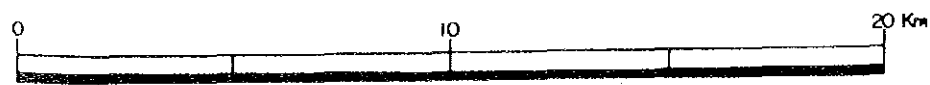


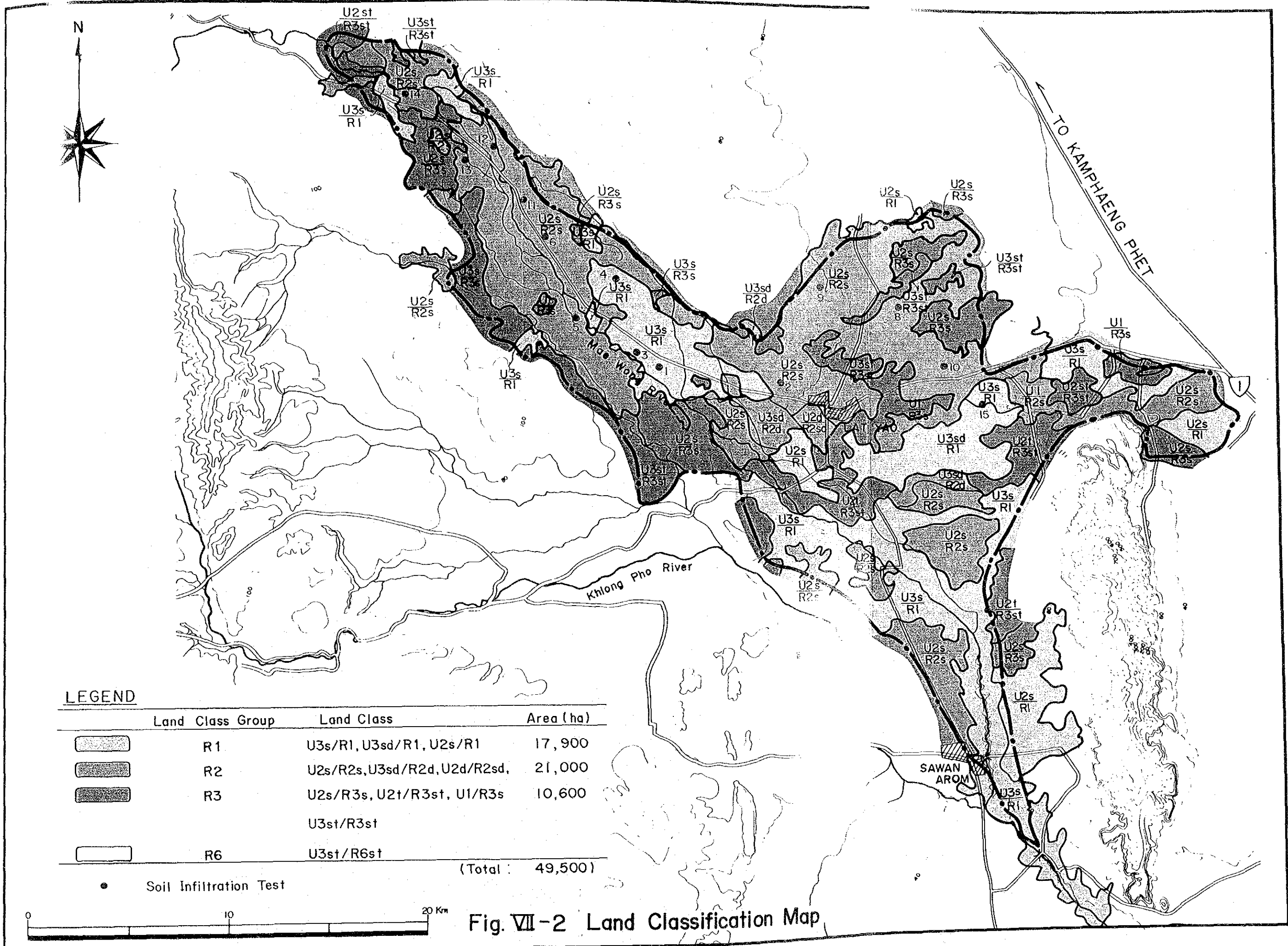
**LEGEND**

Great Soil Group	Soil Series (Symbols)	Area (ha)
Non Calcic Brown Soils	Kp, Np, Pb, Ks, Ms	27,100
Low Humic Gley Soils	Db, Pth, Re	18,300
Regosols	Kt	500
Gray Podzolic Soils	Ub	200
Reddish Brown Lateritic Soils	Ch, Ng	3,400
<b>Total</b>		<b>49,500</b>




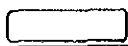
● Soil Physico-Chemical Analysis



**Fig. VII-1 Soil Map**



**LEGEND**

Land Class Group	Land Class	Area (ha)
	R1 U3s/R1, U3sd/R1, U2s/R1	17,900
	R2 U2s/R2s, U3sd/R2d, U2d/R2sd,	21,000
	R3 U2s/R3s, U21/R3st, U1/R3s	10,600
	R6 U3st/R6st	

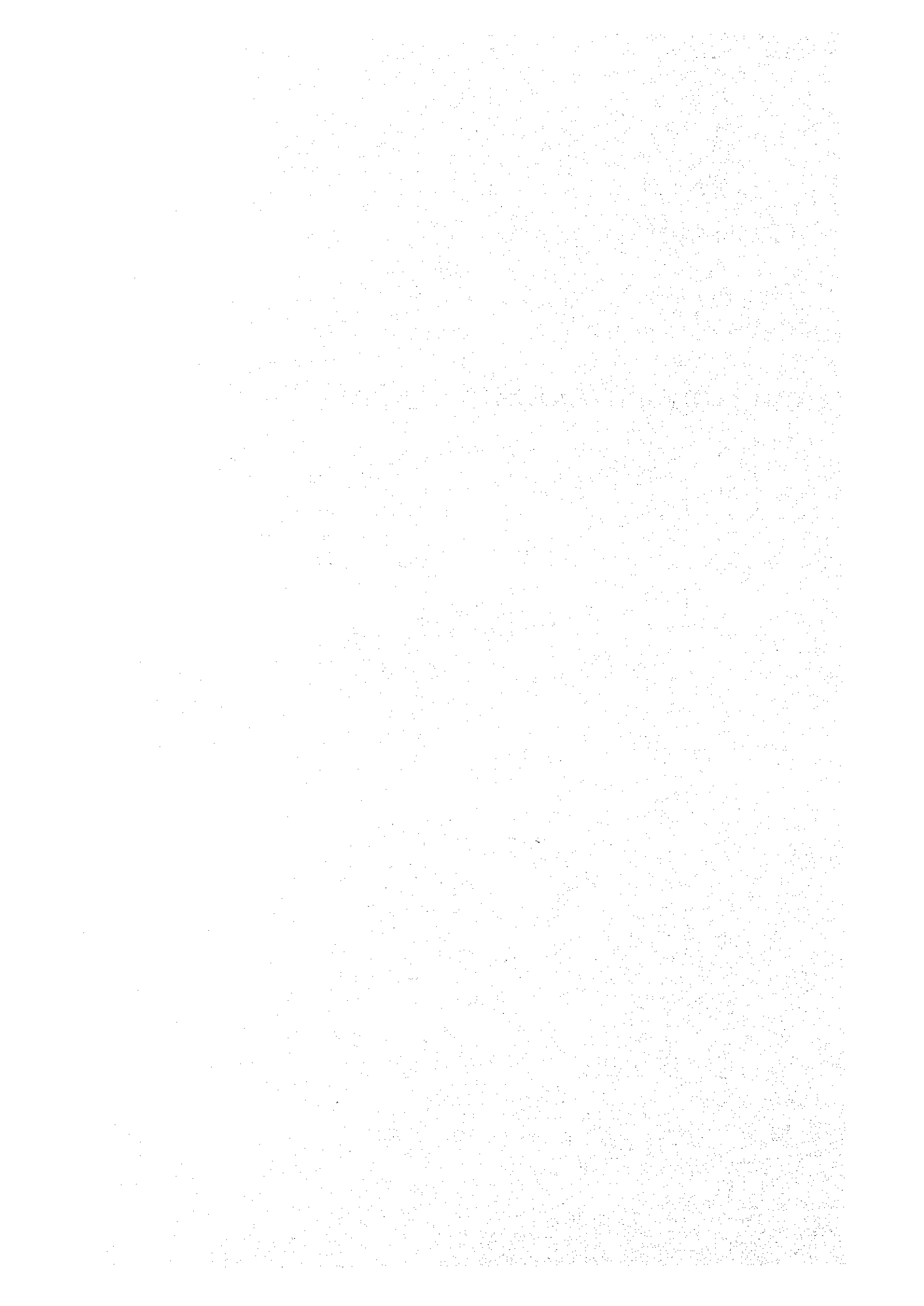
(Total : 49,500)

• Soil Infiltration Test

**Fig. VII-2 Land Classification Map**



**ANNEX—VIII**  
**AGRICULTURE AND AGRICULTURAL ECONOMY**



ANNEX - VIII

AGRICULTURE AND AGRICULTURAL ECONOMY

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## ANNEX - VIII

## AGRICULTURE AND AGRICULTURAL ECONOMY

## 1. PRESENT CONDITION OF AGRICULTURE

## 1.1 Demography

The Mae Wong irrigation area is administratively located within the jurisdictions of three provinces, i.e., Nakhon Sawan, Uthai Thani and Kamphaeng Phet. About 90% of the Mae Wong irrigation project area is covered by Nakhon Sawan province. The number of districts, sub-districts and villages concerned within the project area is as shown in the following table.

	Nakhon Sawan Province	Uthai Thani Province	Kamphaeng Phet Province	Total
District	2	1	1	4
Sub-district	14	3	2	19
Village	90	6	3	99

As seen in the following table (for details, see Table VIII-1), the total population of the project area is estimated at about 74,500 persons in 1985. The average annual growth rate is estimated at about 2.4% from 1970 to 1980. Total number of household is estimated at about 13,500, out of which farm households account for 10,200 or 76% of the total households.

	Population	Household	Farm Household
Nakhon Sawan province			
District			
Nakhon Sawan	2,792	494	414
Lat Yao	67,350	12,160	8,977
Uthai Thani province			
District			
Swan Arom	2,688	489	481
Kamphaeng Phet province			
District			
Kanuwaralaksabri	1,665	319	295
Total	74,492	13,462	10,167

The average population density in the project area is 150 persons per km<sup>2</sup>. Average size of farm household is 5.5 persons. Farm labor force is about 3 persons per household on an average.

### 1.2 Land Tenure and Land Holding

The situation of land tenure and land holding in the Mae Wong irrigation area is estimated based on Agricultural Census in 1978. The percentage of owner farmer, partial tenant and tenant (rented) are 77%, 7% and 16% of the total farm households, respectively. The land holding by farm size in the project area is as follow (for details, see Tables VIII-2 and VIII-3). Average size of farm is 28.7 rai (4.6 ha).

Land Holding Size (rai)	Number of Farm Household	% of Farm Household	Area of Holding (ha)	% of Area
Less than 6	40	0.4	-	-
2.1 to 10	1,028	10.1	608	1.3
10.1 to 20	1,586	15.6	2,521	5.4
20.1 to 30	1,932	19.0	5,371	11.5
30.1 to 50	2,766	27.2	12,282	26.3
50.1 to 80	1,474	14.5	9,901	21.2
More than 80	1,338	13.2	16,071	34.3
<b>Total</b>	<b>10,165</b>	<b>100.0</b>	<b>46,700</b>	<b>100.0</b>

### 1.3 Present Land Use

The total area of the Mae Wong river basin is about 1.36 million rai (2,171 km<sup>2</sup>), of which permanent agricultural land holdings account for 0.44 million rai (710 km<sup>2</sup>) or about 33% of the total area. The rest of 0.92 million rai (1,461 km<sup>2</sup>) comprises mountains, steep slopes, forest reserve, river and swamps, roads and public compounds. The major types of agricultural land use are paddy, upland crops, orchard, forest and pasture. The pattern of land utilization closely relates with land form patterns and soil-type distribution. Paddy field is mostly confined to semi-recent alluvial plain of the Mae Wong river and low terraces. Upland crops field mainly extends on the high terraces, while orchard and pasture sporadically exist within the upland crop area. The present agricultural land use of the Mae Wong river basin is as follows:

(Unit: km <sup>2</sup> )				
Agricultural Land			Non-	Total
Paddy	Upland	Orchard & Others	agricultural Land	
520	170	20	1,461	2,171
(24.0%)	(7.8%)	(0.9%)	(67.3%)	(100.0%)

Source: 1978 Agricultural Census

The prospective irrigation area envisaged under the Project has been delineated within semi-recent alluvium and low terraces where major land use is paddy field. The gross delineated area is about 309,400 rai (49,500 ha). The present land use of the area is as follows:

(Unit: rai)				
Paddy Field	Upland Field	Scrub & Forest	Villages & Others	Total
278,800 (44,600 ha)	13,100 (2,100 ha)	4,400 (700 ha)	13,100 (2,100 ha)	309,400 (49,500 ha)

Source: RID land use survey, 1985

The irrigation area will be selected within the above area, excluding scrub/forest and villages compounds. The maximum potential area for irrigation development will therefore be 291,900 rai (46,700 ha).

Irrigation facilities are well developed in this area. About 230,000 rai (36,800 ha) or 83% of the existing paddy fields, are more or less presently provided with irrigation facilities, while all of the upland crop fields are rainfed. In this area, existence of irrigation facilities does not mean continuous year-round irrigation, but supplement water supplies for rainy season paddy cultivation. Even though irrigation facilities are provided, all these paddy fields are not always actually irrigated due to limited availability of water. In general, paddy fields extending along upstreams of major rivers, are rather sufficiently irrigated, while the ones along the downstream are less irrigated or not actually irrigated and are likely subject to annual drought damages.

Difficulties are involved in estimating the extent of well irrigated paddy field, because the area well-irrigated largely fluctuates year by year depending upon seasonal water availability. Water balance study on existing condition indicates that about 60% of the total paddy fields with irrigation facilities, or about 137,500 rai (22,000 ha) of the paddy fields are irrigated in the rainy season under normal condition with 80% probability rainfall. Field observations confirm that the study result reflects well the actual irrigated condition in the area; i.e. The potential irrigation area under the project is classified:

Land Use	Area		
	rai	ha	%
<b>Paddy Field with Irrigation Facilities</b>			
(1) irrigated (partly double cropping)	137,500	22,000	47.1
(2) semi-irrigated (mostly single cropping)	92,500	14,800	31.7
Sub-total	230,000	36,800	78.8
Rainfed Paddy Field	48,800	7,800	16.7
Rainfed Upland	13,100	2,100	4.5
<b>Total</b>	<b>291,900</b>	<b>46,700</b>	<b>100.0</b>

As seen from the above, only 47% of the area is actually irrigated; others are put under rainfed condition or are not fully guaranteed a continuous water supplies during the entire growth period even if irrigation facilities are provided.

The present land use map is shown on Fig. VIII-1.

#### 1.4 Present Cropping Pattern

The representative cropping pattern on each of land use categories is shown on Fig. VIII-2.

The irrigated paddy field where some double cropping is carried out, mainly extends along the upstream of the Mae Wong river. In these areas, paddy is planted from mid-June and harvested in November - December. Local varieties of paddy like Luang Pra Tarn and Kao Dawk Mali are planted on about 60% of the area; the rest is planted with high yielding varieties (H.Y.V.) like RD 7 and RD 21. Dry season cropping usually starts immediately after harvesting of rainy season paddy. The extent of dry season cropping is around 20% of the area. Major crops in the dry season are mung beans (15%) and paddy (5%).

The mung beans are usually planted immediately after harvest of paddy, using the soil moisture remained in the paddy fields. In most cases, mung beans are grown under rainfed condition due to lack of irrigation water.

The paddy field where irrigated single paddy cropping is almost practiced with partial supply of irrigation water, is observed on the downstream areas of each existing irrigation block. In these area, only rainy season paddy is cultivated on almost 100% of the paddy field. Local varieties are predominantly used for about 75% of the area. Paddy is usually planted from early July and harvested in December - January. Rainfed paddy fields extend over the downstream areas. Only rainy season paddy cropping is practiced in these areas. Planted area, however, largely fluctuates year by year; only about 50% of the area is planted in drought years and almost 100% in rainy years (however, harvested area is usually smaller than the planted area due to drought damages in drought years and flood damages in rainy years). Average planted/harvested area is estimated at about 75% of the paddy field.

Upland crop area extends mainly on middle and high terraces. In the rainy season, maize is the major crop. In some parts, sorghum is also planted, together with maize. Second season cropping is common. About 40% of the upland crop fields are utilized for second cropping, depending on the rainfall in September/October. Major second crop is mung beans.

## 1.5 Present Farming Practices

The farming practices in the Mae Wong river basin are still of conventional.

Land preparation: A combination of tractor power (8 ps class two wheel hand tractor) and animal draft is used; in interview with extension workers, it appeared that about 90% of paddy field are cultivated by hand tractors and 10% by buffaloes. This greater dependence on tractor power may be attributed to the large farm size and the fact that only short period is generally available for land preparation due to uncertain water supplies in the rainy season. Before land preparation, previous season's paddy stubble is burned in the dry months of March-April, and the field is ploughed using light showers of rain, or taking the irrigation water into the field where water is available, to moisten the soil, in May-June. A second harrowing is common. According to the RID socio-economic survey, about 52% of farmers own their tractors and lend them to the neighbours at the cost of 120-150 Baht per rai. Second harrowing is usually carried out with standing water in the field, mainly in June.

Nursery/Transplanting: Nursery establishment is made in June-July and transplanting of 3-4 week old seedlings is in July-August. In the Mae Wong river basin, the transplanted rice is predominant. Most of the rice grown in the area is non-glutinous. In nursery, seed requirement is large, ranging from 55 kg to 70 kg per ha. This may be resulted from low germination rate and high number (more than 5) of seedlings to be transplanted. Transplanting is usually made by manual labour. Farmers exchange the labour among the neighbours for transplanting.

Crop management: This comprises weed control, fertilizer application, control of plant pests and diseases and distribution of irrigation water. Weed control is generally made by hand. Investment for weeding is however, generally low and present condition of weed control is unsatisfactory. Use of fertilizers is generally limited. The local varieties do not receive any fertilizers, but HYVs do receive an application of some fertilizers. The RID socio-economic survey shows that the farmers use about 30 kg of fertilizer per ha on an average. Types of fertilizer used are Ammonium Sulphate and Ammophos (16-20-0). Chemical control of pest and diseases is not common. The farmers spend only  $\text{฿}15/\text{ha}$  for insecticide on an average. There is no farmer's institutions responsible for collective irrigation water distribution. Farmers take water at discretion from rivers/canals as they require if water is available. No rotational irrigation schedule is applied. Two wheel small tractors are fully used as power source for pumping water from river/canal and tube wells. About 30% of the farmers in the irrigated area have water pumps of their own.

Harvesting: The rainy season paddy is harvested in the dry months of November/December. Harvesting is carried out manually with sickle knives; the sheaves are left in the field for a period of drying and thereafter boulded and removed to the threshing floor. Threshing is usually made by tractor or under the feet of buffaloes. Winnowing is effected manually. Threshing/Winnowing is rather leisurely operation carried out over a 2-3 month period. The rice is thereafter bagged and transported, either for storage or for sale.

## 1.6 Agricultural Production

### 1.6.1 Crop yield and production

Paddy yield largely fluctuates year by year. Reasons are manifold. Decisive factor is, however, unstable water supply resulting from uneven seasonal distribution of rainfall as well as irregular total depth of annual rainfall which causes drought and flood repeatedly.

Crop production in the prospective irrigation area of 46,700 ha is roughly estimated, by multiplying the estimated crop areas and unit yield data given by the Agricultural Extension Office at Lat Yao, as follows:

Crops	Cultivated Area		Unit Yield		Production (ton)
	rai	ha	kg/rai	ton/ha	
Wet season paddy					
- irrigated	137,500	22,000	450	2.8	61,600
- semi-irrigated	92,500	14,800	250	1.6	23,100
- rainfed	48,800	7,800	200	1.3	9,800
Dry season paddy	6,900	1,100	560	3.5	3,900
Mung beans (paddy)	20,600	3,300	100	0.6	2,000
Mung beans (Upland)	5,000	800	80	0.5	400
Maize (Upland)	13,100	2,100	350	2.2	4,600

### 1.6.2 Livestock

Various kinds of livestock; i.e., buffaloes, cattle, swine, goat, chicken and duck, are raised individually in the Mae Wong river basin. Buffaloes still play an important role in land preparation. Others are not economically significant in present farm economy.

The RID socio-economic survey shows that livestock income accounts for only 5% of the total farm income.

## 1.7 Crop Marketing and Processing

### 1.7.1 General

In respect of the crop production and the marketing policy for agricultural produces in Thailand, crops are classified into following three groups:

- Those which are subject to government control; rice and sugarcane
- Those which are primarily produced to meet domestic demand, with some export, under negligible government control; mung beans, soy beans, groundnuts and cotton

- Those which are almost exclusively oriented to exports; cassava, maize and rubber

Fundamentally, the marketing policy for agricultural produces in Thailand is characterized as a free trade. Rice, however, is put under government control which is not direct and compulsory nature at present as described in following section.

### 1.7.2 Rice marketing policy

The Government adopted several measures to strengthen the domestic market and to promote rice exports. The principal policy measures are summarized as follows:

#### Market intervention measures

##### (1) Minimum paddy price scheme

The Minimum Price Guarantee Scheme was designed to reduce fluctuation in paddy price and to prevent them from falling too low, through direct government intervention in market. This scheme was, however, suspended for the entire 1983/84 marketing year although target prices were set out. The substitute for this scheme, the Minimum Paddy Price Scheme was approved for implementation in 1985. Under the new scheme, loans totalling some 1,500 million Baht are made available jointly by the Government and financial institutions at an interest rate of 5.75% per annum to private millers to buy paddy from farmers at new minimum paddy price.

##### (2) Institutional organizations for direct paddy procurement

The Marketing Organization of Farmers (MOF) under the MOAC was responsible for procuring paddy at target prices until October 1983, when its activities were suspended. However, since its establishment in 1974, MOF procurement had been small. In October 1983, MOF ceased buying paddy, and its target price paddy procurement programme was suspended up to the end of 1984. While plans exist for it to buy paddy in 1985 from farmers to whom it sells fertilizers, as of mid-February no purchase had been made.

The Public Warehouse Organization (PWO), which had been established in 1955 under the Ministry of Commerce with the objective of ensuring that the population would be able to buy sufficient rice at reasonable prices, had its role expanded in 1981 to give additional support to producer prices. Its new responsibilities also included building a buffer stock. It did not buy paddy directly from farmers; instead, it purchased rice from private millers with a view to supporting the prices of milled rice and hence of paddy during the period of harvest. However, due to budget constraints, the PWO ceased purchasing rice under the buffer stock programme.



### Export policy measures

The objective of Thailand's rice export policy is to be maximize its exports of rice, while maintaining adequate domestic supplies at acceptable price level. To achieve this objective, the Government has applied different forms measures to rice exporters. As of 1985, the following measures are in force:

- (1) Export duty of 2.5% advalorem duty, which is collected by the Ministry of Commerce,
- (2) Export premium, which is collected by the Ministry of Commerce and which is channelled directly into the Farmer's Aid Fund for a wide variety of farm support measures including fertilizer subsidies and irrigation. The premium on 100% white rice is now 200 Baht per ton,
- (3) Minimum stocking requirements, the minimum amounts that exporters are required to stock to 2,000 tons of milled rice during the first four months of the year and 1,000 tons during the rest of the year, which is introduced in early 1984 and is aimed at supporting farm prices by increasing demand for rice, especially during the harvest season of the main crop,
- (4) New Export Quota Scheme, which was introduced in 1985. Under this scheme, private exporters are allocated monthly quotas. The objectives of this scheme are to encourage exporters to carry larger stock in the hope that the increased demand will lead to better farm price and to strengthen export prices through the establishment of a monthly quota, and
- (5) Export licensing, which limited the rice export trade to established exporters, was lifted in 1983 and new exporters were allowed to participate. As a result, the number of rice exporters increased sharply from 84 to 147.

### 1.7.3 Crop marketing

#### (1) Agricultural marketing system

The marketing policy in Thailand is, in principle, of free trade. Furthermore, agricultural institutional organization such as agricultural cooperative has not been well worked mainly due to constraints of their capital, facilities such as storage, staff and so on. Private agents, therefore, has had a very important role in the Thailand's agricultural marketing system. The market for agricultural produces may be divided into three types; local, provincial and terminal (Bangkok) markets.

Local marketing system: Most merchant's business at the village or district level are normally of a private single management. Business premises include merchant's house in the village or shophouse located in the district market place or near the village. Nearly all of these merchants have been in business for long years and are well known among farmers and provincial merchants. These village/district merchants not only buy agricultural product from farmers but also sell seed, farm

implements and fertilizer in addition to daily necessities in cash or on credit. They are also important suppliers of farm credit.

At the village level, the purchase of agricultural product is carried out either at the farm gate or by farmers bring their produce to sell at merchant's business premises. Pricing is based on Bangkok prices or provincial market prices.

Provincial marketing system: Provincial level merchants act as middlemen, buying agricultural produce from local markets and selling it to market in Bangkok. Very often, farmers dealing with local or district merchants may sell their produces to merchant from adjacent provinces.

Provincial merchants normally buy all types of produces grown in the region. They deal in much larger quantities than the local merchants. Most of them have been in business for more than 10 years. Beside being in business in agricultural produce trading, some merchants are also engaged in other trading such as supplying farm inputs both in cash and on credit. One of the main functions they perform is that of grading the produces. Most of the traders in this market are partnerships or limited partnerships enterprises and have some sort of a permanent working relationship, though in varying forms, with terminal traders.

The Bangkok market: Bangkok is the final destination of most agricultural produce. It serves the export as well as the reshipping markets to the local and the provincial markets. Furthermore, it is, by far, the largest consumer market in the country. The Bangkok market, therefore, has a function to establish the prices for all agricultural produces in the country.

Important buyers of agricultural commodities in Bangkok are the exporters and yong (Chinese term for broker or middleman), who act as middleman in buying agricultural produces for export. However, the role of yong as middleman for exporters has recently been declining significantly, due to the improved communication and transportation net work between Bangkok and provinces. This, combined with improved banking facilities, has enabled exporters and provincial merchants to deal directly and more conveniently with each other. According to the results of survey conducted by a research team from Chiangmai University in association with the Chulalongkorn University Social Research Institute in 1983, the declining role of the yong is clearly evident from the smaller marketing margin received by them, with in the past it was estimated that yong enjoyed as high as a 3% to 5% marketing margin for each transaction, but they now receive only 0.5% to 1.0% of the total commodity value.

## (2) Marketing situation in the project area

In the project area, most villages are accessible by road. Local merchants can visit almost all villages by truck. The market is therefore quite competitive, with a smaller range of price variation. The pricing of a particular agricultural produce is generally based on its Bangkok price, taking away of transportation costs plus a profit margin. Therefore, it can be said that marketing conditions are quite flexible regarding the sale of farmer's produce, provided that a farmer has not any economic and social conditions.

According to the socio-economic survey conducted by the Economic Branch of RID in 1985, the percentage of crop production sold to local merchants (including rice millers) in the project area are estimated as follows:

	Percentage of Crop Production Sold	Average Price (Baht/kg)
Wet season		
Paddy	72.6	2.80
Maize	99.9	2.09
Mung beans	99.4	7.12
Dry season		
Mung beans	97.1	7.63

The farmer usually sell his paddy at his home or field. The value of paddy depends on its grain quality which is in turn chiefly a matter of variety and cultivation method. Grading of paddy is normally undertaken by hand milling of a few sample grains and quality is judged by eye.

#### 1.7.4 Current price of major crops

Farm price of major crops produced in the project area are as follows:

		(Unit: Baht/ton)	
		1982	1983
Rice	- 100% white rice	3,388	2,952
	- 5% broken	2,957	2,868
Mung beans	- Best grade	7,760	8,520
	- Ordinary grade	6,950	7,310
Maize		2,120	2,660

Note : Farm price in Nakhon Sawan province

Source: Office of Agricultural Economic, MOAD

Farm price of rice and maize are recently rather stagnant with declining from the last peak in 1980 as shown in Fig. VIII-3. This well reflects the result of reduced demand throughout the world, including the reduced demand for feed grain by the livestock industry and the large harvest world-wide. On the other hand, trend of mung bean's farm price is gradually increasing with considerable fluctuation.

Seasonal fluctuation in farm price is relatively high. Particularly for rice as shown in Fig. VIII-4, farmers are often compelled to sell their produce to the merchants or rice millers immediately after harvesting (November in wet season's paddy and May in dry season's paddy), resulting in comparatively low selling price.

#### 1.7.5 Processing

Number and capacity of rice mills in the Mae Wong project area are shown in Table VIII-4. The total number of rice mills amounts to 130. The milling capacity is estimated at about 1,230 tons per day and this is considered to be sufficient for the present output and to have a plenty of reserve capacity for the incremental paddy in future. Furthermore, paddy is not necessarily milled in the area where it is grown. Farmers may transport it to other mills outside the project area, seeking the best price.

Village mills which have a capacity of less than 1 ton per day are used throughout the year on demand of farmers who come to mill for their home consumption. On the other hand, middle- and large-capacity's mills have in general, two functions; one is a miller, and another a middleman for paddy. Particularly, it is worth noticing that, under the Minimum Paddy Price Scheme introduced in 1985, loans totalling about 1,500 million Baht are made available jointly by the government and financial institutions at an interest rate of 5.75% to private millers to buy paddy from farmers at new minimum price. The millers may sell some of their rice locally, but much of their rice will go to the Bangkok wholesale or export market.

### 1.8 Farmer's Economy

#### 1.8.1 Socio-economic survey

In order to grasp economic activities of farmers in the Mae Wong project area, the Socio-economic Survey was conducted for one hundred eighty (180) farmers. The method of the Socio-economic Survey is shown belows:

##### Method of Socio-economic Survey

##### (1) The survey

The survey was carried out during June-July 1985 (about 40 days) by a team of 5 enumerators and 1 supervisor from the Economic Branch of RID. The survey items are; i) household composition, ii) farm inventory,

iii) land characteristics, iv) input and output per crop, v) livestock, vi) off farm hired labor income, vii) non-agricultural income, viii) consumption expenditure and ix) marketing.

## (2) Sampling design

A two stages sampling method was employed for the sample selection. First stage, a total 111 villages in and around the project area were listed out. 22 villages of total villages were randomly selected as the sample village unit.

Second stage, the sample households were randomly selected from the sample village unit. The total selected sample household was 180 households accounted for approximately 2% of the total project household.

## (3) Data processing

The processing of all data obtained through this survey was done by computer using the FARMUP PACKAGE PROGRAM. All works have been carried out by the economists of the Economic Branch which were trained in the FARMUP PACKAGE PROGRAM under the co-ordination of the experts of FAO and AIT.

## Results of Socio-economic Survey

The results of Socio-economic Survey are compiled by way of the form of Table. Detailed table of contents of the survey are as follows and they are attached in the end of this ANNEX for reference (Table VIII-17 to -32).

- Household structure of farms by group averages
- Education completed by frequency of household members
- Farm inventory by area
- Land characteristics, price and value
- Quantity and value of crops sold
- Input price for main crops in 1984/85
- Cash income and expenditure per farm by operation
- Gross margins for rice, mung beans and maize
- Production inputs use for rice, mung beans and maize
- Labor requirements by crop and operation

## (1) Crop farming budgets

### Yields

The Socio-economic Survey provides data on the present yields. There are significant yield variations according to farm size class and fields conditions.

The results are summarized as follows:

(Unit: kg/rai)

Farm Size:	Irrigated Area			Non-irrigated Area		
	S	M	L	S	M	L
<b>Yield</b>						
- Paddy (wet season)	480	380	380	330	300	270
- Mung beans (dry season)	90	50	50	-	-	-
- Maize (wet season)	-	-	-	-	380	340

#### Farm inputs

The present use of farm inputs such as seeds, fertilizer are also determined by the Socio-economic Survey. The survey showed that apart from hired labor input, there are a considerable drop in using farm inputs as farm size grow larger. As a result, small farmers usually obtain higher yield than others. Furthermore, it can be said that more intensive crop farming are operated in irrigated area as compare with those in non-irrigated area. A summary of the input use excluding farm family labor cost, expressed in monetary values, is given in following table:

(Unit: Baht/rai)

Farm Size:	Irrigated Area			Non-irrigated Area		
	S	M	L	S	M	L
Paddy (wet season)	338	273	279	281	227	197
- Seed	21	16	11	18	17	15
- Fertilizer	27	27	11	25	19	19
- Agro-chemical	5	3	2	7	2	2
- Hired-labor	144	130	161	71	90	98
- Other	141	97	94	160	99	63
Mung beans (dry season)	88	53	52	-	-	-
Maize (wet season)	-	-	-	-	379	339

#### Farm gate price

Farm gate prices using in this analysis are as follows:

Paddy : 2.8 Baht/kg  
 Mung beans: 7.6 Baht/kg  
 Maize : 2.1 Baht/kg

Source: 1985 Socio-economic survey RID

#### (2) Income from other activities

Both income from livestock and non-farm income are included into the farm budgets without any modification on the results of Socio-economic Survey to give a complete picture of the income stream at present.

(3) Consumption expenses

As for the consumption expenditure, the data provided by the survey are fully used without any modifications. Careful attention, however, must be paid the fact that a figures are considered to be rather conservative. The survey shows that average annual consumption expenditure per farm family in the project area is only 14,257 Baht. On the other hand, the 1979/80 Socio-economic Survey conducted by the National Statistical Office, Office of the Prime Minister shows that average annual expenditure per household at village level in the Northeastern Region is 24,012 Baht. Furthermore, attention must be also paid the fact that the farm expenses shown in below table doesn't include farm family labor cost, if such cost put into the farm expenses by calculating in terms of the same monetary value as hired labor cost, then the balance will be more worse figures.

The results of analysis are summarized as follows (for details, see Table VIII-5):

	(Unit: Baht)					
	Irrigated Area			Non-irrigated Area		
	S	M	L	S	M	L
<u>Planted area</u>						
- Paddy* (ha)	1.2	4.5	12.0	1.2	3.5	9.5
- Mung beans (ha)	-	0.4	1.0	-	-	-
- Maize (ha)	-	-	-	-	1.0	2.5
<u>Net Cash Income (A)</u>	<u>20.2</u>	<u>40.0</u>	<u>95.4</u>	<u>12.1</u>	<u>29.2</u>	<u>63.3</u>
	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)
Farm income	12.4	32.4	86.8	7.0	24.2	56.4
	(61.4)	(81.0)	(91.1)	(57.8)	(82.9)	(89.1)
- Paddy	10.1	30.0	79.8	6.9	18.4	44.9
	(50.0)	(75.0)	(83.6)	(57.0)	(63.0)	(70.9)
- Others	2.3	2.4	7.0	0.1	5.8	11.5
	(11.4)	(6.0)	(7.3)	(0.8)	(19.9)	(18.2)
Others	7.8	7.6	6.6	5.1	5.0	6.9
	(38.6)	(19.0)	(8.9)	(42.2)	(17.1)	(10.9)
<u>Expenditure (B)</u>	<u>16.1</u>	<u>22.3</u>	<u>41.0</u>	<u>13.7</u>	<u>19.5</u>	<u>34.3</u>
- Farm expenses**	2.7	7.8	41.0	13.7	19.5	34.3
- Living expenses	13.4	14.5	19.7	11.6	12.2	17.3
<u>Balance (A - B)</u>	<u>4.1</u>	<u>17.7</u>	<u>54.4</u>	<u>-1.6</u>	<u>9.7</u>	<u>29.0</u>

Note: \*: Paddy fields is used for double cropping such as paddy and upland crops after harvesting of paddy.

\*\* : Excluding farm family labor cost

Through the analysis of farmer's economy, the characteristics of the farmer's economy in the Mae Wong project area are summarized as follows:

- 1) About 60% to 90% of net income is derived from farm income and remaining 10% to 40% consists of off/non-farm income.
- 2) Off/non-farm income play an important role for the small farmer's economy.
- 3) Most of farm income is derived from paddy production in irrigated area, but in non-irrigated area, upland crop production increase its weight in farmer's economy.
- 4) Source of livestock raising is very small, particularly in non-irrigated area.
- 5) The farmers operating their farming in the non-irrigated area obtain only about 50% to 75% as less income compared to those in irrigated area.
- 6) A rising farm income with increasing farm size, but small farmers, by using more farm inputs per hectare in their farming system, succeed in obtaining a higher income per hectare.
- 7) Production cost of paddy occupies about 30% of total farm paddy income. A half of production cost is comprised of hired labor and hired machine cost.

## 2. AGRICULTURAL DEVELOPMENT PLAN

### 2.1 Assessment of Land Resources

In the Mae Wong river basin, the water resources are limited; on the contrary, the land resources seem to be unlimitedly available, if soil and topographic conditions are disregarded. For selection of the land for irrigation development, the following concepts were considered:

- 1) The existing irrigation areas of 230,000 rai (36,800 ha) should be benefited with first priority. These should be the minimum area of the land for irrigation development.
- 2) If the available water would still remain after supplying sufficient water to the existing irrigation areas, the rainfed areas that would be irrigable within economically reasonable range, should be developed to the maximum extent.

The potential maximum area for irrigation development which has been delineated, comprises the existing irrigation areas and the following three (3) potential irrigable areas:

- 1) 35,000 rai (5,600 ha) on the right bank in the upstream reach of the Mae Wong river,



- 2) 20,000 rai (3,200 ha) on the right bank in the middle reach of the Mae Wong river, and
- 3) 6,900 rai (1,100 ha) on the left bank in the downstream reach of the Mae Wong river.

The potential areas were delineated carefully with special attention to topographic condition, present land use and land capability for irrigation. The selected potential areas are all irrigable by gravity and are endowed with productive soils suitable for irrigated paddy cultivation. Most of the potential areas are presently put under cultivation, particularly of rainfed rice.

The potential maximum area for irrigation development is thus estimated at 291,900 rai (46,700 ha), as shown below:

(Unit: rai)		
Existing Irrigation Area	Rainfed Area	Total
230,000 (36,800 ha)	61,900 (9,900 ha)	291,900 (46,700 ha)

The lands outside the delineated potential maximum area are generally not irrigable due to their undulating topographic features coupled with poor soil conditions.

## 2.2 Change in Land Use

The present land use in the potential maximum area will be changed as follows:

(Unit: ha)		
Land Use Categories	Without Project	With Project
Paddy field		
- irrigated	22,000	46,700
- semi-irrigated	14,800	-
- rainfed	7,800	-
Sub-total	44,600	46,700
Upland (rainfed)	2,100	-
Total	46,700	46,700

Paddy cultivation is a mainstay in the area and its importance in rural economy will increase continuously. Drastic change in land use will not be occurred under such condition. All the paddy fields will be provided with the irrigation facilities through realization of the Project. The potential maximum area includes about 13,100 rai (2,100 ha) of upland where, if irrigation water is provided, paddy cultivation will become possible. These upland areas are to be reclaimed into new paddy fields.

### 2.3 Proposed Cropping Pattern

Paddy and mung beans are selected as main crops in future framework of cropping pattern. Paddy will be cultivated in the wet season and mung beans will be grown after harvest of wet season paddy in the dry season.

Paddy is Thailand's most important crop. It is the main staple for domestic consumption and is also the major source of foreign exchange earning. The country produces about 14 to 19 million tons of rice annually. About three-fourth of production is consumed domestically and the rest is exported.

In January 1985, the Government of Thailand announced that in anticipation of over-production problems for rice, the Government would change its policy for dry season paddy and seek the possibility of a reduction in local paddy production by encouraging rice farmer to grow other cash crops in the dry season yielding parallel income. The Government accorded its priority to sorghum and mung beans as substitute crops. For wet season paddy, in due consideration of its importance and present unstable production largely affected by the weather, the Government would make every possible efforts to stabilize the production.

Mung beans is one of the prospective crop since its demand in the world market is high. Thailand is one of the major producers and exporters of mung beans. The country produces about 10% of the world output and export a value of over one (1) billion Bahts annually (about 133,000 tons). In the Mae Wong area, mung beans is main crop in the dry season, being planted with the area of 25,600 rai (4,100 ha) per annum. The farmers have long experience for mung beans cultivation and local marketing channels for this crop have already been well networked. Moreover, mung beans is one of the ideal crop in crop rotation and soil amendment due to leguminous crops.

The proposed cropping pattern is shown in Fig. VIII-5. Two kinds of paddy varieties will be introduced; i.e., (1) high yielding RD varieties (H.Y.V.) and (2) improved local varieties. High yielding varieties will be cultivated mainly for export and improved local varieties will mainly be for home consumption.

### 2.4 Proposed Farming Practices

After the Mae Wong irrigation project is realized, the existing paddy fields will be fully irrigated and improved farming practice will be gradually introduced to the project area. The recommendable farming practices will be those developed by the Chainat Rice Experimental Station and the Field Crop Research Institute.

Standard cultivation method of paddy (HYV) is shown in Table VIII-26, and is summarized as follows:

The amount of seed needed is about 35 kg per hectare. Prior to the seeding, the seed should be selected by a solution of 1.13 specific gravity, and further be treated by using agro-chemicals to control the diseases.

Land preparation for transplanting will be started about a half month before the transplanting in general. The recommended number of seedling per hill is 3 to 4, and the optimum planting density is about 20 hills per m<sup>2</sup>.

With regard to the basal fertilizer application for paddy, it is better to apply fertilizers of about 120 kg of compound fertilizer per hectare at the time of about 5 days before transplanting. Top dressing with fertilizer will be carried out 2 to 3 times.

Insect and disease control has to be carried out at the proper time without delay. Recommendable agro-chemical are Sumithion, Diazinon, etc. for insect control and Kasumin, Kitazin, etc. for disease control.

Weed control in the paddy field is to be carried out about 2 or 3 times according to the condition of the weed growth. The proposed practice for weeding is to use the rotary weeder.

Proper water management is very essential on paddy cultivation. There are critical periods in the life of the paddy plant against the lack of water, i.e. just after sowing or transplanting time, panicle initiation stage, reduction division stage, flowering stage, etc.

The standard cultivation method of mung beans is shown in Table VIII-27. Modern cultivation techniques such as introduction of high yield varieties, reasonable fertilizer application method and control of insects and diseases should be introduced into the area after completion of the Project.

## 2.5 Anticipated Crop Yield and Production

Crop yields will substantially increase after completion of the Project, with gradual introduction of the improved farming practices under the assured irrigation system. The anticipated crop yields under future condition with the Project are estimated, on the basis of data and information given by the Department of Agriculture, as follows:

Paddy	- H.Y.V.	720 kg/rai (4.5 tons/ha)
	- Local	640 kg/rai (4.0 tons/ha)
Mung beans		190 kg/rai (1.2 tons/ha)

Rice research and experiments have been carried out at Chainat Agricultural Centre. In 1969/70, nitrogen response to the variety C4-63 was examined, and more than 800 kg/rai of crop yield was obtained under standard cultivation technique with irrigation. The crop was grown during the period from August to November.

N Level (kg N/ha)	Paddy Yield	
	(kg/rai)	(ton/ha)
50	846	5.29
75	822	5.14
100	928	5.80
150	845	5.58

RD varieties have been released since 1969, by the Rice Division, Department of Agriculture. RD varieties have a high productivity and a good response to fertilizer application under irrigated condition. In 1979, RD-7 and RD-11 were tested at Chainat.

N Level (kg N/rai)	Paddy Yield (kg/rai)	
	RD-7	RD-11
13	-	823
17	773	-
19	-	838
28	802	-

The experiments on the effect of different soil series on the N response of rice grown in the farmers fields were conducted in many locations in the Central Chao Phrayo Plain during the years of 1976 to 1983. Seven soil series were tested. Nakhon Pathom series which is one of the representative soil type in the prospective irrigation area, is included in the experiments. It has been observed that there is a clear relationship between N application level and paddy grain yield on the Nakhon Pathom series. Paddy yield is expressed as a result of the experiments, as follows:

$$\text{H.Y.V.} \quad Y = 609.6 + 22.8X - 0.41X^2$$

$$\text{Local} \quad Y = 541.9 + 20.0X - 0.39X^2$$

where, Y: paddy grain yield (kg/rai)  
X: N level (kg/rai)

The proposed amount of fertilizer under the Project is 100 kg/ha of Urea and 120 kg/ha of Ammophos (16-20-0) which approximately corresponds to 65 kg N/ha (10.4 kg N/rai). If applied to the above equation, the expected paddy yield amounts to 802 kg/rai for RD varieties and 708 kg/rai for improved local varieties.

Judging from the above information, the anticipated paddy yield mentioned above would surely be attained.

The anticipated mung beans yield of 190 kg/rai is not high as compared with the experimental results obtained at Chainat which show about 350 kg/rai (2.17 tons/ha) under irrigated condition with proper farming practices. The anticipated mung beans yield is rather conservative.

## 2.6 Farm Inputs and Labor Requirement

Farm inputs and labor requirement per hectare for proposed farming practices are shown in Table VIII-9, included in the estimate of crop production costs under the condition "with" the project.

The total requirement of farm inputs in the project area is calculated as below:

### Farm Inputs Requirement

	<u>Seeds (ton)</u>		<u>Fertilizer (ton)</u>		<u>Agro-chemicals (lit)</u>	
	H.Y.V	Local	Urea	Compound	Insecticides	Fungicides
Paddy	1,050	70	4,670	5,600	112,080	56,040
Mung beans	90	-	-	230	4,200	1,400
<b>Total</b>			<b>4,670</b>	<b>5,830</b>	<b>116,280</b>	<b>57,440</b>

The proposed farming will be basically practiced by family labor with some agro-machinery such as hand tractor, sprayer, thresher, etc. The labor balance with project area is also studied under the conditions given in footnotes in Table VIII-10. This table shows the ten day requirement for crop cultivation. According to this table, the family labor can cover the labor requirements throughout the year. Some temporary labor and exchanged labor, however, will be actually employed during the period of transplanting and harvesting of paddy.

## 2.7 Marketing and Price Prospect

Production surplus of rice in the year 1995, when full development of the Mae Wong irrigation project is attained, is estimated as follows:

	<u>Mae Wong Irrigation Area</u>	<u>Nakhon Sawan Province</u>
Population in 1985	74,500	1,028,000
Population Growth Rate (%)	2.4	2.2
Population in 1995	94,440	1,277,900
Rice Consumption per Capita (kg)	300	300
Total Consumption in 1995 (ton)	28,330	383,370
Total Paddy Production in 1983	95,420	825,180
Total Paddy Production in 1995	205,480	935,240
Total Production of Milled Rice in 1995	133,560	607,906
Surplus	105,230	224,536

Anticipated surplus of rice in 1995 will be significant in and around the project area. These surplus will be transported to the outside of the province particularly to the Bangkok market. The annual marketable surplus is estimated at 105,230 tons at full development stage. In view of the present annual export volume of about 3.0 million tons the project output will constitute about 3 percent of the total rice exports. Incremental rice production of the project would be considered to have a some, but not so much, effect on the whole rice export market.

In 1984, production of mung beans in Nakhon Sawan province is 38,090 tons, which form 14 percent of total production in Thailand. Present production of mung beans in the project area is estimated about 2,400 tons. The farmers usually sold almost of their produce to the local market or to Bangkok through local merchants. After completion of the project, the incremental production of mung beans will be about 400 tons. This is a negligible fraction of the total domestic production of about 280 thousands tons.

For making evaluation of the projects, economic prices of paddy and mung beans at farm gate are estimated as follows (for details, see Table VIII and -12):

Paddy	:	4,230 Baht/ton
Mung beans	:	6,920 Baht/ton

These prices are estimated on the basis of the projected international market prices forecasted by IBRD for the year of 1995.

## 2.8 Farm Budget

From the farmer's viewpoint, the financial evaluation in "with project" and "without project" conditions is made for the same farmers as classified in Section 1.8.2.

Calculations for both income and outgo in 1995 are made on the following assumptions:

- 1) The proposed potential irrigation area is considerably matured for agricultural production, where numerous irrigation systems have been implemented and the available water is fully utilized with almost fixed cropping system. Under such condition, significant changes in agricultural production will not be expected unless new water resources are exploited. With this in view, agricultural economy under future condition without the project is considered same as that under present condition.
- 2) Crop yield under future condition without project is estimated as follows:

Wet season paddy

- irrigated	:	450 kg/rai (2.8 tons/ha)
- semi-irrigated	:	250 kg/rai (1.6 tons/ha)
- rainfed	:	200 kg/rai (1.3 tons/ha)

Dry season paddy	:	560 kg/rai (3.5 tons/ha)
Mung beans	:	100 kg/rai (0.6 ton/ha)
Maize	:	350 kg/rai (2.2 tons/ha)

- 3) Crop yield under future conditions with project is estimated as follows:

Wet season paddy		
- H.Y.V.	:	720 kg/rai (4.5 tons/ha)
- Improved local	:	640 kg/rai (4.0 tons/ha)
Mung beans	:	190 kg/rai (1.2 tons/ha)

- 4) The financial prices of agricultural products in 1995 are estimated as follows:

	(Unit: Baht/ton)	
	1995*	(1985)
Paddy	3,950	(2,800)
Mung beans	8,400	(7,600)
Maize	2,880	(2,100)

Note:

\*: Financial price of each crop in 1995 are calculated by multiplying 3.5% per annum for paddy, 1.0% for mung beans and 3.2% for maize to the 1985 farm gate price, respectively. These coefficient are estimated based on the average whole sale prices index on rice, mung beans and maize in 1976-1983 (Source: Office of Agricultural Economic).

- 5) Crop production costs under future condition both "with" and "without" the project are estimated as follows:

	(Unit: B/ha)	
	1995 <sup>/1</sup>	1985 <sup>/2</sup>
<u>Without Project</u>		
Wet season paddy		
- irrigated	6,140	(4,350)
- semi-irrigated	5,150	(3,650)
- rainfed	4,700	(3,330)
Dry season paddy	7,380	(5,230)
Mung beans	3,130	(2,220)
Maize	3,390	(2,400)
<u>With Project</u>		
Paddy	8,650	(6,130)
Mung beans	5,600	(3,970)

Note: <sup>/1</sup>: Crop production costs of each crop in 1995 are calculated by multiplying by 3.5% per annum to the each crops cost in 1985.

<sup>/2</sup>: For detail, see Table VIII-8 and -9.

- 6) Off farm income, other non-agricultural income, consumption expenditure (except food and non-alcoholic beverage) and non-consumption expenditure in 1995 are estimated by multiplying by 6.7% per annum to those which provided from socio-economic survey. Growth rate of 6.7% per annum is calculated based on the growth rate of agricultural income per farm household in 1977-1983. As for the food and non-alcoholic beverage is calculated by multiplying at 3.5% per annum.
- 7) In addition to the above assumption, under the "with" project condition, the income and outgo of each farm size classes in non-irrigated area are assumed same as those in irrigated area.

The results of the analysis are summarized as follows (for details, see Table VIII-14):

(Unit: 10<sup>3</sup> Baht)

	Irrigated Area					
	Small		Medium		Large	
	With Project	Without Project	With Project	Without Project	With Project	Without Project
Planted area						
- Paddy	1.2 ha	1.2 ha	4.5 ha	4.5 ha	12.0 ha	12.0 ha
- Mung beans	0.1 ha	0.1 ha	0.2 ha	0.4 ha	0.6 ha	1.0 ha
Gross income (A)	39.6	29.2	96.6	59.7	237.5	137.8
- Farm income	34.5	14.1	82.3	45.4	221.0	121.3
- Others	15.1	15.1	14.3	14.3	16.5	16.5
Out-go (B)	33.0	29.4	63.8	51.5	139.9	106.3
- Farm expenses	11.0	7.4	40.0	27.7	107.2	73.6
- Living expenses	22.0	22.0	23.8	23.8	32.7	32.7
Balance (A - B)	6.6	-0.2	32.8	8.2	97.6	31.5

(Unit: 10<sup>3</sup> Baht)

	Non-irrigated Area					
	Small		Medium		Large	
	With Project	Without Project	With Project	Without Project	With Project	Without Project
Planted area						
- Paddy	1.2 ha	1.2 ha	4.5 ha	3.5 ha	12.6 ha	9.5 ha
- Mung beans	0.1 ha	0.1 ha	-	0.1 ha	0.6 ha	0.2 ha
- Maize	-	-	-	1.0 ha	-	2.5 ha
Gross income (A)	39.6	15.8	96.6	34.5	237.5	77.2
- Farm income	34.5	6.0	82.3	25.3	221.0	64.0
- Others	15.1	9.8	14.3	9.6	16.5	13.2
Out-go (B)	33.0	25.0	63.8	39.8	139.9	82.6
- Farm expenses	11.0	5.6	40.0	20.2	107.2	53.8
- Living expenses	22.0	19.4	23.8	19.6	32.7	28.8
Balance (A - B)	6.6	-3.5	32.8	-4.9	97.6	-5.4



Based on the above tables, the payment capacity under the Project at the full development stage is estimated:

#### Payment Capacity

Farm Size	Average Farm Size		Existing Irrigation Area (36,800 ha)	(Unit: ₪/farm/year)	
	rai	ha		Rainfed Area (9,900 ha)	Weighted Average
(1) Small Size Farm (less than 20 rai)	7.5	1.2	6,800	10,100	7,500
(2) Medium Size Farm (21 - 50 rai)	28.1	4.5	24,600	37,700	27,400
(3) Large Size Farm (more than 51 rai)	75.0	12.0	66,100	103,000	73,900

Implementation of the scheme is expected to result in a significant increase in farm income in all farm size classes. As can be seen from above tables, farm incomes without the scheme will be changed, because of the impact of irrigation on agriculture, into a near two times in the irrigated area and about three and a half times in the non-irrigated area. Thus, the balance (or capacity to pay) in all farm size classes will also be increased remarkably.

#### 2.9 Gross and Net Crop Production Values under the Proposed Project

Net incremental benefit of the Project is defined as the difference between the net production value "with" the Project and the net production value "without" the Project. The net production value is defined as the difference between the gross production value and the production cost.

Table VIII-15 shows the net incremental benefits at the full development stage in both "with project" and "without project" conditions. The following table shows the summary of net incremental benefit of the Project.

	(Unit: ₪/million)		
	With Project	Without Project	Net Incremental
Wet season paddy			
- Irrigated	166.7	604.1	437.4
- Semi-irrigated	44.3	-	-44.3
- Rainfed	15.8	-	-15.8
Dry season paddy	10.9	-	-10.9
Mung beans (Paddy field)	6.3	10.7	4.4
Mung beans (Upland field)	1.0	-	-1.0
Maize	5.8	-	-5.8
<b>Total</b>	<b>250.8</b>	<b>614.8</b>	<b>364.0</b>

### 3. AGRICULTURAL SUPPORT SYSTEM

#### 3.1 Present Organization and Activities

##### 3.1.1 Outline of governmental organization and activities

- (1) Organization of Royal Thai Government Ministries is shown in Fig. VIII-6. Agricultural and rural development services are provided by a large number of agencies. Major units involved in agricultural development include:

##### Ministry of Agriculture and Cooperatives

- Department of Agricultural Extension (DAE)  
Agricultural extension work in field crops, rice, fruit and other tree crops, and related agricultural activities.
- Department of Agriculture (DOA)  
Research on rice, field crop, and tree crops, including plant breeding, pest control, disease control, and seed production.
- Department of Fisheries (DOF)  
Research and extension services in fisheries.
- Department of Livestock Development (DOLD)  
Research and extension activities involving all types of livestock.
- Department Cooperatives Promotion (DCP)  
Support services in the establishment and operations of cooperatives.
- Department of Land Development (DLD)  
Research and technical assistance on soils, soil classification, soil and water conservation, and soil nutrients.
- Office of Agricultural Economics (DAE)  
Coordinating policy, plans, and budgets among the Department of the MOAC, as well as evaluating projects, carrying out economic research, and gathering agricultural statistics.
- Royal Irrigation Department (RID)  
Planning and construction of the irrigation works, and operation and maintenance of the irrigation facilities.

##### Ministry of the Interior

- Community Development Department (CDD)
  - Group organization and training at the village level, and planning and construction of the various terminal facilities such as road, pond, etc.

- Department of Land (DOL)

Land titles and all records and documents concerning land ownership, and land assessment and some land taxes.

Office of Prime Minister

- Office of Accelerated Rural Development

Development of rural infrastructure, especially the construction of rural roads and reservoirs.

- (2) In 1981, Thai Government implemented a new approach to rural development in accordance with the Prime Minister's Regulation on Administering Rural Development 1981, which gives greater power in planning and budget control to local authorities, especially the provincial Governor. The Rural Development Committees have been set up at the national, provincial, district and sub-district levels in accordance with the said regulation. The Work Flow of the National Development Committee in new rural development system is shown in Fig. VIII-7.
- (3) The services required for the irrigation project can be provided by numerous institutions. Table VIII-16 shows a list of the principle agencies and organizations by type of service provided. Most of the Departments listed are in the MOAC. The remainder are spread among different ministries and offices, notably the Ministry of Interior and the Office of the Prime Minister. The MOAC is organized very clearly along function lines (see Fig. VIII-8). The MOAC also has a large number of administrative and operational units within the Northern region. The service areas of these units tend to be rather large, with boundaries and office sites differing between departments.

Unit	Site	Province		
		Kamphaeng- Phet	Nakhon- Sawan	Utani- Thani
Regional Agriculture Office	Ching Mai	o	o	o
Regional Agriculture Extension	Ching Mai	o	o	o
Provincial Agri. Extension Office	Kamphaeng Phet Nakhon Sawan Uthai Thani	o	o	o
Agricultural Economics - Zone 8	P'nulok	o		
- Zone 6	Nkn. Sawan		o	o
Irrigation - Office 3	P'nulok	o		
- Office 7			o	o
Livestock - Zone 6	P'nulok	o	o	o
Forestry - Nak. Sawan Zone	Nakhon Sawan	o	o	o
Cooperatives Promotion - Office 7	Nakhon Sawan	o	o	o
Fisheries - Nakhon Sawan	Nakhon Sawan	o	o	

### 3.1.2 Agricultural extension

The Ministry of Agriculture and Cooperatives (MOAC) consists of nine major departments, one of which is the Department of Agricultural Extension (DAE). The DAE is primarily responsible for providing extension services for most agricultural crops to farmers. Within MOAC, the Department of Livestock Development, Fisheries, Land Development and Cooperative Promotion provide these services for animal husbandry and pasture production; aquaculture; land development; and the agricultural cooperative, respectively.

The DAE is divided at the head quarters level into eight divisions with extension, technical and administrative responsibilities. There are also six Regional Agricultural Extension Offices which have principally a training function. In the field, provincial and district level officials who are responsible for the extension activities of the Department of Agriculture are put under the DAE as Provincial Agriculture Officers and District Agricultural Officers.

The extension services of DAE are currently being expanded and strengthened a country-wide program in two phase; National Agricultural Extension Projects I and II (NAEP-I and -II) with technical and financial assistance from IBRD. The first phase is being implemented over the five year period 1977 - 1981 and second phase in 1980 - 1984. These projects have provided one extension agent for every 1,000 farmers at the sub-district (Tambon) level. The work of the sub-district extension agents follows the training and visit system (T and V system), in which the agents visit each village in their sub-district at least once every two weeks and attend bi-weekly training sessions given by the district agricultural officers and subject matter specialist (SMS) from the provincial office on a variety of topics relating to their work.

Government organizations are concentrated in Bangkok running from there to the regional, provincial, district, sub-district and village level. Agricultural extension work in the area also focusses on carrying out the policy formulated by the DAE in Bangkok for the country as a whole.

Based on the national agricultural extension policy of the DAE, agricultural extension policy of Nakhon Sawan has been formulated by the provincial office. The principal policy are as follows:

- To stress on the production of paddy, maize, sorgham, mung beans, cotton, sugarcane and cassava, by increasing their yield and using a suitable technology,
- To promote double cropping in irrigated area,
- To stress on the activity of group working such as farmer's group, home economic group, 4H group,
- To improve the farmer's standard of living under the cooperated working plan with all agency concerned, and
- To solve urgent problems such as natural damage, marketing systems, in order to contribute to farmer's economy.

The Nakhon Sawan province has been covered in NEAP-I, and the number of agricultural extension staff has been increased with other strengthening measures down to the district office level.

The organization and its staffs of Nakhon Sawan provincial agricultural extension office are shown in Fig. VIII-9. Agricultural extension staff and change in number of agricultural extension agents' (EA) in Nakhon Sawan province are as follows:

Agricultural Extension Staff in Nakhon Sawan Province (1984)

	Chief	Assist. Chief	SMS/ <sup>1</sup>	Home Eco-nomic	Ext. Agent	Adminis-tration	Employ-ee	Total
Provincial agri- extension office	1	2	2	1	-	1	11	16
Amphoe Muang Nakhon Sawan sub-district office	1	1	-	1	17	1	1	22
Amphoe Lat Yao sub- district office	1	1	-	1	18	1	1	23
Other Amphoe sub- district office	10	10	-	10	105	10	11	164
Nakhon Sawan provin- ce Total	13	14	2	13	140	13	24	225

Note: <sup>1</sup>: Subject Matter Specialist (SMS)

Change in Number of Extension Agents (1978 - 1984)

	1978	1979	1980	1981	1982	1983	1984
Amphoe Muang Nakhon Sawan sub-district office	5	7	14	17	17	17	17
Amphoe Lat Yao sub-district office	3	3	15	17	17	18	18
Nakhon Sawan province Total	21	33	107	137	137	140	140

Based on the plan of operation for extension works, EAs has executed their responsibility. T and V system has been used by monthly workshop of SMS, monthly training of Amphoe level, fortnight training of Tambon level and transfer technology to leader farmers and/or contract farmers.

In addition to the T and V system, various agricultural promotion project has been carried out by provincial extension office. These project are summarized as follows:

(Paddy promotion project)

- Paddy seed exchanged project
- Cropping system trial in irrigated area
- Direct sowing project

(Upland crops promotion project)

- Mung beans promotion project
- Soy beans promotion project
- Ground nut promotion project

(Other)

- Intensive fertilizer promotion project

### 3.1.3 Agricultural research

Agricultural research is mostly carried out by the Department of Agriculture (DOA), but universities, Regional Agricultural Centers, and a few other organization also conduct basic and applied research. Well over 70 experimental station, of which 22 rice and 18 upland experiment station, are widely distributed over the major agro-economic regions of Thailand.

The DOA is divided into 11 divisions, 6 institutes and one office, of which institutes have specialized in research functions. Three deal with specific crops: rice, rubber, and silk production. Two others are responsible for a variety of crops; one for field crops and the other for horticulture. The rest dealt with farming systems. The research divisions mainly dealt with pests, plant diseases, agricultural chemistry, agricultural engineering, and so on.

In general, rice research has concentrated on breeding, agronomic practice, and foundation seed production. Field crops research has emphasized on improved agronomic practices and plant breeding to increase yield of economic field crops.

In the project area, there is no research station, but several stations are operated in Nakhon Sawan province and in Chainat province.

The Chainat Rice Experiment Station, which is one of the branch of Phitsanulok Rice Research Center under the Rice Research Institute of DOA, is a major experiment station for paddy on irrigated farming. The main objectives of the station are to test the paddy varieties suited for the area and to produce of foundation seed for paddy seed multiplication. The station has been consisted of four sections: administration, research, seed multiplication and demonstration, with twelve research officers and four administrative officers.

Field Crop Experiment Stations under the Field Research Institute are situated in Nakhon Sawan province and Chainat province. The Nakhon Sawan Experiment Station is mainly conducting the research for maize and cotton under rainfed condition. The Chainat Experiment Station is also conducting the research for mung beans, soy beans, maize, cotton and sugarcane under irrigated condition. The main research work of these station are to tests new crop to determine their suitability for double cropping, selects varieties of the more promising crops having disease resistant and high yielding, and studies the cultural techniques. The Chainat Field Crop Experimental Station has been consisted of six sections, administration, breed, seed, cultural practice, soil and plant protection, with twenty six research staffs and six administrative officers. The Chainat Station, in this year, has succeeded in the breeding of new variety of mung beans which has a property of shorter growing period with high yielding than the recommended variety of U-Thong 1, this variety will be expected to spared among the mung beans growing farmers in near future.

The data and information accumulated in these stations has been available to the extension workers through following means:

- research report published by DOA
- lecture given by the research staff at training session to be held in the station, and
- direct advice from the research staff to extension staff who visits the station with specific technical problems.

#### 3.1.4 Agricultural credit

Agricultural credit in Thailand is available through credit institutions and from informal sources. Traditionally, about half of Thailand's farmers borrow from informal sources, such as relatives, friends, merchants and money-lenders at varying, but usually high, interest rates. With government support, however, institutional credit has been increasing steadily in recent years. The Bank of Thailand (BOT) has played a leading road in this increase. In particular, BOT introduced in 1975 a guideline which established annual targets for the commercial banks to lend a certain portion of their sources to farmers, directly in the form of loans or indirectly by placing deposits with Bank for Agriculture and Agricultural Cooperatives (BAAC).

The two major sources of institutional credit are BAAC and commercial banks. BAAC has expanded its programme rapidly over the past ten years to cover virtually the entire country and now reaches approximately 30% of all farmers. Terms and condition for agricultural credit in Thailand are generally secured by mortgages on land, personal guarantors and/or floating charges on crops or movable property. Both BAAC and the commercial banks follow these practices.

The BAAC provided direct loans to farmers and loans to farmers' cooperatives for on-lending to their members. Short-term loans are given for crop production inputs, medium-term for purchase of hand tractor and cattle, etc., and long-term loans for numerous types of farm investment such as land consolidation, big farm machinery. Interest rate are regulated by the Government. BAAC will charge an interest rate of 12% to 18% for short and medium-terms loan to individual farmers. The BAAC rate to Cooperative and Association is also 12% and the on-lend to their members at 15%. Commercial banks now charge a minimum of 17% per annum for both short and medium-term loans.

The BAAC has a provincial office in almost all provinces including Nakhon Sawan, Uthaithani and Kamphaeng Phet province. The provincial office control field operations such as lending appraisal, approval within authorized limits, disbursement, supervision, collection and soliciting deposits. Under the direct control of provincial office, the field office assist borrowers in preparing loan application and contact them periodically to check their adherence to loan conditions, particularly on use of funds and repayment. There are field officers in each field office, one field officer per 500 farmhouseholds in general, and they are supporting farmers through the field work mentioned above.

According to the information from the Nakhon Sawan Branch of BAAC, there are 123,600 farm households in Nakhon Sawan province at present, of which 45% of total farm households do not receive any credit through credit institutions. About 24% of the farmers, or 30,000 families receive loans directly from the BAAC, 15% from Farmers Associations, 10% from Agricultural Cooperatives and 6% from Commercial Banks. The loans of Nakhon Sawan Branch of BAAC amounted to 425 million Baht in 1984 and its items are as shown in the following table.

Item	(Unit: 1,000 Baht)					
	Nakhon Sawan		Amphoe Nakhon Sawan		Amphoe Lat Yao	
	Amount	%	Amount	%	Amount	%
<b>Short-term loans</b>						
to individual farmers	309,271	72.8	33,985	75.3	25,882	73.2
to agricultural cooperatives	53,226	12.6	4,292	9.5	4,209	11.9
to farmers association	1,420	0.3	600	1.3	-	-
Sub-total	363,917	85.7	38,877	86.1	30,091	85.1
<b>Medium-term loans</b>						
to individual farmers	31,609	7.4	2,763	6.1	3,097	8.8
<b>Long-term loans</b>						
to individual farmers	29,455	6.9	3,502	7.8	2,160	6.1
<b>Total</b>	<b>424,981</b>	<b>100.0</b>				



As seen in the above table, short-term loan form an overwhelming share of about 85%. The repayment rate is about 80%, and good repayment has been made for short-term loan rather than medium- and long-term loan.

As for the commercial bank, there exist several commercial bank in each provinces. The commercial banks are generally lent to medium- and large-scale farmers for their working capital. In this sence, the role of commercial bank is smaller than the BAAC, but it is worth of notice that the commercial bank have to lend a certain portion of their resources to farmers directly or indirectly by placing deposit with BAAC since 1975.

In addition to these institutional credit, informal credits has been played vary important role in the project area. According to the information from BAAC officers, about a half of farmers in the project area might be borrowed from non-institutional source especially from merchants, with interest rate of about 5% per month for short-term loan.

### 3.1.5 Agricultural inputs

Seed In view of the large differences between the yields of improved varieties including high yield variety (H.Y.V) and other varieties, considerable emphasis should be placed on promoting improved varieties. In fact, it is said that more than 90% of paddy seeds of farmers are produced by farmer themselves and supply of good seed of recommended varieties to farmers is limited in Thailand. However, the Government has operated Seed Exchange Program since 1981 to accelerate the replacement of low yielding native varieties and deteriorated quality of recommended varieties grown by the farmers with improved varieties. The program is mainly implemented by the DAE and the DOA. The DOA is responsible for producing foundation seeds and the DAE for multiplication of the foundation seeds through the seed centers. The program covers most of the provinces in Thailand. During 1982 - 1985, the program will cover approximately 35.6 million rai (5.7 million hectares), of which about 22% in the North region.

On the other hand, there are no Seed Exchange Program for other crops, though foundation seed of some upland crops has been produced by experimentation stations and multified by seed centers.

In Nakhon Sawan province, about 90% of paddy seed of farmers are produced by the farmer themselves and used of local varieties. In order to increase the yield of paddy, the seed exchange project has launched for 3 years plan from 1982, with total target area 700,000 rai (112,000 ha) or 30% of total paddy planted area in Nakhon Sawan province.

The target area and its result in 1983 are as follows:

	No. of Related Sub-district	Target Area (rai)	Result/ <sup>1</sup>		
			No. of Farmer	Area (rai)	Kg of Seed (kg)
Amphoe Muang Nakhon Sawan	9	67,663	1,919	2,707	24,560
Amphoe Lat Yao Nakhon Sawan	12	48,000	964	1,928	9,640
	89	270,698	5,586	11,244	115,985

Note: <sup>1</sup>: Paddy seed produced under this project should be distributed to other farm in next year.

On the other hand, the MOAC has now carried out the Thailand Seed Development Project with a financial assistant from USAID, EC funds and OECF funds. Under this project, total number of 20 seed centers are planned to establish throughout the whole country. In Chainat province, Seed Center No. 4 was already established, and Seed Center No. 16 are now under way of construction in Nakhon Sawan province. The objective of these center are mainly to produce certified seed of economic crops such as rice, corn, mung beans, etc., and to sell seed to farmers, DOAE crop promotion and demonstration projects, cooperative and farmer organization, MOF, and other private and government agencies.

Fertilizer Rainfed rice farmers, in general, apply only minimal amount of chemical fertilizer. The reasons are mainly due to higher risk of under erratic rainfall, loss of fertilizer through leaching, higher price of fertilizer and lack of cash for purchasing it. But, consumption of fertilizer by rice farmers, though still low, has more than doubled over the last decade, mainly because of the rapid growth in the area planted to rice in the dry season when fertilizers are essential to achieve high yields. Another reason for the expansion has been the activities of the Marketing Organization of Farmers (MOF) which has distributed increasing volume of fertilizer.

The institutional channels dealt in fertilizer are two organizations; one is agricultural cooperative and the another is farmer's group under the control of DOE. In 1984, agricultural cooperative dealt in 1,300 tons of fertilizer and farmer's group also dealt in 1,000 tons of fertilizer in Nakhon Sawan province. The fertilizer dealt in these institutional channel has been supplied through MOF with government subsidy. The prices of fertilizer are, therefore, cheaper than the market prices. However quantity of fertilizer distributed by MOF has some limitations due to Government budgets' constraint. For instance, the price of compound fertilizer (16-20-0) is 4,200  $\text{฿}$ /ton from MOF compared to 6,000  $\text{฿}$ /ton from merchant.

According to the officer of provincial extension office, distribution of fertilizer through the institutional channel meets only about 10% of its demand of the province.

### 3.1.6 Farmer's Organization

#### (1) Agricultural cooperatives

In Thailand, there are six types of cooperative, of which Agricultural Cooperative, Land Settlement Cooperative and Fishery Cooperative are related in agriculture. As of December 31, 1983, there are 1,007 Agricultural Cooperatives, 90 Land Settlement Cooperatives and 20 Fishery Cooperatives in the whole country, with its member of 816,402, 68,516 and 4,557 family, respectively.

The Department of Cooperative Promotion (DCP) is incharge of providing support services in the establishment and operation of cooperative throughout the country. Department of Cooperative Auditing in the MOAC also has responsibility for auditing the accounts of the cooperative. The DCP has both provincial cooperative promotion offices and representative working at the office of the particular cooperative.

According to the officer of provincial cooperative promotions office, there are fifteen agricultural cooperatives (total members of 13,434 family) and one fishery cooperative (269 members) in Nakhon Sawan province. In the project area, there are two agricultural cooperatives with total members of 1,544. The activities of these cooperative are focused on the credit field, which sources mainly come from BAAC, and other activities are very small. For instance, marketing of rice and fertilizer dealt in these cooperative in 1984 are only five millions Baht (less than 2,000 tons) of rice and 1,300 tons of fertilizer. As for the fertilizer, which are supplied through MOF, its volume deal in these cooperative has been limited in only 100 tons in each district due to MOAC's budget constrain.

#### (2) Farmer's group

The DAE has now promoted to set up the agricultural group, women's group, and agricultural youth group (4H club). The major function of farmer's group are to distribute agricultural extension advice from DAE, to distribute farm inputs with fair price through the MOF, and to credit on a group basis from BAAC. As of December 31, 1983, the number of registered agricultural group in whole Kingdom are 3,820 group and its member are 514,892 families.

DAE also leads member of agricultural youth group for introduction of modern farming practices through EAS. The home economist of DAE supports women's group through guidance on improvement of living conditions.

There are 82 farmer's group (total member of 18,835 person) and 10 farmer's group (total member 2,127 person) in Nakhon Sawan province and in the project area, respectively. These farmer's group has involved in the above-mentioned activities.

### 3.2 Proposal for Future Improvement of Agricultural Supporting Services

RID has been responsible for planning and construction of the irrigation work and for the operation and maintenance of the project, but RID alone can not provide all services which needed to maximize return from the project investment (See Table VIII-13).

Under the Mae Wong irrigation project, farmers will require advice on general farm management, farming practice and on farm water management. Moreover, the agricultural inputs to be necessary for operating modern irrigated farming should be supplied. Agricultural credit is also needed for the purchase of agricultural inputs.

A part of these services have been tendered through private sector such as merchant, rice mill, etc., but it would be strongly expected to enhance their role and ability in order to provide smoothly such services as needed more with the advance of modern irrigated farming after implementation of the Mae Wong irrigation project.

As regards the services provided through the Government agencies, it should be recommended that these services will be provided through the existing channel such as the aforementioned agencies in 3.1.1. Because, these existing channel have established a structural pattern of well, and have been remarkably strengthen of their political and implemental measures during last few years, though they are not still necessarily enough. Furthermore, the Thai Government system is highly centralized with the head of the agency having significant power and independence over project and implementation. These tendency of the line agencies will not be able to expect to overcome easily. Thus, a new executive organization for providing agricultural supporting service will not be necessary to establish.

However, it is much desirable to achieve successful implementation of the Mae Wong irrigation project that (i) the Government agencies involved in agricultural supporting service should be accomplish their own responsibility in cooperation with one another, as far as possible, (ii) each agency should allocated their personnel resources and/or budgets to the project area as far as possible, within a framework of existing system in force. In addition to aboved desirability, there are some possibility that project needs may differ somewhat from current activities of the agencies, furthermore some additional resources as well as training will be needed.

In order to cope with such desirability and possibility, some institutional arrangement may be needed at national (Bangkok) and provincial level.

Then, RID should be investigated of the possibility of setting up a suitable institutional arrangement for coordination of the activities among the agencies concerned, if necessary, keeping in mind of attaining of effectiveness and also taking into account of the experience of other similar irrigation projects.

Table VIII-1 POPULATION, HOUSEHOLD AND AGRICULTURAL HOUSEHOLD IN THE PROJECT AREA

Province Amphoe (District)	Tambon (Sub-district)	Number of Village Concerned	Number of Popu- lation	Number of House- hold	Number of Agri- cultural Household
<u>Nakhong Sawan</u>					
Amphoe Muang- Nakhon Sawan	Nong khod	1	1,850	320	240
	Nong kra done	1	942	174	174
	Sub-total	2	2,792	494	414
Amphoe Lat Yao	Lat Yao	15	21,282	3,528	1,760
	Noen Khi Lek	4	2,894	216	195
	Mapkae	5	1,984	403	356
	Mae Wong	7	12,134	2,419	1,833
	Wang Sam	7	8,646	1,554	1,492
	Wang Ma	13	4,898	918	763
	Wang Muang	10	2,514	577	504
	Soei La Korn	9	2,173	416	319
	Nong Nom Wua	7	3,856	819	721
	Nong Yao	9	4,074	723	547
	Huai Nam Hom	1	1,020	212	187
Mae Lae	1	1,875	375	300	
	Sub-total	88	67,350	12,160	8,977
<u>Uthai Thani</u>					
Amphoe Sawang Arom	Sawang Arom	1	660	120	115
	Nong Luang	4	1,653	295	292
	Plong Song Nang	1	375	74	74
	Sub-total	6	2,688	489	481
<u>Kam Phaeng Phet</u>					
Amphoe Kanu- Woralaksaburi	Pang Mabho	2	1,220	230	213
	Bo Tun	1	445	89	82
	Sub-total	3	1,665	319	293
Total		99	74,492	13,462	10,165

Source: The National Statistical Office,  
Office of the Prime Minister

Table VIII-2 NUMBER OF HOLDINGS WITHIN THE PROJECT AREA  
BY SIZE OF HOLDINGS

Province District	Under 2 Rai	2- 10	10.1- 20	20.1- 30	30.1- 50	50.1- 80	80.1 and Over	Total No. of Holding
Nakhon Sawan								
Muang Nakhon- Sawan	1	42	65	79	113	60	54	414
Lat Yao	36	907	1,400	1,706	2,442	1,302	1,184	8,977
Uthai Thani								
Sawang Arom	2	49	75	91	131	70	63	481
Kamphaeng Phet								
Kanu- Waralaksaburi	1	30	46	56	80	42	38	293
Total	40	1,028	1,586	1,932	2,766	1,474	1,338	10,165
(%)	0.4	10.1	15.6	19.0	27.2	14.5	13.2	100.0
Area of Holding								
Total (ha)	-	608	2,521	5,371	12,282	9,901	16,017	
%	-	1.3	5.4	11.5	26.3	21.2	34.3	

Source: Estimation was made based on the 1978 Agricultural Census

Table VIII-3 NUMBER OF HOLDINGS WITHIN THE PROJECT AREA  
BY TENURE

Province District	No. of Holdings Operated under One Form of Tenure			No. of Holdings Operated under One Form of Tenure			Total No. of Hold- ing
	Owned by the Holder	Rented from Others	Others	>50% of Total Area Owned by the Holder	≥ 50% of Total Area Rented from Other	Others	
Nakhon Sawan							
Muang Nakhon- Sawan	330	34	9	20	20	1	414
Lat Yao	6,715	1,346	359	234	314	9	8,977
Uthai Thani							
Sawang Arom	345	100	1	14	20	1	481
Kamphaeng Phet							
Kanu- Waralaksaburi	229	32	1	16	15	-	293
No. of Total Project Area (%)	7,619 75.0	1,512 14.9	370 3.6	284 2.8	369 3.6	11 0.1	10,165 100.0

Source: Estimation was made based on the 1978 Agricultural Census

Table VIII-4 NUMBER OF MILLS BY CAPACITY

(Unit: ton/day)

Province District	1 ton and Less than One ton	1.1 - 5 ton	5.1 - 10 ton	10.1 - 30 ton	30.1 - 50 ton	Over 50 ton	Total
Nakhon Sawan							
Muang Nakhon Sawan							
Nong Khod	3	1	1	5	-	-	10
Kong Kra Done	6	1	2	6	-	1	16
Lat Yao							
Lat Yao	-	4	6	1	2	1	14
Noen Khi Lek	1	-	2	1	-	-	4
Map Kae	-	1	4	1	-	-	6
Mae Wong	-	5	12	1	-	-	18
Wang Sam	2	2	2	-	-	-	6
Wong Ma	1	-	1	2	-	-	4
Wong Muang	1	1	3	1	-	-	6
Soei La Korn	-	1	1	-	1	-	3
Nong Nom Wua	-	-	3	2	-	-	5
Nong Yao	-	-	2	2	-	-	4
Huai Nam Hom	6	9	7	-	-	-	22
Mae Lae	-	5	2	3	-	-	10
No. of Total	20	30	48	25	3	2	128
Total Capacity	15	120	400	410	120	160	1,225

Source: Nakhon Sawan provincial office, as of 1984

Table VIII-5 ANNUAL FARM BUDGETS PER FARM SIZE CLASS

	(Unit: 10 <sup>3</sup> Baht)					
	Irrigated Area			Non-irrigated Area		
	S	M	L	S	M	L
Number of farms	2,090	4,863	1,057	562	1,309	284
Total area	2,460 ha	21,710 ha	12,620 ha	663 ha	5,842 ha	3,395 ha
Av. farm size. - Paddy	1.2 ha	4.5 ha	12.0 ha	1.0 ha	3.5 ha	9.5 ha
- Upland	-	-	-	0.2 ha	1.0 ha	2.5 ha
Planted area						
- Paddy (wet season)	1.2	4.5	12.0	1.2	3.5	9.5
- Mung beans (dry season) /1	0.1	0.4	1.0	-	-	-
- Maize (wet season)	-	-	-	-	1.0	2.5
Income (A)						
- Farm income	20.2 (100.0%)	40.0 (100.0%)	95.4 (100.0%)	12.1 (100.0%)	29.2 (100.0%)	63.3 (100.0%)
- Paddy	12.4 (61.4%)	32.4 (81.0%)	86.8 (91.1%)	7.0 (57.8%)	24.2 (82.9%)	56.4 (89.1%)
- Mung beans	10.1 (50.0%)	30.0 (75.0%)	79.8 (83.6%)	6.9 (57.0%)	18.4 (63.0%)	44.9 (70.9%)
- Maize	0.4 (2.0%)	1.0 (2.5%)	2.4 (2.5%)	-	-	-
- Livestock /2	-	-	-	-	5.0 (17.1%)	11.3 (17.9%)
Off-farm income	1.9 (9.4%)	1.4 (3.5%)	4.6 (4.8%)	0.1 (0.8%)	0.8 (2.8%)	0.2 (0.3%)
Other non-agri. income	4.7 (23.3%)	5.6 (14.0%)	4.4 (4.6%)	2.5 (20.7%)	2.7 (9.2%)	4.5 (7.1%)
Out-go (B)	3.1 (15.3%)	2.0 (5.0%)	4.2 (4.3%)	2.6 (21.5%)	2.3 (7.9%)	2.4 (3.8%)
Farm-expenses	16.1	22.3	41.0	13.7	19.5	34.3
- Paddy /3	2.7	7.8	21.3	2.1	7.3	17.0
- Mung beans /3	2.5	7.7	20.9	2.1	5.0	11.7
- Maize /3	0.2	0.1	0.3	-	-	-
Living-expenses	-	-	-	-	2.3	5.3
- Consumption exp.	13.4	14.5	19.7	11.6	12.2	17.3
Food	12.9	13.9	18.5	11.4	11.9	16.3
Other	7.1	7.7	9.9	5.9	7.3	8.7
- Non-consumption exp.	5.8	6.2	8.6	5.6	4.6	7.6
Balance (A - B)	0.4	0.6	1.2	0.2	0.3	1.0
	4.1	17.7	54.4	-1.6	9.7	29.0

Note: /1: Mung beans is planted after harvesting of paddy.

/2: Net value of production

/3: Excluding farm family labor cost



Table VIII-6 STANDARD CULTIVATION METHOD OF IRRIGATED PADDY (H.Y.V.)

Days	Management	Amount of Implementation
(Preparation of Nursery)		
- 3	Seed selection	Salt solution for seed selection 10 liters of water + 2 kg of NaCl
- 3	Seed disinfection	Benlate-T (200-400 times, 6-12 hours) or Homai (200-400 times, 6-12 hours)
- 2	Seed soaking	36 hours
- 2	Hastening of germination	24 hours
- 1	Application of fertilizer	Urea 100 g, compound fertilizer 50 g per rai
0	Sowing	Acreage 500 m <sup>2</sup> /ha, seed 35 kg/ha
Nursery Period: 20 days (After transplanting)		
(Preparation of Paddy Field)		
- 5	Basal manuring	Compound fertilizer 120 kg/ha
0	Transplanting	Spacing 20 x 25 cm (20 hills per m <sup>2</sup> ) 3 seedling per hill, 20 days-aged seedling.
13	Control of disease and insect damage (1st)	Diazinon 0.8 lit/ha Kasumin 0.6 lit/ha
15	Application of fertilizer	Urea 50 kg/ha
20	Weeding (1st)	Hand rotary weeder
40	Control of disease and insect damage (2nd)	Sumithion 0.8 lit/ha Kasumin 0.6 lit/ha
50	Weeding (2nd)	Hand rotary weeder
60	(Panicle initiation period)	
63	Application of fertilizer (2nd)	Urea 50 kg/ha
70	(Booting period)	
73	Control disease and insect damage (3rd)	Diazinon 0.8 lit/ha
80	(Heading period)	
105-110	Harvesting	Use of sickle

Table VIII-7 STANDARD CULTIVATION METHOD OF MUNG BEANS

Days	Management	Amount of Implementation
(Preparation of field)		
0	Sowing	Seed 40 kg/ha, row 50 cm and hole 20 cm with dig 4-5 seeds/per hole.
17	Application of fertilizer	Compound fertilizer 60 kg/ha
20	Intertillage and weeding	Hoe and hand
30	Control insect damage (1st)	Spraying of Sumithion 0.9 lit/ha
45	Application of fertilizer (2nd)	Compound fertilizer 40 kg/ha
47	Intertillage and weeding (2nd)	Hoe and hand
50	Control insect and disease damage (2nd)	Spraying of Sumithion 0.9 lit/ha and 0.6 lit/ha of fungicide
80	Harvesting	By hand, about 2 times
	Drying	2-3 times

Note: Recommendable high yield variety; U-Thong 1

Table VIII-8 CROP PRODUCTION COST UNDER "WITHOUT PROJECT" CONDITION (1/2)

Item	Unit Price (Economic)	Rain-fed		Wet Season Paddy		Irrigated		Dry Season Paddy		(Unit: Baht/ha)				
		Quantity		Value		Quantity		Value			Quantity		Value	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		Quantity	Value		
<b>Farm Input</b>														
1. Seed		60 kg	252.0	60 kg	252.0	60 kg	252.0	60 kg	252.0	17 kg	71.4	48 kg	264.0	
- Local Variety (Paddy)	4.2/kg													
- High Yield Variety (Paddy)	5.5/kg	20 kg	110.0	20 kg	110.0	20 kg	110.0	20 kg	110.0					
- Local Variety (Mung beans)	6.6/kg	-	-	-	-	-	-	-	-	-	-	-	-	
- High Yield Variety (Mung beans)	11.9	-	-	-	-	-	-	-	-	-	-	-	-	
2. Fertilizer		48 kg	206.4	42 kg	180.6	30 kg	183.0	60 kg	258.0	50 kg	366.0	100 kg	430.0	
- Urea	6.1/kg													
- Compound fertilizer	4.3/kg													
3. Agro-chemical		-	-	-	-	-	-	-	-	0.21 l	36.1	1 l	172.0	
- Insecticides	172/l													
- Fungicides	143/l													
4. Land Preparation		6.3 day	529.2	6.3 day	529.2	6.3 day	529.2	6.3 day	529.2	6.3 day	529.2	6.3 day	529.2	
- Hand Tractor	84/day													
- Large Tractor	110/hour													
5. Threshing Machine		1.8 day	151.2	2.0 day	168.0	2.2 day	184.8	2.2 day	184.8	2.2 day	201.6	2.2 day	201.6	
Sub-total (A)			1,249.0		1,362.0		1,553.0		1,553.0		2,091.0		2,091.0	
<b>Labour Requirement</b>														
1. Nursery Preparation	37/day	1.5 day	55.5	1.5 day	55.5	1.5 day	55.5	1.5 day	55.5	1.5 day	55.5	1.5 day	55.5	
2. Land Preparation	37/day	6.3 day	233.1	6.3 day	233.1	6.3 day	233.1	6.3 day	233.1	6.3 day	233.1	6.3 day	233.1	
3. Transplanting or Sowing	37/day	20.0 day	740.0	21.0 day	777.0	22.0 day	814.0	22.0 day	814.0	22.0 day	814.0	22.0 day	814.0	
4. Weeding	37/day	2.0 day	74.0	2.0 day	74.0	3.0 day	111.0	3.0 day	111.0	3.0 day	111.0	3.0 day	111.0	
5. Fertilizer Application	37/day	1.0 day	37.0	1.5 day	55.5	2.0 day	74.0	2.0 day	74.0	2.5 day	92.5	2.5 day	92.5	
6. Chemical Application	37/day	-	-	-	-	1.0 day	37.0	1.0 day	37.0	2.0 day	74.0	2.0 day	74.0	
7. Harvesting	37/day	21.0 day	777.0	22.8 day	843.6	24.0 day	888.0	24.0 day	888.0	24.0 day	888.0	24.0 day	888.0	
8. Threshing, Drying & Winnowing	37/day	4.0 day	148.0	4.5 day	166.5	6.0 day	222.0	6.0 day	222.0	6.0 day	222.0	6.0 day	222.0	
9. Water Management	37/day	-	-	1.0 day	37.0	2.0 day	74.0	2.0 day	74.0	3.0 day	111.0	3.0 day	111.0	
Sub-total (B)		55.8 day	2,065.0	60.6 day	2,242.0	67.8 day	2,509.0	70.3 day	2,601.0	70.3 day	2,601.0	70.3 day	2,601.0	
Miscellaneous Cost	5% of (A+B)		166.0		180.0		203.0		203.0		235.0		235.0	
Total			3,480.0		3,784.0		4,265.0		4,265.0		4,927.0		4,927.0	

Note: This table is made based on the Farm Economic Survey. Some modification, however, were done by the data and information from the Extension Office, Office of Agricultural Economic, etc.

Table VIII-6 CROP PRODUCTION COST UNDER "WITHOUT PROJECT" CONDITION (2/2)

Item	Mung Beans (Dry Season)		Maize (Wet Season)	
	Quantity	Value	Quantity	Value
<b>Farm Input</b>				
1. Seed				
- Local Variety (Mung beans)	40 kg	276.0	-	-
- High Yield Variety (Mung beans)	-	-	-	-
- Local Variety (Maize)	-	-	40 kg	100.0
2. Fertilizer				
- Urea	-	-	-	-
- Compound Fertilizer	-	-	30 kg	129.0
3. Agro-chemical				
- Insecticides	-	-	-	-
- Fungicides	-	-	-	-
4. Land Preparation				
- Hand Tractor	-	-	-	-
- Large Tractor	6.0 hour	660.0	6.0 hour	660.0
5. Threshing Machine				
-	-	-	-	-
Sub-total (A)		<u>936.0</u>		<u>889.0</u>
<b>Labour Requirement</b>				
1. Nursery Preparation				
-	37/day	-	-	-
2. Land Preparation				
-	37/day	92.5	2.5 day	92.5
3. Transplanting or Sowing				
-	37/day	111.0	3.0 day	185.0
4. Weeding				
-	37/day	259.0	7.0 day	610.5
5. Fertilizer Application				
-	37/day	-	1.5 day	55.5
6. Chemical Application				
-	37/day	-	-	-
7. Harvesting				
-	37/day	666.0	13.0 day	481.0
8. Threshing, Drying & Winnowing				
-	37/day	74.0	6.0 day	222.0
9. Water Management				
-	37/day	-	-	-
Sub-total (B)		<u>1,203.0</u>	<u>44.5 day</u>	<u>1,647.0</u>
Miscellaneous Cost				
-	5% of (A+B)	107.0		126.8
<b>Total</b>		<u>2,246.0</u>		<u>2,663.0</u>

Table VIII-9 CROP PRODUCTION COST UNDER "WITH PROJECT" CONDITION

Item	Unit Price (Economic)		Paddy		(Unit: Bant/ha)	
	Quantity	Value	Quantity	Value	Mungbeans Quantity	Value
<u>Farm Input</u>						
1. Seed - Local Variety (Paddy)	7 kg	29.4	-	-	-	-
- High Yield Variety (Paddy)	28 kg	154.0	-	-	-	-
- Local Variety (Mungbean)	-	-	-	-	-	-
- High Yield Variety (Mungbean)	-	-	40 kg	500.0	-	-
2. Fertilizer - Urea	100 kg	610.0	-	-	-	-
- Compound fertilizer	120 kg	516.0	100 kg	430.0	-	-
3. Agro-chemical - Insecticides	2.4 lit	412.8	1.8 lit	309.6	-	-
- Fungicides	1.2 lit	171.6	0.6 lit	85.8	-	-
4. Land Preparation - Hand Tractor	84/day	529.2	6.3 day	-	-	-
- Large Tractor	110/hour	-	-	6.0 hour	660.0	-
5. Threshing - Machine	84/day	252.0	3.0 day	-	-	-
(A) Sub-total		2,675.0				1,985.0
<u>Labour Requirement</u>						
1. Nursery Preparation	37/day	55.5	1.5 day	-	-	-
2. Land Preparation	37/day	233.1	6.3 day	2.5 day	92.5	-
3. Transplanting or Sowing	37/day	814.0	22.0 day	3.0 day	111.0	-
4. Weeding	37/day	148.0	4.0 day	8.0 day	296.0	-
5. Fertilizer Application	37/day	111.0	3.0 day	3.0 day	111.0	-
6. Chemical Application	37/day	148.0	4.0 day	2.0 day	74.0	-
7. Harvesting	37/day	888.0	24.0 day	18.0 day	666.0	-
8. Threshing, drying & winnowing	37/day	222.0	6.0 day	3.0 day	111.0	-
9. Water management	37/day	111.0	3.0 day	1.0 day	37.0	-
(B) Sub-total		2,731.0	73.8 day	40.5 day	1,499.0	174.0
Miscellaneous Cost	5% of (A) + (B)	270.0				
Total		5,676.0				3,658.0

Note: This table is made based on the Standard Cultivation Method (see Table VIII-6 and -7).

Table VIII-10 TEN DAY LABOR REQUIREMENT IN THE PROJECT AREA

	Labor Force Available (A)/1	Labor Requirement for Farming (B)	Paddy (H.Y.V) (37,360ha)	Paddy (Local Variety) (9,340ha)	Mung Beans (2,335 ha)	Balance (A - B)
Jan. I	313.2	7.0	-	5.1	2.0	306.2
II	313.2	3.9	-	-	3.9	309.3
III	313.2	5.9	-	-	5.9	307.3
Feb. I	313.2	6.3	-	-	6.3	306.9
II	313.2	7.5	-	-	7.5	305.7
III	317.2	6.3	-	-	6.3	306.9
Mar. I	313.2	7.8	-	-	7.8	305.4
II	313.2	5.3	-	-	5.3	307.9
III	313.2	0.5	-	-	0.5	312.7
Apr. I	313.2	22.8	-	-	22.8	290.4
II	312.2	24.5	-	-	24.5	288.7
III	313.2	1.8	-	-	1.8	311.4
May I	313.2	-	-	-	-	313.2
II	313.2	-	-	-	-	313.2
III	313.2	-	-	-	-	313.2
Jun. I	313.2	1.4	-	1.4	-	311.8
II	313.2	13.0	10.2	2.8	-	300.2
III	313.2	67.1	52.6	14.5	-	246.1
Jul. I	313.2	266.0	208.8	57.2	-	249.2
II	313.2	275.5	218.3	57.2	-	237.7
III	313.2	309.8	248.4	61.4	-	3.4
Aug. I	313.2	313.1	249.3	63.8	-	0.1
II	313.2	271.6	219.4	52.2	-	41.6
III	313.2	153.8	143.7	11.1	-	159.4
Sep. I	313.2	183.5	72.4	11.1	-	129.7
II	313.2	54.8	46.5	8.3	-	258.4
III	313.2	48.6	44.0	4.6	-	264.6
Oct. I	313.2	50.7	39.6	11.1	-	262.5
II	313.2	47.8	36.7	11.1	-	265.4
III	313.2	189.8	178.7	11.1	-	123.4
Nov. I	318.2	230.5	219.4	11.1	-	82.7
II	313.2	285.5	219.4	66.1	-	27.7
III	313.2	269.8	210.3	59.5	-	43.4
Dec. I	313.2	267.0	210.3	56.7	-	46.2
II	313.2	179.6	122.9	56.7	-	133.6
III	313.2	75.5	20.5	55.0	-	237.7
Total	11,275.2	3,538.7	2,755.3	688.8	94.6	7,736.5

Note: /1: Labor force from farm households x Ten day workable days (9 days)

Labor force from farm households (Lff) is estimated as follows:

$$Lff = (Fh \times Fs \times Ra1 \times Rf1) + (Fh \times Fs \times Ra2 \times Rf2)$$

where, Fh: number of farm households (10,167)

Fs: family size (5.5)

\*Ra1: ratio of age distribution between 15 and 65 (63.5%)

\*Rf1: ratio of available family labor force (90%)

\*Ra2: ratio of age distribution between 10 and 14 (12.7%)

Rf2: ratio of available family labor force (40%)

\* Ratio are estimated by the Farm Economic Survey

Table VIII-11 ECONOMIC PRICE STRUCTURE OF PADDY

Items	Unit	Constant 1985 Price
Projected 1995 world market price <sup>/1</sup>	US\$/ton	319
Converted to Thai Baht	฿/ton	8,610
Grade differential <sup>/2</sup>	฿/ton	-260
Export price	฿/ton	8,350
Port charges <sup>/3</sup>	฿/ton	-175
Exporter's margin <sup>/4</sup>	฿/ton	-370
Wholesaler's margin <sup>/5</sup>	฿/ton	-420
Ex-mill price of rice	฿/ton	7,385
Ex-mill price of paddy <sup>/6</sup>	฿/ton	4,950
Miller's margin <sup>/7</sup>	฿/ton	-330
Price of paddy at mill	฿/ton	4,620
Merchant's margin <sup>/8</sup>	฿/ton	-390
Farmgate price of paddy	฿/ton	4,230

- Note: <sup>/1</sup>: Based on the IBRD Commodity Price Projection, June 1985. The IBRD estimated price given in 1983 constant US\$ has been adjusted by a factor of 0.977 (MUV) to allow for price escalation between 1983 and 1985.
- <sup>/2</sup>: Weighted average F.O.B. price assuming 67% is Grade A (100% white rice and 5% broken), 20% is Grade B (10% and 20% broken) and 13% is Grade C (25% and 45% broken) equivalent to 97% of the price for 5% broken.
- <sup>/3</sup>: ฿180 of port charge, conversion factor 0.92 (S.C.F)
- <sup>/4</sup>: The margin covers ฿310/ton of handling charge (conversion factor 0.87) and 1.5% of export price as profit (conversion factor 0.84).
- <sup>/5</sup>: The margin covers ฿240/ton of transportation cost (conversion factor 0.87) and 3.0% of export price as profit (conversion factor 0.84).
- <sup>/6</sup>: Milling ratio of 67% including the value of bran which is 2% of ex-mill price of rice.
- <sup>/7</sup>: On average 8% of ex-mill price of paddy, conversion factor 0.84.
- <sup>/8</sup>: Includes transport and profit, corresponding to about 10% of paddy price at Mill, conversion factor 0.84.

Table VIII-12 ECONOMIC PRICE STRUCTURE OF MUNG BEANS

Item	Unit	Constant 1985 Price
Export price F.O.B. price at Bangkok <sup>/1</sup> in 1995	฿/ton	8,740
Exporter's margin <sup>/2</sup>	฿/ton	450
Wholesale price of mung beans	฿/ton	8,290
Transport to Bangkok and handling <sup>/3</sup>	฿/ton	590
Retail price	฿/ton	7,700
Merchant's margin <sup>/4</sup>	฿/ton	780
Farmgate price of maize	฿/ton	6,920

- Note: <sup>/1</sup>: The international market price of mung beans for the year of 1995 is estimated by using the forecasted soy beans price, because mung beans is correlative with soy beans in its price change. According to IBRD commodity projection, the soy beans price in 1995 will become lower by 13% in 1995, from US\$282/ton to US\$244/ton. The price of mung beans, C.I.F. Bangkok in 1983, was ฿10,285/ton. The estimated mung beans price in 1995 is therefore ฿8,948/ton at 1983 constant US\$. The estimated price is adjusted, by using a factor of 0.977 (MUV) to allow for price escalation between 1983 and 1985.
- <sup>/2</sup>: The margin covers ฿260/ton of handling charge (conversion factor 0.87) and 3% of F.O.B. Bangkok price as profit (conversion factor 0.84).
- <sup>/3</sup>: This item covers ฿240/ton for transportation cost (conversion factor 0.87) and 5.5% of wholesale price as handling and profits (conversion factor 0.84).
- <sup>/4</sup>: The margin covers transport, handling and profit, corresponding to 12% of retail price (conversion factor 0.84).

Table VIII-13 ECONOMIC PRICE STRUCTURE OF FERTILIZER

Items	Unit	Ammophos, 16-20-0	Urea, 46% N
		Economic	Economic
Projected 1995 world market price <sup>/1</sup>	US\$/ton	179	234
International transport and handling	US\$/ton	50	50
Import price C.I.F. at Bangkok	US\$/ton	129	184
Convert to Thai Baht	฿/ton	3,483	4,968
Importer's/wholesaler's margin <sup>/2</sup>	฿/ton	293	417
Transport Bangkok to Nakhon Sawan <sup>/3</sup>	฿/ton	209	209
Wholesaler's price	฿/ton	3,985	5,594
Retailer's margin <sup>/4</sup>	฿/ton	335	470
Farmgate price	฿/ton	4,320	6,064

- Note: <sup>/1</sup>: 1983 C.I.F. Bangkok price of Ammophos was US\$135/ton. Ammophos is expected to follow DAP in its price increase, which is 74% in real terms between 1983 and 1995, according to IBRD commodity projection, June 1985. Ammophos and Urea have been adjusted by a factor of 0.977 (MUV) to allow for price escalation between 1983 and 1985.
- <sup>/2</sup>: The margin covers handling charge and profit, corresponding to 10% of C.I.F. Bangkok price (conversion factor 0.84).
- <sup>/3</sup>: ฿240 from Bangkok to Nakhon Sawan (conversion factor 0.87).
- <sup>/4</sup>: The margin include local transportation cost, handling charge and profit, corresponding to 10% of wholesaler's price (conversion factor 0.84).

Table VIII-14 ANNUAL FARM BUDGET PER FARM SIZE CLASS (1/2)

Item	Irrigated Area (Unit: 103 Bahts)			
	S	M	L	I
Number of farms	2,090	4,963	1,057	
Total area (ha)	2,460	21,710	12,620	
Av. farm size	1.2 ha	4.5 ha	12.0 ha	
Planted area				
- Paddy (wet season)	1.2 ha	4.5 ha	12.0 ha	12.0 ha
- Mung beans (dry season) <sup>1/</sup>	0.1 ha	0.2 ha	0.4 ha	0.6 ha
- Maize (wet season)	-	-	-	1.0 ha
Income (A)	30.6	29.2	96.6	59.7
Farm income	34.5	14.1	82.3	45.4
- Paddy	20.9	11.0	78.2	41.2
- Mung beans	1.0	0.5	2.0	2.1
- Maize	-	-	-	-
- Livestock <sup>2/</sup>	2.6	2.6	2.1	2.1
Off-farm income	9.1	9.1	10.7	10.7
Other non-agri. income	6.0	6.0	3.6	3.6
Out-go (B)	33.0	29.4	63.8	51.5
Farm expenses	11.0	7.4	40.0	27.7
- Paddy	10.4	7.1	38.9	26.4
- Mung beans	0.6	0.3	1.1	1.3
- Maize	-	-	-	-
Living expenses	22.0	22.0	23.8	23.8
- Consumption exp.	21.0	21.0	22.7	22.7
Food	10.0	10.0	10.9	10.9
Other	11.0	11.0	11.7	11.7
- Non consumption exp.	1.0	1.0	1.1	1.1
Balance (A - B)	6.6	-0.2	32.8	8.2
				97.6
				31.5

Note: <sup>1/</sup> Mung beans is planted after harvesting of paddy  
<sup>2/</sup> Net Value of Production

Table VIII-14 ANNUAL FARM BUDGET PER FARM SIZE CLASS (2/2)

Item	Non-irrigated Area (Unit: 103 Bahts)			
	S	M	L	I
Number of farms	2,090	4,863	1,057	
Total area (ha)	2,960	21,710	12,620	
Av. farm size	1.2 ha	4.5 ha	12.0 ha	
Planted Area				
- Paddy (wet season)	1.2 ha	1.2 ha	4.5 ha	3.5 ha
- Mung beans (dry season)	0.1 ha	-	0.2 ha	0.1 ha
- Maize (wet season)	-	-	-	1.0 ha
Income (A)	39.6	15.8	96.6	34.9
Farm income	34.5	6.0	82.3	25.3
- Paddy	20.9	5.9	78.2	17.3
- Mung beans	1.0	-	2.0	0.5
- Maize	-	-	-	6.3
- Livestock <sup>2/</sup>	2.6	0.1	2.1	1.0
Off-farm income	9.1	4.9	10.7	5.1
Other non-agri. income	6.0	4.9	3.6	4.5
Out-go (B)	33.0	25.0	63.8	39.8
Farm expenses	11.0	5.6	40.0	20.2
- Paddy <sup>3/</sup>	10.4	5.6	38.9	16.5
- Mung beans	0.6	-	1.1	0.3
- Maize	-	-	-	3.4
Living expenses	22.0	19.4	23.8	19.6
- Consumption exp.	21.0	19.0	22.7	19.0
Food	10.0	8.4	10.9	10.3
Other	11.0	10.7	11.7	8.7
- Non consumption exp.	1.0	0.3	1.1	0.6
Balance (A - B)	6.6	-3.5	32.8	-4.9
				97.6
				-5.4

Note: <sup>1/</sup> Mung beans is planted after harvesting of paddy  
<sup>2/</sup> Net value of Production  
<sup>3/</sup> Excluding farm family labor cost



Table VIII-15 IRRIGATION BENEFIT ESTIMATES

Crop	Cultivated Area (ha)	Unit Yield (ton/ha)	Total Production (ton)	Unit Price (₹/ton)	Gross Production Value (₹/million)	Unit Cost		Total Production Cost (₹/million)	Net Production Value (₹/million)
						Production Cost (₹/ha)	Production Value (₹/ha)		
<u>(1) Without Project</u>									
Wet Season Paddy									
- Irrigated	22,000	2.8	61,600	4,230	260.6	4,270	93.9	166.7	
- Semi-irrigated	14,800	1.6	23,100	4,230	100.2	3,780	55.9	44.3	
- Rainfed	7,800	1.3	9,800	4,230	42.9	3,480	27.1	15.8	
Dry Season Paddy	1,100	3.5	3,900	4,230	16.3	4,930	5.4	10.9	
Mung Beans (Paddy field)	3,300	0.6	2,000	6,920	13.7	2,250	7.4	6.3	
Mung Beans (Upland Field)	800	0.5	400	6,920	2.8	2,250	1.8	1.0	
Maize	2,100	2.2	4,600	2,470	11.4	2,660	5.6	5.8	
<u>Total</u>					<u>447.9</u>		<u>197.1</u>	<u>250.8</u>	
<u>(2) With Project</u>									
Wet Season Paddy									
- H.Y.V	37,400	4.5	168,300	4,230	711.9	5,680	212.4	499.5	
- Improved local	9,300	4.0	37,200	4,230	157.4	5,680	52.8	104.6	
Mung Beans	2,300	1.2	2,800	6,920	19.1	3,660	8.4	10.7	
<u>Total</u>					<u>888.4</u>		<u>273.6</u>	<u>614.8</u>	
<u>(3) Incremental Benefit (1) - (2)</u>									
								<u>364.0</u>	

Table VIII-16 LIST OF INSTITUTIONS BY SERVICES  
PROVIDED FOR IRRIGATION PROJECT

Service	Governments' Agency	Private or Semi-Government Institution
Irrigation Construction	Royal Irrigation Department	Contractors, Water User Groups (on-farm development)
Irrigation Operation and Maintenance	Royal Irrigation Department	Water User Groups
Agricultural Extension	Department of Agricultural Extension, Department of Livestock, Department of Fisheries	
Agricultural Research	Department of Agriculture, Department of Agricultural Extension (demonstration plots), Department of Livestock, Department of Fisheries, Universities	
Credit		Bank for Agriculture and Agricultural Cooperatives, Commercial Banks, Farmer Cooperatives, Local Merchants and Money-lenders, Agri-businesses
Input Supply	Department of Agriculture, Department of Agricultural Extension, Department of Livestock, Department of Fisheries	Farmer Cooperatives, Local Merchants, Agri-business
Marketing	Marketing Organization for Farmers, Department of Cooperatives Promotion	Farmer Cooperatives, Local Merchants, Agri-business
Group Organization and Action	Department of Cooperatives Promotion, Department of Agricultural Extension, Community Development Department	Farmer Cooperatives, Water User Groups, other farmer groups

Table VIII-17 HOUSEHOLD STRUCTURE OF FARMS  
BY GROUP AVERAGE

	All Farms	Group 1 Non-Irrigated Area	Group 2 Irrigated Area
<b>Group Composition</b>			
- No. of Farms	180.00	88.00	92.00
- No. of Members	870.00	421.00	449.00
- % of Total	100.00	48.39	51.61
<b>Household Size</b>			
- Total	4.83	4.78	4.88
- On Farm	4.49	4.43	4.54
- Off Farm	0.32	0.32	0.33
- On/Off Farm	0.02	0.03	0.01
<b>Sex Composition</b>			
- Male	2.53	2.57	2.49
- Female	2.31	2.22	2.39
<b>Age Composition</b>			
- 0 to 10	0.99	1.15	0.84
- 10 to 15	0.61	0.59	0.62
- 15 to 25	1.06	0.97	1.14
- 25 to 45	1.36	1.36	1.36
- 45 to 65	0.66	0.61	0.70
- Above 65	0.17	0.10	0.23
Average Family Age	26.72	25.38	27.98
Average Long Live in the Village-Years	29.11	27.03	31.10
<b>Literacy Status</b>			
- Illiterate	0.87	0.98	0.77
- Read Ability	0.11	0.10	0.12
- Literate	3.85	3.70	3.99
<b>Work Status</b>			
- Total Avail.	3.19	3.10	3.28
- Full Time	3.15	3.02	3.27
- Part Time	0.04	0.08	0.01
- Not Active	1.64	1.68	1.60

Table VIII-18 EDUCATION COMPLETED BY FREQUENCY  
OF HOUSEHOLD MEMBERS

Item	Total		Non-Irrigated Area		Irrigated Area	
	No.	%	No.	%	No.	%
<b>Attending School</b>						
- Very Young	98.00	(11.26)	58.00	(13.78)	40.00	( 8.91)
- Attend Primary	130.00	(14.92)	70.00	(16.63)	60.00	(13.36)
- Attend Second	30.00	( 3.45)	11.00	( 2.61)	19.00	( 4.23)
- Att. Vocation	11.00	(1.26)	4.00	( 0.95)	7.00	( 1.56)
<b>Education Completed</b>						
- Never Study	45.00	( 5.17)	23.00	( 5.46)	22.00	( 4.90)
- Lower Pathom 4	50.00	( 5.75)	25.00	( 5.94)	25.00	( 5.57)
- Primary or Eq.	489.00	(56.21)	222.00	(52.73)	267.00	(59.47)
- Second. or Eq.	11.00	( 1.26)	4.00	( 0.95)	7.00	( 1.56)
- Diploma or Eq.	5.00	( 0.57)	3.00	( 0.71)	2.00	( 0.45)
- Bachelor	1.00	( 0.11)	1.00	( 0.24)	0.00	( 0.00)
<b>Total</b>	<b>870.00</b>	<b>(100.00)</b>	<b>421.00</b>	<b>(100.00)</b>	<b>449.00</b>	<b>(100.00)</b>

Table VIII-19 FARM INVENTORY BY AREA

Type of Farm Inventory	Irrigated Area		Non-irrigated Area	
	Number of Farms Having	No. of Inventory (Units)	Number of Farms Having	No. of Inventory (Units)
Dwelling	91	92.00	87	91.00
Storage Barn	57	57.00	37	37.00
Penstock	10	10.00	15	15.00
Silk Worm House	0	0.00	0	0.00
Other Improvement	0	0.00	0	0.00
Sprayer by Hand	44	50.00	42	48.00
Cart/Push Cart	23	23.00	31	32.00
Push-Cart by Labor	8	8.00	3	3.00
Plow	8	14.00	20	41.00
Harrow	4	4.00	17	18.00
Sickle/Knife	94	396.00	80	348.00
Hoe	89	261.00	87	247.00
Others	0	0.00	0	0.00
Tractor L-size	0	0.00	0	0.00
Tractor M-size	9	10.00	3	3.00
Tractor S-size	53	53.00	30	30.00
Agri. Truck	3	3.00	3	3.00
Water Pump	29	30.00	12	12.00
Planting Machine	0	0.00	0	0.00
Harvest. Machine	0	0.00	0	0.00
Engine Sprayer	12	14.00	11	11.00
Cassava Cutting Machine	0	0.00	5	5.00
Thresh. Machine	3	3.00	0	0.00
Winnow. Machine	16	16.00	3	3.00

Table VIII-20 LAND CHARACTERISTICS, PRICE AND VALUE

	No. of Plots	Total Area (rai)	Land Price (Baht/rai)	Land Value (Baht)	Av. Distance (km)
<b>Owned Land</b>					
- Lowland R. Fed	43.00	930.25	4,946.73	4,601,700	1.76
- Upland R. Fed	75.00	1,314.00	1,797.98	2,362,550	2.13
- Lowland Irr.	72.00	1,917.00	5,877.23	11,207,800	4.07
- Upland Irr.	17.00	267.00	3,544.19	946,300	0.85
<b>Total</b>	<b>206.00</b>	<b>4,418.25</b>	<b>4,327.15</b>	<b>19,118,440</b>	<b>2.62</b>
<b>Rented Land</b>					
- Lowland R. Fed	13.00	289.00	4,560.55	1,318,000	1.81
- Upland R. Fed	16.00	285.00	1,689.47	481,500	2.69
- Lowland Irr.	33.00	956.00	7,147.49	6,833,000	2.10
- Upland Irr.	6.00	145.00	3,724.14	540,000	2.25
<b>Total</b>	<b>68.00</b>	<b>1,675.00</b>	<b>5,476.12</b>	<b>9,172,500</b>	<b>2.20</b>
<b>Other Land</b>					
- Lowland R. Fed	9.00	228.00	4,440.79	1,012,500	2.19
- Upland R. Fed	6.00	63.00	1,730.16	109,000	0.95
- Lowland Irr.	9.00	199.00	4,633.17	922,000	0.91
- Upland Irr.	4.00	57.00	3,649.12	208,000	1.25
<b>Total</b>	<b>28.00</b>	<b>547.00</b>	<b>4,116.09</b>	<b>2,251,500</b>	<b>1.38</b>
<b>Total Land Tenure</b>					
- Lowland R. Fed	64.00	1,447.25	4,789.91	6,932,200	1.83
- Upland R. Fed	97.00	1,662.00	1,776.81	2,953,050	2.15
- Lowland Irr.	114.00	3,062.00	6,192.98	18,962,890	3.25
- Upland Irr.	27.00	460.00	3,612.58	1,694,300	1.22
<b>Total</b>	<b>302.00</b>	<b>6,640.25</b>	<b>4,599.59</b>	<b>30,542,440</b>	<b>2.41</b>

Table VIII-21 QUANTITY AND VALUE OF CROPS SOLD

	Quantity of Crop Production	Quantity of Crop Production Sold	%	Value of Crop Sold (Bahts)	Price (Baht/unit)
Wet Season					
Single Crop					
- Trans. Rice	1,872,890.00	1,360,710.00	75.65	3,804,512.25	2.80
- Broad. Rice	49,550.00	34,500.00	69.63	95,775.00	2.78
- Maize	71,266.00	71,170.00	99.87	148,718.00	2.09
- Mung Bean	12,626.50	21,549.00	99.39	89,314.00	7.12
- Cassava*	1,879.50	677.00	Not Available	214,130.00	316.29
- Cassava Shredded*	570.15	570.14	100.00	500,762.50	878.31
Inter Crop					
- Maize	50,929.00	50,679.00	99.51	111,708.00	2.20
Dry Season					
Double Crop					
- Mung Bean	34,620.50	33,597.50	97.05	256,223.00	7.63

Remarks: \* Tons Unit

Table VIII-22 INPUT PRICE FOR MAIN CROPS

	Rice			Maize			Mungbeans			Cassava		
	Quantity	Value	Price	Quantity	Value	Price	Quantity	Value	Price	Quantity	Value	Price
<u>Seed (Baht/kg)</u>												
Seed Hyv.	2.22	4.17	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Seed Improved	0.33	0.93	2.80	4.74	67.50	14.23	3.56	40.78	11.47	0.00	0.00	0.00
Seed Local	1.28	3.63	2.84	0.29	1.28	4.34	6.97	61.03	8.76	0.00	0.00	0.00
<u>Fertilizer (Baht/kg)</u>												
Fert 16-20-0	50.97	249.11	4.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fert 20-20-0	0.56	3.11	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Am. Sulphate	79.04	278.63	3.52	1.39	4.72	3.40	0.00	0.00	0.00	2.22	6.61	2.97
Other Fer.	15.58	96.55	6.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<u>Water (Baht/lit)</u>												
Water	0.44	3.11	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<u>Fuels &amp; Lubricants (Baht/lit)</u>												
Fuels	120.07	1,008.99	8.40	0.98	7.08	7.26	9.33	74.51	7.98	5.99	54.69	10.94
Lubricants	4.44	125.22	28.20	0.01	0.36	26.00	0.29	8.31	29.03	0.10	2.79	28.74
<u>Human Labour (Baht/man day)</u>												
Hired Labour	93.53	3,700.86	39.57	5.57	197.75	35.48	8.77	340.94	38.87	29.53	1,122.87	38.02
<u>Hired Machinery Inputs (Baht/hour)</u>												
Small Size	32.22	1,553.57	48.22	1.56	123.31	78.85	1.84	83.55	45.40	7.97	372.63	46.77
Medium Size	0.03	2.57	77.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	1.60	229.38	143.62	0.58	139.28	241.06	0.64	98.53	153.16	3.55	735.29	207.08
<u>Rented Machinery Inputs (Baht/hour)</u>												
Small Size	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.83	23.57
Medium Size	0.01	0.16	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<u>Animal Rate (Baht/man day)</u>												
Hired Animal	0.00	1.00	360.00	0.01	0.83	75.00	0.00	0.00	0.00	0.15	29.94	206.32
Rented Animal	1.04	78.06	75.18	0.08	13.22	170.00	0.09	8.36	97.03	0.09	8.81	99.13

Table VIII-23 CASH INCOME AND EXPENDITURE BAHT PER FARM BY OPERATION

No. Farm Having	Non-Irrigated Area										Irrigated Area													
	1-20		21-30		31-40		41-50		Over 50		Total		1-20		21-30		31-40		41-50		Over 50		Total	
	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	Rai	
Cash Income from Farming <sup>/1,2</sup>	12	31	20	15	10	88																		
- Paddy	4,765	9,003	17,100	23,453	21,910	13,683																		
- Other Crops	6,171	7,393	7,845	16,796	30,476	11,555																		
- Livestocks	83	858	730	933	43	644																		
Sub-total	11,019	17,253	26,675	38,183	52,429	25,882																		
Off-Farm Income Hired Labour																								
- Farm Work	1,305	2,238	606	998	1,177	1,461																		
- Off-Farm Work	1,221	551	550	49	2,255	1,546																		
- Wages, Sala.	0	1,568	0	192	1,100	994																		
- Others	0	0	0	0	0	0																		
Sub-total	2,526	4,347	1,156	1,239	4,532	4,001																		
Other Non-Agriculture Income	583	2,207	914	4,547	2,376	2,110																		
Total	14,128	23,807	27,743	43,968	59,337	31,993																		
Consumption Expenditure																								
- Food, Non-Alcoholic Beverages <sup>/3</sup>	5,872	7,597	6,394	7,856	8,731	7,489																		
- Alcoholic Beverages and Tobacco	787	561	745	708	1,042	713																		
- Clothes and Foot Wear	853	801	805	867	1,290	932																		
- Personal Cares	1,186	786	853	1,029	1,456	973																		
- Transportation, Communication Equipment	281	372	472	321	469	498																		
- Party	318	530	640	427	1,160	580																		
- Education and School Fees	1,188	532	838	359	1,219	853																		
- Medical Cares	994	667	926	550	1,000	845																		
Sub-total	11,477	11,846	11,674	12,116	16,367	12,885																		
Non-Consumption Expenditure	174	330	171	538	1,008	385																		
Total	11,651	12,175	11,845	12,655	17,375	13,269																		
Family Net Cash Income	2,477	11,632	15,900	31,314	41,962	18,723																		

Note: /1: Excluded farm product for consumption  
 /2: Net income  
 /3: Included crop product produced in farm



Table VIII-24 PRODUCTION INPUTS FOR SINGLE RICE IN  
WET SEASON IN 1984/85 (1/2): IRRIGATED AREA

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total Rai
Number of Farms in Survey in Group	20.00	20.00	15.00	15.00	21.00	91.00
Total Area under Activity (Rai)	278.75	499.00	538.50	658.00	1,295.75	3,270.00
Number of Plots in Group	21.00	25.00	23.00	23.00	39.00	131.00
<u>Seeding Rate (kgs.)</u>						
Seed HYV	4.09	4.39	1.56	1.81	1.07	2.06
Seed Improved	1.00	0.00	0.37	0.93	0.99	0.72
Seed Local	5.63	5.44	9.90	5.70	4.96	6.05
<u>Seed Total</u>	10.73	9.83	11.83	8.43	7.02	8.84
<u>Fertilizer Rate (kgs.)</u>						
Fert. 16-20-0	3.44	1.90	2.51	1.87	0.19	1.45
Fert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Amm. Sulphate	2.91	3.91	1.51	3.74	1.72	2.53
Other Fers.	0.00	0.00	0.27	0.00	0.94	0.42
<u>Fert. Total</u>	6.36	5.82	4.29	5.61	2.86	4.40
<u>Pesticide and Hormone (Baht/Rai)</u>						
Pesticide	2.50	1.32	2.40	0.38	0.94	1.26
Weedicide	2.49	3.72	0.26	0.27	0.72	1.16
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Chemicals</u>	5.00	5.04	2.66	0.65	1.67	2.42
<u>Water</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Fuels</u>	2.78	3.73	4.90	4.04	3.42	3.78
Lubricants	0.17	0.20	0.17	0.16	0.11	0.15
<u>Total Fuel + Lubri.</u>	2.95	3.93	5.07	4.20	3.53	3.93
<u>Hired Labour (MD)</u>	3.42	3.69	3.30	2.55	7.15	4.75
<u>Tractor Labour (Hours)</u>						
<u>Hired Machinery Input</u>						
Small Size	4.71	1.30	0.66	0.76	1.02	1.26
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.19	0.03	0.01	0.02	0.02	0.04
<u>Total</u>	4.90	1.33	0.67	0.78	1.04	1.30
<u>Rented Machinery Input</u>						
Small Size	0.00	0.00	0.30	0.00	0.00	0.05
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	0.00	0.00	0.30	0.00	0.00	0.05
<u>Total Tractor (HR)</u>	4.90	1.33	0.97	0.78	1.04	1.35
<u>Hired Animal (MD)</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal (MD)</u>	0.05	0.00	0.06	0.00	0.00	0.01
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	4.51	8.66	6.04	4.27	4.15	5.21
Medium Size	0.02	0.00	0.01	0.00	0.01	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	4.53	8.66	6.05	4.27	4.16	5.21
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.04	0.00	0.12	0.00	0.03
<u>Family and Exchange Labour Inputs in Mandays</u>	7.18	5.76	6.31	6.84	4.50	5.69
<u>Total Mandays</u>	10.60	9.45	9.62	9.39	11.65	10.44

Table VIII-24 PRODUCTION INPUTS FOR SINGLE RICE IN  
WET SEASON IN 1984/85 (2/2): NON-IRRIGATED AREA

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total Rai
Number of Farms in Survey in Group	6.00	24.00	17.00	11.00	6.00	64.00
Total Area under Activity (Rai)	93.75	513.25	570.00	402.00	375.00	1,954.00
Number of Plots in Group	8.00	30.00	23.00	16.00	12.00	89.00
<u>Seeding Rate (kgs.)</u>						
Seed HYV		2.86	2.28	2.44	1.87	2.39
Seed Improved	2.35	1.93	1.12	1.14	0.67	1.26
Seed Local	7.36	5.05	5.84	4.08	7.12	5.59
Seed Total	10.99	9.84	9.25	7.66	9.65	9.24
<u>Fertilizer Rate (kgs.)</u>						
Fert. 16-20-0	0.00	0.50	1.75	2.61	4.80	2.10
Fert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Ann. Sulphate	5.12	3.01	4.53	0.81	1.55	2.82
Other Fers.	0.09	0.00	1.59	1.24	0.00	0.73
Fert. Total	5.21	3.51	7.88	4.66	6.35	5.65
<u>Pesticide and Hormone (Baht/Rai)</u>						
Pesticide	1.28	1.15	1.01	1.12	1.44	1.17
Weedicide	5.78	0.35	0.10	2.18	0.88	1.02
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
Total Chemicals	7.06	1.50	1.11	3.30	2.32	2.18
<u>Water</u>	0.00	0.00	0.00	0.00	0.21	0.04
<u>Fuels</u>	2.24	4.37	2.59	5.76	2.45	3.67
<u>Lubricants</u>	0.10	0.22	0.11	0.14	0.10	0.14
<u>Total Fuel + Lubri.</u>	2.34	4.59	2.71	5.90	2.55	3.81
<u>Hired Labour (MD)</u>	1.93	3.33	1.86	1.89	3.13	2.50
<u>Tractor Labour (Hours)</u>						
<u>Hired Machinery Input</u>						
Small Size	2.05	0.45	1.40	0.23	0.47	0.76
Medium Size	0.00	0.00	0.00	0.01	0.00	0.00
Large Size	0.17	0.12	0.03	0.08	0.11	0.09
Total	2.22	0.57	1.43	0.32	0.58	0.85
<u>Rented Machinery Input</u>						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Tractor (HR)</u>	2.22	0.58	1.43	0.32	0.58	0.85
<u>Hired Animal (MD)</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal (MD)</u>	0.25	0.09	0.10	0.04	0.00	0.07
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	2.61	6.06	4.94	11.58	3.72	6.25
Medium Size	0.00	0.03	0.01	0.00	0.00	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.61	6.09	4.95	11.58	3.72	6.27
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.09	0.10	0.53	0.08	0.18
<u>Family and Exchange Labour Inputs in Mandays</u>						
	5.62	4.76	5.60	6.16	4.22	5.23
<u>Total Mandays</u>	7.55	8.09	7.47	8.04	7.35	7.73

Table VIII-25 PRODUCTION INPUTS FOR SINGLE RICE IN DRY SEASON IN 1984/85: TOTAL AREAS

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total Rai
Number of Farms in Survey in Group	3.00	2.00	0.00	3.00	1.00	9.00
Total Area under Activity (Rai)	16.00	22.00	0.00	62.00	10.00	110.00
Number of Plots in Group	3.00	3.00	0.00	5.00	3.00	14.00
<u>Seeding Rate (kgs.)</u>						
Seed HYV	18.75	14.09	0.00	2.26	9.00	7.64
Seed Improved	3.75	0.00	0.00	4.03	0.00	2.82
Seed Local	0.00	0.00	0.00	0.00	0.00	0.00
<u>Seed Total</u>	22.50	14.09	0.00	6.29	9.00	10.45
<u>Fertilizer Rate (kgs.)</u>						
Fert. 16-20-0	1.88	0.00	0.00	4.84	0.00	3.00
Fert. 20-20-0	0.00	0.00	0.00	0.00	10.00	0.91
Amm. Sulphate	0.00	2.73	0.00	4.52	15.00	4.45
Other Fers.	1.25	0.00	0.00	0.00	0.00	0.18
<u>Fert. Total</u>	3.13	2.73	0.00	9.35	25.00	8.55
<u>Pesticide and Hormone (Baht/Rai)</u>						
Pesticide	23.00	0.00	0.00	3.71	120.00	16.35
Weedicide	0.00	36.14	0.00	24.19	0.00	20.86
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Chemicals</u>	23.00	36.14	0.00	27.90	120.00	37.21
<u>Water</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Fuels</u>						
Fuels	30.69	8.23	0.00	20.65	21.00	19.65
Lubricants	0.63	0.00	0.00	0.20	1.20	0.31
<u>Total Fuel + Lubri.</u>	31.31	8.23	0.00	20.85	22.20	19.97
<u>Hired Labour (MD)</u>	7.72	4.20	0.00	3.73	4.50	4.47
<u>Tractor Labour (Hours)</u>						
<u>Hired Machinery Input</u>						
Small Size	3.09	0.36	0.00	3.50	0.72	2.56
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.06	0.00	0.00	0.02	0.00	0.02
<u>Total</u>	3.16	0.36	0.00	3.52	0.72	2.58
<u>Rented Machinery Input</u>						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Tractor (HR)</u>	3.16	0.36	0.00	3.52	0.72	2.58
<u>Hired Animal (MD)</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal (MD)</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	29.00	9.45	0.00	21.42	10.78	19.16
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	29.00	9.45	0.00	21.42	10.78	19.16
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.00	0.00	0.00	0.00	0.00
<u>Family and Exchange Labour Inputs in Mandays</u>						
	2.21	2.08	0.00	4.69	0.70	3.45
<u>Total Mandays</u>	9.93	6.28	0.00	8.42	5.20	7.92

Table VIII-26 PRODUCTION INPUTS FOR MUNG BEANS IN  
 DRY SEASON IN 1984/85: TOTAL AREAS

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total Rai
Number of Farms in Survey in Group	5.00	8.00	5.00	8.00	6.00	32.00
Total Area under Activity (Rai)	39.00	127.00	83.00	100.00	198.75	547.75
Number of Plots in Group	5.00	9.00	7.00	10.00	10.00	41.00
Seeding Rate (kgs.)						
Seed HYV	0.00	0.00	0.00	0.00	0.00	0.00
Seed Improved	3.97	1.26	4.13	0.91	0.00	1.37
Seed Local	1.42	3.43	1.27	10.20	5.31	4.88
Seed Total	5.39	4.69	5.39	11.11	5.31	6.24
Fertilizer Rate (kgs.)						
Pert. 16-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Pert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Amm. Sulphate	0.00	0.00	0.00	0.00	0.00	0.00
Other Pers.	0.00	0.00	0.00	0.00	0.00	0.00
Pert. Total	0.00	0.00	0.00	0.00	0.00	0.00
Pesticide and Hormone (Baht/Rai)						
Pesticide	46.67	34.80	13.95	43.51	15.90	27.22
Needicide	0.00	0.00	0.00	0.00	0.00	0.00
Hormone	4.31	7.28	3.96	0.64	1.13	3.12
Total Chemicals	50.97	42.09	17.92	44.15	17.03	30.34
Water	0.00	0.00	0.00	0.00	0.00	0.00
Fuels	4.05	3.80	3.25	2.21	1.26	2.52
Lubricants	0.03	0.24	0.07	0.03	0.01	0.08
Total Fuel + Lubri.	4.08	4.03	3.32	2.24	1.27	2.60
Hired Labour (MD)	1.71	1.51	1.88	2.46	1.23	1.65
Tractor Labour (Hours)						
Hired Machinery Input						
Small Size	0.77	0.13	0.53	0.32	0.65	0.46
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.05	0.06	0.13	0.12	0.04	0.07
Total	0.82	0.19	0.66	0.44	0.69	0.54
Rented Machinery Input						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.04	0.00	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.04	0.00	0.01
Total Tractor (HR)	0.82	0.19	0.66	0.48	0.69	0.54
Hired Animal (MD)	0.00	0.00	0.00	0.00	0.00	0.00
Rented Animal (MD)	0.33	0.00	0.00	0.03	0.00	0.03
Owned Machinery Input - Hours Unit						
Small Size	45.90	3.72	4.94	3.71	2.18	6.35
Medium Size	0.00	0.02	0.00	0.02	0.00	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	45.90	3.74	4.94	3.73	2.18	6.36
Owned Animal - Manday Unit						
Owned Animal	0.00	0.00	0.00	0.00	0.00	0.00
Family and Exchange Labour Inputs in Mandays	2.66	2.74	2.55	3.42	1.08	2.23
Total Mandays	4.36	4.25	4.43	5.88	2.31	3.88

Table VIII-27 GROSS MARGINS FOR MAIZE IN BAHT PER RAI, WET SEASON IN 1984/85  
: TOTAL AREAS

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total Rai
Number of Farms in Survey in Group	0.00	2.00	3.00	3.00	2.00	10.00
Total Area under Activity (Rai)	0.00	45.00	31.00	65.00	47.00	188.00
Number of Plots in Group	0.00	2.00	8.00	8.00	4.00	22.00
<u>Seeding Rate (kgs.)</u>						
Seed HYV	0.00	0.00	0.00	0.00	0.00	0.00
Seed Improved	0.00	12.89	9.29	6.83	12.26	10.04
Seed Local	0.00	0.00	1.19	4.18	0.00	1.64
<u>Seed Total</u>	0.00	12.89	10.48	11.02	12.26	11.69
<u>Fertilizer Rate (kgs.)</u>						
Fert. 16-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Fert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Amn. Sulphate	0.00	15.11	5.48	0.00	0.00	4.52
Other Fers.	0.00	0.00	0.00	0.00	0.00	0.00
<u>Fert. Total</u>	0.00	15.11	5.48	0.00	0.00	4.52
<u>Pesticide and Hormone (Baht/Rai)</u>						
Pesticide	0.00	0.00	0.00	0.00	0.00	0.00
Weedicide	0.00	0.00	0.00	0.00	25.53	6.38
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Chemicals</u>	0.00	0.00	0.00	0.00	25.53	6.38
<u>Water</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Fuels</u>	0.00	0.00	2.55	10.34	0.00	3.99
<u>Lubricants</u>	0.00	0.00	0.00	1.00	0.00	0.35
<u>Total Fuel + Lubri.</u>	0.00	0.00	2.55	11.34	0.00	4.34
<u>Hired Labour (MD)</u>	0.00	109.00	167.74	145.85	28.51	111.30
<u>Tractor Labour (Hours)</u>						
<u>Hired Machinery Input</u>						
Small Size	0.00	97.33	89.81	20.74	33.19	53.57
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	150.00	122.58	66.15	185.53	125.37
<u>Total</u>	0.00	247.33	212.39	86.89	218.72	178.95
<u>Rented Machinery Input</u>						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Tractor (HR)</u>	0.00	247.33	212.39	86.89	218.72	178.95
<u>Hired Animal (MD)</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal (MD)</u>	0.00	15.56	0.00	25.85	0.00	12.66
<u>Total Cost</u>	0.00	399.89	398.65	280.94	285.02	329.84
<u>Production VI B</u>	0.00	862.40	1,098.10	582.06	829.28	796.06
<u>Production VI KG</u>	0.00	410.67	522.90	277.17	394.89	379.07
<u>Gross Margin</u>	0.00	462.51	699.45	301.12	544.26	466.22
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	0.00	0.00	0.54	2.85	0.00	1.07
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total</u>	0.00	0.00	0.54	2.85	0.00	1.07
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.00	0.00	0.00	0.00	0.00
<u>Family and Exchange Labour Inputs in Mandays</u>	0.00	2.03	1.90	7.54	2.84	4.12
<u>Gross Margin per Manday</u>						
Family Labour	0.00	228.40	367.51	39.92	191.97	113.30

Table VIII-28 GROSS MARGINS FOR RICE IN BAHT PER RAI,  
WET SEASON IN 1984/85 (1/2): IRRIGATED AREA

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total
Number of Farms in Survey in Group	20.00	20.00	15.00	15.00	21.00	91.00
Total Area under Activity (Rai)	278.75	499.00	538.50	658.00	1,295.75	3,270.00
Number of plots in Group	21.00	25.00	23.00	23.00	39.00	131.00
Seed HYV	12.27	13.17	4.68	5.43	3.20	6.18
Seed Improved	3.01	0.00	1.11	2.78	2.96	2.17
Seed Local	5.63	5.44	9.90	5.70	4.96	6.05
Seed Total	20.91	18.61	15.69	13.91	11.12	14.41
Fert. 16-20-0	17.04	11.76	13.04	12.74	0.85	8.29
Fert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Ann. Sulphate	9.61	20.36	6.07	12.85	5.64	9.74
Other Fers.	0.00	0.00	6.77	0.00	4.48	2.89
Fert. Total	26.65	32.13	25.88	25.59	10.96	20.93
Pesticide	2.50	1.32	2.40	0.38	0.94	1.26
Weedicide	2.49	3.72	0.26	0.27	0.72	1.16
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
Total Chemicals	5.00	5.04	2.66	0.65	1.67	2.42
Water	0.00	0.00	0.00	0.00	0.00	0.00
Fuels	19.78	26.22	34.30	31.48	46.37	36.05
Lubricants	4.81	5.14	4.91	5.41	2.84	4.22
Total Fuel + Lubri.	24.59	31.36	39.21	36.89	49.22	40.26
Hired Labour	144.48	173.20	127.37	99.31	161.47	143.69
Tractor Costs Hired Machinery Input						
Small Size	95.66	73.74	50.32	41.76	52.65	56.96
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	15.78	5.41	3.34	3.34	1.62	4.04
Total	111.44	79.15	53.67	45.10	54.28	61.00
Rented Machinery Input						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00
Total Tractor Costs	111.44	79.15	53.67	45.10	54.28	61.00
Hired Animal	0.00	0.36	0.00	0.00	0.00	0.06
Rented Animal	4.96	0.00	0.00	0.00	0.00	0.42
Total Cost	338.03	339.83	264.48	221.45	288.71	283.19
Production VI B	1,235.41	1,121.70	850.83	956.43	993.75	1,002.83
Production VI KG	475.16	431.42	327.24	367.86	382.21	385.70
Gross Margin	887.38	781.87	586.35	734.98	705.04	719.64
Owned Machinery Input - Hours Unit						
Small Size	4.51	8.66	6.04	4.27	4.15	5.21
Medium Size	0.02	0.00	0.01	0.00	0.01	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.53	8.66	6.05	4.27	4.16	5.21
Owned Animal - Manday Unit						
Owned Animal	0.00	0.04	0.00	0.12	0.00	0.03
Family and Exchange Labour Inputs in Mandays	7.18	5.76	6.31	6.84	4.50	5.69
Gross Margin per Manday Family Labour	124.96	135.79	92.85	107.49	156.53	126.44

Table VIII-28 GROSS MARGINS FOR RICE IN BAHT PER RAI,  
WET SEASON IN 1984/85 (2/2): NON-IRRIGATED AREA

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total
Number of Farms in Survey in Group	6.00	24.00	17.00	11.00	6.00	64.00
Total Area under Activity (Rai)	93.75	513.25	570.00	402.00	375.00	1,954.00
Number of Plots in Group	8.00	30.00	23.00	16.00	12.00	89.00
Seed HYV	7.04	8.59	6.84	7.31	5.60	7.17
Seed Improved	3.84	5.79	3.37	3.43	2.00	3.78
Seed Local	7.36	5.05	5.84	4.08	7.12	5.59
<u>Seed Total</u>	18.24	19.43	16.05	14.83	14.72	16.54
Fert. 16-20-0	0.00	2.26	6.57	13.25	13.45	7.82
Fert. 20-20-0	0.00	0.00	0.00	0.00	0.00	0.00
Amm. Sulphate	24.58	8.87	8.52	3.43	5.47	7.75
Other Fers.	0.60	0.00	8.17	6.22	0.00	3.69
<u>Fert. Total</u>	25.17	11.13	23.26	22.90	18.92	19.26
Pesticide	1.28	1.15	1.01	1.12	1.44	1.17
Weedicide	5.78	0.35	0.10	2.18	0.88	1.02
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Chemicals</u>	7.06	1.50	1.11	3.30	2.32	2.18
<u>Water</u>	0.00	0.00	0.00	0.00	1.49	0.29
Fuels	16.11	35.37	18.40	41.38	17.10	27.22
Lubricants	3.02	6.30	3.18	4.20	2.22	4.02
<u>Total Fuel + Lubri.</u>	19.13	41.66	21.58	45.58	19.33	31.24
<u>Hired Labour</u>	70.51	121.29	76.40	70.80	97.64	90.83
Tractor Costs Hired Machinery Input						
Small Size	106.99	35.86	63.54	28.56	24.67	43.70
Medium Size	0.00	0.00	0.00	1.15	0.00	0.24
Large Size	18.77	24.18	3.68	10.25	19.23	14.12
Total	125.76	60.04	67.23	39.96	43.89	58.06
Rented Machinery Input						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.05	0.00	0.00	0.00	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.05	0.00	0.00	0.00	0.01
<u>Total Tractor Costs</u>	125.76	60.09	67.23	39.96	43.89	58.07
<u>Hired Animal</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal</u>	26.67	7.71	8.82	2.96	0.00	6.48
<u>Total Cost</u>	292.53	262.80	214.44	200.31	198.31	224.89
<u>Production VI B</u>	854.19	853.23	675.36	845.97	707.89	772.00
<u>Production VI KG</u>	328.53	328.16	259.75	325.37	272.27	296.92
<u>Gross Margin</u>	561.65	590.42	460.92	645.66	509.58	547.11
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	2.61	6.06	4.94	11.58	3.72	6.25
Medium Size	0.00	0.03	0.01	0.00	0.00	0.01
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.61	6.09	4.95	11.58	3.72	6.27
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.09	0.10	0.53	0.08	0.18
<u>Family and Exchange Labour Inputs in Mandays</u>	5.62	4.76	5.60	6.16	4.22	5.23
<u>Gross Margin per Manday</u>						
Family Labour	99.88	123.94	82.24	104.86	120.72	104.55

Table VIII-29 GROSS MARGINS FOR RICE IN BAHT PER RAI,  
 DRY SEASON IN 1984/85: TOTAL AREAS

	1 to 20 Rai	21 to 30 Rai	31 to 40 Rai	41 to 50 Rai	Over 50 Rai	Total
Number of Farms in Survey in Group	3.00	2.00	0.00	3.00	1.00	9.00
Total Area under Activity (Rai)	16.00	22.00	0.00	62.00	10.00	110.00
Number of Plots in Group	3.00	3.00	0.00	5.00	3.00	14.00
Seed HYV	56.25	42.27	0.00	6.77	27.00	22.91
Seed Improved	11.25	0.00	0.00	12.10	0.00	8.45
Seed Local	0.00	0.00	0.00	0.00	0.00	0.00
<u>Seed Total</u>	67.50	42.27	0.00	18.87	27.00	31.36
Fert. 16-20-0	51.56	0.00	0.00	26.13	0.00	22.23
Fert. 20-20-0	0.00	0.00	0.00	0.00	56.00	5.09
Amn. Sulphate	0.00	46.36	0.00	30.32	51.00	31.00
Other Fers.	45.00	0.00	0.00	0.00	0.00	6.55
<u>Fert. Total</u>	96.56	46.36	0.00	56.45	107.00	64.86
Pesticide	23.00	0.00	0.00	3.71	120.00	16.35
Weedicide	0.00	36.14	0.00	24.19	0.00	20.86
Hormone	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Chemicals</u>	23.00	36.14	0.00	27.90	120.00	37.21
<u>Water</u>	0.00	0.00	0.00	0.00	0.00	0.00
Fuels	224.19	52.50	0.00	74.79	168.00	100.54
Lubricants	18.75	0.00	0.00	6.05	36.00	9.41
<u>Total Fuel + Lubri.</u>	242.94	52.50	0.00	80.84	204.00	109.95
<u>Hired Labour</u>	305.63	204.09	0.00	168.06	220.00	200.00
Tractor Costs Hired Machinery Input						
Small Size	204.06	21.82	0.00	141.05	270.00	138.09
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	7.50	0.00	0.00	5.65	0.00	4.27
Total	211.56	21.82	0.00	146.69	270.00	142.36
Rented Machinery Input						
Small Size	0.00	0.00	0.00	0.00	0.00	0.00
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Tractor Costs</u>	211.56	21.82	0.00	146.69	270.00	142.36
<u>Hired Animal</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Rented Animal</u>	0.00	0.00	0.00	0.00	0.00	0.00
<u>Total Cost</u>	947.19	403.18	0.00	498.82	948.00	585.75
<u>Production VI B</u>	1,592.50	1,418.18	0.00	1,140.65	1,820.00	1,323.64
<u>Production VI KG</u>	612.50	545.45	0.00	438.71	700.00	509.09
<u>Gross Margin</u>	645.31	1,015.00	0.00	641.82	872.00	737.89
<u>Owned Machinery Input - Hours Unit</u>						
Small Size	29.00	9.45	0.00	21.42	10.78	19.16
Medium Size	0.00	0.00	0.00	0.00	0.00	0.00
Large Size	0.00	0.00	0.00	0.00	0.00	0.00
Total	29.00	9.45	0.00	21.42	10.78	19.16
<u>Owned Animal - Manday Unit</u>						
Owned Animal	0.00	0.00	0.00	0.00	0.00	0.00
<u>Family and Exchange Labour Inputs in Mandays</u>	2.21	2.08	0.00	4.69	3.60	3.71
<u>Gross Margin per Manday</u>						
Family Labour	291.87	488.09	0.00	136.75	242.22	198.88