The Developing Economies, XXVI-3 (September 1988)

THE ECONOMICS OF LAND TENURE AND RICE PRODUCTION IN A DOUBLE-CROPPING VILLAGE IN SOUTHERN THAILAND

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I. INTRODUCTION

THAILAND is a major producer and exporter of rice in the world market. The country is geographically divided into four regions, i.e., Northeastern, Northern, Central, and Southern regions. Even though rice is grown in all regions, Central Thailand constitutes the major portion of the country's total irrigated area and rice production, whereas the position occupied by Southern Thailand is rather small. Rice being the most important crop, there is a large accumulation of socioeconomic and agronomic studies on rice farming in the country. However, these studies are mostly limited to the Central and Northern regions, and there is a large vacuum in our knowledge of the precise state of rice farming in the Southern region.[1] For example, what is the rate of adoption of new rice technology, what is the present situation with respect to land holdings and tenancy, and what is the level of income among rice farmers? These are basic questions for an assessment of the condition of rice farmers and their farming activities, and are critically important for any meaningful development planning.

This paper attempts partly to fill this vacuum by discussing the current state of rice farming in a double-cropping village in Phatthalung Province in Southern Thailand. A detailed questionnaire survey was conducted in 1985 in Tambon Khao Jeak, Amphoe Muang, Changwat Phatthalung.[2] Based on data collected from a total of 111 farm households, this paper deals mainly with the economic aspect of land tenure and rice production.

In the following section, characteristics of the study village will be discussed within the context of Southern Thailand. Section III will be devoted to a discussion and analysis of the current land tenure systems in the village, including patterns of land ownership, tenurial status, tenancy forms, and landlord-tenant relations. This will be followed in Section IV by a description of rice technology and farming practice. In Section V, production costs will be analyzed and a production function

[1] The available socioeconomic studies in the region include [1] [10] [11], but none of them focuses on the economics of rice production.

[2] The survey was conducted as a part of a cooperative study under the JSPS-NRCT Program which covered three villages in Phatthalung, Suphan Buri, and Chiang Mai, and financial aid was provided by the Grant-in-Aid for Overseas Scientific Research No. 60041070, Japanese Ministry of Education, Science and Culture. For an interim report, see [4].

TABLE I

LAND AREA BY TYPE OF CROP AND BY PROVINCE IN SOUTHERN REGION IN 1983

(Rai)

	Rice	Permanent Crops	Total[a]
Krabi	156,803	346,469	550,836
Chumphon	187,850	587,685	940,078
Trang	221,694	552,475	804,777
Nakhon Si Thammarat	1,191,593	1,042,501	2,372,651
Narathiwat	154,630	583,636	767,888
Pattani	255,349	185,309	452,433
Phangnga	53,298	341,658	405,307
Phatthalung	545,664	344,017	910,897
Phuket	7,676	87,434	101,987
Yala	50,823	436,546	496,657
Ranong	15,510	68,812	122,663
Songkhla	492,250	824,438	1,393,904
Satun	107,185	160,745	302,469
Surat Thani	364,258	991,766	1,502,558
Regional Total	3,804,583	6,553,491[b]	11,125,105

Source: [9, p. 14].

[a] Includes land area under field crops, vegetables, and pasture. Therefore, the sum of rice land area and permanent crops area does not correspond to the total area.

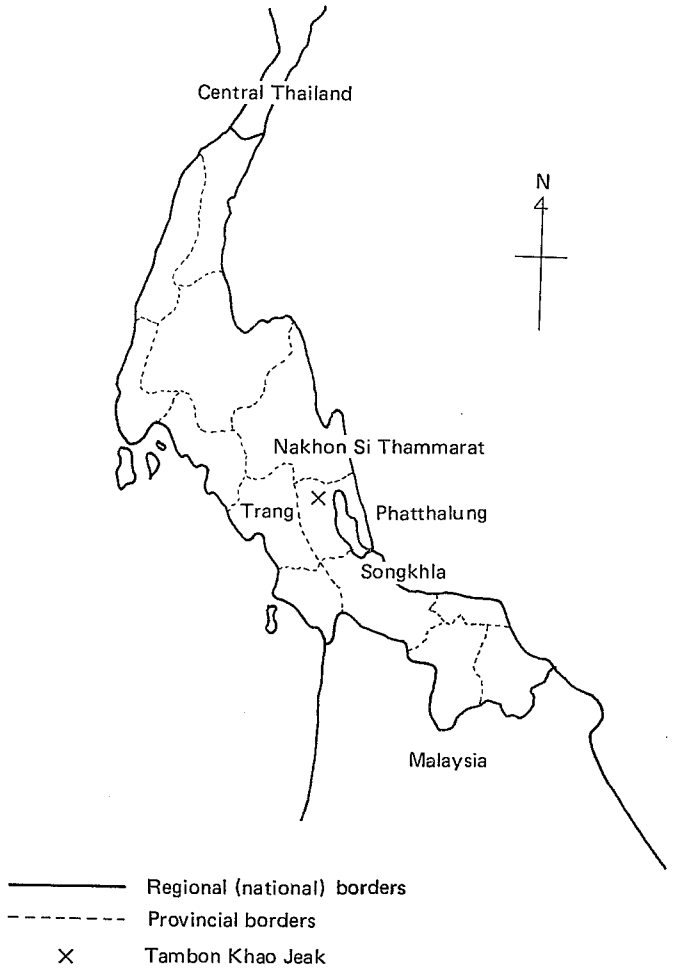
[b] Of this total area, 4,846,587 rai are given to para rubber. One rai is 0.16 ha.

estimated in order to assess the relative contribution of various factors to rice production in the village. The last section will summarize conclusions and discuss policy implications of the research findings.

II. CHARACTERISTICS OF THE STUDY AREA

The Southern region is located on the Malay Peninsular in the southern part of the country and consists of fourteen provinces, the administrative center being Haddyai in Songkhla Province. Agriculture in the region is characterized by the production of para rubber and the cultivation of rice on rain-fed fields. As is seen in Table I, the total planted area in Southern Thailand amounted to more than 11 million rai (one rai is 0.16 ha) in 1983, which was about 12 per cent of the national total. Of this, 6.5 million rai were given to permanent crops, predominantly para rubber. Rice land area was about 3.8 million rai, of which only 683,383 rai, or 18 per cent, was under irrigation, the rest being rain-fed. The number of farm households which grew rice was 453,554, or 73 per cent of the total, with the average area being 8.45 rai per household. It is clear that Nakhon Si Thammarat Province constituted 31 per cent, Phatthalung 14 per cent, Songkhla 13 per cent, and Surat Thani 10 per cent of the total land area under rice. In other words, Phatthalung was the second largest province in the region in terms of rice land area.

Fig. 1. Southern Thailand and the Location of the Study Village



Phatthalung Province is located about 800 km south of Bangkok, and surrounded by Nakhon Si Thammarat, Songkhla, and Trang provinces (see Figure 1). The Banthat Mountain range lies in the middle of the peninsular from south to north and divides Phatthalung and Trang. This part of the province is mountainous and hilly, and gradually slopes downward to the plains in the east, facing the Lake of Songkhla, forming a suitable land area for rice farming.

The climate may be characterized by a heavy rainfall and high temperatures, caused by both northeast and southwest monsoons. The average temperature in the Songkhla Meteorological Station is 31.4 degrees maximum and 23.6 degrees minimum. There are 148 days of rain and the annual rainfall reaches well over

TABLE II

NUMBER OF FARM HOUSEHOLDS AND AREA OF LAND OPERATED BY TENURE IN PHATTHALUNG IN 1983

	No. of Farm Households		Area of Operated Land (Rai)	
Owned	43,046	(78.8)	719,625	(79.0)
Rented	1,667	(3.0)	11,702	(1.3)
Others[a]	105	(0.2)	7,326	(0.8)
Mixed tenure[b]	9,711	(17.8)	172,244	(18.9)
Landless[c]	111	(0.2)	—	
Total	54,640	(100.0)	910,897	(100.0)

Source: [9, pp. 5–6].

Note: Figures in parentheses are percentages.

[a] Refers to all types of tenure other than owned and rented, e.g., cultivating land in a national park.

[b] Refers to cases under more than one form of tenure; presumably owner-tenant farmers are included in this category.

[c] Landless farm households include those which raise chickens, silkworms, mushrooms, and orchids.

2,000 millimeters [7, pp. 13–17]. The rainy season extends from September to January, with February to August the dry season.

The total land area of the province is approximately 2.2 million rai, of which 41.3 per cent is given to various crops including rice. The total population was 424,511 people in 1985, and about 85 per cent were in the agricultural sector. Table II shows the total number of farm households and operated land area by tenure. It should be noted that the original word used in the *1983 Intercensal Survey of Agriculture* [9] is the "holding" and refers to an agricultural production unit, which is interpreted as a farm household in this paper. About 55,000 households are engaged in agriculture. In terms of tenurial status, 79 per cent, 18 per cent, and 3 per cent are owner farmers, owner-tenant farmers, and tenant farmers respectively. Their average farm size is 16.7 rai, 17.7 rai, and 7.0 rai per household respectively.

The study village, Tambon Khao Jeak, is located about 6 km northwest of the provincial capital, Phatthalung, in Amphoe Muang. The village consists of ten hamlets (*muban*), and Mu 4 and Mu 5 were selected for an intensive questionnaire survey. The total number of households was 38 and 73 respectively, and all of them, including 14 non-farming households, were studied in 1985. The total population of 111 households amounted to 561 persons at the time of study. Data on rice farming was obtained from a total of 97 households engaged in the cultivation of rice. Even though the majority of people in provinces close to Malaysia are Muslim, most people are Bhuddhists in Phatthalung and there were no Muslims in the study village. A large Bhuddist temple located in Mu 6 served the village (*tambon*).

It should be mentioned that even though the Southern Region as a whole is

TABLE III

DISTRIBUTION OF HOUSEHOLDS BY THE AREA OF RICE LAND OWNED AND OPERATED IN THE STUDY VILLAGE, 1985

Area (Rai)	Owned			Operated		
	No.	%	Cumulative Percentage	No.	%	Cumulative Percentage
0	13	11.7	11.7	14	12.6	12.6
0.1–4.9	36	32.5	44.2	26	23.4	36.0
5.0–9.9	34	30.6	74.8	34	30.7	66.7
10.0–14.9	18	16.2	91.0	19	17.1	83.8
15.0–19.9	7	6.3	97.3	12	10.8	94.6
20.0–29.9	3	2.7	100.0	3	2.7	97.3
30.0–39.9	0	0.0	100.0	3	2.7	100.0
Total	111	100.0	—	111	100.0	—

characterized by the predominance of rain-fed rice cultivation, Phatthalung is fortunate to have a number of irrigation projects. There are seven major projects at present,[3] and the study village is supplied with sufficient water for rice double-cropping by one such project, the Nathom Irrigation Project under the Royal Irrigation Department. This is the oldest project in the South, completed in 1953 and expanded from 1966 to 1972, and now covers approximately 50,000 rai of rice fields, of which about 20,000 rai were planted with two rice crops in 1985. Under the double-cropping rice system, the rainy season rice was normally transplanted in late September and harvested in early March, while the dry season crop was transplanted in early May and harvested in early August. In this sense, the study village may be atypical in Phatthalung but a relatively fortunate one in the regional context.

III. LAND TENURE SYSTEMS

A. *Land Ownership and Tenurial Status*

Farmers in the study village owned various types of land, the total area being 737.5 rai of rice land, 488.2 rai of orchard, 5.0 rai of upland, and 82.9 rai of homeyard.[4] Of these lands, most of the orchard lands were located in former forest area at a distance and thus rented out to people living nearby, only 88 rai

[3] According to the classification of the Royal Irrigation Department, a project which requires more than 200 million baht and construction taking more than five years is considered a large-scale project, while if the investment is 4 to 200 million baht and construction two to five years it is a medium-scale project. A small-scale project requires less than 4 million baht and the construction takes one year or less. In Phatthalung Province, there existed seven medium-scale and thirty small-scale projects at the time of study. (Information obtained from the Provincial Office of Royal Irrigation Department, Phatthalung, August 1985.)

[4] This section draws heavily from my earlier paper [3].

TABLE IV

NUMBER OF FARMERS AND AVERAGE RICE LAND AREA OPERATED BY TENURIAL STATUS IN THE STUDY VILLAGE, 1985

	No. of Farmers	%	Average Area (Rai)
Landlords[a]	7	6.3	—
Landlord-farmers[b]	20	18.0	6.24
Owner farmers	33	29.7	8.27
Owner-tenants	38	34.3	12.14
Tenant farmers	6	5.4	7.71
Landless	7	6.3	—
Overall	111	100.0	9.33

[a] Landlords refer to those owners who rent out all their holdings and do not cultivate rice themselves.

[b] Landlord-farmers refer to those farmers who rent out part of their holdings and cultivate the rest themselves, sometimes with rented-in land. Of the twenty landlord-farmers, thirteen were landlord-owner farmers, but six were landlord-owner-tenants and the remaining one was a landlord-tenant farmer.

being operated by the owners themselves. On the other hand, rice land was mostly cultivated by the owners, some of whom also rented additional rice land. Since the village is located in the middle of the rice growing area, ownership of other types of farmland was very limited. Therefore, the analysis in this paper is limited to rice land.

Table III presents frequency distribution of farmers according to rice land area owned and cultivated at the time of study. It is seen that ninety-eight households (88 per cent of the total) owned some area of rice land. The average area owned was 8.4 rai per household, and the majority owned less than 10 rai. Those households owning 10 rai or more accounted for only 25.2 per cent of the total. The number of households which grew rice was ninety-seven, an almost identical figure to the number of land owners. However, the average cultivated area appeared to be larger than the owned land area and stood at 9.33 rai, and one-third of the farmers operated more than 10 rai of rice land. Needless to say, the above differences in owned land and operated land were due to the existence of tenancy. A total of 155.5 rai of rice land were rented out by twenty-seven households, while a total of 323.3 rai of rice land were rented in by fifty-one farmers in the village in the 1984/85 rainy season. These contracts included cases of mortgage. The larger rented-in area contributed to the increase in average operated land area.

Table IV shows the number of farmers and the average rice land area operated according to tenurial status. Two points seem to deserve mentioning here. First, farmers in the study village largely depended upon their own land for rice farming. Tenant farmers who had no land of their own accounted for only six, or 5.4 per cent of the total households. Certainly there were seven landlords and one landlord-farmer who rented out all of their holdings, but a total of ninety households (81.1 per cent of the total households and 97 per cent of all landowners) cultivated their own land. In spite of the predominant land ownership, there were some

TABLE V

NUMBER OF TENANCY CONTRACTS BY LANDLORD-TENANT RELATIONS AND FORM OF CONTRACT IN THE STUDY VILLAGE, 1985

	Close Relatives	Distant Relatives	Non-Relatives	Total
Fixed-rent (cash)	15	8	17	40
Mortgage	15	7	18	40
Share tenancy	7	3	3	13
Rent-free	7	0	0	7
Total	44	18	38	100

Note: There was actually one more tenancy contract, for which the form and landlord-tenant relation could not be identified. Close relatives refer to relations up to and including first cousins, while distant relatives are other relations.

farmers who obtained additional land for rice cultivation. The number of these owner-tenant farmers accounted for thirty-eight, or 34.3 per cent of the total households. Second, the average rice land area was largest among owner-tenant farmers (12.14 rai), followed by owner farmers (8.27 rai) and tenant farmers (7.71 rai), while it was smallest among landlord-owner farmers (6.24 rai). The large farm size among owner-tenants was due to the existence of rented-in land (6.58 rai per owner-tenant on the average) in addition to owned land (5.56 rai). In other words, tenancy in most cases was not necessarily a critical means of obtaining the basic factor of production or livelihood among villagers but appeared to function as an important method of farm enlargement among some of the landowners.

B. *Tenancy Forms and Landlord-Tenant Relations*

As mentioned earlier, of the ninety-seven rice farmers in the village, fifty-one cultivated some area of rented-in land at the time of study. There were a total of 101 tenancy contracts among them, averaging 2.0 contracts per tenant. As is seen from Table V, there were four types of tenancy contracts; fixed-rent tenancy, mortgage, share tenancy, and rent-free, each constituting 40 per cent, 40 per cent, 13 per cent, and 7 per cent of the total respectively. In terms of landlord-tenant relations, 44 per cent of all the contracts were established between close relatives, 18 per cent between distant relatives, and only 38 per cent were between non-relatives. It is clear that the major form of tenancy contract at the time of study was fixed-rent in cash. According to farmers, this form of contract began to appear in the village after the introduction of rice double-cropping which was made possible by the improvement of the Nathom Irrigation Project in 1972. The average rental was initially around 250 baht per rai but is now 376.2 baht per rai per season,[5] with a relatively high degree of variation. The standard deviation of

[5] According to a previous study conducted in a Songkhla village in the 1960s [11], rental was usually agreed on a yearly basis. However, in our Phatthalung village, where rice double-cropping was the predominant pattern of land use, the annual rental was rather exceptional. Yet in other double-cropping villages in Suphan Buri and Chiang Mai, the annual contract was the main form of fixed-rent tenancy [3].

the mean rental was 171.0 baht, the coefficient of variation being as high as 45.5 per cent. It is also interesting to note that the agreed rental was highest (446.5 baht) under contracts established between close relatives, followed by contracts between distant relatives (345.3 baht), and lowest (328.8 baht) in the case of non-relatives. The precise reason for this phenomenon remains unknown.

An equally common form of contract was mortgage, which was the traditional rural credit institution and involved a transfer of the usufructuary right to land to a creditor for a sum of money. The creditor acquired the right to use the land until the loan was repaid and interest was not charged. Depending upon the need of the debtor, the value of the loan obtained and the area of land mortgaged showed a considerable variation. The value of loan ranged from a minimum of 1,000 baht to a maximum of 40,000 baht, and the area of land from 0.75 rai to 9.0 rai. The average value of loan among forty contracts was 5,215 baht, for which an average of 2.39 rai of rice land was mortgaged. It should be pointed out that forty mortgage contracts in the village represented the cases of creditors, who did not have to pay any rent to the landowner.

Share tenancy, the predominant form of contract before the emergence of fixed-rent tenancy, was still practised under thirteen contracts, most of which were between relatives. This involved the equal sharing of product between landlord and tenant, which was accompanied by cost-sharing arrangements; seeds were borne by the tenant under all of the thirteen contracts, fertilizer was equally shared between the two parties under nine contracts but totally borne by the tenant under four contracts, and costs of ploughing, transplanting, and pesticide were usually paid by the tenant alone. The uniqueness of share tenancy in the village can be seen from the arrangement for harvesting. Without exception, the harvest cost was equally shared between landlord and tenant. In the traditional cases, just before harvesting a parcel of land under share tenancy was divided by the use of rope into two long sections and each section cross ways into three sub-sections, making a total of six segments. The landlord retained the right to select either one of the first two segments and other segments were automatically allocated alternately to tenant and landlord. The landlord may have harvested his share himself or employed someone else, who might also be the tenant. It is considered that this type of arrangement probably came into practice because of the traditional method of farming. That is, seeds of different varieties were often mixed and ripened at different times, and the use of a hand-knife was most effective for harvesting only those ripened panicles, which could easily be brought home in case of a sudden shower under typically uncertain weather conditions, even after the end of the rainy season in Southern Thailand. Under such conditions, the above sharing method probably resulted in the fair sharing of not only unevenly ripened paddy but also risk of harvest loss. Actually, the use of hired labor has been very common in harvesting since the introduction of double-cropping, and at the time of study there were cases of the equal sharing of harvest labor wages between landlord and tenant, rather than physically dividing the land into two parties.

The fourth type of tenancy was rent-free, literally the use of land owned by

TABLE VI

NUMBER OF TENANCY CONTRACTS ACCORDING TO CHARACTERISTICS OF LANDLORDS IN THE STUDY VILLAGE, 1985

	No. of Contracts	Average Area per Contract (Rai)
Occupation of landlord:		
Farmer	73	2.70
Trader	16	5.05
Government officials	2	4.50
Retired	5	3.20
Others	2	2.25
Unknown	3	4.0
Age of landlord:		
–29	6	2.38
30–39	17	3.00
40–49	29	2.62
50–59	24	2.59
60–	23	4.58
Unknown	2	5.13
Overall	101	3.16

someone else with no rental payment. Needless to say, this was observed only between close relatives, usually between a parent and a child, and effectively equivalent to inheritance of land.

Following the discussion of tenancy forms, let me briefly mention the nature of landlord-tenant relations in the village. Table VI presents the breakdown of tenancy contracts according to occupation and age of landlord. It is clearly seen that most of the landlords were farmers, who rented out part of their holdings, and the area rented per contract was generally small. However, it should be mentioned that there were sixteen contracts in which landlords were traders and their rented-out area was relatively large. One such example was a rice-mill owner in the village, who acquired land not only through inheritance but also purchases. This certainly suggests that land concentration may have been taking place, but in view of the equal inheritance system it is rather unreasonable to foresee the emergence of large landholding over generations. The predominance of small-scale and farmer-landlords seems consistent with the traditional economic structure in that rice farming has been the main activity for the majority of villagers who have had some land of their own. In other words, tenancy emerged mostly as a means of reallocating resources among the farmers, and therefore tended to concentrate on kinship ties under social influences.

Table VII presents reasons for renting out among twenty-seven landlords in the village who rented out all or part of their holdings. There seem to exist three major types of economic reasons: (1) resource endowments in rice farming, (2) alternative sources of income, and (3) economic hardship. The first type refers to a situation where the size of land holding is too large for available family labor

TABLE VII

LANDLORDS' REASONS FOR RENTING OUT LAND IN THE STUDY VILLAGE, 1985

	No. of Rent-out Contracts	%
Insufficient labor	16	32.6
Too busy with other work	9	18.4
Children's education	6[a]	12.2
Land located too far away	4	8.2
Retired	3	6.1
Loan repayment	2[b]	4.2
Others	9	18.4
Total	49	100.0

[a] All these contracts took the form of mortgage.
[b] These two were also mortgage contracts.

under the prevailing rice technology, while the second type means that family labor is insufficient for cultivating all the holding because of engagement in off-farm employment. The third type refers to the necessity of raising a sum of money for some reason, and typically in these cases a mortgage contract was adopted. However, the fact that insufficient labor was the major reason cited seems to reflect the prevalence of landownership and support the argument that tenancy functioned as a means of reallocating resources among the farmers.

IV. RICE TECHNOLOGY

In this section, discussion will be focused on the current state and problems of rice technology in the study village in preparation for an economic analysis of rice production. Let me begin with a brief review of past changes in farming techniques in the area, as it is probably useful to understand the nature of changes before discussing contemporary problems. According to intensive interviews with the village headman and some farmers, the major technological changes in the village can be summarized in chronological order, as follows.[6]

1953 Nathom Irrigation Project completed; began to supply water in the rainy season.

1972 Nathom project expanded to supply water for both rainy and dry season crops. Rice double-cropping began.

1975 Tractor ploughing on contract basis became available. Chemical fertilizers introduced.

1978 Power tiller began to be owned by villagers.

[6] Based on data collected from each household in the village, Inoue shows the yearly proportion of farmers who adopted the modern inputs [5]. According to this, early adopters began to use chemical fertilizer in the 1950s, pesticide in the 1960s, tractor ploughing in 1969, and modern varieties in 1975. Therefore, my definision of technological changes refers to the timing when a particular change was regarded as "significant" by the farmers in the village.

1980 RD varieties and pesticide introduced.
1981 Mechanical thresher and sickle introduced.

In relation to these changes, some points should be mentioned here. First, the crucial change in the village was the introduction of rice double-cropping. Apparently, from the late 1960s when the Nathom Irrigation Project was under improvement, the government encouraged farmers to plant rice in the dry season as well. The farmers, however, were rather reluctant as they had formerly witnessed the failure of a dry season rice crop which was planted by a farmer without the supply of irrigation water. In 1972, however, the village headman planted a dry season crop, and his success inspired extensive and immediate adoption of rice double-cropping.

Second, the adoption of modern varieties, generally called the IR varieties in Thailand, was delayed until sometime after the introduction of double-cropping, which means that double-cropping was initially adopted with the use of local varieties and chemical fertilizer. This is very surprising, as it is generally assumed that double-cropping becomes possible only when improved, short-maturing, fertilizer-responsive, non-photo-sensitive varieties are adopted, at least in the dry season. As will be shortly shown, local varieties were still very popular even in the dry season at the time of study. Unfortunately, the precise origins and agronomic nature of these local varieties could not be ascertained, but it is certain that some of the local varieties are suitable for the dry season cropping.

Third, the introduction of modern varieties was followed by the adoption of a sickle for harvesting, which in turn coincided with the use of a mechanical thresher. Traditionally, a hand-knife has been used presumably because of uncertain weather conditions in the area. If harvested by a hand-knife, panicles were not threshed but stored as they were, while the use of a sickle necessitated threshing of rice grains before storing or selling. At the time of study, panicles harvested by a hand-knife were also threshed by a mechanical thresher before selling, but the question remains as to whether or not panicles harvested by a hand-knife were threshed before selling and, if threshed, how they were threshed before the introduction of a mechanical thresher.

Fourth, soon after the adoption of double-cropping, tractor ploughing was introduced on a contract basis. This service was provided by contractors from the neighboring province of Trang. However, from the late 1970s, farmers in the village began to acquire their own power tillers and by the time of study contract ploughing had been completely replaced by the villagers themselves.

With this background, let me now turn to the current state of rice technology adopted by the farmers in the village. Table VIII shows the proportion of farmers who owned farm machinery and adopted new inputs such as modern variety, chemical fertilizer, and pesticide at the time of study. The following points seem important in the context of the present analysis. First, the recommended varieties were RD7, RD21, and RD23 in the dry season, and RD7, RD13, Nang Pya 132, and Kaen Chan in the rainy season, the last two being improved local varieties. However, the great majority of farmers planted such local varieties as Kai Mot Lin, Saree, and Chor in the rainy season and predominantly Baton in the dry

TABLE VIII

ADOPTION OF NEW RICE TECHNOLOGY IN THE STUDY VILLAGE, 1985

	Proportion of the Farmers Who Used/Owned New Inputs in:	
	1984/85 Rainy Season	1985 Dry Season
Modern varieties	12.4	15.6
Fertilization in nursery	99.0	97.9
Pesticide in nursery	15.5	17.7
Mechanical ploughing	100.0	100.0
Basal-dressing[a]	6.2	5.2
Top-dressing	99.0	97.9
Hand weeding	60.8	59.4
Weedicide	4.1	5.2
Pesticide	37.1	36.5
Sickle harvesting[b]	3.1	89.6
Mechanical threshing	91.8	89.6
Ownership of power tiller	44.3	—
Ownership of irrigation pump	17.5	—
Ownership of mechanical thresher	18.6	—

[a] Include those farmers who applied manure, instead of chemical fertilizer.

[b] Include those farmers who concurrently used both sickle and hand-knife. In fact, in the rainy season, all the farmers used a hand-knife, and only 3.1 per cent of them also used a sickle in a different field.

season. According to farmers, Baton could be planted only in the dry season, indicating the existence of photo-sensitivity suitable for transplanting in May and harvesting in August. Modern varieties planted were predominantly Nang Pya 132 in the rainy season and RD7 in the dry season.

Second, the use of mechanical power in ploughing was a fully established practice among the farmers in the village at the time of study. As mentioned above, it was originally a large four-wheel tractor that was used in ploughing but now all the farmers depended on a power tiller of less than 10 BHP. About 44 per cent of the farmers actually owned their machines, which were also used for contract ploughing in the area. The ongoing charge was 200 baht per rai for two ploughings, although it was only 100 baht when first introduced in 1978.

Third, chemical fertilizer was adopted by all the farmers, and was applied not only in the main field but also the nursery. The most common type used was a compound fertilizer (N:P:K=16:20:0). However, basal-dressing was seldom practised and fertilization was heavily oriented toward topdressing.

Fourth, the use of pesticide and herbicide was rather limited, even though some of the farmers applied pesticide in the nursery as well. These pesticides included Parathion, Panadol, and Furadan. Hand weeding also was not practised by all the farmers. Perhaps due to the practice of keeping water deep in the field, weeds may not have been a serious problem in the area.

Fifth, a very interesting difference between the rainy season and dry season can be seen from the use of the sickle in harvesting. In the rainy season, all the

farmers used a hand-knife, but three farmers concurrently used a sickle in a different field. On the other hand, as many as 90 per cent of the farmers used a sickle in the dry season, and only 10 per cent exclusively depended on a hand-knife. Taking into account the fact that local varieties were predominant in both seasons, the difference was not considered due to the variety planted but probably caused by weather conditions. The unpredictable rainfall pattern in Southern Thailand at the time of harvesting the rainy season crop, as pointed out earlier, has traditionally established the use of a hand-knife. In contrast, harvesting of the dry season crop involved a much lower risk of a sudden rainfall, which enabled farmers to leave reaped paddy straws in the field for a few days before threshing. In view of the marked improvement in labor efficiency,[7] the farmers preferred to use a sickle in the dry season. It should be noted that harvesting was commonly done by hired labor, and the workers were paid on a daily basis, implying that the use of a sickle would also reduce hired labor cost. Interestingly and understandably, the tool to be used by the workers was actually determined by the employing farmer. Therefore, further increase in the wage rate is assumed to enhance the adoption of a sickle even in the rainy season.[8]

Sixth, the great majority of farmers used a mechanical thresher in both seasons. This, however, differed from those large-scale engine-powered threshers, common in Central Thailand. It had no engine of its own and applied the power of a power tiller using a long belt. Since less than 20 per cent of the farmers owned a thresher, most of them adopted mechanical threshing on a contract basis. It is again interesting to note that the charge for threshing differed according to the method of harvesting. When harvested by a hand-knife, only panicles were there to be threshed, while a certain length of paddy straws were also cut by a sickle. This difference apparently caused different efficiencies of threshing work and thus different rates: 10 baht per bag (80 to 90 kg) in the wet season, and 15 baht per bag in the dry season.[9]

Likewise, rice technology in the village has been rapidly changing. Some traditional techniques still remained but the introduction of modern inputs appeared to be in progress, and overall it seemed that farmers were making an economically

[7] According to farmers, the use of a hand-knife required ten man-days to harvest one rai of rice field, while the same area could be harvested in five man-days if a sickle was used. Thus, it seems that labor efficiency could be doubled by the use of a sickle.

[8] The prevailing wage rate in the village was 40 baht per day at the time of study, but about 35 baht in 1980, and 30 baht in 1978. The rate was equally applicable to both male and female workers, and for transplanting and harvesting. It should be noted that the use of hired labor became common after the introduction of double-cropping, and most of the workers were coming to the village in a number of different groups from various areas in the province where rice double-cropping was not practised. While working for the farmers in the village, they stayed at the employer's house and received three meals free of charge. Apparently, often the same set of workers, usually consisting of a few couples sometimes including children, have been coming to the same farmer four times a year, i.e., for transplanting and harvesting in both seasons.

[9] According to a thresher owner, about 4 tons of rice grains could be threshed in a day when harvested by a hand-knife, but the amount was reduced to only 2.4 tons if a sickle was used in harvesting.

TABLE IX

AVERAGE YIELD PER RAI ACCORDING TO FARM SIZE AND TENURIAL STATUS IN THE STUDY VILLAGE

	1984/85 Rainy Season		1984 Dry Season	
	No. of Farmers	Yield (Kg)	No. of Farmers	Yield (Kg)
Rice land area (rai):				
0.1–4.9	27	505.6 (173.7)	29	531.8 (161.1)
5.0–9.9	34	457.5 (95.3)	33	480.9 (109.5)
10.0–14.9	19	436.1 (63.3)	18	444.0 (83.5)
15.0–19.9	11	402.0 (71.4)	11	359.2 (119.7)
20.0–29.9	5	398.0 (130.1)	6	418.6 (120.4)
30.0–39.9	1	375.0 (0.0)	0	—
Tenurial status:				
Landlord-owner farmers	20	511.0 (172.5)	20	516.5 (159.9)
Owner farmers	33	445.3 (92.3)	33	464.3 (119.6)
Owner-tenants	38	438.0 (111.0)	38	457.3 (136.5)
Tenant farmers	6	453.8 (82.5)	6	454.7 (86.3)
Overall	97	456.5 (121.0)	97	470.0 (133.3)
Average area operated (rai)		9.12 (6.15)		8.94 (6.00)

Note: Figures in parentheses are the standard deviations.

rational adaption to the available technology. Even though an economic assessment of various farming techniques seems necessary to judge their rationality in technological change, this is actually beyond the scope of the present paper. In the following section, let me proceed to the economic analysis of rice production.

V. THE ECONOMICS OF RICE PRODUCTION

A. *Yield and Input Use*

The national average rice yield was 310 kg and 312 kg per rai in the 1984/85 and 1985/86 rainy season respectively, while the dry season yield was 591 kg and 596 kg in 1984 and 1985 respectively. However, there existed marked differences in the average yield according to area; for instance, in the 1984/85 rainy season cropping, the regional average was 251 kg, 398 kg, 364 kg, and 274 kg for the Northeastern, Northern, Central, and Southern regions respectively. The corresponding figures for the 1984 dry season were 395 kg, 594 kg, 623 kg, and 415 kg respectively. It is clear from these figures that the level of yield in the Southern region was much lower than the national average for both the rainy and dry seasons. The average yield in Phatthalung was 396 kg in the 1984 dry season and 318 kg in the 1984/85 rainy season [8, pp. 17–27].

According to the Phatthalung Rice Research Center, the low yield levels in Southern Thailand were due to various factors, some of which should be mentioned

TABLE X

AVERAGE AMOUNT OF FERTILIZER AND PESTICIDE APPLIED PER RAI IN THE STUDY VILLAGE

(Baht)

	1984/85 Rainy Season		1984 Dry Season	
	Fertilizer	Pesticide	Fertilizer	Pesticide
Rice land area (rai):				
0.1–4.9	164.7 (106.8)	1.3 (3.2)	166.1 (109.5)	1.7 (3.5)
5.0–9.9	153.4 (77.4)	1.5 (2.2)	145.2 (68.8)	1.2 (1.8)
10.0–14.9	118.0 (32.9)	1.9 (2.0)	108.4 (40.1)	1.7 (2.0)
15.0–19.9	100.9 (35.0)	0.9 (1.2)	109.4 (39.1)	3.3 (5.1)
20.0–29.9	143.3 (60.6)	9.1 (14.3)	152.0 (59.5)	7.5 (12.0)
30.0–39.9	137.5 (0.0)	1.1 (0.0)	—	
Tenurial status:				
Landlord-owner farmers	154.2 (115.6)	1.6 (2.4)	146.9 (122.1)	1.6 (2.4)
Owner farmers	136.3 (60.2)	1.2 (2.0)	141.2 (59.1)	1.2 (1.9)
Owner-tenants	141.0 (66.6)	2.7 (6.0)	137.1 (68.6)	2.9 (5.6)
Tenant farmers	154.6 (99.4)	0.2 (0.6)	144.1 (72.6)	3.8 (7.6)
Overall	143.0 (78.3)	1.8 (4.1)	140.9 (78.9)	2.1 (4.3)

Note: Figures in parentheses are the standard deviations.

here. The first factor relates to the low level of irrigation in the region, where farmers are generally poor and new technology may not be adopted, which in turn presents an urgent need for developing high-yielding varieties under rain-fed conditions. The second factor relates to weather conditions, which are characterized by heavy rainfall. This often brings about various diseases and insects, whose control may not be sufficiently carried out due to the prevailing poverty and low level of farming techniques among the farmers. The third factor relates to soil fertility. Typical acid and peat soils in the region are important causes of low productivity.[10]

Table IX shows the average yield in the study village by farm size and tenurial status. It is clear that the average yield in the village (457 kg per rai in the rainy season and 470 kg in the dry season) was significantly higher than the provincial average in both seasons, presumably because of better irrigation conditions and the use of new technology. It is noted that smaller farmers attained a higher yield than larger farmers, partly because of a larger quantity of fertilizer used, as seen in Table X. In terms of tenurial status, the landlord-owner farmers seemed to attain a higher yield than other farmers, but this may have been due to their smaller farm size (see Table IV). Except for this group, average yields did not differ much among farmers of different tenurial status. The economic meanings of yield and input levels can be explored by the analysis of production cost.

[10] This information was obtained from Dr. Vichien Petpisit of the center in a personal interview in August 1985.

TABLE XI

AVERAGE COST OF RICE PRODUCTION IN THE STUDY VILLAGE

(Baht)

	1984/85 Rainy Season		1984 Dry Season	
	Per Rai	Per 60 Kg	Per Rai	Per 60 Kg
Seeds[a]	18.03	2.37	18.50	2.36
Fertilizer	143.00	18.80	140.91	17.99
Pesticide	1.82	0.24	2.10	0.27
Family labor[b]	485.07	63.76	421.82	53.85
Exchange labor[c]	43.45	5.71	25.76	3.29
Hired labor	144.41	18.98	103.93	13.27
Charges[d]	140.32	18.44	185.10	23.63
Depreciation[e]	72.14	9.48	84.97	10.85
Rental paid	100.11	13.16	103.75	13.24
Interest on owned land[f]	820.67	107.86	874.88	111.69
Rate and tax	1.75	0.23	1.88	0.24
Total	1,970.77 (840.65)[g]	259.03	1,963.60 (869.67)[g]	250.67

[a] Estimated on the basis of 2.70 baht/kg.
[b] Estimated on the basis of ongoing wage rate; 5 baht/hour.
[c] Estimated in the same manner as that for family labor cost.
[d] Refers to contract charges for ploughing and threshing.
[e] Includes such farm machinery as power tiller, irrigation pump, sprayer, duster, mechanical thresher, and milling machine.
[f] Estimated by charging 10 per cent p.a. interest rate (5 per cent for one cropping season) on the current value of owner-operated rice land.
[g] Figures in parentheses are the standard deviations. The average cost per 60 kg of rice produced was estimated from the cost per rai on the basis of the average yield for each season.

B. *Production Cost and Returns*

According to the Ministry of Agriculture [5, p. 119], the national average cost of rice production was 2,973 baht per ton for the rainy season and 2,518 baht for the dry season in the 1984/85 crop year. The corresponding figures for the Southern region were 3,721 baht and 2,989 baht respectively. Table XI presents my estimation of production costs in the study village. The average production cost was 259 baht per 60 kg in the rainy season and 251 baht in the dry season, equivalent to 4,317 baht and 4,161 baht per ton respectively. Because no detailed explanation of the method of cost estimation by the Ministry of Agriculture was available, the differences unfortunately remain unsolved. However, on the basis of my estimation, the following points can be made on the structure of production costs and consequent returns from rice farming in the village.

First, the average total cost per rai was 1,971 baht in the rainy season and 1,964 baht in the dry season. The largest cost component was the interest on owned land, which constituted 42 per cent and 45 per cent of the total in the

TABLE XII

AVERAGE COST OF RICE PRODUCTION IN THE STUDY VILLAGE BY FARM SIZE AND TENURIAL STATUS

(Baht)

	1984/85 Rainy Season, Cost per Rai	1984 Dry Season, Cost per Rai
Rice land area (rai):		
0.1–4.9	2,395 (1,304)	2,407 (1,140)
5.0–9.9	1,923 (475)	1,976 (780)
10.0–14.9	1,758 (577)	1,669 (385)
15.0–19.9	1,749 (413)	1,585 (425)
20.0–	1,435 (247)	1,288 (275)
Tenurial status:		
Landlord-owner farmers	2,263 (1,386)	2,282 (1,321)
Owner farmers	2,248 (582)	2,285 (684)
Owner-tenant farmers	1,723 (471)	1,656 (480)
Tenant farmers	1,045 (348)	909 (386)
Overall	1,971 (841)	1,964 (870)

Note: Figures in parentheses are the standard deviations.

rainy and dry seasons respectively. Also a very high proportion was occupied by family labor cost; 25 per cent in the rainy season and 21 per cent in the dry season. Total labor cost constituted 34 per cent in the rainy season and 28 per cent in the dry season, while the cost of material inputs (seeds, fertilizer, pesticide, and depreciation) and contract charges constituted only 19 per cent and 22 per cent respectively, suggesting that rice farming in the village was labor intensive rather than capital intensive.

Second, the high proportion of interest on owned land implies that production costs were much higher among owner farmers than tenant farmers who did not own land. This can be confirmed by Table XII, which also shows that the average cost tended to decline as the farm size became larger, indicating the economies of scale.

Third, even though the average total cost was very similar in both seasons, interesting differences can be observed in some of the components, which seems to reflect differences in farming techniques in both seasons. The charges and depreciation were higher but labor cost was lower in the dry season than the rainy season. The higher charges were caused by the higher rate of threshing charge in the dry season because of the widespread use of the sickle in harvesting. This however resulted in improved labor efficiency and therefore lower labor costs. Depreciation was lower in the 1984/85 rainy season as the depreciation of some machines had been completed by the 1984 dry season.

Fourth, the average cost of production was 4.32 baht per kg in the rainy season and 4.18 baht in the dry season. These costs appeared to be much higher than the average rice price in both seasons—2.7 baht per kg. However, this does not

TABLE XIII

AVERAGE RETURNS FROM RICE FARMING IN THE STUDY VILLAGE BY FARM SIZE AND TENURIAL STATUS

(Baht)

	1984/85 Rainy Season			1984 Dry Season		
	Returns per Rai[a]	Total Returns[b]	Per Capita Returns[c]	Returns per Rai[a]	Total Returns[b]	Per Capita Returns[c]
Rice land area (rai):						
0.1–4.9	697	1,924	444	686	1,900	439
5.0–9.9	574	4,271	870	576	4,372	890
10.0–14.9	615	7,429	1,440	666	8,012	1,553
15.0–19.9	551	8,981	1,829	461	7,427	1,513
20.0–	530	13,075	2,306	586	13,964	2,463
Tenurial status:						
Landlord-owner farmers	675	4,529	924	663	4,316	881
Owner farmers	644	5,371	1,074	630	4,832	966
Owner-tenants	534	6,184	1,288	560	6,464	1,346
Tenant farmers	622	3,601	981	644	4,882	1,330
Overall	607	5,536	1,141	608	5,436	1,121

[a] Returns per rai were estimated by subtracting management expenses from gross income, on a per rai basis. The total number of farmers used for the estimation was ninety in the rainy season and seventy-seven in the dry season, after omitting extraordinary figures.

[b] Obtained by multiplying by the average farm size.

[c] Obtained by dividing the total returns by the number of family members.

necessarily mean that farmers actually received a negative income from rice farming, because the cost components included family labor, exchange labor and interest on owned land which were imputed costs and not actually paid by the farmers.

Fifth, deducting these imputed costs from the total, we obtain the total management expenses; 621.58 baht per rai in the rainy season and 659.43 baht in the dry season. The difference between gross income and management expenses would be the average returns from rice farming; 611 baht per rai in the rainy season and 610 baht in the dry season. The returns from rice farming were a net income that farmers actually earned, and however low it may be, a positive net income presented farmers an economic incentive for continued engagement in rice cultivation.

Table XIII presents the average returns by farm size and tenurial status in the study village. Due to double-cropping, the average returns from rice farming amounted to nearly 11,000 baht per year per household, or 914 baht per month. Taking the family size into account, per capita returns were 2,262 baht per year. This places the average farmer in the village slightly above the poverty line

income of about 2,000 baht per capita per year [6, p. 64]. However, there existed a large variation in the average returns among farmers, reflecting differences in farm and family size. As expected, the larger the farm size, the higher the income from rice farming. Roughly speaking, the size of 10 rai seemed to be the border line between the poor and not-poor. The farmers with more than 20 rai appeared to have attained a level of per capita returns five times as high as the farmers with less than 5.0 rai.

In terms of tenurial status, owner-tenant farmers appeared to have attained the highest total returns as well as per capita returns because of their larger farm size. It may be interesting to note that the landlord-owner farmers seemed to suffer from a low level of income. This reflected their small area of land under operation, but it should be remembered that they could also expect rental income from the average 3.98 rai of rice land rented out. Overall, the differences in per capita returns by tenurial status appear to be less significant than the differences by farm size. In other words, tenurial status did not appear to be a fundamental determinant of rice income in the village where the great majority of farmers owned some area of rice land.

C. *Production Function Analysis*

In order to analyze the relative importance of various production factors in the determination of rice income, a production function was estimated. The Cobb-Douglas type was used for the estimation with the following variables. The dependent variable was the total production of rice in physical terms (kg). A total of seven independent variables were used under various combinations. The first independent variable was the total rice land area operated in the cropping season studied (expressed in rai). The second was the total labor input, while the third was family labor input, both in man-hours. No distinctions were made between male and female labor input. The fourth variable was the total amount of fertilizer applied and expressed in baht. These four variables refer to the basic production factors which are conventionally used in a production function analysis. In addition, some nonconventional variables were also included in the analysis in order to assess the possible contribution of managerial ability and tenancy to the determination of rice income. Thus, the fifth variable used was formal school education of the head of the household, while the sixth was his/her level of experience in rice farming, both expressed in number of years. It is hoped that they relate to the managerial ability of the farmer. The seventh was a dummy variable for tenurial status (0 for landlord-owner farmers and owner farmers; 1 for owner-tenants and tenant farmers).

With these variables, a production function was estimated on the basis of ninety-seven farmers for the 1984/85 rainy season and 1984 dry season respectively. The results of the estimation are presented in Tables XIV and XV. The following points deserve mentioning here. First, the coefficients of multiple determination indicate that the variation in total production can be well explained by these variables included in the regression, especially by the three conventional factors of land, labor, and fertilizer. The highest coefficient reached 0.924 (Model

TABLE XIV

PRODUCTION FUNCTION ESTIMATES FOR THE 1984/85 RAINY SEASON

	I	II	III	IV
Constant	5.866**	6.304**	6.278**	6.308**
	(16.008)	(20.541)	(19.720)	(20.295)
Land	0.829**	0.882**	0.887**	0.885**
	(13.073)	(16.392)	(16.638)	(16.619)
Total labor	−0.029			
	(−0.463)			
Family labor		−0.119**	−0.124**	−0.117**
		(−2.810)	(−2.861)	(−2.695)
Fertilizer	0.112**	0.113**	0.114**	0.113**
	(2.516)	(2.688)	(2.691)	(2.678)
Education		0.012		
		(0.443)		
Farming experience			0.019	
			(0.465)	
Tenurial status				−0.011
				(−0.223)
R^2	0.915	0.921	0.924	0.921
DW ratio	1.810	1.998	2.027	2.004

** Denotes significance at the 1 per cent level.

TABLE XV

PRODUCTION FUNCTION ESTIMATES FOR THE 1984 DRY SEASON

	I	II	III	IV
Constant	6.180**	6.185**	6.098**	6.254**
	(15.632)	(20.064)	(19.233)	(20.683)
Land	0.804**	0.802**	0.815**	0.794**
	(12.083)	(14.559)	(14.838)	(14.705)
Total labor	−0.042			
	(−0.592)			
Family labor		−0.045	−0.060	−0.061
		(−0.841)	(−1.091)	(−1.141)
Fertilizer	0.097**	0.096**	0.094**	0.099**
	(4.921)	(4.784)	(4.702)	(4.976)
Education		0.007		
		(0.203)		
Farming experience			0.053	
			(0.996)	
Tenurial status				0.088*
				(1.418)
R^2	0.866	0.866	0.868	0.869
DW ratio	2.066	2.088	2.101	2.054

** Denotes significance at the 1 per cent level.

* Denotes significance at the 10 per cent level.

III) in the rainy season and 0.869 (Model IV) in the dry season. As indicated by *t*-values in parentheses, most of the regression coefficients for conventional factors are statistically significant at the 1 per cent level.

Second, land appears to be the most important determinant of rice income in both seasons, with the magnitude of regression coefficient ranging from 0.794 to 0.887. This is followed by fertilizer, which ranged from 0.094 to 0.114. The elasticity of production with respect to the combined use of these two factors reaches about 1.0 in the rainy season and 0.9 in the dry season, suggesting that constant returns can be expected from the increased use of land and fertilizer.

Third, it is interesting to note that even though the regression coefficient for total labor input is not statistically significant, it has a negative sign attached in both seasons. The coefficient for family labor is significant in the rainy season, not in the dry season, and it also has a negative sign attached. The negative sign generally suggests that labor use was beyond the optimum level, which was probably caused by low work efficiency. The fact that the coefficient is significant only in the rainy season seems to relate to the difference in harvesting methods between both seasons, and the use of a hand-knife in the rainy season appeared to have significantly reduced labor efficiency.

Fourth, the regression coefficients for the two variables related to managerial ability are not significant. It seems that rice farming in the village was still at a stage where the use of land and material input per se largely determined the size of production, and managerial ability played only a small role.[11] As regards tenurial status, the regression coefficient is significant at the 10 per cent level in the dry season, but is insignificant and has a negative sign in the rainy season. This result points to an inconsistency in the role of tenurial status in rice production, which in turn may be interpreted as supporting my earlier argument that tenurial status did not necessarily correspond to the size of rice income in the village.

Based on the Model III in the rainy season and the Model IV in the dry season, the marginal product was also estimated for land and fertilizer: for land, 384 kg and 346 kg per rai; and for fertilizer, 0.371 kg and 0.245 kg per baht in the rainy and dry season respectively. Multiplied by the average rice price, the marginal value product of land would be 1,036 baht per rai in the rainy season and 934 baht in the dry season. These figures were significantly larger than the average rental under fixed-rent contracts at the 1 per cent level, suggesting that the increased use of land under tenancy would be economically rational.

However, a similar analysis of fertilizer use showed somewhat different results. The marginal value product of fertilizer was 1.002 baht in the rainy season and 0.662 baht in the dry season for each additional baht of fertilizer used. Thus, fertilizer use was at the optimum level in the rainy season but beyond it in the dry season (as the difference from the opportunity cost was significant at the 1 per cent level). This points to the problem of the variety planted. Heavy

[11] It is considered that when farming becomes more capital-intensive and requires a high level of decision-making, there is a significant contribution of managerial ability measured in terms of formal school education. For an empirical study of this point in Malaysia, see [2].

concentration on one traditional variety (Baton) in the dry season probably resulted, on an overall basis, in a smaller fertilizer-response than in the rainy season where many different varieties were planted. It seems that in order to further increase the contribution of fertilizer use, new varieties which are fertilizer-responsive and suitable to local conditions should be developed.

VI. CONCLUSIONS

This paper was an attempt to document the current state of land tenure and rice production in a double-cropping village in Phatthalung Province, Southern Thailand. Data were collected from a total of 111 farm households in 1985 and, because of the limited availability of information on the area, rather detailed discussion was presented on land ownership, tenancy forms, landlord-tenant relations, and rice technology in the village. The economic aspect of rice production was analyzed by the presentation of production costs, returns from rice farming, and the estimation of a production function.

The village was predominantly occupied by rice landowners, who mostly cultivated their own land. Some of them, however, rented out all or part of their holdings while others obtained additional land for cultivation. Tenancy in most cases appeared to be a rational means of reallocating land resources among the farmers in relation to the available family labor, but there were also indications of land concentration among a few villagers on the one hand and prevailing economic hardship on the other.

However, the study village was rather fortunate in that it had been served with sufficient water for rice double-cropping since 1972. It was interesting to note that rice double-cropping was introduced with the use of local varieties, which were still predominant not only in the rainy season but also dry season cropping at the time of study. Probably the continued use of local varieties was due to weather conditions in the area, which also largely determined the use of a hand-knife in harvesting. However, the adoption of new rice technology, represented by the use of modern varieties, chemical fertilizers, pesticides, power tillers, and mechanical threshers, has certainly been in progress especially after the establishment of double-cropping in the village. The resulting yield appeared to be relatively high in the regional context, but still much lower than Central Thailand. There seem to be various conditions necessary for an increase in yield in the village, the most urgent one being the development of a high-yielding variety suitable to local conditions.

The cost-and-return analysis revealed that the average rice farmer obtained a level of net income above the poverty line. This was largely due to the relatively large farm size, and an area of 10 rai was considered to be the border line between the poor and not-poor under the prevailing technology and price relations, assuming no other sources of income. Tenurial status was not directly related to the size of rice income, because of the predominant land ownership in the village. For small farmers, however, it is necessary to further raise the yield level and reduce the cost in order to increase their net income.

According to the production function analysis, land was the most important factor in the determination of rice income. Obviously, larger farm size would be desirable, but this would require the enhancement of labor-saving technological innovation, which in turn would reduce wage opportunities for seasonal workers from more disadvantaged areas of the province. Furthermore, under the given land area, the enlargement of small farms would be possible only if some of the farmers could be absorbed into other sectors. Under the given conditions in the area, the first step for improvement therefore seems to be a marked increase in yield levels.

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