavidhaya (Head)	KU-Agri '59 (H)	Oregon St. '62	Purdue '69		Farm Management/Production Economics
4.	Mr. Suphan Tosunthorn	KU-Ag Econ '59	Oregon St. '65			Farm Management/Policy
5.	Dr. Tongroj Onchan	KU-Ag Econ '64 (H)	U. of Ill. '66	U. of Ill. '69		Credit, Policy, Land Economics
6.	Dr. Chamnien Boonma	KU-Econ Coop '58	U. of Hawaii '65	U. of Ill. '72		Marketing and Operation Research
7.	Mr. Arkom Soothiphan[3/]	KU-Ag Econ '59	U. Philippines'67		12/	Farm Mgt./Production Economics
8.	Mr. Prinya Yamsiri[3/]	KU-Ag Econ '60				Credit
9.	Dr. Suthiporn Chirapanda	UNE-Econ '69	Iowa St.	Iowa St. '72		Production Economics, quantitative methods
10.	Mr. Prasert Chomjanta	KU-Econ '60	13/			Credit, land economics
11.	Mr. Tongruay Chungtes	KU-Ag Econ '59	14/			Farm Mgt./Production Economics
12.	Mr. Phaitoon Hathamart	KU-Ag Econ '60 (H)	U. of Minn. '71		15/	Marketing, Prices, Agribusiness

Appendix 6 (continued)

13.	Mr. Chamras Arunpoo[4/]	KU-Ag Econ '63 (H)	IARI (India) '69		Credit, resource economics, water use
14.	Mr. Chaiwat Konjing[5/]	KU-Ag Econ '65 (H)	Michigan St. '70	(E - '76)	Marketing, prices
15.	Mrs. Supanee Artachinda	KU-Ag Econ '66 (H)	N. Carolina St. '71		Marketing, Statistics, quantitative methods
16.	Mr. Kumphol Puepanich[6/]	PCE-Educ '65	KU '71	(E - '77)	Land Economics
17.	Mr. Prem Boonruang[7/]	KU-Econ '67	UP Agri Univ. (India) '71	(E - '78)	Farm Management/Production Economics
18.	Mr. Chatt Chumchong[18/]	KU-Ag Econ '66 (H)	KU '73	(E - '79)	Marketing
19.	Mr. Somkit Tugsinavisuitti[8/]	KU-Ag Econ '68	KU '72	(E - '78)	Agribusiness, Finance
20.	Mr. Jerachone Sriswasdilek[9/]	KU-Ag Econ '66 (H)	UPCA Los Baños '73	(E - '78)	Farm Mgt./Production Economics
21.	Mr. Wattanutchariya[10/]	KU-Ag Econ '68	KU '73	(E - '77)	Farm Mgt./Production Economics
22.	Mr. Somsak Priebprom	KU-Ag Econ '70	KU '73		Farm Mgt./Production Economics
23.	Mr. Somporn Isvilananda	KU-Ag Econ '70	KU '73		Farm Mgt./Production Economics, Quantitative methods
24.	Mr. Apisith Issariyanukula	KU-Ag Econ '71	NTU '73		Marketing, prices
25.	Mr. Yongyuth Chalamwong	KU-Ag Econ '71	KU '73		Resource economics, quantitative methods
26.	Mr. Montri Congtrakultien[16/]	KU-Ag Econ '74	(E - '76)		Agribusiness
27.	Mr. Jeerakiat Apibunyopas[16/]	KU-Ag Econ '74	(E - '76)		Agribusiness

Appendix 6 (cOntinued)

28.	Mr. Boonjit Titapiwatanakul 17/	TU-Econ '71 (H)	TU-Econ '74) (E - '78)	Agribusiness
29.	Dr. Delane E. Welsch (Visiting Professor)			Farm Management/Production Economics, Policy, Agribusiness
30.	Mrs. Sriaroon Rasanond (Head)	CU-Acctg '56	M.B.A.(Mgt.) - Cornell '61	General Management and Personnel Administration
31.	Mr. Somsit Wichitpongse	TU-LL.B. '54	1/ '67 2/	Law
32.	Mr. Pasom Petchumrut	KU-Agronomy '57	M.P.A. - NIDA '67 3/	Organization and Management and Personnel Administration
33.	Mrs. Lekha Sinleau	4/		Secretary Science
34.	Mr. Puengchai Puengpanich	KU-Econ Coop '60	1/ '66	Insurance and Advertising
35.	Mr. Suthum Phongsamran	BHU-Com '66	M. Com (Mgt) '68 (B.H.U. (H)	General Management, Insurance and Industrial Relations
36.	Mr. Manit Kijpaitul	KU-Econ Coop '54	1/ '71	General Management and Personnel Administration
37.	Mrs. Chanphen Japakasetr	TU-Com '65	M.B.A. '67 - Fairleigh Dickenson	Finance
38.	Mr. Vinich Verayangkur	TU-Com '65	M.B.A. '71 - East Texas State	Production and Industrial Management
39.	Mr, Damrong Hunchangsit	TU-LL.B. '71		Law
40.	Miss Vasana Chandapasa	CU-Acctg '59	M.S. (Bus. Adm.) U. of N.C. (Chapel Hill) '68	Personnel Management, Quantitative Methods and Data Processing
41.	Miss Preyanuch Sangpassorn 5/	CU-Bus. Adm. '74		Agribusiness

Appendix 6 (continued)

NOTES:

CU - Chulalongkorn University, BHU - Banaras Hindu University (India), NIDA - National Institute of Development Administration, KU - Kasetsart University, TU - Thammasat University, (H) - Honors Degree, (E) Expected Date of Receiving Degree, PCE - Prasanmitr College of Education, UNE - University of New England, Armidale, Australia, NTU - National Taiwan University.

1/ On leave to serve as full time coordinator of Kasetsart University Development Project

2/ On leave as Dean of the Faculty

3/ Half time on Kasetsart University Development Project

4/ Full time secretary to the Dean of the Faculty

5/ On leave from August 1972 to study for Ph.D. at the University of Minnesota

6/ On leave from September 1973 to study for Ph.D. at the University of the Philippines at Los Baños

7/ On leave from September 1974 to study for Ph.D. at the University of Florida

8/ On leave from October 1973 to study for MAB (Agribusiness) at the University of the Philippines in Diliman

9/ On leave from September 1974 to study for Ph.D. at Oregon State University

10/ On leave from June 1973 to study for Ph.D. at North Carolina State University

11/ Three years additional advanced study at Cornell University

12/ IRRI Research Fellow '65-'67, one year additional advanced study at University of Minnesota '70-'71

13/ C.R.S. Statistics Canterbury (New Zealand) '66

14/ IRRI Scholar, advanced study at UPCA Los Baños '65-'67 and '69

Appendix 6 (continued)

15/ Post-Graduate Diploma, Sydney University, Australia '66

16/ To be appointed upon completion of MAB (Master of Agribusiness) at the University of the Philippines in Diliman

17/ To be appointed upon completion of Ph.D. at the University of Minnesota

18/ Will go on leave in January 1975 to study for Ph.D. at the University of Queensland, Brisbane, Australia

29/ Certificate in Public Relation, Department of Public Relation, Office of the Prime Minister

30/ Certificate in Investigation '57, Department of Police

31/ Diploma in Education, Ministry of Education, '59

32/ Diploma in Secretarial Science + Typing Technical Institute

33/ To be appointed upon completion of MBA (Agribusiness) at the University of the Philippines

Appendix V

Agricultural Colleges and Universities in Thailand

A. Bangpra Agricultural College
Cholburi, Thailand

1. Location

Bangpra Agricultural College is located near the Bangpra Reservoir, about 12 kilometers from the town of Sriracha, and 112 kilometers from Bangkok. It is about four (4) kilometers from the Southeast National Highway and readily accessible by motor vehicle from Bangkok.

The total campus area is about 215 acres ranging from foothill to marshland. The land was bought from many farmers and consisted of coconut and mango plantations, sugarcane, cassava and paddy fields. The prevalent soil type is sandy overlying a clay substance which is quite low in fertility.

The college farm covers 140 acres and it is divided into nine sections. Land usage of these sections
the Farm Management Committee to ensure balanced utilization of the available land.

2. Institutional Background

The college was established in 1957 by the Department of Vocational Education, Ministry of Education. From 1957-1960, it served as an in-service training center for upgrading teachers to an elementary

level teaching certificate in agriculture (equivalent to grade 13). Since the establishment of the college, numerous conferences and workshops had been conducted for headmasters and staff members from all agricultural schools in Thailand.

In 1961, the Department of Vocational Education discontinued the elementary level teaching certificate and transferred secondary level agricultural teacher training from Chiengmai Agricultural College to Bangpra. This made Bangpra Agricultural College the only vocational agriculture teacher training institute in Thailand.

Since 1962, the college has offered two levels of training. The first level is Higher Vocational Agriculture or Maw Saw 4-5-6 (equivalent to grade 11-12-13). The second level - Teacher Training in Agriculture is equivalent to a junior college level (grade 14-15). The admission requirement for Higher Vocational Agriculture is completion of lower secondary education or grade 10. For teacher training level, the student must be a graduate in Higher Vocational Agriculture.

In 1967, the LIVE Project (Loan for the Improvement of Vocational Education through the World Bank) designated Bangpra Agricultural College as the development center for ten vocational agriculture schools and colleges. A team of agricultural specialists from California State Poly-technic College was contracted to assist the LIVE Project in developing vocational agriculture.

3. Present Structure

Under the Ministry of Education, the Department of Vocational Education is responsible for the administration and supervision of 19 vocational agriculture schools and 5 two-year agricultural colleges. Bangpra Agricultural College is the only institution responsible for training agricultural teachers at the Junior College level. The other four (4) agricultural colleges which are located in different regions of the country offer both Higher Vocational Agriculture (grade 11-12-13) and Technical Agriculture (grade 14-15).

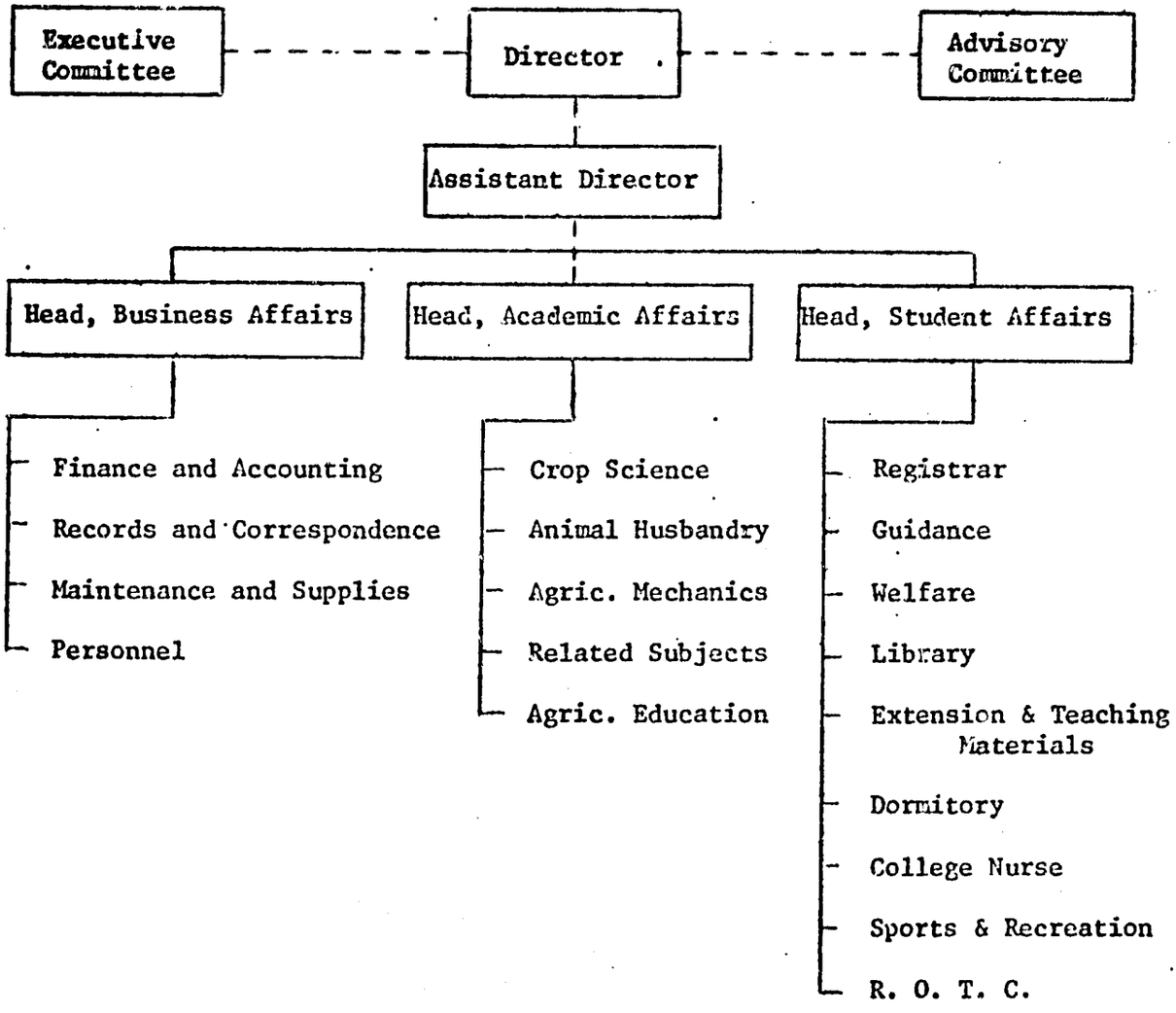
Bangpra Agricultural College is administered by a college director who is directly responsible to the Chief of Agricultural School Division and the Director-General of the Department of Vocational Education. The college director is appointed by the Minister of Education upon the recommendation of the Director-General of the Department of Vocational Education. The college director is assisted by an assistant director. Directly under the assistant director are three head divisions, namely, Head of Academic Affairs, Head of Business Affairs and Head of Student Affairs. Under each division, there are several sections headed by chief of sections in their respective fields of assignment (see Figure 7.A).

4. Programs Offered

a) Teaching

At present, Bangpra Agricultural College offers two curricula. The first three-year curriculum is Higher Vocational Agriculture

Figure 7.A
Organizational Structure
Bangpra Agricultural College



equivalent to grade 11-12-13. The second two year curriculum, a secondary teacher training in agriculture, is equivalent to grade 14-15 or a junior college level. The student who applies for admission to the first year of Higher Vocational Agriculture must possess a certificate of lower secondary education (grade 10). Those who wish to apply for admission to teacher training must have completed Higher Vocational Agriculture from any agricultural school or college under the Department of Vocational Education.

b) Higher Vocational Agriculture Curriculum

Higher Vocational Agriculture curriculum at Bangpra is basically the same curriculum used in all agricultural schools and colleges under the Department of Vocational Education since 1962. Vocational agriculture level provides opportunity for trainees to secure on-campus teaching experience and to maintain a demonstration class for initiating new curriculum and methods in teaching vocational agriculture.

The present Higher Vocational Agriculture curriculum is as follows:

	Unit	Percent
1. Vocational Agriculture	68	56.60
2. Academic or Core courses	32	26.70
3. Related subjects	20	16.70
Total -	120	100.00

Aside from class and laboratory work, each student is required to conduct a supervised farming program during his study at the college. The supervised farming program relating to crop or animal production is selected in accordance with the student preference. This program is closely supervised by the instructor of the department concerned. Students are also required to work 10 hours/week on different projects at the college farm. (See Tables 7.1-7.3 for the member enrolment and graduates from Bangpra and other colleges in Thailand).

c) Teacher Training Curriculum

The present teacher training curriculum was revised and an improved version of the old curriculum was used from 1959 to 1968. The revised curriculum was used from 1959 to 1968. The revised curriculum was developed to utilize class and laboratory time more effectively. The practice teaching period was extended from 4 weeks to 8 weeks and the evaluation method was changed from percentage to credit system. In this curriculum there were 42 required subjects or 93 units to be completed in 2 school years.

The revised teacher training curr . is organized as follows:

		Unit	Percent
1.	Technical Agriculture	49	52.70
2.	General and Related Subjects	22	23.65
3.	Professional Education	22	23.65
	Total -	93	100.00

Table 7.1

Areas of Agricultural Studies and Number of Students in 19 Agricultural Schools and 5 Agricultural Colleges[1/]

Areas	Number of Students			
	Teacher Education (Grade 14-15)	Technical Education (Grade 14-15)	Upper Secondary (Grade 11-13)	Lower Secondary (Grade 10)
Agriculture	178	574	6,443	13
Farm Mechanics	-	75	86	-
Heavy Equipment Mechanics	-	41	-	-

[1/] 1971 Annual Report, Department of Vocational Education, Ministry of Education.

Table 7.2

Enrollment, Teaching Staff, Graduates and Operational Budget 1958-1970

Year	Enrollment	Teaching Staff	No.of Graduates	Operational Budget (Baht)
1958	33	7		739,704
1959	71	11		440,615
1960	94	12	33	242,380
1961	54	17	30	430,000
1962	135	19	24	445,360
1963	217	26	35	248,100
1964	261	29	98	104,110
1965	254	30	95	823,300
1966	260	32	66	684,527
1967	285	31	122	862,642
1968	284	37	102	1,191,487
1969	305	37	96	1,457,436
1970	372	42	(129)	1,111,879

Table 7.3

Placement of Higher Vocational Agriculture Graduates
(Grade 13) 1963-1968

Placement	Number	Percent
1. In advanced Study	174	64.0
2. Ministry of Agriculture	29	10.6
3. In Semi-government Agencies	23	8.2
4. Private Enterprise	23	8.2
5. In Ministry of National Development	19	7.0
6. College Employees	3	1.2
7. Civil Service in Laos	2	0.8
Total -	273	100.0

Upon graduation, a vocational agriculture student receive a "Certificate of Higher Vocational Agriculture" from the Department of Vocational Education. This certificate is equivalent to a high school diploma. The holder of this certificate is also eligible for employment as a junior officer in the Thai Government with a starting salary of 650 baht/month. He is also eligible to take the entrance examination to any College of Agriculture in Thailand.

A student who graduates from a teacher training curriculum receive a "Secondary Teaching Certificate in Agriculture" (S.T.C. in Agric.). The starting salary for a holder of this certificate in the Thai Government is 950 baht/month. He is also eligible to pursue his advanced study in either College of Education or College of Agriculture in the following institutions:

College	Degree	No. of Years
1. Prasarnmitr College of Education	B.Ed	2
2. Bangsaen College of Education	B.Ed	4 (Evening Class)
3. College of Agriculture, Kasetsart University	B.S.	2
4. College of Agriculture, Chiengmai University	B.Sc.	2

d) Research

Bangpra Agricultural College was designated as a training college under the Department of Vocational Education, Ministry of Education. The primary purpose of this college is to teach

students and to train teachers. As a development center, this college is also responsible for testing new vocational agriculture curricula which will be used in other project schools in the next school year. In addition, new methods and materials of teaching vocational agriculture are introduced and tested in the high school department of this college.

Although the college does not participate in agricultural research activities, results of research work conducted elsewhere are used by the staff members in their instructional program. In the college farm, demonstration plots showing result of research work on new crop varieties, different fertilizer and tillage practices are also developed for instructional purpose.

e) Extension and Public Service Activities

Bangpra Agricultural College serve as the base institution for innovations and improved practices in vocational agriculture education. Through workshops, seminars, conferences and publications, the new concepts and practices were being initiated in the ten (10) LIVE Project schools. The college was also responsible for preparing and making public materials in vocational agriculture for the use of teachers, field workers and other interested persons.

In addition, the college works in cooperation with different government agencies and organizations to offer short course training in agriculture for community development workers, 4-H club leaders, Peace Corps volunteers and agricultural workers from Laos.

One of the functions of Bangpra Agricultural College was to extend its resources and services to the community around it. In many cases, the students and faculty participate in conducting classes for rural school children and teachers. The college also participates in landscaping and beautification of temples and other institutions in the province. The college also serves a source of breeding animals for the farmers in Cholburi and nearbly provinces.

f) Faculty Staff

The teaching staff consists of 42 instructors - 1 Ph.D., 5 M.S., 5 M.A., 13 B.S., 2 B.A., 4 B.Ed. and 12 with Diploma or Certificate in Agricultural Education, Education and Mechanics.

Table 7.4

Classification of the Teaching Staff*

Classification	Ph.D.	M.S. M.A.	B.S. Etc.	Dip. Etc.	Total No. with Foreign Training
First Grade Instructor	1	2	-	1	3
Second Grade Instructor	-	8	15	1	11
Third Grade Instructor	-	-	4	10	-
Total -	1	10	19	12	14

*Including college administrators who were considered as instructors who also carried teaching loads.

g) College Expenditures and Budget Source

Supporting funds for the operation and maintenance of the college is from the national budget through the Department of Vocational Education. The national budget for Bangpra Agricultural College in the past was as follows:

		Baht[1/]	Percent
1.	Salary & wages[2/]	831,836.30	
2.	Social security fund	7,930.00	
3.	Travel fund	32,272.00	
4.	Electricity & water bills	90,612.20	
5.	Installing electricity & water	105,825.00	
6.	Maintenance & Repairs for buildings	83,964.26	
7.	Spare Parts Repairs for Motor Vehicles	24,534.00	
8.	Fuel	84,694.85	
9.	Materials & Supplies for Office and Dormitory	73,452.50	
10.	Instructional Materials	122,355.17	
	Total	1,457,436.28	

Proceeds from the agricultural produce provides the students and the college with supplemental income through sale of produce to the college cafeteria with the excess being sold in the open market. This income amounts to 12,000 baht per year, About one-third of this accrues to individual students as the result of their farming program.

1/ US$1.00 = 20 baht 2/ Salary and wages - 57.74% of the total budget

B. Kasetsart University
Bangkok

1. Campus Site

Kasetsart University is located in Bangkhen, a suburb in the greater metropolitan area of Bangkok, about 14 kilometers north of the down-town area. The campus occupies 360 acres and lies adjacent to the Ministry of Agriculture. A larger campus site at Kamphaengsaen (nearly 3,000 acres) is being developed in the northern portion of Nakorn Pathom province, a rural area about 80 kilometers northwest of Bangkok. The Kamphaengsaen site will be operated as a branch of the main campus and scheduled to start in 1976.

The university also operates five experimental farms. Three are located about 150 kilometers northeast of Bangkok on the Friendship Highway, another is in the Sriracha area 100 kilometers southeast of Bangkok, and the fifth is at Kamphaengsaen. There are also two fishery field stations, one in Sriracha and another in the province of Prachuab Khirikhan in southern Thailand. There are four forestry summer camps, one in the far north in Chiengmai province for watershed management studies, another also in the north in Kampang province, the third in the northeast in Nakorn Rajasima province, and the fourth is located in Prachuab Khirikan province in the south.

2. Institutional Development and Programs

A. In the Thai language, the word "Kaset" means agriculture. Kasetsart University was established in 1943 and functions as the National College of Agriculture. There are eight faculties at

the present time: Agriculture, Economics and Business Administration (formerly Cooperative Science), Education, Fisheries, Forestry, Engineering (formerly Irrigation Engineering), Veterinary Science and the Graduate School.

Recently, the Institute of Food Research and Development was formed. Its main function is for food research and promotion.

The Faculty now consists of various departments as follows:

Faculty of Agriculture

Department of Animal Science
Department of Entomology and Plant Pathology
Department of Farm Mechanics
Department of Food Science and Technology
Department of Home Economics
Department of Plant Science
Department of Soils

Faculty of Economics and Business Administration

Department of Accounting
Department of Agricultural Economics
Department of Business Administration
Department of Cooperative Science
Department of Economics
Department of Marketing

Faculty of Engineering

Department of Agricultural Engineering
Department of Civil Engineering
Department of Hydraulics and Hydrology
Department of Irrigation Engineering
Department of Mechanical and Electrical Engineering

Faculty of Fisheries

Department of Agriculture
Department of Fisheries
Department of Fishery Biology
Department of Fishery Products

Faculty of Forestry

Department of Conservation
Department of Forest Biology
Department of Forest Engineering
Department of Forest Management
Department of Forest Products
Department of Silviculture

Faculty of Science and Arts

Department of Biology
Department of Chemistry
Department of Languages
Department of Mathematics
Department of Social Sciences and Humanities
Department of Statistics

Faculty of Education

Department of Vocational Education
Department of Physical Education
Department of Education
Department of Veterinary Science

Graduate School

Kasetsart University could be considered to be in a growing stage. The University Council designated four major areas of responsibility for the University and has strengthened its programs in each of the following areas:

a. Resident Instruction

b. Research and Graduate Study

c. Extension Services

d. Student Welfare

The aims of the University are:

1) to strengthen the faculties and courses of study at both the undergraduate and graduate levels;

2) to increase the field and depth of scientific research by the faculty and graduate students;

3) to improve the short course offerings and informational services for extension personnel, adults and young farmers; and

4) to develop the campus into an attractive community for young and mature scholars.

Administration had taken steps to involve the faculty in the long range academic and campus planning for the University. It has been aggressive in securing research support for members who have advanced degrees. It is the first university in Thailand to receive continuing appropriations from the Budget Bureau for its research program. Additional research support had been obtained from the National Research Council, Applied Scientific Research Corporation, Ministry of Agriculture, Ministry of National Development, Bangkok Bank, Tobacco Monopoly, U.S. National Science Foundation, Rockefeller Foundation and Agricultural Development Council.

However, the research staff, including college trained technicians, should be increased since 14,000 qualified and well-trained personnel will be needed by the Government for its agricultural research and extension programs.

In order to achieve the goals established by the Government, the number of well-trained staff in various disciplines of agriculture must be increased substantially.

Table 7.5

Number of Students Receiving Bachelor's Degrees in Agriculture, in All Faculties, and Number Receiving the Master's Degrees, Kasetsart University, by Five-Year Intervals, 1945-1970

Year	B.S. (Agr.)	B.S. (Total)	M.S.	Total
1945	6	19	-	19
1950	12	12	-	12
1955	45	84	-	84
1960	105	227	1	228
1965	194	421	4	425
1970	216	559	38	597
Total for 26 Year Period	2,662	5,461	74	5,535

Kasetsart University is the main source of qualified men for agriculture. Over 75% of its graduates are with the government ministries. These graduates provide leadership throughout the government especially in the Ministry of Agriculture and the Ministry of National Development. The University produces about 200 graduates in agriculture, 110 in forestry, 50 in agricultural economics and cooperative science, 50 in fisheries and 90 in engineering annually. These figures are low in comparison with the needs of the country to expand its educational programs at new universities, to serve growing industries, and to fill available positions in the government agencies. Requirements will not be met if funds for an expanding program are not provided.

To produce enough qualified personnel for the Government, both in research and extension, Kasetsart University has to expand its facilities in various faculties- Agriculture, Forestry, Fisheries, Economics and Business Administration, Engineering, Sciences and Arts, Vocational Education, Veterinary Science. An increase in the staff members and new student enrollment must go hand in hand. Kasetsart University also needs to expand its floor space - lecture rooms, laboratories, workshop and library - and to enlarge its inventory of equipment for both laboratory and field research.

3. Organization

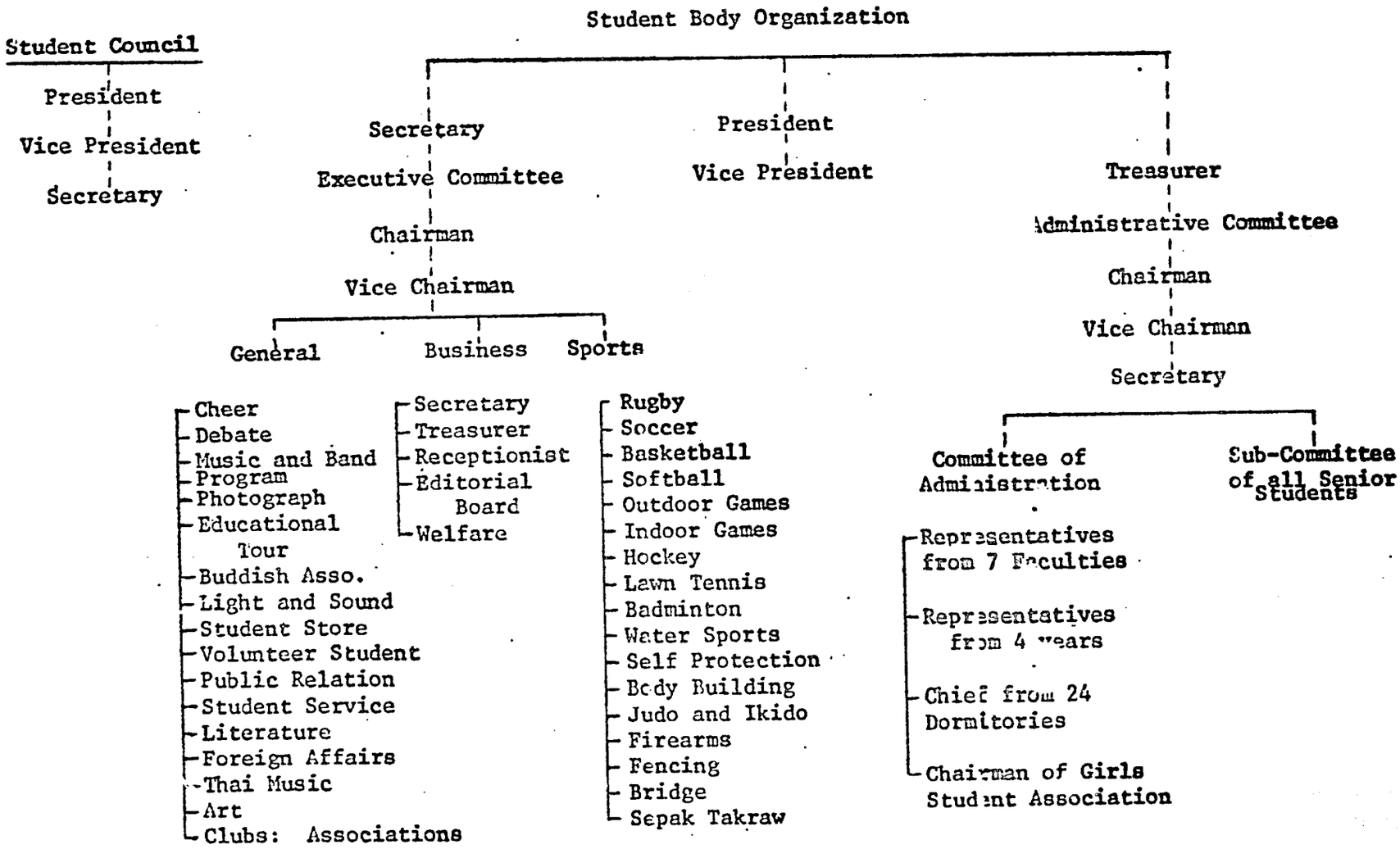
The University is composed of eight (8) Faculties and a Graduate School for providing professional training based on liberal education.

The Rector of the University is empowered to carry on the tasks assigned to Kasetsart by law, and the policy entrusted by the Kasetsart University Council. The Rector answers to the Council on policy and academic matters and to the office of the Prime Minister. The Rector delegates his administrative power through the four (4) Vice Rectors (Academic Affairs, Development, Business Affairs and Student Affairs), see Figure 7.B.

Study programs employ an accumulated credit system, allowing for the use of cross-registration between departments, between faculties and between universities. A credit is based upon one semester-hour of

Figure 7.B

CHART OF ACTIVITIES OF KASETSART UNIVERSITY STUDENTS



Source: Preeda Prapertchob: "The Feasibility of Southeast Asian Regional Student Organization." See: KU News, July, 1968. Volume 16, No. 1, pp. 24-25

work completed satisfactorily. A semester-hour is equivalent to a minimum of 15 hours (50 minute/hour) of lecture, discussion, recitation per semester (18 weeks) or 15 periods (2 or 3 hour period) of laboratory work or work practice per semester.

A regular academic year consists of two semesters of sixteen weeks each: (1) from mid-June through mid-October; (2) from mid-November through mid-March. A summer session is open in May and early June to provide instruction in certain appropriate courses. The inter-semester holidays are usually reserved for field work practices.

4. Academic Affiliation

Kasetsart University is an independent university, directly responsible to the Prime Minister's office, and subject to a number of regulatory/supporting agencies, such as the Civil Service Commission and the Budget Bureau.

The most important regulatory agencies from an academic standpoint are the National Education Council, through the University Development Commission. There are nine universities in Thailand which are under the Council. Other universities include the following:

Chulalongkorn University	-	Bangkok
Thammasat University	-	Bangkok
Kasetsart University	-	Bangkok
Mahidol University	-	Bangkok
Silapakorn University	-	Bangkok

Prasarnmitr Teacher College	-	Bangkok
Chieng Mai University	-	Chieng Mai (North)
Khon Kaen University	-	Khon Kaen (Northeast)
Songkhla University	-	Songkhla & Had Yai (South)

Three regional universities which were recently created, plant to have Faculties of Agriculture. Formal relationships between these three new faculties and Kasetsart is based on their common responsibilities to the Bureau of State University and the National Education Council. However, close informal relationships have existed since the start among the faculties of agriculture in the regional universities. Kasetsart staff members have also helped with the teaching. Some staff members of these regional universities are currently studying for their Master's degree at Kasetsart. The University Development Commission has always initiated closer informal ties between all the Universities in Thailand.

Thailand also has 19 technical or vocational agriculture schools and 5 agriculture colleges which provide the last two years of high schools, and sometimes an additional two years of "junior college" agricultural education and training. There is no direct connection between these schools and Kasetsart University, although many of the teachers in these schools graduated from Kasetsart. Some are also working towards Master's degrees on a part-time basis at the University.

5. Government Relations

Kasetsart University has no formal administrative relationships with the five Ministries (Agriculture, National Development, Economic Affairs, Interior, and Industry) which deal with agriculture and agricultural problems in Thailand. However, there are a number of working relationships between the Ministries, the University and its staff. One example is the National Corn and Sorghum Research and Training Program, which is a three way partnership between the Ministry of Agriculture, Kasetsart University and the Rockefeller Foundation. Some Kasetsart staff also serve on official committees in the government. Many Ministry staff members with higher degrees serve as part-time instructors for graduate and undergraduate courses at Kasetsart. Frequently, there is unofficial but close collaboration on research projects of mutual interest. The University and some departments of the Ministry of Agriculture share a common site at Bangkhen.

In addition, most of the Ministry staff are Kasetsart alumni which enables closer ties.

Administrative, regulatory, and planning relationships are shown in Figure 7.C.

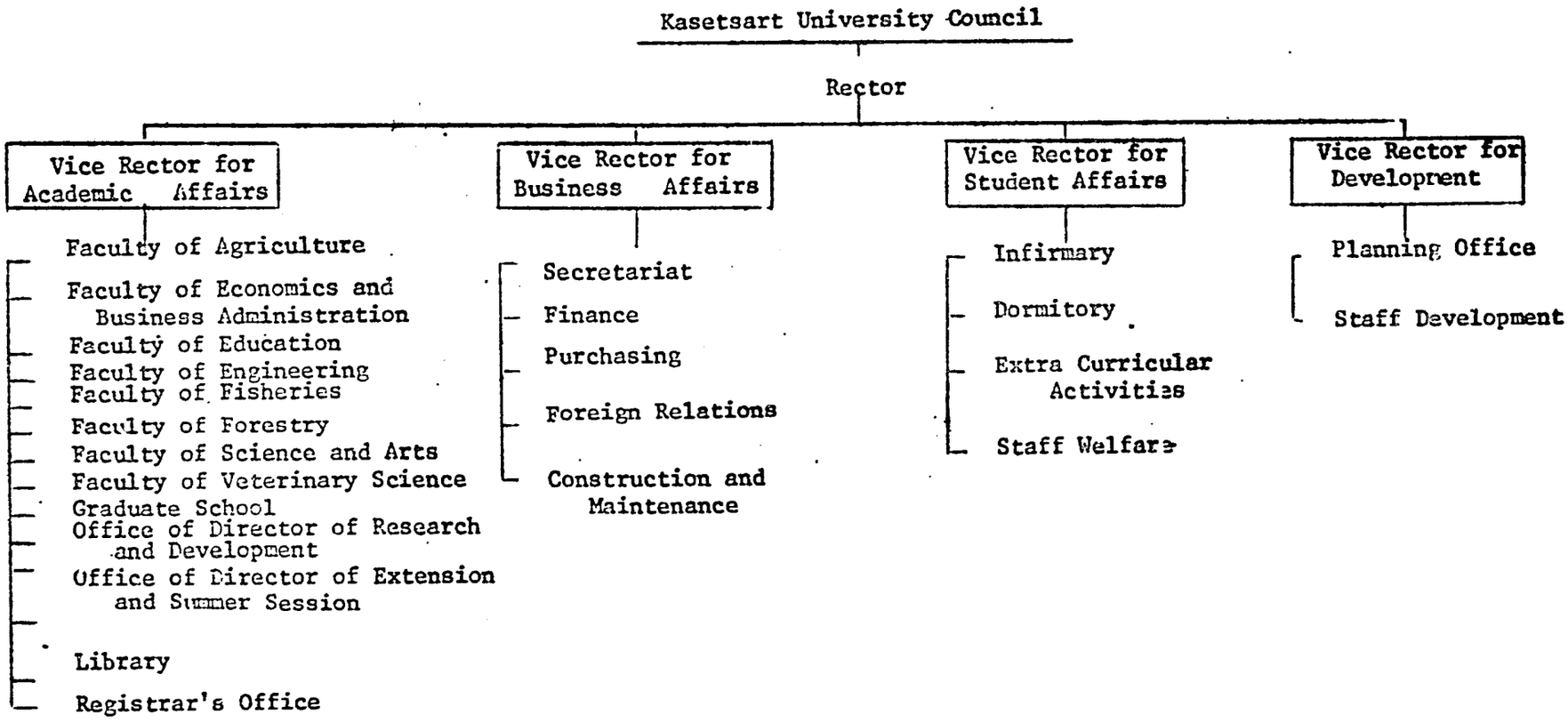
6. Programs Offered

A. Teaching

The curricula presently in effect at Kasetsart University evolved from many sources as the original requirements of the

Figure 7. C

Organization Chart of Kasetsart University



Departments of Agriculture, Forestry, Fisheries, Cooperatives, Livestock, Irrigation; the curricula of colleges and universities in the Philippines, the United States, Australia and Europe; and the former 5-year curricula that were deleted following the graduating class of 1968.

The main body responsible for the curricula is the Education Committee, appointed from the teaching staff by the Rector for a period of two years. This committee recommends a broad guideline for all curricula. Each Faculty, by soliciting ideas from staff members through Department heads, and after deliberating within the Faculty Committee, would propose a new or re-arranged curriculum or suggest an improvement to the Education Committee. The proposal is subject to review or revision if necessary, before a recommendation is made to the University Council. A new curriculum or a proposal to change a core curriculum must get approval from the National Council.

The language of instruction at the university is in Thai. Undergraduate students receive a few reading assignments and laboratory instructions and some lectures in English for the upper-division courses. Graduate students must rely more, or exclusively in many courses, on English.

The broad guideline for all curricula is given as follows:

1. The total credit for a 4-year course = 150 $\pm$ 10 units;
2. The composition of the total credit being -

   25 $\pm$ 5% basic natural sciences

25 ± 5% basic social sciences and general knowledge

50% professional or major subjects

The core curricula leading to either a B.S. or B.A. degree, or both were established for each Faculty.

B. Graduate Program

Kasetsart University has offered opportunities for graduate work to qualified students since 1955. The first advanced degree was conferred to a Filipino who enrolled in the Faculty of Agriculture in 1956. Later the Faculty of Economics and Business Administration and the Faculty of Forestry also offered graduate programs. In 1966, a Graduate School was organized and the Dean, Associate Dean and Secretary were appointed.

The Faculty of the Graduate School was appointed on a highly selective basis in keeping with guidelines and procedures which were designed to ensure an orderly development of a strong graduate staff.

Kasetsart University currently offers graduate study leading to a Master's degree in 25 different fields of specialization, in 15 different academic departments. The programs require a minimum of 36 semester credits of coursework beyond the Bachelor's degree, a comprehensive exam, and a research thesis. The four major areas of responsibility of the University are:

1. Resident Instruction
2. Research and Graduate Study
3. Extension
4. Student Welfare

C. Major Lines of Research

In its early days, the main function of the University was as a teaching and training area of the Ministries. As qualified staff increased, the University Council designated research responsibilities to the University. The Budget Bureau allocated research funds directly to the University. At present, two allocations are made: one to the University in general support of research and the other directly to the National Corn and Sorghum program. The general University research funds, through the University Research Committee, are allocated to project funds directly to designated leaders of these projects. The same procedure is followed for the Corn and Sorghum research funds. Annual appropriations for both allocations range from three to three and one-half million baht. ($150,000 to $175,000) Unfortunately, the research funds had not increased over time. With an increasing number of qualified staff, the University had to look elsewhere for funds. Each year outside grants from external agencies are received directly by staff members, with the permission of the University. Frequently, staff members participate in research of various

Table 7.6

Student Enrollment by Curricula or Specialization
for Academic Year 1969-1970

Faculty	Freshman	Sophomore	Junior	Senior	5th	Total
Agriculture						
Male	297	263	285	226	3	1,074
Female	124	112	84	82	-	402
n. & B.A.						
Male	161	113	101	89	-	464
Female	119	76	54	37	-	286
Engineering						
Male	152	54	43	91	-	340
Female	-	-	-	-	-	-
Fisheries						
Male	41	29	29	47	-	146
Female	19	8	6	10	-	43
Forestry						
Male	180	148	115	119	-	562
Female	-	-	-	-	-	-
Science & Arts						
Male	21	16	15	20	-	72
Female	77	57	54	25	-	213
Veterinary Science						
Male	28	32	29	21	4	114
Female	13	22	7	1	-	43
TOTAL	1,232	930	822	768	7	3,759
Male	880	655	617	613	7	2,772
Female	352	275	205	155	-	987

Table 7.7

Number of Students Receiving Degrees at the July 16, 1970 Commencement, by Areas of Specialization

Degree	Number of Graduates
M. Sc.	29
M. A.	9
B. S. Agriculture	210
B. S. Food Science	16
B. S. Fisheries	39
B. S. Forestry	92
B. S. Science	32
B. S. Engineering	62
B. S. Agricultural Economics	53
B. A. Economics	28
B. A. Business Administration	20
B. A. Accounting	6
Total -	596
M.S.	38
B.S.	559

Ministries, using funds allocated directly to the Ministries. The University continually looks for opportunities to share facilities to develop cooperative research projects with other Universities, and government and private agencies.

The University operates five experimental farms. The Suwan farm with an area of more than 1,000 acres is now the National Center of Corn and Sorghum Research. The Pakchong station (170 acres) is a research and training station for horticultural crops. The Tab Kwang station has been used primarily for student training and growing of some livestock feed. The station has about 150 acres and will be used as a swine production station. The Sriracha training farm is used as a training station for students in animal husbandry especially for dairy farming. These four stations have physical facilities needed for research and training. The Kamphaengsaen site is planned to develop an extension farming area for national agricultural experiment purposes in joint programs with the Ministry of Agriculture, and supplemented by technical and material contributions from the Rockefeller Foundation.

6.1 Research and Training

The University encourages all staff members to carry out research in addition to their teaching. However, the University still lacks intermediate or senior staff positions for full-time research. In evaluating each staff member's performance for

purposes of salary and promotion, research activities are considered. About one-third of a staff member's full load should be spent on research.

D. Extension

1. Institution designated responsibility in extension

To cope with the three functions of the University, an Office of Extension was organized in 1953. The University Act B.E. 2511 (1968) permitted the University to legalize the Office of Extension. The Office works very closely with other governmental departments in extension work.

2. Major Types of Extension Activity

At present, the Office of Extension takes charge of in-service training, extension work, extramural, mass communications, home economics and the annual 4-H club rally.

The extension office staff also cooperates in teaching in addition to his extension job. The subjects taught by the staff are confined to extension education and methods.

E. Other Public Service Activities

1. Radio Programs

The University maintains three radio stations, one located in Bangkok and the other two are located in Chiengmai (north) and Khon Kaen (northeast). It is

estimated that 2 million people listen daily to Kasetsart's radio programs. However, the quality of operation depends entirely on the income collected from advertisements.

2. Short Courses

The University initiates courses for the public during the summer period, after the regular school year. People from all walks of life register in the classes. The programs are scheduled for four weeks during the month of April. There are 40 courses offerred and more than 5,000 men and women attend the classes each year. Subjects taught include canning, and plant propagation. swine raising, poultry raising, plant propagation, etc. These courses are offered in order to meet the need of persons interested therein.

3. Newspapers, Magazines

There is no daily newspaper at the University. However, it publishes a monthly bulletin in the Thai language called "Kaosarn Kasetsart". Several student clubs occasionally publish their own technical journals separately.

4. Youth Activities

Kasetsart University encourages extra curricular activities of students on the campus to serve as outlets to develop their concepts of democracy. There are a

Research fund from the government budget is rather limited. Nevertheless, research activities in agricultural science have been largely supported by the Rockefeller Foundation.

3. Ratio of funds budgeted for salaries and operations

Year	Salaries	Operations	Total
	(Thousand Baht)		
1964	7,926	13,145	21,121
1965	8,511	14,986	23,497
1966	9,428	20,505	29,933
1967	12,141	32,225	44,366
1968	14,228	47,675	61,903
1969	15,324	52,497	67,821

c) Ratio of student to teachers (full-time equivalent is 1:12)

B. Financial

1. Major sources of support for the various activities of the institutions:

	In Thousand	
	1968	1969
Government Budget	61,903	67,821
Forest Industry Organization	3,000	3,000
Rockefeller Foundation	5,500	7,000

2. The total annual university expenditure (government budget) are as follows:

Year	Total	%	Expenditures (Baht) Capital*	% of Total	Recurrent	% of Total
1964	21,120,800	100	7,128,600	34	12,992,200	66
1965	23,496,900	100	7,823,900	34	15,673,000	67
1966	29,933,100	100	12,460,200	42	17,472,900	58
1967	44,366,400	100	19,179,000	43	25,187,400	57
1968	61,902,600	100	32,709,400	53	29,193,200	47
1969	67,820,900	100	37,377,600	55	30,483,300	45

*Equipment, land and construction.

number of student organizations as the Student Council and Student Body Organization. The Student Council serves as the legislative body - gathers opinions, suggestions from students, and design rules to be adopted by the Student Body Organization. The Student Body Organization was set up to exercise self-government, to promote goodwill and responsibility among students.

7. Institutional Resource

A. Personnel

1. Number of professionals (full-time equivalent) in teaching, research, extension and other activities are as follows:

On campus	394
Overseas	45
Total -	439

2. Executive and Administrative Staff are the following:

	Ph.D.	M.S.	B.S.
a) Administrative Executive	15	28	10
b) Staff (Academic rank is being considered and Civil Service rank is not applicable)	25	131	187
Total - 394	38	159	197

CHAPTER I

National Economic Development Board, Office of the Prime Minister, Bangkok, Summary of the Second and the Third Five-Year Plans, (1966-1971 and 1972-1976).

Office of the National Economic Development Board, Bangkok, Thailand, National Income of Thailand.

CHAPTER II

Meteorological Station, Cotton Development Centre, Takfar.

CHAPTER III

Davis, Lance, Capital Immobility and Finance Capitalism, EEH, Fall, 1963.

Thisyamondol, P., Arromdee, V., and Long, M. F., Agricultural Credit in Thailand, Theory, Data and Policy, Bulletin of Kasetsart University, Bangkok, Thailand, 1965.

Japan Export Statistics, Ministry of Finance, Japan.

The National Economic Development Board, The Third National Economic and Social Development Plan, 1972-1976, Government of Thailand.

CHAPTER IV

Division of Agricultural Economics, Ministry of Agriculture and Cooperatives.

CHAPTER V

Chantarangsy, Sirirak, "Corn Transportation, "The Daily Trade News", Special Issue, March 1, 1972, Ministry of Commerce.

Preecha Tanprasert, "Corn", Fifteen Year Anniversary Report, The Thai Maize and Produce Traders Association, Bangkok, 1972.

Tavil, Paonil, "Market Structure of Corn i hailand", 1971, (Unpublished M.S. Thesis, Department of Agricultural Economics, Kasetsart University), Bangkok, Thailand.

CHAPTER VI

Panyatorn, Sommai and Chaopetr, Pranuan, "Feedmilling Industry", Monthly Bulletin, Vol. XIV, No. 3, March 1974, Bank of Thailand.

CHAPTER VII

Acceleration of Corn Production and Marketing Program, 1972-1976, Agricultural Economic Document No. 55, 1972. Division of Agricultural Economics, Ministry of Agriculture and Cooperative.

A Study on Marketing and Prices of Agricultural Products in the Upper Chao Phya Basin, Thailand. Division of Agricultural Economics, Ministry of Agriculture and Cooperative, 1969.

The Thai Maize and Produce Traders Association, Bangkok, Thailand.

CHAPTER VIII

Report on Protein Food Promotion, November 22-December 1, 1970. The Institute of Food Research and Product Development, Kasetsart University.