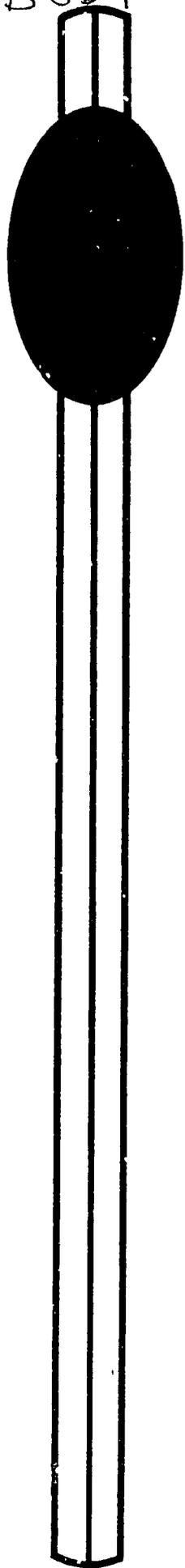
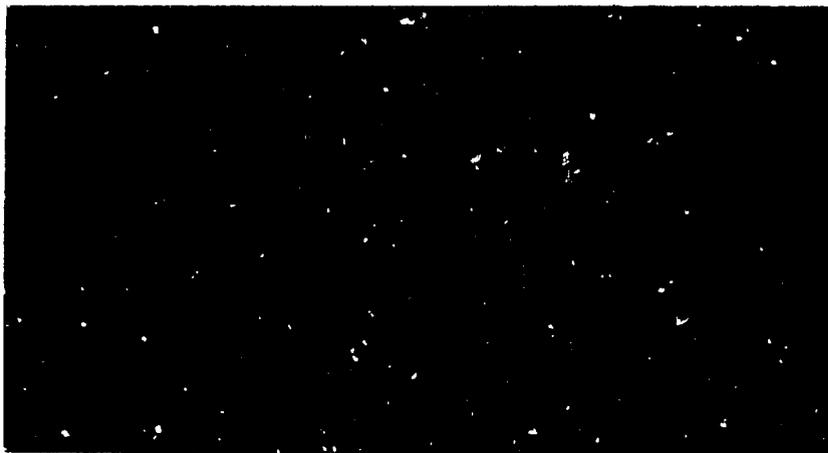


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The Agriculture Sector in Thailand:

A Brief Assessment

Russell H. Brannon

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I. THE ROLE OF AGRICULTURE WITHIN THE TOTAL ECONOMY.

In many respects, agriculture dominates the Thai economy. The rural labor force comprises approximately 80 percent of the total labor force, and direct agricultural production activities account for 60-70 percent of rural employment. By including those agribusiness industries which are either directly or indirectly dependent upon agriculture, the employment role of agriculture is further expanded to the 80-90 percent range.

Historically, agricultural exports have been the major source of foreign exchange earnings, and thus a major factor in maintaining a consistently strong international balance of trade situation. During the period 1970-76, agricultural exports have made up at least 70 percent of total export value in each year, and have ranged as high as 77 percent.

Agriculture's contribution to the Gross Domestic Product (GDP) in 1960 was 39 percent. However, as the economy has grown and other sectors have increased at more rapid rates than agriculture, its share has declined to 26.4 percent in 1976. A further relative decline to around 24 percent of GDP is forecast by 1981. The gradual decline in *relative* importance of the agricultural sector, as a structural transformation process, is to be expected and should be viewed as a normal consequence of economic development. It is important to keep in mind, however, that in *absolute* terms (people employed, revenue generated, foreign exchange earned, etc.) the sector will continue to grow for many years. Average annual increase in Gross Agricultural Product (in real terms) during the period 1972-76 was nearly 4 percent, and the Fourth Five Year Plan calls

for an acceleration to 5 percent per annum for the 1977-81 period (2 percentage points below the targeted GDP growth rate).

In the sections that follow, a detailed look at rural Thailand -- and particularly agricultural Thailand -- is undertaken. Where it appears useful to do so, statistics are broken down by region, since there are substantial regional variations in production patterns, employment, income levels, and other significant indicators of levels of living.

II. THE LAND RESOURCE BASE.

The total land area of Thailand is approximately 51.4 million hectares, 36 percent of which was classified as being in "farm holdings" in 1975. Paddy land comprises 63 percent of the farm land, upland crops 18 percent, fruits and other tree crops (including rubber) 10 percent. The remaining farm land area is devoted to vegetable crops, farm houses and other structures, uncultivated scrub land, etc. (See Table 1). It has also been estimated that approximately 19 million hectares were in forest in 1973, but the accuracy of this figure has been questioned by many observers.

TABLE 1. CLASSIFICATION OF LAND, 1975
(Million Hectares)

Total Land	Land in Farms	Usage Classification & Land in Farms in Million Hectares and as a Percentage of Farm Land							Non-Farm
		1/ Paddy	Upland Crops	Tree Crops	Vege- tables	Scrub Land	Struc- ture	Other	
51.4	18.6	11.7	3.3	1.8	.09	.8	.4	.4	32.8
100%	36%	63%	18%	10%	-	4%	2%	2%	64%

Source: Constructed from data provided by the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives.

For many years, observers of the Thai scene have been predicting that the "agricultural frontier" was soon to close and that little potential existed for continued expansion of land area devoted to farms. Undoubtedly, this time must arrive, but expansion at a fairly rapid rate has continued to occur during the period 1971-75. Although data are scarce, it is very probable that this expansion has been primarily at the expense of the forested area.^{2/} Table 2 below shows areas classified as "farm holdings", by region, 1971-75.

1/ Note that the area classified as paddy land is 11.7 million hectares, yet annual area planted to rice in recent years has been only around eight million hectares. This is because area reported as paddy land includes bunds around the paddies, paths, termite hills, trees, etc., all of which are deleted from the area reported as planted. Moisture conditions, particularly in the rainfed Northeast, also militate each year against planting some of the area which is classified as paddy land.

2/ As reported in the RTG Fourth Five Year Plan, p. 149, an aerial photo survey conducted in 1963 showed 57 percent of the land area in the Kingdom to be in forest. The 1974 satellite census showed forest area to comprise only 37 percent. Assuming comparability of the estimates, this suggests a deforestation of some 5.9 million hectares over the period.

TABLE 2. EXPANSION OF FARM HOLDINGS, BY REGION 1971-75
(Million Hectares)

Region	1971	1973	1975	Percent Change 1971-1975
North	2.9	3.7	3.8	+31%
Northeast	6.8	7.8	8.1	+19%
Central	3.9	4.4	4.4	+13%
South	1.9	2.2	2.3	+21%
Whole Kingdom	15.5	18.1	18.6	+20%

Source: Constructed from Division of Agricultural Economics data,
Thailand Agricultural Statistics in Brief, Crop Year 1976/77,
Table 6.

Data in the table indicate that the Northern region has expanded land in farms by a greater percentage than any of the other areas during the period, although the greatest absolute expansion occurred in the Northeast. Major expansion occurred between 1971 and 1973, with a substantial slackening recorded between 1973 and 1975.^{3/}

A cross-check with the percentage growth in planted area of principal food and feed crops and principal non-food crops (Tables 22 and 24) also shows an increase in farm land area of 20 percent for the whole Kingdom between 1971 and 1975.

^{3/} Discussions with MOAC Division of Agricultural Economics statistical personnel indicate that beginning in 1971 land use data have been collected annually on a systematic basis, involving actual on-farm interviews. DAE assigns a reasonable level of confidence to the validity of these statistics.

Estimates of the quality of the land resource are not yet precise. The best available data are those developed by the Ministry of Agriculture and Cooperatives (MOAC) and the FAO.^{4/} This study indicates an area of approximately 29.7 million hectares which is suitable for agricultural production (See Table 3).

TABLE 3. LAND CAPABILITY OF THAILAND

Total Area of Soils Suited to Paddy: 9.62 million hectares

Area very well suited to rice production (1.96 million)
Area moderately well suited to rice production (4.05 million)
Area moderately to poorly suited to rice production (3.61 million)

Total Area of Combined Paddy and Upland Soils: 5.92 million hectares

Area well suited to either rice or upland depending on drainage (.89 million)
Area moderately suited to rice or upland depending on drainage (5.03 million)

Total Area of Soils Suited to Upland Crop Production: 14.20 million hectares

Area well to moderately well suited (1.84 million)
Area moderately to poorly suited (12.36 million)

Soils Not Suited for Cultivated Crops: 21.65 million hectares

Source: General Land Capability Map of Thailand, 1972.

Since only 18.6 million hectares of land were "in farms" in 1975, and much less of this land actually cultivated, this suggests the potential for substantial continued expansion of agricultural land if it becomes

^{4/} See General Land Capability Map of Thailand, developed under a joint project of the RTG and the United Nations Special Fund, with cartography by the Soil Survey Division of the Ministry of Agriculture and Cooperatives, 1972.

economically attractive to do so. It should be emphasized, however, that if this expansion is not carefully controlled it may result in serious depletion of timber reserves and damage to watersheds.

More limiting to increases in agricultural production than land scarcity is controlled water availability. Land classified as "irrigable" is estimated by the Royal Thai Government (RTG) at about 3.2 million hectares, and "irrigated" at 2.4 million hectares. However, it should be noted that the irrigation is primarily supplemental during the rainy season. Less than a third of a million hectares represents area with adequate water control to permit double cropping and not all of this is double cropped during the dry season. Regionally, the Central Plains contain almost 60 percent of the irrigable area. Next in importance is the North. The Northeast contains only 12 percent of the irrigable land and the South an even smaller fraction.

Given the close correlation which exists between controlled moisture availability, crop yields, and return on investments in purchased inputs, it is quite understandable that the poorest farmers are found in those areas with limited irrigation facilities and unpredictable rainfall distribution patterns. These are also the groups facing the greatest risks in terms of technological innovation, and thus are prone to follow low-yield, but low-risk, traditional methods of production. In view of the prohibitively high costs of modifying the environment (irrigation) on a sufficiently large scale to affect significant numbers of poor farmers, it is essential that technology be developed, field tested, and disseminated which is adapted to the prevailing rainfed conditions under which some 80 percent of the Kingdom's farmers operate.

III. SIZE OF HOLDINGS AND LAND TENURE PATTERNS.

Size of farm holdings. Although reference is commonly made to a decreasing size of Thai farms resulting from rapid rate of population growth and continued parcelization among children as required by inheritance laws, available data suggest that for the Kingdom as a whole the rate of farm land expansion has been faster than the rate of population growth.

National Statistical Office (NSO) data show that average farm holdings per person in the agricultural population were 0.56 hectares in 1963 and 0.70 hectares per head in 1971 -- an increase of 25 percent.^{5/} Division of Agricultural Economics (DAE) data cited in the previous section indicate a further 20 percent expansion in total farm holdings between 1971 and 1975, an increase somewhat above the 19 percent growth in population, thus suggesting a further slight gain in per capita land availability. These aggregate data do not indicate the distributional pattern of land holdings. Table 4 provides a breakdown of farm holdings by region in 1973/74.

^{5/} Regionally, farm population increased at a faster rate than the area of farm holdings only in the South and in the lower Central Plains, but for the whole Kingdom farm holdings were up 36 percent and farm population only 11 percent. See unpublished analysis by Trent Bertrand, "The Rural Sector in Thailand: A Preliminary Report", July, 1977.

TABLE 4. NUMBER AND PERCENTAGE OF FARMS BY SIZE CATEGORY, BY REGION
(Crop Year 1973/74)

Region	.96 ha. and under	.96-2.4	2.4-4.8	4.8-7.2	7.2-9.6	9.6-22.4	Over 22.4	Total
<u>North</u>								
Number of farms	119,177	247,847	188,179	113,604	76,421	100,713	7,490	1,512,226
Percent of Region	14%	29%	22%	13%	9%	12%	1%	100
<u>Northeast</u>								
Number of farms	63,223	288,488	519,325	327,982	155,557	149,624	8,027	853,831
Percent of Region	4%	19%	34%	22%	10%	10%	1%	100
<u>Central</u>								
Number of farms	58,123	106,235	193,466	131,034	86,538	106,103	10,975	692,500
Percent of Region	8%	15%	28%	19%	13%	15%	2%	100
<u>South</u>								
Number of farms	40,455	153,071	166,537	64,637	31,225	22,538	2,175	480,719
Percent of Region	8.5%	32%	35%	13%	6%	5%	0.5%	100
<u>Whole Kingdom</u>								
Number of farms	280,978	795,641	1,067,507	637,257	349,741	378,978	28,667	3,539,276
Percent of Total	8%	22%	30%	18%	10%	11%	1%	100

Source: MOAC, Division of Agricultural Economics 1973/74
General Farm Survey data (unpublished).

When interpreting Table 4, it must be borne in mind that a viable sized farm unit is strongly influenced by soil quality, availability of irrigation, cropping pattern, and a number of other factors. Thus, substantially larger

areas of land will be required for an unirrigated farm on poor soils in the Northeast than for intensively cropped irrigated areas in the North or the Central region. As a percentage of all farms, those of 4.8 hectares or smaller represent 65 percent in the North, 57 percent in the Northeast, 51 percent in the Central, and 70.5 percent in the South.

Crop cutting surveys of rice farmers conducted by the NSO provide further information on secular trends in farm sizes in recent years, and again the picture that emerges is not one of decreasing farm size. In fact, the average size of rice farm in the samples increased between 1971 and 1973 from 3.2 hectares to 3.7 hectares for the whole Kingdom, a 16 percent increase.^{6/} Furthermore, available data do not suggest increases in landlessness due to farm merger or consolidation. During this period, only the Northeast showed a decline in average size of rice farm, falling from 4.1 hectares to 3.7 hectares. Thus, although the absolute size of farms may present a problem in some areas in terms of providing an adequate base for income generation, the available data do not suggest that average farm size is decreasing.^{7/}

^{6/} NSO, Crop Cutting Surveys 1971, 1972, and 1973 (rice)

^{7/} It should be noted that this is not a consensus view. A 1974 study by Chaiyong Chuchart and Suthiporn Chirapan "Change in Agrarian Structure in the Central Plains" (Bangkok: Department of Land Development) reports that the average farm size in the Central Plains declined from 7.4 hectares in 1965 to 6.7 hectares in 1971, and the number of farms larger than 9.6 hectares decreased from 44 percent in 1965 to 21 percent in 1971. The previously cited Crop Cutting Surveys of NSO, however, report the average size of a Central region rice farm as 3.8 hectares in 1970 and 5.1 hectares in 1973. These surveys also show Central region farms in the less than .96 hectare category declining from 10.5 percent in 1970 to 4.6 percent in 1973 while those in the larger than 4.8 hectare category increased from 28.8 percent to 43.9 percent. The bulk of the rice farms in this region (51.5 percent) remained in the mid-range size of .96 - 4.8 hectares.

Tenure Patterns. There is currently considerable concern being expressed by the RTG and others over changing tenure patterns in rural Thailand, particularly in the Central region. An Agricultural Land Reform Act was passed in March, 1975, and an Agricultural Land Reform Office (ALRO) was subsequently established to implement reform activities. Table 5 indicates the status of regional land tenure patterns in 1975.

TABLE 5. REGIONAL LAND TENURE PATTERNS, 1975
(Thousand Hectares and Percentage of Area)

Region	Total Area	Owned		Rented		Combination of Owned and Rented	
		Area	%	Area	%	Area	%
North	3,811	3,012	79%	543	14%	256	7%
Northeast	8,074	7,481	93	221	3	372	5
Central	4,399	2,878	65	1,352	31	169	4
South	2,303	2,174	94	72	3	56	2
Whole Kingdom	18,587	15,545	84	2,188	12	853	5

Source: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Land Utilization of Thailand, 1975 (Agricultural Statistics Bulletin No. 57) p. 14.

One of the most striking features of the data presented in Table 5 is the fact that over 84 percent of the total farm land in Thailand in 1975 was owner-operated.^{8/} Relative to most other countries in the region - or even to LDC's generally -- there does not appear to be a significant

8/ Eighty-four percent of the land is in the owner-operated category and another 5 percent in the owned-rented category, thus increasing the "owned" category to something over 84 percent.

tenure problem in Thailand today. To the extent that a problem does exist, it is concentrated in the Central region, where a reported 31 percent of the land is rented.

A detailed study of land tenure patterns in 26 provinces of the Central Plains in 1967-68 concluded that 62 percent of the farmers in this region were "full owners" and another 16 percent were "owner-renters". The remaining 22 percent represented tenants without their own land.^{9/} To the extent that these data and the DAE data presented above are comparable, they would suggest some increase in renting over the time period -- but not a startling change. Furthermore, an increase in full ownership is indicated. Thus, the magnitude of the problem remains sufficiently small that ameliorative programs should be feasible without placing undue pressure on government budgets and administrative capabilities, or encountering insurmountable resistance from threatened landed classes.^{10/}

^{9/} See Land Policy Division, Land Development Department, Land Tenure Situation in Twenty-six Changwats of Central Plains Region, 1967-68. The tenancy situation is much more acute in some individual provinces than in the region as a whole. The study found, for example, 79 percent of the land being rented in Nakorn Nayok and only 4 percent in Sukhothai.

^{10/} Although the Reform Act provides for expropriation, under certain conditions, of some private holdings for redistribution, actual practice to date has been to distribute public land (112,000 hectares in 1977) and crown land (6,880 hectares in 1977). See Memorandum of Conversation between Dr. Chamlong Attanatho, Secretary-General of the ALRO and Mr. Frederick J. Vogel, Economic/Commercial Officer, American Embassy, December 12, 1977.

There are very few available data regarding another important category of rural people, the "landless laborers" -- i.e. those who neither own land nor have access to land through rental arrangements. To the extent that a problem exists, it too is probably concentrated in a few provinces in the Central Plains. A survey of twelve provinces of the Central Plains conducted by the Agricultural Land Reform Office sheds some light on the current situation. Table 6 presents some of the findings of this survey.

A critical problem confronting the RTG at the moment is that of identifying squatters and others with unclear claims to the land which they are presently occupying and farming, and providing a mechanism for equitably awarding clear titles within the constraints imposed by the desire to preserve forests against continued slash and burn incursions. Another problem of a very special nature is arising from the influx of substantial numbers of refugees from neighboring countries.

TABLE 6. NUMBER AND PERCENTAGES OF TENANT HOUSEHOLDS AND LANDLESS HOUSEHOLDS, 1976 (Twelve Central Plains Provinces)

Province	Total Farm Households 1970	Total Farm Households 1976	Tenant ^{1/} Farm Households, 1976		Landless ^{1/} Farm Households, 1976	
			Number	Percent	Number	Percent
Nakorn Sawan	24,246	27,712	17,526	63%	2,119	7.6%
Chachoengsao	32,948	39,062	20,215	52	6,466 ^{2/}	17.5
Prachinburi	35,095	41,481	16,148	39	5,258 ^{2/}	13.9
Nakorn Pathom	13,477	15,930	9,868	62	2,254	14.1
Pathumthani	17,535	20,727	12,995	63	2,495 ^{2/}	14.6
Lopburi	17,264	20,406	12,015	59	3,200	15.7
Samut Prakarn	6,452	7,626	4,600	60	1,708	22.4
Phichit	19,065	22,535	12,530	56	2,067	9.2
Ayutthya	26,559	31,512	16,978	54	9,079	28.8
Suphanburi	67,625	79,943	43,953	55	no data	no data
Angthong	11,928	14,098	7,550	54	2,540	18.0
Nakorn Nayok	17,234	20,360	11,713	58	4,618 ^{2/}	31.5
Total for the twelve Provinces	289,428	341,392	186,091	55	41,804 ^{2/}	17.0

Source: Constructed from data contained in Statistical Bulletin No. 1010, prepared by the Agricultural Land Reform Office, Ministry of Agriculture and Cooperatives, 1976.

Note: Data contained in this report cover only 12 of the 26 provinces in the Central Plains.

^{1/} Note that Thai tenure statistics commonly include under the "tenant" category all farms that represent a combination of *owned* and *rented* land, and "landless" does not mean no *access* to land.

^{2/} Data for one of the 7 districts in Chachoengsao, one of the 8 districts in Prachinburi, one of the 6 districts in Pathumthani, and one of the 4 districts in Nakorn Nayok were missing. Appropriate adjustments were made in calculating the percentage of landless households in these provinces and as a percentage of households in the total sample.

IV. INCOME AND INCOME DISTRIBUTION.

In Thailand, as in most countries, there exists a substantial gap between average farm and non-farm incomes. This is particularly apparent when considering only cash income, but remains quite substantial even after allowing for income "in kind". Table 7 illustrates these disparities.

TABLE 7. FARM AND NON-FARM AVERAGE ANNUAL INCOME
PER CAPITA, 1976
(U.S. Dollars)

Region	Farm Sector	Non-Farm Sector	Farm As A % Of Non-Farm
North	\$184	\$315	58%
Northeast	81	177	46
Central	271	615	44
South	211	418	51
Whole Kingdom	160	426	38

Source: National Accounts Division, National Economic and Social Development Board.

Note: Calculations include cash income, income in kind, and a value for imputed rent.

Kingdom-wide, farm incomes in 1976 were only 38 percent as great as non-farm incomes even after adjusting for significant amounts of home produced and consumed goods. An analysis by Meesook indicates that, for the whole Kingdom, income in kind in rural areas in 1968 represented almost 23 percent of total income in non-municipal^{11/} areas and only about 4 percent

^{11/} In Thailand, "non-municipal" is the close equivalent of "rural", and will be so used in this discussion.

in municipal areas. In the Northeast region, income in kind in the rural sector constituted nearly 39 percent of total income -- a not unexpected situation given the subsistence orientation of much of the production and consumption of this region. See Table 8 for comparable figures for all regions.^{12/}

TABLE 8. CASH INCOME AND INCOME IN KIND OF NON-MUNICIPAL (RURAL) HOUSEHOLDS, BY REGION, 1968/69 (U.S. Dollars)

Region	Total Income	Cash Income	Income In Kind	Income In Kind As A Percent Of Total
North	\$473	\$374	\$99	21%
Northeast	416	255	161	39
Central	753	650	103	14
South	423	342	81	19
Whole Kingdom	522	404	118	23

Source: Derived from table contained in Oey Meesook, "Income Distribution in Thailand", Thammasat University Discussion Paper No. 50, p. 11, and based upon NSO data in the Socio-Economic Survey 1968/69.

Note: Conversions from the original Baht figures to dollars made at the rate of 20 Baht per dollar.

^{12/} Also of interest is the fact that income in kind as a percentage of total income increases substantially among the lower income classes. For example, in 1968/69, for those rural households earning less than \$150 per year, income in kind represented 62 percent of total income, and for those households earning between \$150 and \$225 per year, the comparable figure was still 40 percent. This suggests that traditional income augmenting programs may prove relatively ineffective in addressing the target population.

Tables 7 and 8 are not directly comparable because the former depicts income per capita and the latter income per household. Furthermore, the data represent two different time periods some eight years apart. Nevertheless, they are consistent in identifying the Northeast as the region with the lowest income levels of any of the four regions of the Kingdom.

In terms of one arbitrary minimum level of income, the largest percentage of all "poor" households in the Kingdom are in the Northeast. Calculations by Meesook indicate that approximately 40 percent of all Thai households earned less than \$86 in 1969. Almost all of these were in rural areas of the North, Northeast, and South. The Northeast, alone, accounted for 48 percent of the total, followed by the North with 27 percent.

TABLE 9. REGIONAL DISTRIBUTION OF HOUSEHOLDS EARNING LESS THAN EIGHTY-SIX DOLLARS PER ANNUM, 1968/69
(As a Percentage of All Such Households in the Kingdom)

	North	Northeast	Central	South	Whole Kingdom
Total	27.4%	48.3%	9.0%	14.9%	100.0%
Municipal	0.2	0.2	0.1	0.3	1.1
Non-Municipal (Rural)	27.2	48.1	8.9	14.6	98.9

Source: Constructed from data contained in Meesook, op.cit.; based upon total income per adult equivalent.

Note: This distribution is approximately proportional to the regional distribution of households except for the Northeast, which contained about 30 percent of the Kingdom's households, but 48 percent of the "poor" households.

Another, and perhaps more meaningful way, of looking at the incidence of poverty is to analyze, by regions, the percentages of households which fall below the \$86 per household per annum line. These data are presented in Table 10.

TABLE 10. PERCENTAGE OF HOUSEHOLDS EARNING LESS THAN EIGHTY-SIX DOLLARS PER ANNUM, BY REGION, 1968/69 (Percentage of All Households in Each Region)

	North	Northeast	Central	South
All Households	39%	62%	17%	49%
Municipal	6	6	3.5	8
Non-Municipal (Rural)	41	64	18	55

Source: Constructed from data contained in Meesook, op.cit.; based upon total income per adult equivalent.

The incidence of poverty is clearly greatest in the Northeast, followed by the South and the North. The percentage of the population in the Central region which falls below the designated level is quite small relative to the other regions.

In another paper, Meesook has attempted to achieve comparability between the 1962/63 Household Expenditure Survey and the 1968/69 Socio-Economic Survey data in order to estimate the changes in income levels and distribution over this time period. Her summary conclusion was that some improvement had occurred in average incomes in all regions, but that in the Northeast "... the very poor households have not been taken out of

poverty at as fast a rate as in the other regions."^{13/}

Data from a still incomplete and as yet unpublished 1975/76 Socio-Economic Survey conducted by the NSO suggest that there may have been some improvement in the relative income share of the Northeast's poor in the intervening years since the 1968/69 survey. However, because of somewhat different definitions and sampling procedures, this remains a very tentative conclusion.

In a number of countries of Asia, particularly those with a large landless labor class, wage income represents a very high percentage of total income. While Thailand is in quite a different situation, in that truly landless laborers represent an almost insignificant percentage of the rural population, it is nevertheless instructive to look at wages and wage movements.^{14/} The 1968/69 NSO Socio-Economic Survey revealed that, even in Thailand, wage income as a percentage of *cash* income in rural households represented about 30 percent in the North, Northeast, and South, and about 26 percent in the Central region. Wage data, particularly rural time series data, are very scarce in Thailand, for

^{13/} Oey Meesook, Income Distribution in Thailand, University of the Philippines Discussion Paper Series No. 76-12, November, 1976. The data suggest that the same statement is applicable to the South.

^{14/} The 1963 Census of Agriculture identified 450,477 agricultural holdings (14 percent of the total) as being farmed under conditions other than full ownership, part ownership, cash rent, or crop rent. This category, which is classified as "other", includes all those who have cleared and occupied unclaimed land, obtained the use of land rent-free, received the use of land in exchange for services, squatters, and those renters who are paying a combination of cash and crop rents. Some writings on the tenure situation in Thailand have identified this broad group of people as the "landless", whereas the more commonly accepted definition of this term would include only those who neither own land nor have access to land.

a number of reasons. Much of the off-farm agricultural employment is exchange labor among friends and relatives; a combination of cash and payment in kind complicates measurement of the wage rate; job or piece rates are commonly used instead of fixed wage rates. Although fragmentary, there is some evidence that both nominal and real wage rates rose between 1965 and 1976 in the Central Plains -- with nominal wages tripling and real wages increasing by 56 percent. There is also an indication of some improvement in real terms in selected areas of the North and in the rubber producing areas of the South, but real wages in the Northeast have remained about constant -- growing approximately apace with inflation.^{15/} Thus, wage data are consistent with other available indicators which suggest that the Northeast region, despite some improvement, continues to represent the "poorest of the poor" in the Kingdom.

^{15/} Estimates made by Trent Bertrand in an unpublished study entitled "The Rural Sector in Thailand: A Preliminary Report", July 7, 1977. His calculations are based on a number of micro-level studies conducted between 1965 and 1976. His tentative net conclusion is that real rural wages have "... significantly risen in areas where changes in cropping patterns, booming markets for certain crops, or expanded potential for controlled water supplies have been experienced while remaining roughly constant in more isolated or less favored regions."

As an average for all farm households in the Kingdom, non-agricultural activities generated about 40 percent of total net *cash* income in 1975, but for the Northeast and the South, the comparable figure was 53 percent according to DAE/MOAC Agricultural Statistics of Thailand 1975/76. Data contained in the Lam Nam Oon Socio-Economic Survey (1976) indicated an even higher non-agricultural component of total cash income -- 62 percent, in the downstream portion of the project.

V. RURAL EMPLOYMENT.

Current Situation. Labor force surveys are carried out twice a year by the NSO. One survey covers the period January - March and the other July - September, thus permitting comparisons between the dry and rainy seasons. The population is defined as either municipal or non-municipal, with the latter corresponding very closely to usual definition of the *rural* population, and will be so interpreted in the following discussions.

In 1974, the NSO estimated the rural labor force for the entire Kingdom at 11.7 million persons in the dry season and 15.2 million in the rainy season, reflecting the substantial seasonality of rural employment.^{16/} This seasonal fluctuation is particularly striking in the Northeast region, where the dry season labor force was on average 67 percent as large as that reported in the wet season. Estimates of actual rural employment in 1974 show 60 percent of the employment in *agriculture* in the dry season and 74 percent in the rainy season. Manufacturing employment accounted for only 14 and 8 percent respectively.

Remarkably little *open unemployment* in the rural sector was reported in 1974, totalling, for the whole Kingdom, only 0.7 percent and 0.3 percent respectively in the dry and rainy seasons.^{17/} Such figures, however, reveal

^{16/} In Thailand, the rural labor force comprises approximately 80 percent of the total labor force. Significantly, although male participation rates increase about 15 percent in the rainy season relative to the dry season, female participation rates jump by 45 percent.

^{17/} Defined to include those without work but actively seeking work.

little about possible underemployment. There are large numbers of unpaid family workers who are spending 20 hours a week or more in some form of economic activity, but little factual information is available regarding the *productivity* of this labor. A not uncommon phenomenon documented in micro-level studies in many countries is "work - stretching" -- extending the number of hours required to complete a task in order to remain occupied. NSO data do report 35 percent of the agricultural labor force working less than thirty hours per week during the dry season in the Kingdom as a whole, and the comparable figure for the Northeast is 42 percent.^{18/}

Needed Strategy. In the final analysis, if the objective is to increase per capita incomes of target populations, our emphasis should be less on the number of hours worked per day or week, and more on the *productivity* of the labor and the distribution of access to productive employment opportunities. It is evident, in view of the size of the agricultural sector as an employer relative to other sectors of the economy, that in the coming years agriculture must absorb a significant portion of the annual 2.6 percent increase in labor supply. Even at very rapid rates of expansion in the industrial sector, the relatively low elasticity of employment (probably less than 0.5) and the small absolute size of the sector suggest only limited capacity to create new jobs.

^{18/} At the same time, the data indicate 13 percent working more than 70 hours per week in both the Kingdom as a whole and in the Northeast. In the rainy season in the Northeast a reported 32 percent of the agricultural labor force worked more than 70 hours per week in 1974.

Within the agricultural sector, labor absorptive capacity will be strongly affected by a number of factors. Key among these are the availability, adaptability, and economic attractiveness of new technology suited to the rainfed production conditions under which the majority of the poorest farmers must earn a living.^{19/} Past experience with development programs aimed at increasing gross agricultural product without specific concern for distributional impacts have amply demonstrated the weaknesses inherent in the "trickle-down" theory of development. What is needed is a program which increases the *intensity* of agricultural production per unit of land and the return per hour worked by the target population.

Site specific, high payoff, rainfed technology must not only be developed and rigorously tested under field conditions prior to release to farmers, but provision must be made for an efficient delivery system aimed at these limited resource, risk-averting, largely uneducated populations. Government policies -- particularly those dealing with input and product pricing, credit, investment, agricultural research and extension, and import and export control -- will be critical to the success of any rural employment program.

^{19/} Unfortunately, much of the so-called "green revolution" technology which has been highly successful in increasing both output per hectare and employment per hectare in many Asian countries is highly dependent upon the availability of well-controlled irrigation. Research reported by IRRI in Rai Rot and Nong Sarai, Thailand in the 1975 wet season indicate increases of 39.5 and 51 percent respectively in labor requirements for the HYV rice varieties compared to traditional varieties. The poorest farmers, however, do not presently and will not in the future have access to controlled irrigation.

Along with efforts to increase productivity and employment through higher input technology, consideration should be given to diversification of production aimed at spreading employment more evenly throughout the year. The very high labor requirements at time of land preparation and planting, and again at harvest and threshing times are common -- particularly in areas devoted largely to the production of a single crop. Increased attention to combined livestock and crop enterprises may have potential in some low income areas. Inland fisheries development should also be explored not only as an employment and income generator but as a low cost source of high quality protein.

Multiple cropping has the potential for greatly expanding both employment and incomes. Although only limited research has been conducted to date, and findings remain inconclusive, there appears to be potential for following the rice crop in low-lying paddy areas with such crops as soybeans, peanuts, and mungbeans even in the absence of irrigation waters. It has been demonstrated that mulching with rice straw is quite beneficial in conserving soil moisture and helping the second crop to become established.

Rural public works may offer some potential for slack season employment of rural poor while at the same time developing needed infrastructure through the construction of farm-to-market roads, irrigation facilities, schools, and perhaps through reforestation programs. Some efforts of this nature have been carried out by the RTG, and have demonstrated that problems are encountered in the administration, and management of such programs.

Cottage industries such as wood carving, silk production, spinning, and weaving hold potential for substantially improving levels of living and generating employment opportunities in some rural areas. The need is to think in terms of opportunities for creating *rural* employment -- not just agricultural employment. Some industrial decentralization, particularly of industries such as meat packing, oil seed pressing, mixed animal feeds, and fruit processing, which depend on agricultural products, could contribute to improved rural income levels while at the same time reducing the rural-urban migration stream. To be effective on a broad scale, such a program would require strong RTG commitment and perhaps the provision of incentives to industry through tax breaks, public investment in improved water systems, power, etc.

VI. AGRICULTURAL TECHNOLOGY.

Introduction

Much of the agricultural production of Thailand is still carried out under conditions of low input technology and traditional practices. Thus, although Thailand is a food surplus country and a major exporter of a number of food and feedstuffs, average yields per unit area remain low for most crops relative to demonstrated potential production levels. Yields and yield growth rates provide one good measure of levels of technology. For illustrative purposes, some of Thailand's crops of major economic importance are discussed below, and yield comparisons are made with other Asian countries.

Rice. The 1971-75 average rice yield in Thailand (approximately 1.7 metric tons per hectare) was somewhat below the 1.9 metric tons average for the LDC's (less developed countries) of South and Southeast Asia, and well below yields achieved in Indonesia, Pakistan, Sri Lanka, West Malaysia, and Korea (See Table 11). Perhaps more significant, Thailand's annual compound growth rate in rice yield for the period 1965-73 of less than 0.25 percent per year was only a fraction of that achieved by most of the countries in South and Southeast Asia. Even Burma and Bangladesh showed more rapid yield growth rates than did Thailand.

TABLE 11. RICE YIELDS AND YIELD GROWTH RATES
SELECTED COUNTRIES 1965-73
(Metric Tons per Hectare)

	Indo- nesia	Paki- stan	Sri Lanka	Philip- pines	India	Korea	West Malaysia	Burma	Bangla- desh	Thai- land
1971-75 Average Yield	2.7	2.4	2.3	1.6	1.7	4.9	2.9	1.7	1.7	1.7
1965-73 Yield Growth Rate (%)	2.76	6.44	2.37	2.52	1.86	1.82	1.72	0.71	0.45	0.25

Source: Asian Development Bank, Asian Agricultural Survey 1976, Rural Asia: Challenge and Opportunity, Manila, April, 1977. Thai average yield for 1971-75 from MOAC data.

Note: The 1965-73 yield growth represents an annual compound rate.

The RTG has continuously supported a rice research program initiated in 1916 and which received a strong impetus in 1950 through technical assistance provided by USAID/Thailand. Work on selection, breeding, and fertilizer utilization has resulted in the development of recommended practices which, if widely adopted, could result in significant yield increases. For example, widespread on-farm fertilizer trials conducted by the MOAC in 1966 and 1967 show very good response to fertilizer under farm conditions even with traditional local varieties. An application of only 12.5 kilograms per hectare of nitrogen (N) and 25 kilograms of phosphate (P_2O_5) increased rice (paddy) output by 481 kilograms in the Northern Region, 525 kilograms in the Central, 513 kilograms in the Northeast, and 863 kilograms in the South. This physical response, in terms of kilograms of additional rice per one kilogram of nutrient applied, of 12.8, 14.0, 13.7, and 23.0 is considered to be very good.^{20/} Since traditional varieties were being used, increased output generated by subsequent additional increments of fertilizer diminished rather substantially except in the South. However, new varieties developed by the Rice Division -- the RD series -- show superior fertilizer response over a wider range of fertilizer applications. These varieties are non-sensitive to day length, are shorter in stature and stiffer strawed, and have a higher yield potential than the majority of the traditional varieties. Released to farmers beginning in 1969, they are being grown in areas where water control is possible. The dry season crop is dependent upon the RD varieties, but they have limited usefulness under

^{20/} Agronomists in the region use a "rule of thumb" of a 10 to one response for rice.

the rainfed conditions of the Southwest monsoon. Thus, the adoption rate has been slow and limited in scope.

North of the Mun River in the Northeast region, and throughout the Northern region glutinous rice predominates. The Central region is planted primarily to non-glutinous varieties. Only the non-glutinous rice is significant in international trade. Of the 2.9 million metric tons of rice exported in 1977, less than 60,000 tons was glutinous.

Maize. Thailand's maize yields are considerably more impressive relative to other countries than are her rice yields. There is some question regarding the reliability of corn production estimates prior to 1977, however. The 1971-75 average yield of 1.96 metric tons per hectare is nearly double the regional average for South and Southeast Asia (1.0 metric ton). The area planted to maize during 1965-73 also expanded at about four times the average compound rate for the region. Although moving somewhat erratically, principally as a function of weather conditions, yields have also trended upwards at a somewhat faster rate than for the region as a whole. However, research trials suggest that continued expansion of planting on new (previously uncropped) soils may be one of the major explanations for yield increases, and as less new land becomes available yields may decline substantially in the absence of widespread adoption of modern technology -- notably the increased application of commercial fertilizer. Field trials in the Pakchong area,^{21/} a leading maize production area of good soils, showed yields of 3.9 metric

^{21/} See Ministry of Agriculture and Cooperatives, Rainfed Crop Production Research and Development in Thailand, Bangkok, October, 1977.

tons per hectare on unfertilized "new" soils and only 1.6 metric tons on unfertilized "old" soils -- those that have been planted to maize continuously for a number of years. These fertilizer trials indicate that applications of approximately 470 kilograms per hectare of 20-20-0 (N and P_2O_5) would be required on impoverished soils in order to bring maize yields up to the level achieved on newly cultivated soils.^{22/}

Research in maize, as in all upland crops, has historically been well behind efforts directed towards rice. As a part of the RTG crop diversification program, however, upland crops have received increased attention in the past decade. A National Corn and Sorghum Center (Farm Suwan) located at Pakchong, and operated cooperatively by Kasetsart University and the MOAC has mounted a strong research effort.^{23/} Both breeding work designed to develop higher yielding, more drought and disease resistant varieties, and farm testing under actual production conditions are being carried out. Twelve locally developed composite varieties are currently being tested for adaptability to the prevailing rainfed production conditions, and for resistance to downy mildew.^{24/} Experimental field tests conducted during 1975 with Suwan 1, one of the more promising new varieties, achieved an average yield of over 3.5 metric tons per hectare with the use of commercial fertilizer.

^{22/} These data should be regarded as suggestive only, since they are derived from a very small number of observations.

^{23/} Technical assistance and financial support is being provided by the Rockefeller Foundation.

^{24/} Downy mildew constitutes a major production problem particularly under wet, humid conditions.

Widespread (29 provinces and 142 districts) farm trials in 1976 conducted in cooperation with agricultural extension workers showed unfertilized local varieties yielding 2.5 metric tons per hectare and unfertilized Suwan 1 3.5 metric tons per hectare -- a 40 percent yield superiority resulting from variety alone. With recommended fertilizer rates, the local variety yield was increased to 3.2 metric tons, and Suwan 1 to 4.4 metric tons.^{25/} Even though weather conditions were not particularly favorable, these yield levels were achieved, but one year's results cannot be reliably used as an estimate. However, there is strong evidence that technology currently exists to substantially increase average Thai maize yields if conditions become favorable for rapid and widespread dissemination to the user level.

Other Crops. As shown in Table 12, with the exception of kenaf and jute, Thai yields are fairly high relative to other Asian developing countries that produce substantial amounts of these crops. Data in the table indicate that Thai cotton and soybean yields are the highest for any of the countries considered. Only India reports a higher cassava yield, only Bangladesh a higher groundnut yield, and only Indonesia a significantly higher sugar cane yield. In kenaf yield, however, Thailand is exceeded by all except Burma.

^{25/} See Ministry of Agriculture and Cooperatives, Rainfed Crop Production Research and Development in Thailand, Bangkok: October, 1977. Average Kingdom-wide maize yields in recent years have been somewhat less than 2.0 metric tons per hectare.

TABLE 12. 1974-76 AVERAGE CROP YIELDS FOR SELECTED COUNTRIES.
(Kilograms per Hectare)

	Bangla- desh	Burma	India	Indo- nesia	Philip- pines	Thai- land	Thai Yield as A % of Avg. Yield for Others
Cotton	465	234	482	418	665	1,011	223
Soybeans		642	733	753	784	962	132
Cassava ^{1/}		8.8	16.7	8.4	6.7	15.2	149
Groundnuts	1,411	737	829	1,269	634	1,292	132
Sugar cane ^{1/}	44	34	51	83	49	50	96
Kenaf & Jute	1,345	842	1,128	1,631		988	80

Source: FAO Production Yearbook 1976. For Thailand, these data vary somewhat from MOAC data but are used for consistency with other country data.

^{1/} Cassava and sugar cane yields are expressed in metric tons per hectare.

Note: The percentage figures in the last column were derived by summing and averaging the yields for all countries other than Thailand, and computing Thai yields as a percentage of this "average" yield.

Cassava. Previously concentrated for the past 30 years near Chonburi along the east coast of Thailand, cassava in recent years has spread very rapidly into the Northeast where it is competing strongly with kenaf for land. Although yields are quite good on newly cultivated land -- over 30 metric tons per hectare -- continuous cropping of cassava will reduce average yields to 12 metric tons or less.^{26/} A long term research project at the Northeast Agricultural Center in Khon Kaen province, designed to

^{26/} Field observations suggest that within four years of opening new land, cassava yields fall to about half that of the initial year.

determine the effects of continuous cropping of cassava and the necessary rate of fertilizer application to maintain soil fertility, has been underway for a number of years. Work is also being carried out on soil fertility in the traditional production area in the East. Farm level use of chemical fertilizer in cassava production is practically non-existent, but animal manures are used. Selection and variety testing has been conducted for a number of years, and more recently hybridization efforts using germ plasm provided by the International Center for Tropical Agriculture in Cali, Colombia, are under way. Work is also being conducted to determine the feasibility of inter-cropping with legumes in order to help maintain better nitrogen levels in the soil. At the present time, the MOAC recommends a two year rotation with soybeans and mungbeans alternating with cassava.

Research work with cassava has been quite limited relative to rice and maize, and no significant technological breakthroughs have been achieved.

Soybeans. This crop has been identified as having high priority for expanded production due to favorable outlook in the international market. It also has great potential as a means of increasing domestic human consumption of high quality protein. The Thai oil extracting industry can handle about 300 tons of beans per day and is expanding its capacity.

The MOAC has a target of increasing average soybean yields to 1,562 kilograms per hectare.^{27/} This represents an increase of 75 percent

^{27/} See MOAC, Rainfed Crop Production Research and Development in Thailand, op.cit., p. 39.

over average yields achieved during 1971-75 and is higher than yields currently achieved in Japan. With Japanese assistance, the RTG has mounted an effort to develop superior varieties, concentrating on rust resistance, improved yield, early maturity, and resistance to shattering. In 1976 a new variety, SJ 4, was released to farmers. This variety shows a yield superiority of some 15 percent over previous releases.

Until recently, very little research work had been conducted with soybeans under rainfed conditions. Trials are currently underway with chemical fertilizers, liming, and rhizobium inoculum to increase nodulation. In the Northeast (Korat) preliminary results suggest that proper inoculation alone can potentially increase yields by more than 50 percent. With a combined package of practices including inoculum, fertilizer, variety, and cultural practices, the same trial showed yields of 2,200 kilograms per hectare on farmers' fields under rainfed conditions.^{28/} Other trials in the Northeast (Roi Et) showed farm yields up to 2,331 kilograms per hectare with recommended practices. Thus, there appears to exist a substantial gap between currently known technology and present farm practices.

Kenaf. Primarily grown in the Northeast, kenaf has been a high labor, low technology crop. Yields have showed a strong decline since the late 1960's and through 1975. Subsequently some improvement has been shown, which the MOAC attributes to more widespread utilization of higher yielding varieties.

^{28/} Ibid., p. 43.

Research investment in kenaf has been limited compared to some of the other important crops, and no major yield breakthroughs have been achieved. One variety, THS-30, shows considerable promise. Trials conducted in 1974 at six stations in the Northeast showed average yield of this variety to be 2,175 kilograms per hectare. Three other varieties achieved over 2,000 kilograms per hectare.^{29/}

In 1976, approximately 14.0 metric tons of improved kenaf seed was distributed to farmers and projections were for 24.0 metric tons to be distributed in 1977. The Thai Kenaf Industry Association is now assisting in efforts to improve production and initial processing (retting and drying) practices. During 1977, it is estimated that about half of the kenaf producers in the country will be reached by this program. As with cassava, the application of commercial fertilizer to kenaf remains essentially nil.

Purchased Production Inputs

Commercial Fertilizer. The use of commercial chemical fertilizer per hectare of arable land represents one of the best proxies for modern agricultural technology adoption. From this standpoint, Thailand is far behind many of her Asian neighbors. Average 1972-74 Thai use of 12 kilograms combined NPK (nitrogen, phosphorus, and potash) per hectare may be compared to 21 in Indonesia, 22 in the Philippines, 53 in Vietnam, 341 in the Republic of China, and 319 in the Republic of Korea. Annual increases

^{29/} . The data do not indicate whether any commercial fertilizer was applied to the test plots. Average yields for the Whole Kingdom in recent years have been only 957 kilograms per hectare.

in fertilizer utilization, although starting from a small base, have been rather impressive, averaging 14 percent during 1960-70 and 22 percent during 1970-73.^{30/} The value of fertilizer imports in 1975 reached 81 million dollars, up from 66 million dollars in 1974.^{31/} In 1974, imports comprised over 90 percent of total Thai fertilizer utilization. There is a small amount of domestic production of ammonium sulphate, urea, and bulk blending and granulation of complete mixed fertilizers. Until a few years ago, the import of urea was prohibited even though domestic production capacity is only 35,000 metric tons per year, and a protective tariff was in effect for other fertilizers.

One good reason why fertilizer consumption per hectare is significantly lower than in neighboring countries is the price relationship between crop and fertilizer. Rice illustrates this situation very convincingly. In 1976, at Suphanburi, Thailand, 4.1 kilograms of rice (paddy) were required to purchase one kilogram of nitrogen. The comparable ratios for some of Thailand's neighbors during the same period were as follows: Indonesia, 2.5; Burma, 1.8; Philippines, 3.6; Korea, 1.5; Republic of China, 0.8; Japan, 0.5.^{32/}

^{30/} See Asian Development Bank study, op.cit., pp. 77 and 416.

^{31/} Since world fertilizer prices declined during this period, the real increase is even more substantial. MOAC data supplied by the Division of Agricultural Economics indicate that fertilizer consumption was 55 percent greater during 1974-76 than during 1967-69.

^{32/} Data collected by the International Rice Research Institute, Philippines.

Thai farmers are economically rational individuals, and it appears evident that significantly increased usage of commercial fertilizer on paddy is unlikely to occur in the absence of more favorable factor-product price relationships. This will be particularly true of limited resource farmers, operating under conditions of uncertain moisture availability and high risk.

Even under conditions (and with various crops) where fertilizer would be quite profitable, it will be necessary to convince farmers through on-farm demonstrations of tested and proven technological packages that will show a high payoff. Many studies suggest that in order to achieve rapid and widespread acceptance of modern technology, the return to the farmer must be quite high -- perhaps 50-100 percent.

Irrigation. The timely availability of moisture in appropriate quantities is perhaps the single most important variable currently affecting crop yield levels in Thailand. Studies by Takase and Wickham show a strong correlation between rice yields and the proportion of the rice area of various countries which is irrigated.^{33/} In the absence of good water control, the new HYV's of rice and even some of the locally improved varieties have only limited applicability. Similarly, the response to commercial fertilizer application is strongly conditioned by soil moisture conditions.

Although Thailand has, historically, expended major portions of her agricultural capital investment budget on the construction of irrigation

^{33/} As cited in Asian Development Bank study, op.cit., p. 157.

facilities,^{34/} the Kingdom remains far behind many of her neighbors in terms of irrigated area. This is illustrated in data prepared by researchers at IRRI (see Table 13).

TABLE 13. ESTIMATES OF THE PROPORTION OF RICE AREA IN FIVE MAJOR ENVIRONMENTAL CATEGORIES

COUNTRY	Total rice area ^{a/} ('000 ha)	Proportion of Area (per cent)				
		Irrigated	Rainfed	Upland	Deep-water	Second Crop
Bangladesh	9,766	16	39	19	26	10
Burma	4,985	17	81	1	1	1
India	37,755	40	50	5	5	5
Indonesia	8,482	47	31	17	5	19
Malaysia (West)	771	77	20	3	0	50
Nepal	1,200	16	76	9	0	0
Pakistan	1,518	100	0	0	0	0
Philippines	3,488	41	48	11	0	14
Sri Lanka	604	61	37	2	0	25
Thailand	7,037	11	80	2	7	2
Vietnam	2,713	15	60	5	20	5
TOTAL	78,319	19	47	10	10	14

Source: R. Barker, H.E. Kauffman, and R.W. Heron, "Production Constraints and Priorities for Research", International Rice Research Institute, Los Banos, April 1975 (mimeo).

^{a/} 1970-74 average area, FAO data.

^{34/} During the period 1966-75 inclusive, RTG investment in irrigation, as a percentage of total investment in Agriculture, has ranged from a low of 77.3 percent in 1975 to a high of 86 percent in 1971. See Asian Development Bank study, *op.cit.*, Table I-8.4, p. 158.

More current MOAC estimates for Thailand place irrigated crop area at 2.4 million hectares, or approximately 18 percent of total crop area. Of this 2.4 million hectares, wet season supplemental irrigation represents about 68 percent and another 32 percent can be irrigated during the dry season. However, only about 0.3 of a million hectares (13 percent of the irrigated area) has water control adequate for double cropping. Furthermore, dry season irrigation is commonly underutilized even when it is available. By far the greatest percentage of irrigable area is found in the Central Region -- 1.9 million hectares compared to only 0.4 million hectares in the Northeast.^{35/}

Given the limited amount of irrigated land in the Kingdom and the limited potential for significant expansion in the foreseeable future, major efforts need to be devoted to addressing the problems of rainfed agricultural production. It is under non-irrigated conditions that the bulk of the population must earn their living and it is under these conditions that levels of production and standards of living are the lowest.

Agricultural Mechanization. Although a large percentage of agricultural production practices are still largely dependent upon the use of draft animals (oxen and water buffalo) for power, the rate of increase in mechanization is substantial. Calculations from FAO data suggest an annual increase in tractor horsepower units per thousand agricultural workers of 17.1 percent during the period 1970-73. Actual units per thousand

^{35/} Irrigation data contained in Rainfed Crop Production Research and Development in Thailand, op.cit., p. 2.

agricultural workers in 1973 were estimated at 28, compared to 18 in the Philippines, 18 in Cambodia, 10 in Indonesia, 9 in Laos, 7 in Vietnam, and 82 in Malaysia.

Contract plowing is becoming more important in Thailand each year. A common practice is to contract for initial land preparation to be carried out with large four-wheel tractors, and to conduct subsequent operations with animal power or small two-wheeled walking tractors. Local manufacture of the latter is growing in Thailand.

Where seasonal labor constraints exist, or where timeliness of land preparation due to environmental conditions is critical, mechanization may facilitate production and permit expansion of land under cultivation. Given the relative abundance of agricultural labor, however, policies to encourage widescale tractorization should be viewed with caution.^{36/} There is little evidence to suggest that tractorization *per se* makes any significant contribution to *yields* per unit area. An appropriate policy is probably simply to allow capital to be realistically priced relative to labor (i.e. avoid subsidization) and let mechanization rates be determined by economic opportunities.

^{36/} The tendency to equate "efficiency" with tractorization is a dangerous practice. Inappropriate mechanization and displacement of labor may occur in situations where there exists a wide divergence between private and social costs and benefits, and where there is inadequate attention to the social aspects.

VII. AGRICULTURAL PRICES.

Introduction. Government intervention in agricultural prices is a common practice among the developing countries of Asia, and Thailand is no exception. The major difference is in the objectives of the intervention and the means by which it has been carried out. Since most countries of the region are food deficit countries aspiring to self-sufficiency, they have attempted to stimulate increased domestic food grain production by allowing (even encouraging) internal grain prices to rise--with the expectation that the resultant rise in farm incomes would provide incentive for further production increases. In order to protect urban consumers, it has often been necessary to simultaneously mount efforts to compensate them through subsidized public distribution to lower income groups, and through other similar programs.^{37/} Most of these countries have encountered rather serious administrative and budgetary problems in attempting to implement what are at least partially conflicting policy objectives.

Thailand, by contrast, is a food surplus nation and a major cereal grain exporter. Thus, her price intervention has had a somewhat different set of objectives and procedures and these have changed over the years. Since rice represents the major agricultural product, the most important export, the principal wage good, and the commodity with the longest history of state intervention, it will be discussed in some detail.

^{37/} In low income countries where food expenditures represent a substantial portion of total consumption expenses, rising food prices constitute a potentially explosive political situation, and the voice of the urban consumer, though representing a relatively small percentage of the populace in many countries, is dominant in terms of political power.

Three primary objectives have been pursued, and the first two are shared by both Thailand and the food deficit nations: (1) to maintain a low domestic price for consumers; (2) to stabilize internal rice prices by ironing out large fluctuations; and (3) to augment government revenues. It is worth emphasizing that historically Thai rice pricing policies have not had the objective of increasing production.

Historical background. An excellent account of Thai rice policy is provided by Siamwalla, and his work is drawn upon extensively in this section.^{38/} Prior to the end of WW II, the RTG had intervened in the rice trade only to a very limited extent. As a result of the war reparations agreement (January, 1946), however, and at a time when world rice prices were quite high, Thailand was required by the Allied Nations to provide 1.5 million metric tons of rice.^{39/} To ease the resultant budgetary burden, the RTG established a Rice Office empowered to implement policies designed to shift at least part of this burden to farmers. Within two years, Thailand had met her reparations obligations and could have reverted to the former "hands off" policy with respect to the rice trade, but elected not to do so. Having found that the potential existed for generating substantial government revenues through maintaining domestic rice prices substantially below world prices and controlling export volumes, the government wanted to capture a share of the difference between the two prices. To administer this dual price policy, export

^{38/} Ammar Siamwalla, "A History of Rice Policies in Thailand", Food Research Institute Studies, Vol. XIV, No. 3, 1975, pp. 233-49. See also R. A. Ralston, "Thai Rice Policy 1850-1977", unpublished, n.d.

^{39/} This amount was reduced several times through subsequent negotiations.

licenses had been initially granted to private exporters on a quota basis-- a system which resulted in substantial corruption. To combat this corruption and reduce windfall profits accruing to exporters, the RTG imposed a rice export "premium", or fee which had to be paid to the government on each ton of rice exported.^{40/} A multiple exchange system, which resulted in a tax of approximately 30 percent on rice exports, was also implemented during the period 1947-55. Since that time, export restrictions and the rice premium have been the dominant forms of intervention in rice pricing. Quantitative export controls have been imposed whenever it appeared that domestic prices might rise above some desired level, and have been favored instruments of policy markets.

Impact of rice price policies. As shown in Table 14, RTG policy has generally been designed to hold domestic consumer prices down, and has been effective in accomplishing this mission. Thai rice prices are consistently among the lowest in Asia, and the rice premium (along with export controls) has been freely adjusted to achieve this result. Table 15 provides data on the changing levels of the rice premium during the period 1954-1976. The Ministry of Commerce is the agency responsible for administering the trade policies which influence rice prices.

^{40/} Although functioning, for all practical purposes, as an export tax, the official designation as a "premium" or "fee" permitted its imposition without legislative approval--thus endowing it with great flexibility as a policy instrument. Rates could be raised or lowered at will, depending upon relative price conditions and policy objectives.

TABLE 14. DOMESTIC AND EXPORT RICE PRICES
1965 - 1976

<u>Year</u>	<u>Domestic Wholesale Price \$/ton</u>	<u>Export Price \$/ton</u>	<u>Domestic as % of Export Price</u>
1965	\$ 76.80	\$114.35	67%
1966	104.30	132.70	79
1967	119.90	156.95	76
1968	100.05	176.70	57
1969	101.25	143.95	70
1970	95.25	118.30	81
1971	78.90	92.30	86
1972	91.10	105.05	87
1973	143.25	211.75	68
1974	188.65	475.00	40
1975	186.15	307.60	61
1976	191.10	217.90	88

Source: Bank of Thailand Monthly Bulletin, Vol. XVII, No. 7,
July, 1977, pp. 74 and 96.

Note: Conversions made at the rate of 20 Baht per dollar.
Domestic prices refer to 5% broken rice (Bangkok),
and export price is a weighted average of several
different grades of rice.

TABLE 15. RICE PREMIUM RATES, SELECTED GRADES, 1955-1976
(Dollars per Metric Ton)

Date Imposed	Selected Grades of Rice			Weighted Average ^{a/}
	5% Brokens	A1 Super	C3 Special	
8/55	\$52.50	\$20.00	\$15.00	\$40.65
11/55	46.75	19.00	19.00	37.05
11/56	42.00	21.00	21.00	34.65
7/57	46.75	23.50	23.50	38.60
4/58	46.75	29.50	29.50	40.70
6/59	46.75	23.50	23.50	38.60
8/59	37.50	23.50	23.50	32.60
11/59	46.75	23.50	23.50	38.60
12/59	44.50	22.50	22.50	36.80
8/60	44.50	27.00	27.00	38.40
12/60	44.50	25.00	25.00	37.70
4/61	44.50	27.00	25.00	38.20
4/62	47.50	30.00	27.50	41.15
1/67	49.00	34.00	28.50	43.20
3/67	52.50	35.00	27.00	45.60
4/67	59.50	39.50	30.00	51.55
5/67	61.50	40.50	31.50	53.25
6/67	63.00	40.50	31.50	54.25
7/67	70.00	42.00	33.00	59.30
8/67	78.50	46.50	37.00	66.35
9/67	72.50	44.50	38.00	62.05
10/67	78.50	46.50	40.50	66.70
3/68	98.50	63.50	62.00	86.10
4/68	90.50	54.50	51.50	77.60
6/68	84.00	48.00	46.00	71.20
11/68	72.50	40.00	37.50	60.90
6/69	72.50	25.00	25.00	55.90
8/69	55.00	25.00	25.00	44.50
12/69	50.00	25.00	22.50	41.00
11/70	37.50	18.75	16.85	31.30
4/71	37.50	zero	zero	24.35
9/72	37.50	18.75	18.75	33.15
8/73	37.50	32.50	18.75	35.00
9/73	70.00	32.50	18.75	56.15
12/73	150.00	65.00	50.00	118.75
1/74	225.00	100.00	85.00	179.75
3/74	255.00	117.50	102.50	205.40
6/74	225.00	100.00	85.00	179.75
10/74	187.50	62.50	50.00	142.50
12/74	105.00	45.00	25.00	82.00
6/75	85.00	10.00	5.00	58.25
12/75	40.00	10.00	5.00	29.00
12/76	35.00	10.00	5.00	25.75

a/ Weighted average equals 0.65 for 5% Brokens; 0.25 for A 1 Super; and 0.10 for C 3 Special. Conversions of Baht to dollars were made at the rate of 20 Baht per dollar.

Source: Pookachatikul and Welsch, "Thai Rice Premium Data 1954-1973", Kasetsart University Department of Agricultural Economics Staff Paper No. 12, and Bank of Thailand Monthly Bulletin, (data cited in Bertrand, op.cit.).

In terms of stabilizing domestic rice and paddy prices, RTG policy has been somewhat effective, as the relatively wide fluctuations in world prices have been lessened internally. During the period 1955-1965 world rice prices remained stable and thus changes in the level of the rice premium were small. Domestic prices were also relatively stable during this period. During 1966-68, however, world price fluctuations were substantially greater. In a departure from previous policy the RTG advanced the idea that higher rice prices would be of benefit to farmers and thus should be permitted to continue to rise somewhat. In order to insulate the consumer from price rises, the RTG provided subsidized rice through special shops--rice obtained by requiring exporters to reserve a specified proportion of the rice which they purchased for export, and provide it to the government at less than prevailing market prices. This "reserve ratio" is also subject to change dependent upon governmental rice requirements.

As world rice prices declined in 1970-72, farm paddy prices also declined--so much so that in the spring of 1971 they were only 50 percent of their peak reached in the fall of 1967. Price supports were attempted but proved ineffective because government finances were inadequate to the task.

World price began to firm again in 1972, and farm gate prices also began to rise--up from \$31 per metric ton of paddy in 1971 to an average of about \$100 per ton during the period 1974-77.^{41/} This strengthening of

^{41/} "Paddy" refers to unmilled rice. One ton of paddy is approximately equal to .65 ton of milled rice, but this milling percentage varies by mill. There is considerable debate over what this milling percentage actually is.

farm gate prices has been the result of international supply and demand conditions rather than domestic price policies *per se*, but the RTG has permitted the rise to take place, and at a faster rate than the consumer price index (CPI).^{42/} This action is consistent with the policy expressed in the Third and Fourth Five-Year Plans (1972-76 and 1977-81) of increasing farm prices to strengthen production incentives and improve rural levels of living.

The third objective (historically) of Thai rice policy--the provision of government revenues--has been successful. During the period 1955-65, government revenue generated by the rice premium represented in most years over 11 percent of total revenues. Since 1965, its relative importance has declined steadily, representing in 1975 only about 2 percent. The growth and diversification of the Thai economy has steadily reduced the necessity of depending on rice export taxes as a major source of revenue. However, in absolute terms, the amount of money generated by the rice premium has remained quite substantial (\$40 million in 1975).^{43/}

^{42/} Establishing 1970 as the base year (100), the CPI stood at 165 in 1976, Bangkok wholesale paddy prices at 182, and farm gate paddy prices at 233.

^{43/} Over the years, in addition to the premium, funds have also been generated through small export taxes, licensing fees, etc.

In FY 1976, the RTG decided to earmark all of the proceeds derived from the rice "premium" (\$21.2 million) for agricultural assistance programs; this policy remains in effect as of January, 1978. Thus, although the "premium" is still collected, it no longer appears as a component of general government revenues. Whether these funds represent a net increment to agricultural sector funds or simply a substitution for other RTG funds is unclear.

Various observers of Thai agricultural development have strongly recommended the removal of the rice premium as a major means of increasing agricultural output and improving levels of living of the Thai farmer. While the exact impacts of such action are not known and would require detailed analysis, it may be useful to raise some points which are somewhat contrary to the conventional wisdom--particularly so in terms of the target population of *limited resource farmers*.^{44/}

It may be argued that elimination of the rice premium would have limited beneficial impact upon low resource farmers or the rural poor, since this target group is not producing for export markets but rather for on-farm consumption. Since they have little or no surplus to market, additional income realized from elimination of the export premium would be insignificant. Equally important, unlike Central region farmers who produce non-glutinous rice, North and Northeast farmers produce glutinous rice which for the most part does not enter into world trade. One would have to assume a higher degree of substitutability in domestic consumption than apparently exists between glutinous and non-glutinous rice, for glutinous rice prices to rise significantly with the elimination of the export premium, particularly since the premium no longer represents a large share of the export price. Furthermore, while the export premium is not a progressive tax in the technical sense of the term, it is progressive in the sense that it taxes those farmers best able to afford it and whose

^{44/} This section draws on work by Vincent D. Taylor, Rand Corporation, conducted in 1965 for USAID/Thailand, "The Thai Rice Premium"; and particularly on a recent paper by Jesse Wright, USAID/Thailand economist, entitled "Thai Rice Price Policy", November 30, 1977.

surplus production is eventually exported, but not the smaller subsistence farmers. Furthermore, the proceeds of the export premium are now earmarked for agricultural improvement, and to the extent that these funds are used to aid small farmers, this amounts to an income redistribution program. Finally, it is often argued that small subsistence farmers will never have any incentive to adopt modern technology and increase production for commercial markets if domestic rice prices are held artificially low. While there is merit in this argument for middle and larger sized farms, it has less applicability to subsistence farmers. The difference lies not only in differences in market orientation, but also in the willingness and ability to assume risk. It is one thing to convince a surplus food producer to assume risk, and quite another to convince a subsistence farmer. It may thus prove more fruitful to attempt to raise small farmers' production and income through removal of tariffs on imported agricultural inputs, input subsidization (which has been attempted from time to time) and farm extension programs. High farmgate paddy prices are not likely to be sufficient in and of themselves to accomplish the task.

Furthermore, rice policy is not made in isolation, but must compete with several other (and often conflicting) goals. Historically, Thai agriculture was primarily a rice monoculture, and Thai exports were almost exclusively rice. Lessening this one crop dependence has been a legitimate policy objective of the RTG, and considerable success has been achieved in this respect. Promotion of alternative crops, and export diversification, must conflict to some extent with a policy of maintaining high paddy prices. Most alternative crops are currently more profitable than rice, private

traders have provided a market, and Thai farmers have responded by increasing production of other crops at a faster rate than rice.

An additional point is that Thailand would also like to encourage continued industrialization of her economy, and rice and other agricultural products represent both wage goods and raw materials for manufacturing. Agricultural pricing decisions, therefore, will be evaluated for their impact upon industrialization as well as on farm population.

Other crops. The RTG currently guarantees, through export licensing controls, the price received by farmers for sugar cane at the mill. In 1976, the guaranteed price was set at \$15 per metric ton delivered to the mill. This action resulted in a 50 percent increase in the farm gate price of cane in 1976, and an additional 15 percent increase in 1977. Favorable prices for cane have contributed substantially to the large increases in output in recent years. It is also RTG policy to require mills to provide sugar to the domestic market at subsidized prices in return for permission to participate in the export market.

Through export regulations, licensing and taxes, the prices of maize and rubber are also affected. In some periods, domestic maize prices have actually exceeded world prices as a result of competition among authorized maize exporters (some 130 of them) attempting to meet their monthly export quotas and thus protect their export licenses.

For most other agricultural products, there is little government intervention in the pricing mechanism. Table 16 provides a summary of farm level prices for selected commodities during the period 1967/68 and 1976/77.

Agricultural inputs. The government continues to tax the import of some important agricultural production inputs, key among them fertilizer (currently 20 percent of CIF value). It would appear that there is little justification for this practice, given the weak capacity for domestic production and the significant depressive effect which high input prices have on agricultural modernization. The protection of inefficient domestic input supply production is in reality only another form of tax on the farmer.

TABLE 16. AVERAGE FARM GATE PRICES FOR SELECTED CROPS
(Dollars per Metric Ton)

Year	Paddy Rice	Maize	Mung- beans	Cassava	Sugar Cane	Garlic	Peanuts	Tobacco	Soy- beans	Sesame	Cotton	Kapok	Kenaf	Rubber
1967/ 68	58	48	132	20	-	561	109	655	122	-	155	203	98	255
1969	49	36	136	16	5.45	296	116	678	118	-	198	236	94	278
1970	43	38	90	27	6.75	277	111	763	112	-	195	176	65	347
1971	31	42	115	28	5.35	249	103	759	116	-	195	146	84	286
1972	40	35	112	26	5.50	264	114	754	126	-	194	113	112	237
1973	65	43	128	24	5.55	338	128	787	125	-	192	208	142	238
1974	98	68	134	17	6.55	480	150	1084	170	288	246	225	131	342
1975	112	103	177	15	8.90	506	179	1087	200	300	268	269	118	360
1976	99	92	180	20	12.60	488	188	1175	208	302	284	214	132	321
1976/ 77	100	88	249	23	14.20	543	214	1207	235	350	278	382	150	458

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

VIII. AGRICULTURAL PRODUCTION AND PRODUCTIVITY.

General Overview

Crops. Crops continue to represent the major component of the Gross Agricultural Product, accounting for an estimated value of \$3.4 billion in 1975. The livestock sub-sector contributed another \$.55 billion.^{45/}

Within the crop sub-sector, rice remains dominant, representing in the 1975/76 crop year approximately 44 percent of the value of all crops and some 63 percent of the land classified as being in farms. This latter statistic, although commonly used, somewhat understates the relative magnitude of the crop area devoted to rice because the area reported "in farms" includes uncultivated scrub land, housing area, and a miscellaneous category. As a percentage of area actually devoted to crops, paddy currently accounts for well over 70 percent.

Average area planted to rice during 1971-75 (8.0 million hectares) was 13 percent greater than the average for 1965-69, and yields were also up 10 percent for the same period, rising from 1.58 metric tons per hectare to 1.74 metric tons per hectare.^{46/} More striking, however, are the increased areas being devoted to food and feed crops other than rice. During the same period, maize area has increased 67 percent, sugar cane 78 percent, cassava 167 percent, coconuts 31 percent, soybeans 124 percent,

^{45/} See Table 21 at the end of this section for a breakdown of the value of principal crops and crop groups in recent years.

^{46/} See Tables 22, 23 & 24 for details on area and yields of principal crops. These tables are located at the end of this section on production and productivity.

mungbeans 20 percent, and groundnuts about 3 percent. This relatively faster increase in area devoted to crops other than rice is in keeping with RTG efforts towards crop diversification.

Success in increasing *yields* has been much less satisfactory for most of these crops. During the same time period, average maize yields rose only 5 percent. Sugar cane yields were up an impressive 46 percent, but yields of the remaining food and feed crops were down: cassava about 3 percent, coconuts 20 percent, soybeans 2 percent, mungbeans 7 percent, and groundnuts 6 percent.

Fruits and vegetables are also important in Thailand, but statistics are not commonly collected or reported on a disaggregated basis for these crops. Estimates by the MOAC indicate that vegetable crop area has increased from an average of 196,000 hectares in 1965-69 to 441,000 hectares in 1971-75, an increase of 125 percent. At the same time estimated fruit area has expanded from 405,000 hectares to 920,000 hectares, an increase of 127 percent. No aggregate yield estimates are available for individual crops because of their diversity.

Significant changes are also evident among the principal non-food crops. Again comparing 1971-75 averages to the 1965-69 base period, the area planted to rubber trees is up 23 percent; kenaf, 11 percent; and Virginia tobacco, 111 percent. Cotton area, however, is only 44 percent as great as in the base period. In terms of yield, cotton is the only important non-food crop to show an increase, 19 percent. Rubber yield is down 4 percent and kenaf 21 percent, while tobacco yield has remained essentially constant.

Livestock. Major components of the livestock sub-sector include cattle, buffalo, swine, poultry, eggs, and milk. Between 1970 and 1976, the cattle herd has decreased from 4.7 million head to 4.4 million head; buffalo numbers remained about constant at 5.7 million; and swine numbers dropped from 5.1 million to 3.5 million. Because of rising livestock prices, however, the value of annual output has increased substantially for each class of livestock, up 117 percent for cattle, 122 percent for buffalo, and 99 percent for swine. The value of poultry, eggs and milk has risen by 153 percent.^{47/} Given time for adjustment, the more favorable product prices should result in increased output. As real per capita incomes rise in Thailand, it is likely that there will be a substantially increased domestic demand for livestock products as consumers substitute up the food chain. Estimated average income elasticities of demand for the whole Kingdom are as follows: pork 0.39; beef 0.14; poultry 0.22; eggs 0.46. For rice, however, the coefficient is only 0.05.^{48/} As demand for livestock products increases, this is likely to also increase the domestic demand for feedstuffs -- corn, sorghum, soybean oil meal, and cassava -- most of which are currently exported. Given Thailand's strong position as a producer of feedstuffs, she is in an excellent position to respond.

^{47/} Livestock values refer to 1975 data because 1976 data were not available.

^{48/} Coefficients contained in Ministry of Agriculture and Cooperatives, Selected Economic Indicators Relating to Agriculture, p. 37. The income elasticity of demand indicates the percentage change in expenditure for a given commodity in response to a specific percentage change in income. Given the coefficient for pork in Thailand, a one percent increase in income should increase expenditure on pork by 0.39 percent.

Regional Distribution of Production .

Crops. The Central region dominates in the production of rice, accounting in 1971-75 for 45 percent of the Kingdom's total production and 44 percent of the area devoted to rice production. Average yield for this region of 1.8 metric tons per hectare was slightly above the national average, but below that achieved in the North (2.1 tons). The lowest average yields were realized in the Northeast (1.4 tons).

The North is the Kingdom's leading producer of maize, soybeans, mungbeans, groundnuts, and cotton, producing 42 percent, 89 percent, 78 percent, 53 percent, and 53 percent respectively of these crops. The North also records the highest average *yields* of soybeans, mungbeans, and groundnuts (see Table 17 for a detailed regional breakdown).

Cassava production is divided principally between the Central region and the Northeast, accounting for 60 percent and 32 percent respectively during 1971-75. Growth in area planted to cassava in the Northeast has been very rapid in recent years with the planted area in 1976 over nine times as great as the 1971 area.

Sugar cane production is dominated by the Central region, 87 percent. The Northeast and the North make up the balance, with virtually none in the South. Nearly 100 percent of the kenaf 's produced in the Northeast, and almost all of the rubber in the South.

Coconut production is primarily found in the South, vegetable production tends to be carried on throughout the Kingdom; wherever dry season irrigation water is available and where there are urban markets for the produce. Significant areas of fruit production are located in all regions

of the Kingdom, with different areas being better adapted climatically to the production of different kinds of fruit.

TABLE 17. REGIONAL PRODUCTION, YIELDS, AND AREA CULTIVATED AS A PERCENTAGE OF KINGDOM TOTAL, SELECTED MAJOR CROPS, 1971-75 AVERAGE

Crops	North			Northeast			Central			South		
	% of Area	% of Prod.	% of Yield	% of Area	% of Prod.	% of Yield	% of Area	% of Prod.	% of Yield	% of Area	% of Prod.	% of Yield
Rice	23%	28%	2.12	22%	17%	1.37	44%	45%	1.80	11%	10%	1.62
Maize	50	42	1.63	26	28	2.10	24	30	2.41	negl.	negl.	-
Soybeans	88	89	.93	2	2	.84	10	9	.84	negl.	negl.	.74
Mungbeans	72	78	.81	2	2	.79	18	16	.69	8	5	.47
Groundnuts	44	53	1.55	31	27	1.13	17	13	.99	7	7	1.25
Cassava	4	4	14.10	34	32	12.40	58	60	13.60	5	3	9.30
Kenaf	negl.	negl.	-	99	98	.95	negl.	negl.	-	negl.	negl.	-
Cotton	56	53	.89	32	34	.99	12	13	.97	negl.	negl.	-
Sugar cane	9	8	43.40	7	5	35.00	85	87	50.30	negl.	negl.	-

Source: Constructed from unpublished data provided by the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives.

Note: Yield data are expressed in metric tons per hectare. Percentages may not total to 100 due to rounding.

A summary generalization of the regional picture that emerges is one of superior production and productivity of paddy and upland food crops in the North and Central regions. These regions are also major producers of feedstuffs (maize in the North and cassava in the Central). The Northeast shows dominance in kenaf, and a relatively strong position in the production

of cotton and cassava. The expansion potential for production of maize and groundnuts also appears favorable in the Northeast as does another crop, grain sorghum, which is still of relatively minor importance and thus is not discussed here. With the exception of rubber, among the crops analyzed, the South is not very important.

Livestock. The Northeast region dominates cattle and buffalo production, representing 44 and 62 percent respectively of the Kingdom's total stock in recent years. In terms of swine numbers, the Northeast is exceeded only by the Central region (see Table 18).

TABLE 18. REGIONAL DISTRIBUTION OF MAJOR LIVESTOCK CLASSES 1973-76 (Thousand Head)

	North			Northeast			Central			South			Total		
	C	B	S	C	B	S	C	B	S	C	B	S	C	B	S
1973	928	1211	986	1952	3691	1478	711	809	1466	744	230	530	4335	5941	4460
1974	990	1269	821	1933	3628	948	775	816	1246	734	233	501	4432	5946	3510
1975	971	1230	897	1857	3325	778	791	640	1054	692	244	482	4311	5439	3210
1976	1027	1268	826	1966	3526	737	826	644	988	726	245	469	4545	5683	3020
1973-76 Average	979	1245	883	1927	3543	985	776	727	1189	724	238	496	4406	5753	3550
1973-76 Percent	22%	22%	25%	44%	62%	28%	18%	13%	33%	16%	4%	14%	100	100	100

Source: Constructed from data supplied by the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives.

Note: C = Cattle; B = Buffalo; S = Swine.

In terms of livestock slaughter, however, it is the Central region which is by far the most important. Slaughter facilities tend to be concentrated in Bangkok and its environs, with livestock being shipped in live to be slaughtered (see Table 19).

TABLE 19. REGIONAL DISTRIBUTION OF LIVESTOCK SLAUGHTER, 1975

Livestock Class	North		Northeast		Central		South		Total	
	Head	%	Head	%	Head	%	Head	%	Head	%
Cattle	32,739	15	74,076	33	89,930	40	27,132	12	233,877	100
Buffalo	2,180	3	9,051	13	56,654	79	3,761	5	71,646	100
Swine	233,659	12	328,676	17	1,071,382	55	299,406	15	1,933,123	100

Source: Constructed from data contained in Agricultural Statistics of Thailand, crop year 1975/76.

Note: Swine slaughter percentages do not total to 100 due to rounding.

Given its importance as a producer of both livestock and livestock feeds, the Northeast would appear to have some competitive advantage also in local slaughter and packing. The shipment of chilled carcasses to Bangkok instead of shipping live animals would have the potential for reducing transportation costs, decentralizing industry to the provinces, generating increased employment opportunities, and improving income levels in the Northeast. As the domestic demand for animal protein grows along with rising incomes in Thailand, it is likely that the market for fed beef will rise, making the Northeast increasingly competitive.

Projections

It is hazardous to attempt projections of agricultural output since production is so heavily influenced by weather conditions, international market conditions, domestic and competitor agricultural policies, and a host of other variables. A number of projections have, however, been made. One such projection, which is simply a linear extrapolation of past performance, suggests that total crop production will reach 32 million metric tons in 1980 -- up from 25 million metric tons in 1973.^{49/} A recent study by the Asian Development Bank^{50/} projects the following increases between 1970-74 and 1985 for selected commodities: rice (paddy) 13.3 million metric tons to 19.6 million metric tons; maize, 2.1 million metric tons to 3.8 million metric tons; sugar cane, 7.0 million metric tons to 19.5 million metric tons; kenaf, 0.4 million metric tons to 0.6 million metric tons. These estimates are based upon an assumed production growth rate between 1970-74 and 1985 of 3.0 percent per year for rice, 4.6 percent for maize, 7.9 percent for sugar cane, and 2.8 percent for kenaf.

These projections appear reasonable given current low levels of technology and the gap which exists between farm level yields and yields obtained in experimental trials under farm conditions. They do, however, represent significantly faster growth rates in rice, coconut, and kenaf production than have been achieved in recent years. The projections assume

^{49/} Daly, Rex F. Thailand Agriculture: Trends, Prospects, and Problems, Bangkok: USOM/Thailand, May 1974.

^{50/} Asian Development Bank. Asian Agricultural Survey 1976, Rural Asia: Challenge and Opportunity, Manila: April, 1977. This represents the variant A, or high growth projection.

a substantial decrease in the rate of growth for maize and rubber during the period.

The Thai Fourth Five Year Plan projections are somewhat more modest in their target growth rates for rice and sugar cane, 2.3 percent and 7.2 percent per year respectively for the period 1977-81, than are the ADB projections. With the exception of rice, mungbeans, cotton, and kenaf, target growth rates for 1977-81 are lower than achieved growth rates during the period 1972-76 for the ten main economic crops considered in the plan (see Table 20).

TABLE 20. PRODUCTION PROJECTIONS FOR MAJOR CROPS:
FOURTH FIVE YEAR PLAN

Crop	1976	1977	1981	% Average Annual Increase 1972-76	Annual Increase 1977-81
Rice	14.7	15.6	16.5	1.0	2.3
Rubber	394.0	407.0	466.0	3.7	3.4
Sugar cane	20.3	21.9	28.6	27.6	7.2
Maize	2.5	3.5	3.8	14.2	9.8
Mungbean	255.9	292.5	390.4	2.4	8.9
Cassava	9.2	9.8	10.8	15.8	3.2
Tobacco	37.0	44.7	65.5	16.1	9.9
Cotton	60.7	63.0	205.0	6.4	28.6
Kenaf	190.0	220.0	250.0	-9.3	3.3

Note: Output is expressed in thousands of metric tons except for rice, sugar cane, maize, and cassava which are in millions of metric tons. There was an error in the kenaf production figure for 1981 in the Fourth Five Year Plan which has been corrected in this Table.

Source: Royal Thai Government Fourth Five Year Plan.

TABLE 21. VALUE OF PRINCIPAL CROPS, BY CATEGORY, 1970-75
(Million U.S. Dollars; 20 Baht = \$1.00)

Year	Rice	Upland Food Crops	Oil Seeds & Coconuts	Fiber Crops	^{1/} Rubber	Fruits	Vegetables	^{2/} Tobacco	Miscel- ^{3/} laneous Crops	Total	Index
1970	426.5	214.6	63.8	52.3	82.1	303.0	91.3	17.0	81.6	1,332.2	100
1971	549.7	209.7	54.2	72.2	75.0	316.9	55.0	19.9	88.7	1,441.3	108
1972	813.7	250.2	66.6	91.5	80.4	283.7	116.1	18.5	113.1	1,833.8	138
1973	1,458.9	380.2	105.2	92.4	131.0	283.5	109.0	30.9	227.4	2,818.5	212
1974	1,494.0	525.5	138.8	88.8	140.0	388.2	146.8	40.1	184.4	3,416.6	256
1975	1,511.1	694.5	111.6	71.6	111.9	475.2	158.7	49.9	231.2	3,415.7	256
1976	1,409.2	-	-	-	183.1	-	-	49.7	-	-	-

Source: Ministry of Agriculture and Cooperatives, Agricultural Statistics of Thailand, Crop Year 1975/76.

^{1/} Refers to value of rubber sheets

^{2/} Refers to Virginia tobacco

^{3/} Includes dried chile, onions and shallots, and garlic.

Note: Values calculated at farm prices. For the index column, 1970 = 100.
Data for 1976 are preliminary estimates made by the Division of Agricultural Economics.

TABLE 22. AREA PLANTED TO PRINCIPAL FOOD AND FEED CROPS
(Thousand Hectares)
1965-69 = 100

Year	Rice	Index	Maize	Index	Ground- nuts	Index	Sugar Cane	Index	Cassava	Index	Coconut	Index	Soy- beans	Index	Mung- beans	Index
1950	5,540	78	43	6	70	60	54	38	N.A.	-	80	30	20	43	41	26
1960	5,921	84	286	42	118	101	158	110	72	49	165	61	22	48	52	33
1965	6,554	92	577	84	99	84	143	100	102	69	248	92	19	41	120	75
1966	7,433	105	654	96	157	134	125	87	130	88	247	91	46	100	136	85
1967	6,658	94	744	109	108	92	150	104	141	96	272	101	64	139	133	83
1968	7,228	102	762	115	119	102	182	127	171	116	286	106	53	115	200	125
1969	7,584	107	680	100	103	88	118	82	191	130	297	110	48	104	208	130
1970	7,494	106	829	121	104	89	138	96	224	152	315	117	59	128	239	150
1971	7,527	106	1,019	149	114	97	138	96	221	150	324	120	57	124	148	93
1972	7,349	104	997	146	119	102	181	126	335	228	338	125	84	183	205	129
1973	8,363	118	1,148	168	124	106	259	180	428	291	353	131	123	267	233	146
1974	7,982	113	1,240	181	130	111	310	216	488	332	368	136	132	287	207	130
1975	8,896	125	1,312	192	118	101	391	272	492	335	385	143	118	257	164	103
1976	8,575	121	1,285	188	122	104	449	312	-	-	-	-	102	222	223	140
Average 1965-69	7,091	100	683	100	117	100	144	100	147	100	270	100	46	100	159	100
Average 1971-75	8,023	113	1,143	167	121	103	256	178	393	267	354	131	103	224	191	120

Source: Constructed from Ministry of Agriculture and Cooperatives data contained in Agricultural Statistics of Thailand, various issues. Data for 1976 are preliminary estimates made by the Division of Agricultural Economics.

TABLE 23. YIELDS OF PRINCIPAL FOOD AND FEED CROPS
(Kilograms per Hectare)
1965-69 = 100

Year	1/ Rice	Index	Maize	Index	Ground- nuts	Index	2/ Sugar Cane	Index	2/ Cassava	Index	3/ Coconuts	Index	Soy- beans	Index	Mung- beans	Index
1950	1,281	81	794	42	900	75	15.6	46	N.A.	-	N.A.	-	719	79	794	85
1960	1,388	88	1,913	102	1,313	101	34.4	102			N.A.	-	1,188	131	1,169	125
1965	1,675	106	1,769	94	1,313	101	31.9	95	14.4	96	34	119	1,019	112	1,038	111
1966	1,606	101	1,719	92	1,400	108	30.6	91	14.4	96	31	108	831	92	969	104
1967	1,444	91	1,638	87	1,225	95	30.0	89	14.4	96	29	101	825	91	925	99
1968	1,431	90	1,744	93	1,331	103	32.5	97	15.6	104	26	91	850	94	919	98
1969	1,769	112	2,500	133	1,206	93	43.1	128	16.3	109	23	80	1,006	111	819	88
1970	1,813	114	2,338	125	1,200	93	47.5	140	15.0	100	23	80	856	94	619	66
1971	1,825	115	2,256	120	1,169	90	42.5	126	14.4	96	23	80	944	104	950	102
1972	1,688	106	1,319	70	1,288	99	52.5	156	15.0	100	23	80	863	95	931	100
1973	1,781	112	2,038	109	1,181	91	51.9	154	15.0	100	23	80	850	94	825	88
1974	1,675	106	2,019	108	1,238	96	46.9	140	14.4	96	23	80	838	92	906	97
1975	1,719	108	2,181	116	1,206	93	50.6	151	13.7	91	23	80	963	106	738	79
1976	1,756	111	2,081	111	1,244	96	50.0	149	14.5	97	-	-	1,119	123	563	60
Average 1965-69	1,585	100	1,874	100	1,295	100	33.6	100	15.0	100	28.6	100	906	100	934	100
Average 1971-75	1,738	110	1,963	105	1,216	94	48.9	146	14.5	97	23.0	80	892	98	870	93

1/ Paddy, wet season

2/ Metric tons per hectare

3/ Fruits per tree

Source: Constructed from Ministry of Agriculture and Cooperatives data contained in Agricultural Statistics of Thailand, various issues. Data for 1976 are preliminary estimates made by the Division of Agricultural Economics.

TABLE 24. AREA AND YIELD OF PRINCIPAL NON-FOOD CROPS
1965-69 = 100

Year	Area in thousand hectares								Yield in kilograms per hectare							
	Rubber	Index	Kenaf	Index	Tobacco (Virginia)	Index	Cotton	Index	<u>1/</u> Rubber	<u>2/</u> Index	Kenaf	Index	Tobacco (Virginia)	<u>3/</u> Index	Cotton	Index
1950	309	28	5	1	12	63	37	37	363	96	981	81			575	73
1960	411	37	140	37	18	95	56	57	500	132	1,300	107	500	62	831	105
1965	941	85	384	101	16	84	75	76	369	97	1,375	113	775	96	794	100
1966	983	88	530	140	17	89	84	85	375	99	1,250	103	794	98	1,063	134
1967	1,181	106	348	92	20	105	112	113	356	94	1,213	100	831	103	719	91
1968	1,212	109	254	67	22	116	133	134	419	110	1,244	102	719	89	881	111
1969	1,244	112	377	99	22	116	93	94	381	100	988	81	925	114	469	59
1970	1,276	115	421	111	24	126	31	31	356	94	906	75	913	113	869	110
1971	1,308	118	463	122	32	168	46	46	344	91	906	75	825	102	881	111
1972	1,340	121	472	125	33	174	61	62	363	96	906	75	706	87	806	102
1973	1,372	123	434	115	42	221	29	29	388	102	1,081	89	756	93	981	124
1974	1,406	126	404	107	46	242	52	53	381	100	950	78	806	100	1,094	138
1975	1,406	126	326	86	47	247	30	30	350	92	944	78	894	111	956	121
1976	1,441	130	161	42	42	221	25	25	365	96	1,136	94	981	121	1,088	137
Average 1965-69	1,112	100	379	100	19	100	99	100	380	100	1,214	100	809	100	792	100
Average 1971-75	1,366	123	420	111	40	211	44	44	365	96	957	79	797	99	944	119

1/ Based upon tappable area.

2/ Based on planted area.

3/ Based on seed cotton.

Source: Constructed from data contained in Ministry of Agriculture and Cooperatives, Agricultural Statistics of Thailand. Data for 1976 preliminary estimates made by the Division of Agricultural Economics.

IX. FORESTRY ANF FISHERIES.^{51/}

Although creation of the Royal Forestry Department (RFD) preceded that of the Ministry of Agriculture and Cooperatives, and is staffed with a high percentage of trained foresters, forestry in Thailand is still in the custodial stage of development. Foresters scale logs, collect fees and taxes, and arrest poachers. Whatever timber management is practiced is handled by the Timber Organization of Thailand, composed of members of the forest products industry.

Reforestation was one of the main agricultural goals of the previous (Thanin) Government, in an effort to "save the denuded and devastated forest land." The Royal Forestry Department has thus far assumed no responsibility for fire prevention and fire control, and has proceeded with a reforestation program even though many plantations are destroyed as soon as they are large enough to burn. In actuality, hardwood forests, including teak, which occupy more than 95 percent of the timber land, do not require artificial regeneration if fire is kept out. Thus, a viable fire organization is a prerequisite to effective timber management,

Furthermore, as in many developing nations, there has been and continues to be severe pressure on timber land by squatters desiring land to cultivate. Frequently, settlers move in following logging operations and clear the land for upland crops such as corn, sorghum, mungbeans, and/or cassava. The Land Reform Program in Thailand is currently engaged in a program of legalizing squatters on public lands. Much of the land

^{51/} This section on forestry and fisheries was prepared by Dr. Robert A. Ralston, assigned to the Ministry of Agriculture and Cooperatives under a Personal Services Contract with USAID.

presently classed as forest land is capable of producing wet season crops without supplementary irrigation.

There have been recent signs that the Royal Forestry Department is nearing readiness to assume its proper role in Thailand's development. A Division of Watershed Management has been recently organized and is carrying out an integrated land use project near Chiang Mai, with help from the UNDP/FAO. A system of planted community fuelwood forests has been proposed to take pressure off the national forests.

A comprehensive National Forestry Plan is needed which recognizes the responsibilities of the Forestry Department and outlines required organizational changes. Implementation will require transfer of foresters from Bangkok to upcountry locations where the trees are.

Management size units should be designated, roads and trails planned and constructed, lookout towers, ranger stations and other facilities built, and technical foresters assigned to these units. The RFD should take over the management of the forests from the timber cutters and sawmillers.

The timing of these actions is not critical, because the timber production capacity can be restored. The U.S. went through almost exactly the same pattern and stages in forestry development. The state of Michigan, for example, was almost in the same stage as Thailand as recently as 1950. The fact that timber can be restored is borne out by results achieved in the USA, where more merchantable board feet of timber exist today than when the Pilgrims landed at Plymouth Rock--not in the same sizes of trees as in 1620, but nevertheless occupying the forests.

Production. As shown in Table 25, the volume of teak cut has decreased since 1974, but the volume of other species has increased. Charcoal and fuelwood harvest has also reportedly decreased, but these statistics are not considered reliable.

TABLE 25. PRODUCTION OF FOREST PRODUCTS 1972-76
(Thousand Cubic Meters)

Items	1972	1973	1974	1975	1976
Teak	180	190	255	215	215
Dipterocarpus spp.	740	750	740	920	1060
Other Species	1240	1255	1775	1950	2245
Firewood	1360	1165	1125	975	1005
Charcoal wood	460	375	245	225	235

Source: Ministry of Agriculture and Cooperatives, Royal Forestry Department.

The recent ban on the export of teak logs, timbers, and lumber was well-intended, aiming to force an increased investment in domestic processing. A more logical policy would be to encourage and even to subsidize export-oriented timber processing plants. Mature timber can be stored on the stump for a little while, but natural mortality and disease and insect damage may result in a negative growth rate. About \$50 million in teak exports will be lost if the ban continues through 1978.

The long term outlook for timber and wood is good, as is the case for all renewable natural resources. The outlook improves each year, and forestry should become increasingly profitable in the future.

Fisheries. Prior to 1972 and the advent of the world-wide energy crisis, the Thai catch of marine fish had been steadily increasing. Since that time it has declined by some 25 percent--from 1.6 million metric tons in 1972 to 1.1 million metric tons in 1976. Both the higher cost of fuel and more recently the barring of entry of Thai fishing boats into Vietnamese and Cambodian waters have contributed to this decline. Some categories of marine catch have, however, increased. Frozen shrimp exports reached 15.5 thousand metric tons in 1977, an increase of nearly 15 percent over 1976, and representing a value of \$67 million.

Inland fisheries production, while small in comparison to the marine catch, has shown steady growth--rising from about 130,000 metric tons in 1972 to 180,000 metric tons in 1976. Efforts are being carried out to improve inland fisheries through production and release of fingerlings in impoundments, rivers, and ponds. Both technical and financial assistance from external sources are being sought.

Prices of fresh seafood are so high relative to income levels in upcountry locations that most rural people consume either dried salted fish or fresh water fish which they catch themselves in ditches and rice paddies near their homes. Increasing the availability of such fish could significantly improve the quality of the diet in these areas.

Domestic marketing of fish is partially carried out through private enterprise and partially through government organizations. Government participation is particularly evident in supplying upcountry markets. Plans are currently underway to improve, through an international loan, the cold storage and transport facilities so as to make fresh fish available to upcountry residents at lower prices than currently prevail.

X. EXPORTS FROM THE AGRICULTURAL SECTOR

Overview

Agricultural products dominate Thai exports. During the period 1970-76 agricultural exports have contributed 70 percent or more of the total export value in each year (see Table 26). Thailand is one of a handful of countries in the world, either developed or developing, that boasts a net export of both food and feed.

TABLE 26. TOTAL, AGRICULTURAL, AND NON-AGRICULTURAL EXPORTS BY YEAR 1970-76 (Millions of Dollars)

Year	Total Export	Index	Agri. Exports	Index	Non-Agri. Exports	Index	Agricultural as A % of Total
1970	\$739	100	\$572	100	\$167	100	77%
1971	864	117	655	115	209	125	76
1972	1,125	152	816	143	309	185	72
1973	1,611	218	1,121	196	490	293	70
1974	2,490	337	1,863	326	627	375	75
1975	2,250	304	1,701	297	549	329	76
1976 ^P	3,040	411	2,287	400	753	451	75

P = preliminary figure.

Source: Bank of Thailand, Monthly Bulletin.

Five agricultural exports -- rice, rubber, maize, cassava, and sugar -- accounted for 56 percent of Thailand's total export value in 1976. Rice

alone earned 430 million dollars (14 percent), followed closely by cassava (12 percent), sugar (11 percent) and maize (9 percent). The growth in value of cassava and sugar exports during the 1970's has been phenomenal.

In terms of volume, rice exports during the period 1965-76 have annually ranged around 1-2 million metric tons. In 1977, rice exports were 2.9 million tons, a new world record. By contrast, maize volume has rather steadily increased from only 0.8 million tons in 1965 to 2.4 million in 1976. Increased cassava export volume has been even more striking, up from 0.7 million tons in 1965 to 3.7 million in 1975. Over the same period sugar exports have risen from 0.08 million tons to 1.12 million tons.^{52/}

TABLE 27. VALUE OF PRINCIPAL AGRICULTURAL EXPORTS BY YEAR, 1970-76 (Million Dollars)

Year	Rice	Index	Rubber	Index	Maize	Index	Cassava	Index	Sugar	Index
1970	\$126	100	\$112	100	\$98	100	\$61	100	\$5	100
1971	145	115	95	85	114	116	62	102	19	380
1972	222	176	93	83	104	106	77	126	63	1260
1973	180	143	229	204	148	132	127	208	58	1160
1974	489	388	252	225	304	271	192	315	188	3760
1975	293	233	174	155	285	254	230	377	298	5960
1976	430	341	264	236	284	254	376	616	342	6840

Source: Bank of Thailand, Monthly Bulletin for 1970-75; Bank of Thailand Customs Data, 1976.

^{52/} See Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Selected Economic Indicators Relating to Agriculture, April, 1977, pp. 26-27.

In 1976, Thailand exported about 13 percent of her total rice production, nearly 90 percent of her maize, and almost all of her rubber. The majority of Thai cassava is also exported, primarily to Europe for livestock feed. Japan remains the major maize market, where it is used as cattle feed; Taiwan, however, is increasing in importance.

Other significant, but much less important, agricultural exports include mungbeans, grain sorghum, tobacco, kenaf, castor beans, and soybeans. Fisheries products, particularly shrimp, and forest production, particularly teak, also contribute significant amounts of foreign exchange.

Agricultural Export Situation and Outlook

Despite a currently impressive volume of agricultural exports, Thailand's potential for expanding production and exports may surpass any other country in the world on a percentage basis. A number of factors contribute to this situation, including the great gap which exists between existing current yields of many crops and their demonstrated potential yields. This is coupled with a very favorable man-land ratio, and the apparent potential for additional expansion of cultivated area should the economic environment so dictate. In the following section, the situation and outlook for some of Thailand's more important export commodities is discussed in greater detail.

Rice. In 1977, Thailand regained the distinction, lost several years ago to the United States, of being the world's leading rice exporter.^{53/}

^{53/} In 1976, Thailand accounted for 19.5 percent of total world rice exports, and the United States share was 22 percent. In the same year, Thailand's share of total world production was 4.3 percent, and the U.S. 1.5 percent. Calculations made from data contained in FAO Production Yearbook 1976 and Trade Yearbook 1976.

Approximately 2.9 million metric tons passed through the port of Bangkok during the year, and some additional but unknown quantity traveled clandestinely via truck to Malaysia and across the borders into Laos, Cambodia, Burma, and probably to Vietnam.

As a result of a relatively low carryover stock from 1977 and an extensive drought in the Northeast, 1978 rice exports are not expected to reach the 1977 level. The drought afflicted Northeast is largely a producer of glutinous rice -- little of which moves in international trade -- and production of non-glutinous rice in the Central Plains is expected to be up some 10 percent in 1978. Thus, there may not be any significant rise in domestic rice price even if as much as 2.0 million metric tons of rice are exported in 1978. The current RTG plan calls for 1978 export of only 1.4 million metric tons.

In the medium and long term, the outlook for Thai rice exports remains fairly bright. Thai rice is very competitive in the world market, both in terms of quality and price. Thus, although world demand for rice is relatively price and income inelastic, Thailand appears to be in a good position to protect her share of the market. The world rice market is relatively "thin", with less than five percent of total world production moving in trade annually. Over the past 30 years the world rice market has grown by only about one percent per year, and much of this growth has been the result of increased concessional sales -- both private and government to government.

Rubber. Thailand exported just over 400,000 metric tons of rubber in 1977, representing a new record. As a result of IBRD and UK loans to finance a rubber replanting project, an additional 400,000 metric tons is expected to be produced by the year 2000, or double present production.

World rubber demand is strong at present and is expected to strengthen even more after 1980. Demand is forecast to increase at 6 percent per annum while production is expected to increase by less than 4 percent. In the long run, natural rubber is likely to be in even greater demand as the cost of petroleum based synthetics increases. The benefits from increased profitability of natural rubber production and marketing will be shared by the myriad of small land holders who own more than 95 percent of Thailand's plantations.

Thailand has recently joined with Indonesia, Malaysia, Singapore and Sri Lanka in an Association of Natural Rubber Producers that hopes to stabilize fluctuations in world rubber prices through the operation of buffer stocks.

In recent years, Thailand has made good progress in improving the quality of her exported rubber, and currently is working to improve assembly, processing, and packaging methods.

Maize. In 1976, Thailand's exports of maize represented 3.8 percent of total world maize exports, but comprised 85 percent of those originating in Asia.^{54/} Japan is a major maize importer -- in 1976 Japan imported

^{54/} North America, principally the United States, dominates world maize exports, accounting in 1976 for 72 percent of the total. See FAO Trade Yearbook 1976.

13.5 percent of the maize moving in world trade -- and she represents Thailand's major market. The Asian market outlook for maize appears fairly good, particularly for continued sales to Japan as well as to Taiwan, South Korea, Hong Kong, and Singapore. As Asian incomes continue to rise, there should be a steadily increasing demand for animal protein, and thus a derived demand for maize, sorghum, and other feedstuffs. Thai maize appears competitive in terms of quality and price, but some adjustments in government regulations surrounding maize exports may be required if a strong competitive position is to be maintained. Potential for increased production is good if internal price relationships are such as to encourage increased use of commercial fertilizers.

Cassava. Thailand's market share of world trade in cassava pellets is currently in excess of 90 percent, with the bulk of her exports going to the Netherlands for re-export or for processing and/or resale as animal feed in western Europe. Presently, cassava is being included in European mixed feeds in an average amount of about 8 percent of the ration. This percentage could conceivably be increased to around 30 percent of the ration depending upon the relative prices of competing feed ingredients including corn, barley, sorghum and other grains. At the present time, cassava pellets containing a binder that is less than 3 percent by weight can enter the European Economic Community (EEC) at a duty of only 6 percent of CIF. The growth of the European mixed feed industry has been relatively stagnant recently, and the world market outlook for cassava flour is poor due to the availability of cheaper and more satisfactory substitutes.

Actions which Thailand is considering as a means of maintaining and strengthening her export market for cassava include: 1) developing an economical method for peeling cassava prior to pelletizing, thus increasing starch content from the present 62 percent to around 75 percent, 2) seeking a binder which is superior to starch in reducing the "dust" associated with pellets and which still represents less than 3 percent of the weight of the pellets, and 3) investigating the economic feasibility of using cassava as the raw product for producing high fructose sugar and other sugar products.^{55/}

Sugar. Thailand's sugar industry is currently very much in its ascendancy. Thailand was first cited in the USDA *World Sugar Report* in 1973, at which time she exported approximately 275,000 metric tons of sugar. In 1977, Thai sugar exports reached 1.6 million tons, catapulting her into fourth place among the world's exporters.^{56/}

Along with the United States, Thailand has rejoined the International Sugar Agreement (ISA) group of countries and has an export quota of 0.9 to 1.2 million metric tons, depending on actual world demand. Participation in the ISA will help to insure a stable sugar export volume for Thailand. In addition to the ISA quota, sugar may also be sold to non-member nations.

Kenaf. World exports of jute and similar fibers in 1976 totaled 682,617 metric tons. Between them, Bangladesh and Thailand supplied 87 percent of the total market, with Bangladesh being by far the world's largest exporter -- 62 percent of total world exports.

^{55/} A high fructose sugar plant is currently operating in South Korea and another is under construction in Singapore.

^{56/} Cuba continues to dominate world sugar trade, accounting for 31 percent of the total in 1976, but Thailand's sugar exports represented over 35 percent of the exports originating in Asia during the same year.

The price of Thai kenaf is strongly influenced by weather and other production conditions for Bangladesh jute. When jute production is high, Thai kenaf price plummets -- when world jute supplies are down, kenaf price rises. In Thailand, cassava has been competing strongly in the Northeast for resources formerly allocated to kenaf production. Currently more favorable kenaf prices, partially caused by domestic demand, are likely to induce some expansion in acreage but net returns per hectare of cassava are presently so much greater than those for kenaf that the response is unlikely to be very great.^{57/}

Thai kenaf traditionally receives a price which is inferior to that paid for jute. Retting practices produce a relatively low quality product in areas where an insufficient supply of clean water exists, and inefficient grading and standardization of product have also penalized Thai exports. At the current time, no major long term expansion in kenaf production and exports is anticipated. However, a pulp mill using kenaf as the cellulose raw material is planned for Khon Kaen. Export value of kenaf, jute, and gunny bags in 1976 was \$34.8 million.

Miscellaneous Exports. Other exports of some significance, and their dollar value in 1976 include: fresh fish, shrimp, lobster and prawns, \$76.3 million; teak, \$37.5 million; tobacco leaf and manufactured tobacco, \$35 million; mungbeans, \$20 million; grain sorghum, \$18.7 million; castor bean, \$12.5 million; and soybeans, \$2.4 million.

The export market facing Thailand for most of these commodities is such that Thai production can be expanded as rapidly as it is feasible to do so without resulting in an export glut.

^{57/} Cost of production studies indicate that in the 1976/77 crop year the net return to cassava was 3.4 times as great as for kenaf (\$128 per hectare compared to \$38 per hectare). Data supplied by Dr. Sawaeng Kulthongkham, NESDB.

XI. CONSTRAINTS TO INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY.

In this section, an attempt is made to identify some of the major constraints to increased agricultural production and productivity. The discussion is brief, and the list is by no means exhaustive.

Factor-product price relationships. The price of major production inputs in Thai agriculture (particularly fertilizer) has been high relative to the farm gate price for agricultural products. RTG policy has been partially responsible for this through import prohibitions, duties, and taxes imposed on inputs and (particularly in the case of rice) export premiums and taxes which have the effect of depressing domestic farm prices. Recently, the rice premium has been reduced, and import restrictions on inputs largely removed. If this signals a long term policy, it should prove beneficial in making modern purchased inputs more economically attractive to farmers. Operating under conditions of high risk brought about not only by unpredictable weather but also unpredictable prices and government policies, the Thai farmer must see a clear opportunity for substantial profit if he is to be induced to invest cash in purchased farm inputs. This is particularly true if he must borrow at high interest rates in order to make these purchases.

High payoff technology. Despite the substantial investments which have been made over the years in agricultural research, there is remarkably little in the nature of farm tested, proven, high payoff technology designed specifically to meet the needs of limited resource farmers in rainfed areas. Historically, the bulk of agricultural research has been

devoted to rice, and the bulk of investment in agricultural infrastructure has gone to irrigation facilities. Although upland crops have received emphasis in recent years there do not appear to be currently available technological production packages for any of the major upland crops such as cassava, kenaf, peanuts, mungbeans. Even less is known about the economics of purchased input use than about the agronomic aspects.

Dissemination of technology. In those instances where there exists a significant gap between existing technology and current practices, it is still essential that an effective and efficient delivery system (agricultural extension) be available to disseminate this information to the user level. The limited resource, low income, poorly educated farmer is particularly difficult to reach--partially because of restricted literacy and isolation, perhaps, but also because extension workers need to show "results", and these are easier to achieve when working with the generally more receptive larger producers who may more readily put into practice the recommendations. Exacerbating the problem is the fact that farmer contact time of the limited number of extension workers is further reduced by administrative and reporting burdens requiring that an inordinate amount of time be spent in the office.

It should be noted that, although as yet unquantifiable, there is a general impression that Extension is now moving ahead more aggressively and with more imagination in discharging its responsibilities. However, in terms of the target population, Extension may soon find that its activities are constrained by the inadequate availability of proven technology to extend.

Labor constraints. Although the overall picture which emerges is one of underemployment in rural areas, there is also evidence of peak labor constraints at key periods in the agricultural production process-- particularly at times of land preparation and planting, and again at harvest time. Although little reliable information is available in this respect, it may be that *appropriate* mechanization could result in increased production by permitting more timely land preparation and thus expanded area under cultivation each year. Mechanization should be viewed with caution, however, to assure that it is in fact introduced in such a way as to *increase* employment opportunities and not simply to substitute scarce capital for relatively abundant labor resources.

Government investment policy. Historically, government investments have discriminated against the rural dweller and the farmer and in favor of urban areas. Infrastructural investments--schools, hospitals, water systems, power, etc.--have been concentrated largely in Bangkok and to a lesser extent in a few other provincial capitals. Industry has understandably tended to locate in these favored areas, and thus employment opportunities, wages, and general levels of living have expanded at much faster rates than in rural areas. This investment pattern and widening rural-urban income disparities has encouraged rural-urban migration and has imposed an increasing burden on social services, transportation, housing and other such facilities--particularly in the Bangkok metropolitan area. A "cheap food policy" for urban dwellers is a further manifestation of the urban orientation and one which has probably acted as a brake on modernization of traditional agricultural practices.

Marketing. Available studies suggest that marketing of some agricultural products, particularly rice, is relatively efficient. Government intervention in the internal market mechanism is relatively limited and most marketing is carried out by the private sector. Competition is apparently reasonably strong, with large numbers of buyers being represented. However, tying arrangements through credit are not uncommon and may restrict sellers alternatives to some extent. Marketing of crops other than rice is less efficient and a lack of an adequately enforced system of grades and standards constitutes a problem for some commodities. The input supply market also appears to be competitive and relatively efficient. With the exception of a few special government programs of restricted scope, the input market system is largely in private hands.

The Thai farmer receives a larger percentage of the consumers' dollar than does the American farmer, primarily because processing requirements are substantially less, and marketing profit margins are probably also lower. There is a continuing need for expanded market information so that farmers can be made aware of their alternatives.

The government intervenes much more strongly in the marketing of agricultural exports, particularly rice, maize, rubber, and sugar. Some of the policies followed have resulted in reduced prices to the producer, and may have thus limited the rate of adoption of technology requiring the use of purchased inputs.

Agricultural credit. Although Thailand's agricultural sector accounts for 26 percent of the gross domestic product, the sector only receives about 4 percent of the institutional credit. Enactment of

legislation in 1975, however, required commercial banks to channel five percent of deposits into agricultural loans, increasing to 7 percent in 1976, 9 percent in 1977, and 11 percent in 1978. Between 1974 and 1976, formal agricultural credit increased from \$200 million to \$565 million. While it is likely that the agricultural sector can effectively use still more credit, some observers are pointing to other problems with agricultural credit.

Predictably, lending institutions have sought the most credit worthy as customers, and have thus far been ineffective in reaching limited resource farmers. Efforts are now under way to channel more formal credit to those without collateral or significant economic power.

Questions are being raised regarding the end use of agricultural credit. Recent large increases in credit volume have not been accompanied by concomitant increases in usage of modern agricultural inputs, and there is concern that credit is being used in consumption activities. Moreover, some observers are equally concerned that middle and large size farmers (who have received the bulk of the credit) are already saturated with credit and have been diverting funds back to urban areas.

It is important to note that there are not, at the present, answers to the questions of how much credit is optimal, who is receiving credit, and to what uses the credit is being applied. It probably is safe to say, however, that it is not enough to merely increase the volume of agricultural credit and expect that it will trickle down to rural poor.

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