SECTORAL REPORT II
AGRICULTURE DEVELOPMENT PLAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This sectoral report presents the agricultural development plan concerned with Khlong Luang, Ban Khai Extension and Khlong Thap Ma Irrigation Schemes as well as Ban Khai irrigation area. Development plan of the above-mentioned three irrigation schemes has been formulated in association with development plan of Khlong Luang, Khlong Yai and Khlong Thap Ma Dam Schemes, which have been planned not only for irrigation but also for domestic and industrial water supply and flood control.

In order to elaborate the agricultural development plan of the respective irrigation area, field survey and investigation were carried out in collaboration with RID during a 2-month period from August to September, 1982. During the period, major effort has been laid out to collect data and information concerned with:

(1) soils, land capability and land use,

(2) socio-economy at regional level,

(3) agricultural yields and productions,

(4) agricultural support services,

(5) prevailing farming practices, and

(6) living conditions of farmers.

The above data and informations were collected from the various government agencies and offices concerned and directly from farmers through a monitoring survey.

The agricultural development plan presented herein was formulated based on data and informations so far made available.

2. THE STUDY AREA

2.1 Location and Area

The Study Area is located in the east coast and extends over two provinces. The total area is about 5,500 km^2, consisting of 3,800 km^2 of Chon Buri Province and 1,700 km^2 of Rayong Province except the Prasae river basin and belongs to the Agro-Economic Zone 15 which is classified into the area of producing cassava and sugarcane, and marine fisheries. The Study Area can be divided into three basin areas, in a viewpoint of geography, i.e. Khlong Luang river basin area, coastal river basin area and Rayong river basin area.

The Khlong Luang river basin area is about 2,100 km^2 and extends over the northern part of Chon Buri Province. The coastal river basin area is about 1,600 km^2 and extends along the seashore of Chon Buri Province. The Rayong river basin area is about 1,800 km^2 and extends over the western part of Rayong Province.

2.2 Topography and Soils

2.2.1 Topography

(1) Khlong Luang River Basin Area

The Khlong Luang river basin area is generally flat with slight undulations except the mountainous areas in the western and southern parts of the area. Main river is the Khlong Luang river flowing in a direction from east to northwest, joining to the Bang Pakong river.

(2) Coastal River Basin Area

The coastal river basin area is also flat with slight undulations except for the mountainous areas in the eastern and southern parts of the area.

There is no big river other than some small rivers in the area.

(3) Rayong River Basin Area

The Rayong river basin area is flat with slight undulations. The mountainous areas are located in the eastern and northern part of the area.

Main rivers are the Rayong river and its tributaries including the Khlong Yai and Nong Pla Lai rivers. The Rayong river flows in direction from north to south and pours into the Gulf of the Thailand. The southern part of the Rayong river suffers so often from flood damages.

2.2.2 Soils

Soils in the Study Area are mainly composed of five soil groups, (1) soils of beach and dune sands, (2) recent alluvium, (3) semirecent alluvium, (4) old alluvium, and (5) transported materials and residuum from granite and gneiss, according to the Detailed Reconnaissance Soil Maps of Chon Buri and Rayong Provinces, in a scale of 1/100,000 published by the Soil Survey Division, Land Development Department.

(1) Soils of Beach and Dune Sands

The soils of beach and dune sands are distributed on the area adjacent to or close to the coastal line. Texture of these soils is evidently very coarse (sand, loamy sand, occasionally sand loam). Natural drainage ranges from moderately well drained to excessively drained. The soils are characterized by very low natural fertility. These soils are unsuitable for irrigated agriculture due to their soil and topographic conditions. Coconut, banana, bamboo are grown on this soil unit under rainfed conditions at present.

(2) Soils of Recent Alluvium

The soils of recent alluvium are distributed on the riverine alluvial plains. Recent alluvial sediments are mainly clayey, but may be locally loamy or even sandy in the minor brook valleys. Generally, the recent alluvium shows signs of wetness because of the low position in respect to the level of groundwater. Natural drainage is somewhat poor to poor. These soils are moderately suitable for rice and upland crop cultivation.

(3) Semirecent Alluvium

The soils of semirecent alluvium are distributed on the higher terraces than the soils of recent alluvium. Sediments of these soils are mostly clayey, showing signs of wetness. Texture is fine and drainability is poor. These soils are commonly well adapted to rice growing if sufficient drainage is provided.

(4) Old Alluvium

The formation of these soils occurs on the various marine and river terraces. Texture and lithologic composition of the old alluvium vary widely, however, medium textured sediments, leached in the surface layers, dominate. These soils are suitable for rice and upland crop growing.

(5) Soils of Transported Material and Residuum from Granite and Gneiss

The soils of this group are distributed on the slightly higher position than the soils mentioned above. Texture ranges from sandy loam to loamy sand or even sand, drainability is well to moderate, fertility is poor to very poor. These soils are suitable for upland crop growing.

The distribution of soil groups by area is presented in Table 1 and Fig. 1 and is briefly described for the respective area hereunder.

Khlong Luang River Basin: Major soils are (1) soils of old alluvium, (2) semirecent alluvium and (3) soils of transported and others. They occupy 33%, 26% and 30% of total area respectively. The soils of the proposed Khlong Luang Irrigation Scheme area are mainly classified into the soils of semirecent alluvium.

Coastal River Basin: Soils of old alluvium (24% of total area) and soils of transported material and others (64%) are dominantly distributed.

Rayong River Basin: Old alluvium (10%) and soils of transported and others (80%) are dominantly distributed. The soils of the Ban Khai Extension, Thap Ma, and Ban Khai Irrigation Scheme areas are mainly composed of the soils of semirecent alluvium.

2.3 Climate

The climate in the Study Area is characterized by the tropical monsoon climate and has two distinct seasons; wet season from May to October and dry season from November to April. The annual rainfall is 1,300 mm. More than 80% of the annual rainfall occurs in the wet season. Consequently cultivation of crops in the dry season is difficult without irrigation except for perennial crops and some crops such as sugarcane and cassava having characteristics of strong tolerance to drought. Features of climate are presented in Table 2.

2.4 Land Use

The land use of the Study Area is obtained as tabulated below based on land use map in a scale of 1 to 100,000, which was prepared by LDD.

Land Use Categories	Khlong River Basin		Coastal River Basin		Rayong River Basin		Total	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Rice field	63,200	30.1	5,500	3.4	15,500	8.6	84,200	15.3
Upland field	84,200	40.1	117,700	73.6	109,000	60.6	310,900	56.6
Perennial crop	4,100	1.9	11,300	7.1	27,600	15.3	43,000	7.8
Forest	55,200	26.3	13,200	8.2	25,800	14.3	94,200	17.1
Others	3,300	1.6	12,300	7.7	2,100	1.2	17,700	3.2
Total	210,000	100.0	160,000	100.0	180,000	100.0	550,000	100.0

According to Agricultural Census Record (1978) published by NSO, approximately 297,700 ha of the entire Study Area is defined to be farm holding area. As shown in Table 3, approximately 96% of farm holding area is used for crop cultivation, comprizing 20% of rice, 66% of upland crop and 10% of tree crops.

2.5 Population

Population and number of household in the Study Area are as summarized hereunder.

Item	Unit	Chon Buri Province	Rayong Province	Study Area
Population/1	10^3 persons	696.8	345.8	1,042.6
Total households/1	10^3 nos.	100.7	55.5	156.2
Population of farm household/2	10^3 persons	184.6	145.1	329.7
Farm household/2	10^3 nos.	37.9	32.0	69.9
Family size of farm household	persons	4.9	4.5	4.7

/1: Records of Registration Division, 1978, DLG
/2: Agricultural Census Report by NSO

2.6 Farm Size and Land Tenure

Distribution of farms by land holding size is shown in detail in Table 4 and average farm size is summarized hereunder.

	Unit	Rayong Province/1	Chon Buri Province	Study Area
Holding area	10^3 ha	195.8	100.9	296.7
Farm households	10^3 no.	37.9	20.7	58.6
Average farm size	ha	5.2	4.9	5.1

/1: Excluding figures of Amphoe Klaeng and King Ampoe Wan Chang

Land tenure situation in the Study Area is presented in Tables 5 and 6. Approximately 80% of farms and owner operator and 10% tenant. Approximately 80% of the entire farm holding area is occupied by owner operators.

2.7 Agricultural Productions

2.7.1 Farming Practices

Major crops cultivated in the Study Area are rice, cassava and sugarcane. Tree crops such as fruit trees and rubber are also grown widely in Rayong Province.

Farming practices are described hereunder for the major crops.

(1) Rice

Major variety of rice are RD7 and RD9 as the improved varieties and Khao Ko Diew, Leuang Pla Lai, Khao Yai Pao, Khao Ta U, Leuang Bang Bai and Levang Rai as the local varieties. All varieties mentioned above are non-glutenous type. The Chon Buri Agricultural Extension Office recommends RD25 as the new improved variety for the Study Area. Ratio between the cultivated areas of local and improved varieties is 60:40 in the Study Area, according to the informations obtained from Agricultural Extension Offices. Generally the local varieties are sown in nursery beds during the period from the beginning of June to the middle of July, transplanted from the beginning of July to the middle of August and harvested from the beginning of November to the middle of December. The improved varieties are generally sown in nursery beds during the period from the middle of June to the end of July, transplanted from the middle of July to the end of August and harvested from the middle of October to the end of November. Where irrigation water is available, the improved varieties are sown from the beginning of December to the middle of January, transplanted from the beginning of January to the middle of February, and harvested from the beginning of April to the middle of May. These cropping features are given in Table 7. Characteristics of RD7 and RD25 are shown in Table 8.

As for fertilizer application for local varieties, a rate of 160 to 190 kg/ha of compound fertilizer (N:16 - P:20 - K:0) for the Study Area is recommended by the government. Generally most of farmers, however, apply no fertilizer. Major diseases are blast and bacterial leaf blight and major insects are brown plant hoppers and

stem borers. Generally most of farmers do not spray any agro-chemicals. Harvesting is done by hand and harvested rice is threshed by trampling of buffaloes or by hitting panicles against wooden plank.

(2) Cassava

Variety of cassava cultivated in the Study Area is "Rayong" which is bred for industrial use by the Rayong Field Crop Experimental Station. The characteristics of this variety are 20% of starch content, 10 to 12 months of growth period and good yield (25.0 to 27.5 ton/ha on the experimental fields). Spacing of plants is 1 m by 1 m 10,000 pieces of set/ha. Application of 310 kg/ha of compound fertilizer (N:15 - P:15 - K:15), is recommended by the government. Planting is done during the period from the middle of October to the end of December, and harvesting is done from the middle of August to the end of October. In the Fifth National Plan, cultivation area of cassava is projected to be maintained the present level to prevent soils from deterioration.

(3) Sugarcane

Varieties of sugarcane are F134, F137, F140, F156, Q83, Pinder and H48-3166. Among these varieties F137 occupies about 50% of the total cultivated area and F140 30%. Planting of plant cane is done during the period from the middle of December to the end of April; favorable period for their growth and operation of sugar factory. Table 7 shows a cropping calender. Spacing of plants is, generally, 1.3 m by 0.3 m (25,600 set/ha). Fertilizers are applied at a rate of 310 kg/ha of compound fertilizer (N:15 - P:15 - K:15). Earthing is done two times; one to one and a half month after planting for the first earthing and two to three months after planting for the second earthing. Harvesting is done by hand and harvested canes are transported to the sugar factory immediately. Ratooning is done just after harvesting with cutting the stubbles of harvested cane. Amount of fertilizers applied is the same as the plant cane. Harvesting is done from the middle of December to the end of April. There are nine sugar factories in the Study Area, six factories in Chon Buri Province and three factories in Rayong Province.

2.7.2 Crop Productions

Crop productions for three major crops in the Study Area were estimated for 1979/80 and 1980/81 as shown in Table 9.

The crop yield and production in a crop year 1979/80 were considerably reduced compared with other years, resulted from severe drought. The crop production in a crop year 1980/81 is 130.7 x 10^3 tons for rice, 2,640 x 10^3 tons for cassava and 2,959 x 10^3 tons for sugarcane.

As reported in Sectoral Report I, Socio-Economy, according to Agricultural Statistics of Thailand published by MOAC, in both the Chon Buri and Rayong Provinces, planted areas of cassava and sugarcane expanded at average annual increasing rates of 1.1% and 5.4% during a 5-year period from 1976 to 1980. On the other hand, yield of sugarcane reduced from 48.3 t/ha in 1976 to 37.7 t/ha in 1980 and yield of cassava remained almost unchanged, 15.4 t/ha in 1980. As for rice, planted area and crop yield increased at 2.3 and 2.8%/annun, respectively.

The above fact implies that production of sugarcane and cassava has been sustained by increase of planted area. The government, in its Fifth National Plan, envisages to raise crop yield to attain the purpose, a high priority is given to development of irrigation system.

2.7.3 Livestock Raising

The livestock raising in the Study Area is presented in Table 10. Raising of cow for milk is none in the Study Area.

2.8 Agricultural Support Services

2.8.1 Research

There are two field crop research stations in the Study Area. One is the Sugarcane Experimental Station of Ministry of Industry, located near by Bang Phra Dam. The other is the Field Crop Experimental Station of MOAC, located in Huai Pong in Rayong Province. The later mainly researches into cassava.

Seeds are available from Seed Centers which are operated by MOAC. There are 6 Seed Centers in Thailand. Nakorn Ratchasima Seed Center is located nearest to the Study Area. The government has a plan to establish a Seed Center in Chon Buri Province in the near future.

2.8.2 Agricultural Extension Services

The agricultural extension services are provided by Department of Agricultural Extension (DAE), MOAC. Provincial Extension Offices are located at Chon Buri and Rayong respectively.

The government, as one of targets in agricultural sector in the Fifth National Plan, plans to strengthen the agricultural extension services. According to the publication entitled "Department of Agricultural Extension" issued by MOAC in 1980, the DAE plans to achieve a service ratio of one extension worker to 1,000 farms (presently 1 to 4,000).

In the Study Area, one extension officer contacts with approximately 1,000 to 1,300 farmers at present.

2.8.3 Agricultural Credit Services

The Bank of Agriculture and Agricultural Cooperatives (BAAC) provide the agricultural cooperatives and farmers with agricultural credit services. There are three types of credit services to farmers as briefly mentioned below.

(1) Short Term Loan

Use:	crop production, small livestock and fishery
Interest:	14%/annum
Term:	one to five years
Security:	guarantee by 2 persons

(2) Middle Term Loan

Use:	land, cattle or buffalo, farming machinery, land improvement, fruit garden opening, etc.
Interest:	14%/annum
Term:	one to five years
Security:	(a) title deed or land (b) guarantee by 2 persons

(3) Big Farmer's Loan

Interest:	(a) 14%/annum for loan amount ฿100,000 - ฿300,000
	(b) 15%/annum for loan amount ฿300,000 - ฿600,000
	(c) 16%/annum for loan amount over ฿600,000
Term:	one to five years
Security:	(a) title deed or land
	(b) guarantee by 2 persons

The amount of BAAS's loan has been standardized for crop and livestock as follows.

Rice:	฿900/rai	(฿5,625/ha)
Cassava:	฿970/rai	(฿6,063/ha)
Sugarcane:	฿3,200/rai	(฿20,000/ha)
Chicken:	฿85/head	

The performance of BAAS's and agricultural cooperative's credit services is shown in Tables 11 and 12 for 1982.

The agricultural cooperatives serve distribution of farming commodities such as fertilizers, agro-chemicals, farming implements and machinery to their members. The agricultural cooperative offices have been established in each district/sub-district. Their activities are needed to be expanded to meet the farmer's demand.

2.9 Marketing

(1) Rice

The marketing of rice in Thailand is largely undertaking by the private sector. The rural middle marchants buy rice (paddy) from farmers.

The big marchants or mill owners buy paddy from the middle marchants and they sell rice to the central markets by themselves or through agents. A recent survey of agricultural marketing studies

in Thailand[/1]. Concluded that system is basically efficient. Marketing margins are low and price throughout the system respond quickly to changes in terminal market conditions. The share of the price quoted on the Bangkok market and actually received by the farmers is high. The relationship between paddy prices in Bangkok, local markets and the farm gate price in 1979 and 1980 is shown in Fig. 2.

The government has intervened in marketing of paddy to provide a minimum price guarantee for farmers.

(2) Other Crops

Other crops such as groundnuts and mungbeans are collected by the rural middle marchants from the farmers and sold to the provincial markets and transported to the central wholesale market through big or middle marchants or agents. In case of fruit, there is no provincial market. Fruits and vegetables are directly transported to the wholesale markets in Bangkok except some quantity for local consumptions.

2.10 Existing Irrigation System

RID has been endeavouring to develop the irrigation systems and water resources facilities. At present, there are several irrigation projects in the Study Area and out of 438,000 ha of arable lands, only 27,000 ha is declared to be irrigated by RID. The irrigation projects in the Study Area are listed up in Table 13.

/1: World Bank: Income growth and poverty alleviation in Thailand, 1980.

3. PLAN FORMULATION

3.1 Surveyed Area

On the basis of compositive studies on topography, soils, geology, hydrology, socio-economy, etc., the following irrigation schemes are identified to have a high potentiality for agricultural development in the Study Area, viz. the Khlong Luang Irrigation Scheme in Chon Buri Province and the Ban Khai Extension and Khlong Thap Ma Irrigation Schemes in Rayong Province. In addition, the upgrading of the Ban Khai Existing Irrigation Scheme is preferentially required and the agricultural development plan is also worked out in this study.

In order to assess the soils, land capability and present land use for selecting the potential irrigable area of each development scheme, the Surveyed Areas were tentatively demarcated by encompassing the scheme area to be developed as shown in Figs. 3 and 4. The Surveyed Area for the Khlong Luang Irrigation Scheme is approximately 300 km^2. The Surveyed Area in the Rayong river basin is approximately 400 km^2, for the Ban Khai Extension and Existing, and Khlong Thap Ma Irrigation Schemes.

3.2 Potential Irrigable Area

Following the results of the land capability classification, present land use and other selecting factors, the potential irrigable areas are delineated in both the Khlong Luang and Rayong river basins as shown in Figs. 3 and 4.

3.2.1 Location

The potential irrigable area for the Khlong Luang Irrigation Scheme area is located immediately to the east of Phanat Nikhom which is located about 30 km northeast from Chon Buri municipality. The area lies on both banks of the Khlong Luang river and is bounded by hill skirts in north and south, extending for 25 km from east to west with an average width of 4 km. Acreage of the area is approximately 11,700 ha in gross.

The Ban Khai Extension area of 9,000 ha in gross lies on the left bank of the Rayong river and outside the Ban Khai Existing Scheme area.

The area is located immediately to the east of Rayong municipality and slenderly extends north to south along the left main canal of the Ban Khai Existing Scheme.

The Khlong Thap Ma area lies over both banks of the Khlong Thap Ma river which is a tributary of the Rayong river. The area covers 2,800 ha in gross and is located immediately west from the Rayong municipality, bounded by the Rayong river in east.

3.2.2 Soils

The soil conditions in the potential irrigable area for each irrigation scheme are studied based on the soil series referring to the Detailed Reconnaissance Soil Survey Maps of Chon Buri and Rayong Provinces in a scale of 1/100,000 published by the Soil Division, Department of Land Development. Distributions of the soils by each scheme area are presented in Tables 14 to 17 and briefed below.

Khlong Luang Irrigation Scheme area: The major soils comprise 57% of Chon Buri series and 27% of Khlaeng series (Kl) grouped into semi-recent alluvium and 9% of Satuk series (Suk) grouped into old alluvium.

Ban Khai Extension Irrigation Scheme area: The major soil distribution is 30% of Khok Khian series (Ko), 18% of Alluvial soils-poorly drained complexes (AC-pd) grouped into semirecent alluvium and 9% of Ban Thon series (Bh) grouped into beach and sand bars.

Ban Khai Existing Irrigation Scheme area: The major soils consist of 61% of Alluvial soils-poorly drained complexes (AC-pd), 22% of Khok Khian series (Ko) and 10% of Ban Thon series (Bh).

Khlong Thap Ma Irrigation Scheme area: The major soils comprise 59% of Alluvial soils-poorly drained complexes (AC-pd) and 10% of Rayong series (Ry) grouped into beach and sand bars.

The brief descriptions on the major soil series mentioned above are as follows:

Chon Buri series (Cb): The Cnon Buri series are soils characterized by the argillic B horizon having an aguic moisture regime. The soils are derived from terrace sediments and mainly extend over the low marine terrace. Relief is flat to nearly flat with slope of 2% or less. The soils have, in general, very deep effective soil depth, loamy to sandy texture and mottled profile. pH value varies from 4.0 to neutral. The soils have high electric conductivity which is ranked in affected class for crop cultivation. However this condition is confined in deep subsoils. Organic matter contents are low in both topsoils and subsoils. Cation exchange capacity is moderately low ranging from 2 meq. to 20 meq. which are highly saturated by bases at a level of 40% to 100%. Inherent fertility is moderate. With respect to the hydrodynamic features, the soils have rather low water holding capacity ranging from 5% to 24% at pF 2.5 (1/3 atom) throughout the profile. Drainage condition is somewhat poor and permeability is moderate. The Chon Buri series are correlated with Low Humic Gley Soils (in National taxonomy) or Typic Paleaqualfs (in USDA taxonomy). They are suitable for rice and upland crops cultivation.

Khlaeng series (Kl): The Khlaeng series are soils characterized by plinthite in the argillic B horizon. They are derived from alluvium underlain by marine deposits. They occupy the level terrain on the low terraces which mainly extend over the north western part of the irrigable area. The soils are deep in effective soil depth, fine to medium in texture and mottled throughout the profile. With regard to chemical properties, pH values show strongly acid. CEC is low in topsoils, while high in subsoils. Inherent soil fertility appears moderate. Drainage conditions are externally and internally poor. Khlaeng series are correlated with Low Humic Gley Soils (in National taxonomy) or oxic Plinthaqualfs (in USDA taxonomy). They are suitable for rice cultivation.

Satuk series (Suk): The Satuk series are soils specifically characterized by silicate clay in argillic horizon. They are strongly weathered and leached. The soils are formed from old alluvium and occur on the middle and high terraces which have undulating to gently rolling topography with slope ranging from 2 to 5%. They mainly extend over the hill zone in the irrigable area. The soils show deep effective depth and coarse in texture. The reaction is strong acid to slightly acid. CEC is very low. Inherent soil fertility is low. Water holding capacity is very low and permeability is moderate. The Satuk series are correlated with Red Yellowish Podozolic Soils (in National taxonomy) or Paleustults (in USDA taxonomy). They are suitable for upland crop cultivation.

Alluvial Soils, Poorly Prained Complexes (AC-pd): These soils are typical alluvial soils on the low-lying alluvial plain developed along the Rayong river and its tributaries. They are characterized by gleic horizon and/or layer. The soils have, in general, fine texture and strong acid reaction. Inherent fertility of the soil is low. Water holding capacity is moderately high. The drainage conditions are externally and internally poor, due to flat or depressed topography and fine soil texture. For upland crop cultivation, proper drainage improvement is needed.

Khok Khian series (Ko): The Khok Khian series are typical wet soils characterized by a thick, mottled, gray argillic horizon. They are formed from relatively old alluvium and occur on the lower parts of terraces. Relief is flat to almost flat. The soils have medium texture, deep effective soil depth and mottled profile. PH values show very strong acid to strong acid. CEC is low, while base saturation degree is moderately high. The essential nutrients such as nitrogen, phosphate and potassium are quite deficient throughout the profile. The lands are poorly drained with slow surface runoff. Khok Khian series are correlated with Low Humic Gley Soils (in National taxonomy) or Typic Paleaquults (in USDA taxonomy). They are suitable for rice cultivation.

Rayong series (Ry) and Ban Thon series (Bh): The soils have been developed in the old sand dune which is nearly flat and slightly elevated than the surroundings. The soils consist of the corse textured deposit of quartz sand. The soil conditions range from 4.0 (extremely acid) to 6.0 (medium acid) in pH value. Inherent fertility is low because of low CEC, low basic saturation and high permeability. Drainage condition is somewhat excessive to excessive. Rayong series and Ban Thon series are correlated with Regosols and Groundwater Podzols (in National taxonomy) or Quartzipsamments. Ban Thon series are correlated with Regosols and Groundwater Podzols (in National taxonomy) or Tipic Tropohumods (in USDA taxonomy). They are suitable for upland crop growing if sufficient water and fertilizers are available.

3.2.3 Land Capability

The land capability classification of each potential irrigable area is made according to the Land Capability Classification Maps for rice in Chon Buri and Rayong Provinces prepared by the Soil Division, Department of Land Development. The result of land capability classification is shown in Figs. 5 and 6 and summarized below.

(Unit: ha)

Class of Land Capability	Khlong Luang	Ban Khai Extension	Ban Khai Existing	Khlong Thap Ma
I	830	0	0	0
II	2,970	0	0	0
III	6,300	4,620	4,700	760
IV	0	420	0	80
V	1,600	3,960	700	1,960
Total	11,700	9,000	5,400	2,800

As shown in the above table, some areas classified into class V are taken up as a potential irrigable area, taking into account the present land use of paddy cultivation and the irrigation and drainage improvements under the with-project condition.

3.2.4 Land Use

Present land use map for the potential irrigable area is prepared based on the land use maps in Chon Buri and Rayong Provinces published by the Department of Land Development and results of reconnaissance survey by the survey team, and shown in Figs. 7 and 8. Proportional extent of major cropping area in each scheme area is presented in Table 18. The following is a brief description of present land use condition in each scheme area.

Khlong Luang Irrigation Scheme Area: Rainfed paddy cultivation predominates in this area. The cultivation area consists of about 10,200 ha or 87% of paddy fields and about 1,000 ha or 9% of upland fields. Unstable paddy cultivation is practiced mainly in the rainy season throughout the project area, and yield of paddy is rather low with large variance from year to year.

Ban Khai Extension Irrigation Scheme Area: No notable irrigation facility exists in this area except some villages, where farmers have simple irrigation facilities mainly in the Bung Ton Chan Irrigation Project. The cultivated lands mainly consist of paddy fields with a total area of about 6,300 ha; 70% of the total area, and the upland fields of about 1,900 ha; 21% of the total area. The remaining lands are mainly used as orchard garden and village yard.

Ban Khai Existing Irrigation Scheme Area: The area is provided with irrigation facilities. Irrigated paddy cultivation is predominant in this area, but stable paddy cultivation cannot be expected even in the rainy season because of insufficient irrigation facilities. About 4,800 ha or 89% of the total area is cultivated with paddy. The remaining lands are used as upland fields and village yard.

Khlong Thap Ma Irrigation Scheme Area: The cultivation area consists of about 2,000 ha or 70% of paddy fields, about 650 ha or 23% of upland fields and about 100 ha or 4% of orchard garden. The remaining lands are mainly used as village yard.

3.3 Plan Formulation

3.3.1 Selection of Crops

The most suitable cropping pattern for each irrigation scheme area is set up based on the following considerations in selection of crops.

(1) Rice

Rice is the principal crop for the nation's food and the major export commodities for Thailand. The Government has been emphasizing increase of rice production to cope with the future population increase and expansion of export to meet the aim of the Fifth National Development Plan.

(2) Groundnuts and Mungbeans

Groundnuts are important resources for food oil and protein and mungbeans are those for protein. These beans are suitable crops for second crop after rice in a rotation cropping system.

(3) Sugarcane

Sugarcane is the major crops cultivated in the Khlong Luang Irrigation Scheme area as well as cassava. Sugar is an important commodity for the Thai economy. The value of sugar exported in 1979 occupied 5% of the total value of the agricultural exported commodities. Recently the international price of sugar is hanging at low level, but importance of sugar production for Thailand is not varied.

(4) Vegetables

Major vegetables cultivated in the Study Area are Chinese kale, water melon, yard long pea and chilli, but these crop areas are not large at present. Taking into consideration the future demand resulted from population increase, production of vegetables should be magnified. Necessity of magnification for vegetable production in the Study Area is expressed in Table 19.

(5) Fruit Trees

Durian and rambutan are special products in the Rayong Province area. These products are not only consumed in the local area, but also most of products are transported to the Bangkok markets.

3.3.2 Cropping Pattern Alternatives

In order to formulate the most suitable agricultural development scale for each irrigation scheme with relation to the water resources development plan, the alternative cropping patterns are planned taking into account the meteorological conditions, soil conditions, water availability, labor requirements and socio-economic conditions. The alternative cropping patterns for each irrigation scheme are presented in Table 20. The basic considerations for setting up the alternatives are briefed below.

Khlong Luang Irrigation Scheme: The proposed Khlong Luang dam reservoir will serve the domestic and industrial water to the coastal area as well as the irrigation water to the irrigation scheme area. Therefore, the six alternatives are set up considering of water-saving type of cropping pattern. In three alternatives, rice will be cultivated in the rainy season and the upland crops such as groundnuts, mungbeans and vegetables will be mainly planted in the dry season, based on the cropping intensities of 150%, 140% and 130%. For other three alternatives, sugarcane cultivation is taken into account in the area corresponding to 4.5% of the total area based on the present land use.

Ban Khai Extension Irrigation Scheme: Three alternative cropping patterns are set up in cropping intensities of 150%, 140% and 130%. In the rainy season rice will be planted, and in the dry season rice, upland crops such as groundnuts and vegetables will be planted. In accordance with the present land use, tree crops will be also planted in 580 ha out of the total area.

Ban Khai Existing Irrigation Scheme: Three alternative cropping patterns are also set up in cropping intensities of 150%, 140% and 130%, taking into consideration the present cropping pattern under the irrigated condition and equal distribution of irrigation water in both the Existing and Extension areas. Although the present cropping intensity is 160%, it is about 90% under the irrigated condition. In the rainy season rice will be cultivated, and in the dry season rice and upland crops will be cultivated.

Khlong Thap Ma Irrigation Scheme: The scheme area will be served the irrigation water from the proposed Khlong Thap Ma reservoir which is blessed with abundant water to be used only for irrigation. Therefore, three intensive cropping patterns are worked out in cropping intensities of 180%, 170% and 160%. Rice will be cultivated in the rainy season, rice and upland crops such as groundnuts and vegetables will be cultivated in the dry season. Fruit trees will be irrigated mainly in the dry season as a perrenial crop based on the present land use.

3.3.3 Selected Agricultural Development Plan

In accordance with the results of optimization studies on each dam scheme presented in Sectoral Report XI, the following agricultural development plans are selected to be most suitable plan:

Khlong Luang Irrigation Scheme: The exploited water resource limits the irrigation area to 6,600 ha in net (7,800 ha in gross) with cropping intensity of 140%. Since sugarcane can be planted in upland fields under the rainfed conditions and the Government put stress on rice cultivation rather than sugarcane, the cropping pattern-2 is adopted as the proposed plan.

Ban Khai Extension and Existing Irrigation Schemes: The exploited water resources of the Nong Pla Lai and Khlong Yai reservoirs can supply water to the whole potential irrigable area of 7,700 ha in net (9,000 ha in gross) in cropping intensity of 140% for the Ban Khai Extension Scheme area other than the Existing Scheme area of

4,800 ha in net (5,400 ha in gross). The cropping intensity for the Existing Scheme area is taken to be 140%, the same intensity as the Extension Scheme area, in order to maintain the same farm income under the with-project condition in the both areas.

Khlong Thap Ma Irrigation Scheme: The most suitable cropping pattern is the cropping pattern-2 with cropping intensity of 170%. The net irrigation area is 2,400 ha (2,800 ha in gross) which is corresponding to the whole potential irrigable area.

3.4 Proposed Irrigation Scheme Area

3.4.1 Location

Locations of each proposed irrigation scheme area are the same place as the potential irrigable areas except the Khlong Luang Irrigation Scheme area, and are described in Section 3.2.1.

In accordance with the result of optimization study of development scale, the proposed irrigation area for the Khlong Luang Irrigation Scheme is selected from the damsite to lower part as far as 6,600 ha are obtained. The selected area extends from the damsite to Phanat Nikhom along the both banks of the Khlong Luang river and is almost identical with that envisaged by RID.

3.4.2 Soils and Land Capability

The soil conditions of major soil series distributed and the land capability in the Ban Khai Extension, Ban Khai Existing and Khlong Thap Ma Irrigation Scheme areas are explained in Sections 3.2.2 and 3.2.3.

In the Khlong Luang Irrigation Scheme Area, Chon Buri series (Cb) occupies 57% of the total area, and Klaeng series (Kl) and Phan Thon series (Ptg) are distributed in 27% and 9% of the total area respectively. Their distributions are shown in Fig. 3. The land capability map is also shown in Fig. 5.

3.4.3 Present Land Use

The present land use in the Ban Khai Extension, Ban Khai Existing and Khlong Thap Ma Irrigation Scheme areas are described in Section 3.2.4.

The present land use in the Khlong Luang Irrigation Scheme area comprise 85% of rice field, 11% of upland crop fields and 4% of others.

The present cropping calendars in each irrigation scheme area are presented in Fig. 9.

3.4.4 Socio-economy

The socio-economic situations in each irrigation scheme area are estimated based on the data obtained from the Town (amphoe) Offices concerned.

Administratively the Khlong Luang Irrigation Scheme area extends over one (1) District (amphoe) and seven (7) Towns (tambons). Number of households, population and family size are 2,140 households, 13,368 persons and 6.2 persons respectively. Number of farmer's households and average farm size are 1,917 households and 4.1 ha respectively.

The Ban Khai Extension Irrigation Scheme area extends over two (2) Districts and ten (10) Towns. Number of households, population and family size are 2,730 households, 15,610 persons and 5.7 persons respectively. Number of farmer's households and average farm size are 2,280 households and 3.9 ha respectively.

The Ban Khai Existing Irrigation Scheme area extends over two (2) Districts and seven (7) Towns. Number of households, populations and family size are 1,840 households, 9,300 persons and 5.1 persons respectively. Number of farmer's households and average farm size are 1,625 households and 3.3 ha.

The Khlong Thap Ma Irrigation Scheme area extends over one (1) District and four (4) Towns. Number of households, populations and family size are 690 households, 4,130 persons and 6.0 persons respectively. Number of farmer's households and average farm size are 580 households and 4.8 ha respectively.

The detailed features of socio-economic conditions for each irrigation scheme area are presented in Table 21.

3.4.5 Agricultural Production

The present situations of agricultural production in each irrigation scheme area are predominant in crop production. Livestock raising is not prevailing, the farmers raise small number of cattles for animal power and small number of poultry for cash income and self consumption. There is no cow for milk in the area. The present crop production for each irrigation scheme area is presented in Table 22.

4. ANTICIPATED YIELD AND PRODUCTION

4.1 Future Land Use

On the basis of the proposed agricultural development plan, the present land use in each irrigation scheme area will be changed into the future land use as shown in Table 24. The net irrigable area will mainly be developed for rice cultivationin the rainy season, and upland crops such as groundnuts, mungbeans and vegetables in the dry season. The remaining non-irrigable area will be used as upland field and for village yards, canals, roads, etc.

4.2 Proposed Cropping Pattern

Paddy is selected as a main crop in each irrigation scheme area. In studying the cropping pattern, the following items are fully taken into consideration:

(a) Climatic condition,

(b) Soil characteristics,

(c) Topography,

(d) Availability of irrigation water,

(e) Agronomic characteristics on crops,

(f) Predominant varieties of crops,

(g) Availability of labour forces,

(h) Farmers' intent, and

(i) National policy for agricultural development.

The proposed cropping patterns for each irrigation scheme are shown in Table 23 and Fig. 10.

4.3 Proposed Farming Practices

Together with the introduction of modernized irrigation and drainage systems and strengthening of agricultural support services, the improved farming practices will be introduced into all the farmers in the scheme area to maintain the high crop productivity. The followings are descriptions of proposed farming practices particularly for rice and other major crop productions.

(1) Rice

For increasing rice yields, distributing seeds of good quality, which are multiplied from high yield varieties, is essential. In this context, the RD varieties such as RD-7, RD-9 and RD-25 are proposed (as the suitable improved varieties). From the viewpoints of self consumption for farmers, some local varieties are planted. The ratio between the improved and local varieties is proposed at 80:20 in the future.

In addition, proper fertilization is essential to obtain the target yields. The total fertilizer requirement would be 80 to 100 kg per ha of nitrogen and 30 to 50 kg per ha of phosphate for the improved varieties. For the local varieties, application of 30 to 40 kg per ha of nitrogen and 20 to 30 kg per ha of phosphate are proposed. Fertilization of nitrogen mentioned above is mainly made for basal and top dressing.

Proper water management is indispensable for cultivation of the improved varieties. Water is supplied in deep depth during the rooting period of seedlings and critical period for the punicle development and fertilization stage of rice plants. Whereas, during the period from about 40 to 50 days after transplanting to about 20 to 30 days before heading for control of non-productive tillers and from about 20 days before harvesting, water supply is stopped.

As regards the plant protection, intensive application of agro-chemicals is required to control insects, i.e. stemborers and plant hoppers, and disease, i.e. blast. It is recommended that spraying should be done systematically through the farmers' group.

Mechanical land preparation by means of tractor is recommended. To decrease loss of paddy grains harvested, thresher will be introduced to the area.

(2) Beans

To improve farming practices for groundnuts and mungbeans, good land preparation, careful pulverizing, optimum application of fertilizers and partient spraying of agro-chemicals are indispendable. As to fertilizer application for beans, 7 to 13 kg per ha of nitrogen, 7 to 13 kg per ha of phosphate and 10 to 20 kg per ha of potassium are recommended. Since conditions of excess moisture content in soils are undesirable for growth of beans, careful attention should be paid to drainage.

(3) Fruit Trees

For durian and rambutan, the proper pruning for young trees, optimum fertilization and proper irrigation especially during the period from floral differentiation to maturity of fruits, and spray of agro-chemicals to control pests and diseases are important.

4.4 Input Requirements

4.4.1 Labor Requirements

The present and future labor requirements in each proposed irrigation scheme area are presented in Tables 25 and 26. According to these tables the peak labor requirements occur in July at present and in August in future. The monthly labor requirements for each area can be applied by the family labor force in each area except the Khlong Thap Ma Irrigation Scheme area. However, the hired labor force for the Khlong Thap Ma Irrigation Scheme area is required only in August and its amount is to be approximately 5,000 man-days per month, or 200 man-days per day, or 2 man-days per ha.

4.4.2 Material Requirements

Annual farming material requirements such as seeds, fertilizers and agro-chemicals for each proposed irrigation scheme area are estimated as shown in Table 27.

In order to meet the future demand of farming materials, the distribution system of farming materials of the Agricultural Cooperatives should be strengthened.

4.5 Anticipated Yield and Production

4.5.1 Anticipated Yield

After completion of construction for the irrigation facilities, farming practices in the scheme areas will be improved in agricultural technics and in investment for farming by strengthening support services. Owing to the results of these improvements, yields of crops will be increased remarkably.

The target yields of crops at the full development stage are projected as shown in the following table referring to the results of experiments conducted by the Agricultural Experimental Stations and information from the Agricultural Extension Offices in the Study Area. Duration to reach the target yields of these crops would be needed at least five years.

(Unit: t/ha)

Crop	Present[1]	Target
Rice		
- Local variety	1.8	4.0
- Improved variety - wet season	2.3	4.5
- Improved variety - dry season	-	5.0
Groundnuts (with shell)	1.3	2.5
Mungbeans	0.8	1.5
Vegetables (average)	5.0	10.0
Fruits (average of durian and rambutan)	5.0	7.0

4.5.2 Anticipated Crop Production

The yield and production of crops in the scheme areas will increase year by year under the proper irrigation farming and drainage improvement as well as strengthening of the agricultural support services, etc. Based on the proposed cropping patterns, irrigation area and target yields of the crops, the total crop productions in each irrigation scheme area under the with-project conditions are estimated as shown in Table 28.

5. BENEFIT

5.1 Price Prospect

5.1.1 Economic Prices

Agricultural benefits are estimated based on the economic prices prospected in 1990. The prices over 1990 are assumed to be constant.

The prices of both output and input commodities for agricultural production are estimated on the basis of the international market prices. The FOB and CIF prices at Bangkok or FOB prices at the main international trading port are converted to the constant prices in 1990 referring to the "Price Prospected for the Major Primary Commodities" published by the World Bank in 1981.

The farmgate prices at the scheme site are calculated by adding or reducing cost required from Bangkok to the farmgates starting from the international market price at Bangkok.

The economic prices of major commodities concerned with agricultural development plan are presented in Tables 29 and 30.

5.1.2 Financial Prices

The current prices are studied for evaluation of farm economy in the scheme area on the basis of the data and information collected from the National Statistical Office, the Department of Economics, MOAC, the Provincial Offices concerned and the results of farm survey carried out by the Study Team. The financial prices of the major agricultural commodities are given in Tables 29 and 30.

5.2 Benefit

5.2.1 Incremental Benefits by Alternative Cropping Pattern

Incremental benefit are estimated to find the remainder between the total net production value under with-project conditions and that under without-project conditions.

The production cost and net production value per ha by crop are estimated as shown in Tables 38 to 45. The total net production value per ha and the incremental benefit per ha by the alternative cropping pattern in each potential irrigable area are estimated as below.

(Unit: ฿/ha)

Irrigable Area	Cropping Pattern	(Cropping Intensity)	Total Net Production Value		Incremental Benefit
			Without-Project	With-Project	
Khlong Luang	1	(1.5)	12,928	43,505	30,577
	2	(1.4)	12,928	40,286	27,358
	3	(1.3)	12,928	38,152	25,224
	4	(1.5)	12,928	43,117	30,189
	5	(1.4)	12,928	39,898	26,970
	6	(1.3)	12,928	37,764	24,836
Ban Khai Extension	1	(1.5)	15,889	44,070	28,181
	2	(1.4)	15,889	41,633	25,744
	3	(1.3)	15,889	39,220	23,331
Ban Khai Existing	1	(1.5)	23,943	41,163	17,220
	2	(1.4)	23,943	38,742	14,799
	3	(1.3)	23,943	36,321	12,378
Khlong Thap Ma	1	(1.8)	14,342	51,533	37,191
	2	(1.7)	14,342	48,363	34,021
	3	(1.6)	14,342	45,328	30,986
	4	(1.5)	14,342	42,413	28,071

5.2.2 Incremental Benefit in the Proposed Irrigation Scheme Area

The total net production value per ha in each proposed irrigation scheme area under without- and with-project conditions is estimated as shown in Tables 54 and 55.

The incremental benefits per ha for each scheme area are estimated as shown below.

(Unit: ฿/ha)

Scheme	Total Net Production Value per Ha		Incremental Benefit
	Without-project	With-project	
Khlong Luang	12,936	40,309	27,373
Ban Khai Extension	15,889	41,633	25,744
Ban Khai Existing	23,943	38,742	14,799
Khlong Thap Ma	14,342	48,363	34,021

6. FARM BUDGET

6.1 General

Financial evaluations for the proposed agricultural development plans in each irrigation scheme are made by the analysis of the typical farm budgets and assessment for repayment of the construction cost.

Farm budget analysis is conducted to assess whether the scheme will have sufficient incentives to the farmers in the area and will bring enough increase of income in the farmer's economy.

6.2 Typical Farm

The typical farmers are selected two types of farmers who have 2.0 ha and 5.0 ha of gross area for the Khlong Luang and Khlong Thap Ma Irrigation Schemes and 2.0 ha and 3.5 ha of gross area for the Ban Khai Extension and Existing Irrigation Schemes, based on the land holding data in Chon Buri and Rayong Provinces presented in the Agricultural Census Report, 1978.

6.3 Farm Budget Analysis

The results of farm budget analysis for each irrigation scheme are presented in Tables 56 to 63.

As shown in the tables presented above, the farmer's economy under with-project condition will be remarkably improved as compared with that under without-project condition in each scheme area. Especially the small land holding farmers meet their balance by off-farm work income. The farmer's economy under with-project conditions will be improved and will have enough reserve to meet capacity to pay.

7. STRENGTHENING OF AGRICULTURAL SUPPORT SERVICES

In order to perform each irrigation scheme successfully, strengthening of the agricultural support services is indispensable.

(1) Agricultural Extension Services

In regard to number of extension agents in the Study Area, one field agent contacts with 1,000 to 1,300 farms. This number nearly achieves the Government's target. On the other hand, especially the low class field extension staff are considered to be insufficient in agricultural technology. Training for the low class field staff and the leading farmers is important. Providing sufficient number of vehicles for the field staff is important to raise effects of the extension services. Especially increasing number of pick-up truck for distribution of farming materials and auto-bycicles for staff are important matters.

(2) Credit Services

Agricultural credit services for farmers are executed by BAAC and the Agriculture Cooperatives in the Study Area. Their activities are carried out successfully to some extent. However, more strengthening is desireable to serve to the small farmers.

(3) Distribution of Farming Materials

The Agricultural Cooperatives distribute the farming materials such as farming machinery, tool, fertilizers and chemicals to the farmers. However, their activities are not sufficient due to lack of fund. Strengthening of finance to them by BACC is important.

REFERENCES

1. AGRICULTURAL CENSUS RECORD, 1978, NATIONAL STATISTICAL OFFICE
2. AGRICULTURAL STATISTICS OF THAILAND CROP YEAR 1979/80, CENTER FOR AGRICULTURAL STATISTICS OFFICE OF AGRICULTURAL ECONOMICS
3. RECORDS OF REGISTRATION DIVISION, DEPARTMENT OF LOCAL GOVERNMENT, MINISTRY OF INTERIOR
4. AGRICULTURAL PRODUCTION RECORD, PROVINCIAL AGRICULTURAL EXTENSION OFFICE OF CHON BURI AND RAYONG PROVINCES
5. WATER RESOURCES DEVELOPMENT IN THAILAND, RID
6. DETAILED RECONNAISSANCE SOIL MAP OF CHON BURI AND RAYONG PROVINCES, LAND DEVELOPMENT DEPARTMENT, MOAC
7. RESULT OF SOIL ANALYSIS FOR KHLONG LUANG IRRIGATION PROJECT, RID
8. LAND CAPABILITY CLASSIFICATION MAPS, LAND DEVELOPMENT DEPARTMENT, MOAC
9. LAND USE MAPS, LAND DEVELOPMENT DEPARTMENT, MOAC
10. FEASIBILITY STUDY REPORT ON THE EAST COAST WATER RESOURCES DEVELOPMENT PROJECT, PAHSE-I, 1982, JICA
11. CROP PRODUCTION STATUS, OPERATION AND MAINTENANCE DIVISION, RID
12. PRICE PROSPECTED FOR MAJOR PRIMARY COMMODITIES, 1981, WORLD BANK
13. THE FIFTH NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN, 1981, NESDB

TABLES

Table 1 DISTRIBUTION OF SOIL GROUP BY RIVER BASIN

Soil Group	Khlong Luang Basin		Coastal Basin		Rayong River Basin		Total	
	(km2)	(%)	(km2)	(%)	(km2)	(%)	(km2)	(%)
Soils of beach and dune sands	1.9	0.1	50.4	3.2	78.7	4.4	131.0	2.4
Soils of recent alluvium	254.9	12.0	4.7	0.3	2.8	0.2	262.4	4.8
Semi-recent alluvium	539.1	25.5	145.8	9.1	106.8	6.0	791.7	14.4
Old alluvium	690.2	32.6	378.1	23.9	174.5	9.8	1,242.8	22.7
Soils of transported material and residiuum and others	631.9	29.8	1,006.0	63.5	1,413.2	79.6	3,051.1	55.7
Total	2,118.0	100	1,585.0	100	1,776.0	100	5,479.0	100

Table 2 SUMMARY OF CLIMATE

Climatological Features	Observation Station	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual	Data Source
Air Temperature (°C)															
Mean	Chon Buri	29.6	29.3	28.9	28.6	28.3	27.9	27.3	26.7	25.8	25.9	27.4	28.8	27.9	(1)
	Sattahip	29.7	29.2	28.9	28.4	28.4	27.9	27.1	26.5	26.1	26.7	27.9	28.9	27.9	(1)
	B. Nong Mapring	28.1	28.1	27.8	27.9	27.7	27.4	27.2	26.0	25.0	24.7	26.0	27.4	26.9	(2)
Mean Max.	Chon Buri	34.1	33.3	32.5	31.9	31.6	31.2	31.3	31.1	31.0	31.3	32.1	33.2	32.0	(1)
	Sattahip	34.6	33.3	32.7	32.4	32.5	32.2	31.9	32.2	32.4	33.2	33.6	34.1	32.9	(1)
	B. Nong Mapring	35.1	33.5	33.4	33.0	32.9	32.9	33.1	32.9	33.1	33.5	33.7	34.9	33.5	(2)
Mean Min.	Chon Buri	25.4	25.4	25.5	25.0	24.9	24.4	23.8	22.1	20.3	20.1	22.4	24.2	23.6	(1)
	Sattahip	26.5	26.2	26.4	25.7	25.6	25.0	24.0	22.6	21.5	22.1	24.2	25.6	24.5	(1)
	B. Nong Mapring	21.6	22.6	21.5	22.0	21.6	20.9	21.2	19.1	16.7	15.9	15.3	20.0	20.1	(2)
Extreme Max.	Chon Buri	38.0	37.8	37.1	35.5	34.7	34.4	34.8	35.2	36.1	36.2	36.6	37.0	38.0	(1)
	Sattahip	40.5	40.5	37.2	37.8	37.2	37.4	36.2	37.4	38.3	39.0	39.4	39.5	40.5	(1)
	B. Nong Mapring	40.0	40.0	39.0	43.5	39.0	40.0	38.9	40.0	38.5	38.5	39.4	39.3	43.5	(2)
Extreme Min.	Chon Buri	20.4	21.2	21.0	20.5	20.9	20.6	18.2	14.2	12.0	9.9	16.5	17.5	9.9	(1)
	Sattahip	21.0	21.5	20.9	19.0	21.5	19.0	19.5	15.0	12.8	12.3	16.8	18.7	12.3	(1)
	B. Nong Mapring	16.2	18.5	18.5	19.0	20.2	19.5	15.2	10.5	9.0	8.0	10.0	9.8	8.0	(2)
Relative Humidity (%)															
Mean	Chon Buri	71.0	75.0	75.0	75.0	76.0	80.0	80.0	73.0	66.0	67.0	71.0	71.0	73.0	(1)
	Sattahip	77.0	79.0	76.0	77.0	77.0	81.0	83.0	76.0	70.0	70.0	75.0	76.0	76.0	(1)
	B. Nong Mapring	92.2	94.5	94.9	94.8	94.9	95.6	94.6	90.1	68.0	92.5	92.8	93.5	93.2	(2)
Mean Max.	Chon Buri	87.6	88.8	87.6	88.5	90.0	92.3	93.0	89.5	85.1	85.0	86.2	87.8	88.5	(1)
	Sattahip	87.3	88.8	86.0	87.4	87.6	90.7	93.3	89.0	84.7	94.2	88.2	87.6	87.9	(1)
Mean Min.	Chon Buri	56.7	60.8	61.3	62.9	64.0	67.1	66.7	57.2	50.1	52.0	56.2	56.5	59.3	(1)
	Sattahip	61.1	66.6	65.5	64.2	65.9	68.3	69.1	60.7	53.0	51.2	57.0	59.9	61.9	(1)
Extreme Min.	Chon Buri	29.0	32.0	42.0	43.0	45.0	46.0	42.0	29.0	22.0	20.0	25.0	23.0	20.0	(1)
	Sattahip	33.0	43.0	43.0	47.0	48.0	45.0	38.0	29.0	21.0	25.0	17.0	29.0	17.0	(1)
Evaporation (mm)															
	B. Nong Mapring	111.3	102.4	93.3	95.0	90.0	77.7	91.2	96.7	101.7	99.4	93.5	112.0	1,164.2	(2)
	Bang Phra	115.9	109.7	101.0	97.3	91.3	78.3	85.1	87.5	84.7	76.2	76.9	103.1	1,110.1	(2)
	Ban Mai	121.3	111.6	107.7	106.6	103.8	90.9	98.8	96.6	107.7	109.1	107.5	125.9	1,287.5	(2)
Wind Velocity (km/ha)															
	Chon Buri	11.9	10.9	13.2	12.2	12.0	9.8	3.3	11.5	12.2	11.9	13.0	13.2	11.7	(1)
	Sattahip	13.3	13.3	18.2	17.4	16.9	13.7	10.7	12.6	13.2	11.1	12.6	13.7	13.8	(1)
Cloud Cover (Oktas)															
	Chon Buri	4.7	6.1	6.5	6.7	6.9	6.7	5.8	4.5	3.6	3.9	3.8	4.0	5.2	(1)
	Sattahip	4.9	6.4	6.5	6.9	6.9	6.9	6.9	4.8	3.7	3.9	4.1	4.3	5.4	(1)
Rainfall (mm)															
	Rayong	62.9	210.7	120.8	122.3	112.3	203.6	203.6	63.2	8.6	17.8	47.6	53.3	1,226.6	(2)
	Ban Khai	87.8	215.3	161.3	123.9	131.4	238.7	195.9	68.2	11.5	24.6	30.1	42.2	1,320.9	(1)
	Sattahip	76.3	193.6	74.4	98.4	97.0	211.5	275.0	86.3	15.6	21.6	41.5	53.6	1,244.9	(1)
	Bang Lamung	102.6	158.5	89.6	94.5	113.6	220.1	252.7	61.5	9.3	10.4	36.9	48.7	1,198.4	(2)
	Si Racha	88.3	150.6	110.8	113.6	131.7	257.7	218.1	51.3	13.7	11.1	31.4	38.7	1,218.9	(2)
	Bang Phra	113.2	161.9	120.3	124.7	154.6	295.4	222.6	48.9	10.2	10.5	47.2	45.6	1,349.1	(2)
	Chon Buri	77.6	158.8	119.4	152.2	162.4	295.2	210.9	53.9	6.0	13.9	11.3	34.1	1,307.6	(2)
	Ban Bung	94.5	151.9	117.8	129.4	136.7	217.5	182.2	41.2	9.4	8.1	26.3	45.3	1,160.3	(2)

Data Source: (1) Climatological Data of Thailand, 25 Year Period (1951-1975), MD.
(2) RID

Table 3 AREA OF HOLDINGS BY TYPE OF AREA UTILIZED BY DISTRICT (AMPHOE)

Province and District	Area of Farm Holdings		Rice Field		Upland Crop Field		Tree Crops		Forest and Pasture		All Others	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Chon Buri Province												
Muang Chon Buri	9,580	100.0	4,070	42.5	3,560	37.2	1,420	14.8	60	0.6	470	4.9
Ban La Mung	20,680	100.0	1,990	9.6	15,720	76.0	2,460	11.9	230	1.1	280	1.4
Ban Bung	35,170	100.0	4,960	14.1	26,120	74.3	1,460	4.2	310	0.9	2,320	6.5
Phanat Nikhom	66,290	100.0	24,660	37.2	38,370	57.9	1,800	2.7	440	0.7	1,020	1.5
Phan Thong	12,020	100.0	10,320	85.9	870	7.2	440	3.7	120	1.0	270	2.2
Si Racha	24,190	100.0	1,590	6.6	19,020	78.6	2,420	10.0	790	3.2	370	1.6
Sattahip	6,600	100.0	340	5.2	5,030	76.2	920	13.9	170	2.6	140	2.1
K.A. Bo Thom	21,250	100.0	410	1.9	19,300	90.8	610	2.9	410	1.9	520	2.5
Total	195,780	100.0	48,320	24.7	127,980	65.4	11,550	5.9	2,550	1.3	5,380	2.7
Rayong Province												
Muang Rayong	30,000	100.0	4,540	15.1	12,790	42.6	10,940	36.5	1,030	3.4	700	2.4
Klaeng	38,090	100.0	8,460	22.2	14,670	38.5	11,120	29.2	2,680	7.0	1,160	3.1
Ban Khai	36,410	100.0	5,660	15.5	23,990	65.9	4,970	13.7	710	2.0	1,080	2.9
K.A. Pluah Daeng	26,390	100.0	490	1.9	23,900	90.6	1,150	4.4	270	1.0	580	2.1
K.A. Ban Chang	8,070	100.0	110	1.4	7,040	87.2	640	7.9	120	1.5	160	2.0
K.A. Wang Chang	14,060	100.0	680	4.8	11,500	81.8	980	7.0	650	4.6	250	1.8
Total	153,010	100.0	19,930	13.0	93,890	61.4	29,790	19.5	5,460	3.6	3,940	2.5
Study Area in Rayong Province	100,860	100.0	10,790	10.7	67,720	67.1	17,690	17.5	2,130	2.1	2,530	2.6
Total of Two Provinces	348,790	100.0	68,250	19.6	221,870	63.6	41,340	11.9	8,010	2.3	9,320	2.6
Total of Study Area	296,640	100.0	59,110	19.9	195,700	65.9	29,240	9.9	4,680	1.6	7,910	2.7

Data source: Agricultural Census Record (1978) by NSO

Table 4 NUMBER OF FARM BY LAND HOLDING SIZE IN CHON BURI AND RAYONG PROVINCES

Farm Size	Chon Buri Province		Rayong Province	
	Nos. of Farm (nos.)	Proportion (%)	Nos. of Farm (nos.)	Proportion (%)
under 2 rai (0.3 ha)	893	2.3	430	1.3
2 - 3.9 (0.3 - 0.6)	2,257	5.9	1,556	4.9
4 - 5.9 (0.6 - 0.9)	2,635	6.9	2,172	6.8
6 - 9.9 (1.0 - 1.6)	3,408	9.0	2,886	9.0
10 - 14.9 (1.6 - 2.4)	5,264	13.9	4,455	13.9
15 - 19.9 (2.4 - 3.2)	3,603	9.5	3,397	10.6
20 - 24.9 (3.2 - 4.0)	4,068	10.7	4,540	14.2
25 - 29.9 (4.0 - 4.8)	2,495	6.6	2,125	6.6
30 - 39.9 (4.8 - 6.4)	5,075	13.4	3,768	11.8
40 - 49.9 (6.4 - 8.0)	2,534	6.7	2,054	6.4
50 - 59.9 (8 - 9.6)	1,979	5.2	1,515	4.7
60 - 79.9 (9.6 - 12.8)	981	2.6	779	2.4
80 - 99.9 (12.8 - 16.0)	1,294	3.4	1,291	4.0
100 - 139.9 (16.0 - 22.4)	679	1.8	606	1.9
140 - 179.9 (22.4 - 28.8)	250	0.6	196	0.6
180 - 249.9 (28.8 - 40.0)	226	0.6	131	0.4
250 and over (40.0 and over)	354	0.9	174	0.5
All Size	37,995	100.0	32,065	100.0

Data Source: Agricultural Census Report 1978 by NSO

Table 5 CLASSIFICATION OF FARMS BY LAND TENURE

Province and District	Total Number of Farms	Land Owner		Tenant		Land Owner cum Tenant		Others	
		Nos. of Farm (nos.)	Proportion (%)	Nos. of Farm (nos.)	Proportion (%)	Nos. of Farm (nos.)	Proportion (%)	Nos. of Farm (nos.)	Proportion (%)
Chon Buri Province									
Muang Chon Buri	3,435	3,007	87.5	146	4.3	217	6.3	65	1.9
Ban Lamung	5,090	4,619	90.7	152	3.0	296	5.8	23	0.5
Ban Bung	4,475	3,057	68.3	1,141	25.5	193	4.3	84	1.9
Phanat Nikhom	13,232	9,522	72.0	1,446	10.9	1,501	11.3	763	5.8
Phan Thong	3,037	1,491	49.1	971	32.0	510	16.8	65	2.1
Si Racha	5,363	3,948	73.6	677	12.6	538	10.0	200	3.8
Sattahip	1,857	1,149	61.9	305	16.4	263	14.2	140	7.5
King A. Nong Yai	1,506	1,283	85.2	67	4.4	12	0.8	144	9.6
Total	37,995	28,076	73.9	4,905	12.9	3,530	9.3	1,484	3.9
Rayong Province									
Muang Rayong	7,762	6,945	89.5	136	1.8	448	5.8	233	2.9
Klaeng	9,396	8,913	94.8	167	1.8	249	2.7	67	0.7
Ban Khai	7,870	7,004	89.0	203	2.6	595	7.6	68	0.8
K.A. Pluak Daeng	3,471	2,987	86.1	407	11.7	58	1.7	19	0.5
K.A. Ban Chang	1,655	1,285	77.6	163	9.8	128	1.7	79	4.9
K.A. Wan Chang	1,911	1,793	93.8	56	2.9	61	3.2	1	0.1
Total	32,065	28,927	90.2	1,132	3.5	1,539	4.8	467	1.5
Study Area in Rayong Province	20,758	18,221	87.8	909	4.4	1,229	5.9	399	1.9
Total of Two Provinces	70,060	57,003	81.4	6,037	8.6	5,069	7.2	1,951	2.8
Total of Study Area/1	58,753	46,297	78.8	5,814	9.9	4,759	8.1	1,883	3.2

/1: Sum of the Chon Buri Province and Study Area in Rayong Province.

Data Source: Agricultural Census Report (1978) by NSO

Table 6 CLASSIFICATION OF HOLDING AREA BY LAND TENURE

Province and District	Holding Area (ha)	Land Owner		Tenant		Land Owner cum Tenant		Others	
		Holding Area (ha)	Proportion (%)	Holding Area (ha)	Proportion (%)	Holding Area (ha)	Proportion (%)	Holding Area (ha)	Proportion (%)
Chon Buri Province									
Muang Chon Buri	9,580	8,280	86.4	370	3.9	370	3.9	560	5.8
Ban Lamung	20,690	18,510	89.5	400	1.9	890	4.3	890	4.3
Ban Bung	35,170	27,890	79.3	5,420	15.4	580	1.6	1,280	3.7
Phanat Nikhom	66,290	46,410	70.0	5,810	8.8	3,540	5.3	10,530	15.9
Phan Thong	12,020	4,480	37.3	4,460	37.1	910	7.6	2,170	18.0
Si Racha	24,190	18,070	74.7	2,180	9.0	1,650	6.8	2,290	9.5
Sattahip	6,600	4,210	63.8	870	13.2	770	11.7	750	11.3
King A. Nong Yai	21,250	19,660	92.5	350	1.6	140	0.7	1,100	5.2
Total	195,790	147,510	75.3	19,860	10.1	8,850	4.6	19,570	10.0
Rayong Province									
Muang Rayong	30,000	27,520	91.7	360	1.2	1,940	6.5	180	0.6
Klaeng	38,090	36,110	94.8	530	1.4	1,390	3.6	60	0.2
Ban Khai	36,410	31,830	87.4	690	1.9	3,800	10.4	90	0.3
K.A. Pluak Daeng	26,390	23,780	90.1	1,840	7.0	650	2.5	120	0.4
K.A. Ban Chang	8,070	6,290	77.9	460	5.7	1,260	15.6	60	0.8
K.A. Wang Chan	14,060	13,410	95.4	180	1.3	470	3.3	0	0
Total	153,020	138,940	90.8	4,060	2.7	9,510	6.2	510	0.3
Study Area in Rayong Province	100,870	89,420	88.6	3,350	3.4	7,650	7.6	450	0.4
Total of Two Provinces	348,810	286,450	82.1	23,920	6.9	18,360	5.3	20,080	5.7
Total of Study Area/1	296,660	236,930	79.9	23,210	7.8	16,500	5.6	20,020	6.7

/1: Sum of the Chon Buri Province and Study Area in Rayong Province.

Data Source: Agricultural Census Report (1978) by NSO

Table 7 CROPPING CALENDAR BY CROP UNDER PRESENT CONDITION

1. Lowland Rice in Wet Season			
Local Variety	- Sowing	:	Beginning of June - Middle of July
	Transplanting:		Beginning of July - Middle of August
	Harvesting	:	Beginning of November - Middle of December
	Growth period:		150 days
Improved Variety	- Sowing	:	Middle of June - End of July
	Transplanting:		Middle of July - End of August
	Harvesting	:	Middle of October - End of November
	Growth period:		120 days
2. Lowland Rice in Dry Season			
Improved variety	- Sowing	:	Beginning of December - Middle of January
	Transplanting:		Beginning of January - Middle of February
	Harvesting	:	Beginning of April - Middle of May
	Growth period:		120 days
3. Groundnuts	- Sowing	:	Middle of June - Middle of July
	Harvesting	:	End of September - Middle of November
	Growth period:		110 - 120 days
4. Mungbeans	- Sowing	:	Beginning of May - Middle of June, or Middle of September - Middle of October
	Harvesting	:	Middle of July - Middle of August or End of November - End of December
	Growth period:		80 - 90 days
5. Cassava	- Planting	:	Middle of October - End of November
	Harvesting	:	Middle of August - End of October
	Growth period:		10 - 12 months
6. Sugarcane, Plantcane			
	- Planting	:	Middle of December - Middle of February
	Harvesting	:	Middle of December - End of April
	Growth period:		12 - 14 months
Ratoon cane			
	- Ratooning	:	Middle of December - End of April
	Harvesting	:	Middle of December - End of April
	Growth period:		11 - 12 months
7. Vegetables, Water melon			
	- Sowing	:	Middle of May - End of June
	Harvesting	:	Middle of August - End of September
	Growth period:		90 - 100 days
Chilli			
	- Sowing	:	Middle of May - End of June
	Harvesting	:	Middle of August - End of September
	Growth period:		90 - 100 days

Table 8 CHARACTERISTICS OF RD 7 AND RD 25

1. RD 7 (C-63/GR88/Sigadis): (Year of Release, 1975)

Type: Non glutenous

Growing period: 115 - 125 days

Dormancy period: 5 weeks

Reaction to diseases:

BL	BS	Sh.B	Sh.R	BB	YOLV	RSV	RKN
S	S	MS	MR	VS	MS	MS	S

Reaction to insects:

BPH	GLH	WBPH	SB	GM
R	R	MS	MR	R

2. RD 25 (KDML105/IR2061, 214-2-3-3/KDML105/IR26): (Year of Release, 1981)

Type: Non glutenous

Growing period: 100 days

Dormancy period: 3 weeks

Reaction to diseases

BL	BS	Sh.B	SR.R	BB	YOLV	RSV	RKN
S	S	S	MR	MR	S	MR	-

Reaction to insects:

BPH	GLH	WBPH	SB	GM
R	MR	R	-	-

Note:
BL: Blast
BS: Brown Spot
Sh.B: Sheath Blight
Sh.R: Sheath Rot
BB: Bacterial Leaf Blight
YOLV: Yellow Orange Leaf Virus
GM: Goll Midge
RSV: Ragged Stunt Virs
RKN: Root Knot Nematode
BPH: Brown Plant Hopper
GLH: Green Leaf Hopper
WBPH: White Back Plant Hopper
SB: Stem Borer

S: Susceptible
MS: Moderately Susceptible
R: Resistant
VS: Very Susceptible
MR: Moderately Resistant

Data Source: Rice Institute, Department of Agriculture

Table 9 PRODUCTIONS OF MAJOR CROPS

Crops	1979/80			1980/81		
	Planted Area (ha)	Average Yield (t/ha)	Production (10^3t)	Planted Area (ha)	Average Yield (t/ha)	Production (10^3t)
Rice						
Chon Buri Province	38,440	1.00	38.4	57,300	1.90	108.9
Rayong Province	11,460	1.96	22.5	12,020	1.81	21.8
Study Area	49,900		60.9	69,320		130.7
Cassava						
Chon Buri Province	89,350	11.7	1,045.4	101,960	14.7	1,498.8
Rayong Province	68,640	14.3	981.6	70,000	16.3	1,141.0
Study Area	157,990		2,027.0	171,960		2,639.8
Sugarcane						
Chon Buri Province	67,080	30.8	2,066.1	64,170	38.5	2,470.5
Rayong Province	14,670	27.8	407.8	13,390	36.5	488.7
Study Area	81,750		2,473.9	77,560		2,959.2

Note: Figures of Rayong Province are limited to the Study Area.

Data Source:

Planted Area: Agricultural Extension Offices in Chon Buri and Rayong

Average Yield: Agricultural Statistics of Thailand

Table 10 LIVESTOCK RAISING

	Chon Buri Province		Rayong Province		Study Area	
	Total Head	Head per Farm	Total Head	Head per Farm	Total Head	Head per Farm
Horse	328	0.9	56	0.0	384	0.7
Cattle	20,953	0.6	10,003	0.5	30,956	0.5
Buffalo	45,795	1.2	10,732	0.5	56,527	1.0
Pig	143,439	3.8	27,598	1.3	171,037	2.9
Goat	2,750		-		2,750	
Chiken	4,116,930		326,450		4,443,380	
Duck	1,951,850		19,180		1,971,030	

Data Source: Agricultural Extension Offices in Chon Buri and Rayong

Table 11 ACTIVITY STATUS OF BAAC IN CHON BURI PROVINCE (1981)

Number of Farmer's Households	Amount of Loan (฿ x 10^6)	Per Farmer's Household (฿)
9,714	174.5	18,000

Source: Information obtained from the BAAC Office in Chon Buri Province

Table 12 ACTIVITY STATUS OF AGRICULTURAL COOPERATIVES IN CHON BURI AND RAYONG PROVINCES (1980)

	Number of Agricultural Cooperatives	Number of Members	Business Volume (฿ x 10^6)	Credit for Member (฿x10^6)	Amount per Member (฿)
Chon Buri Province	11	6,381	693.3	34.3	5,375
Rayong Province	7/1	1,155	-	7.0	6,061

/1: Total number of whole province

Data Source: Information obtained from the Provincial Agricultural Cooperative Offices in Chon Buri and Rayong Provinces

Table 13 SUMMARY OF EXISTING IRRIGATION PROJECTS

(Unit: ha)

Project Name	Total Area	Area involved in Study Area	Conditions
Khlong Luang River Basin			
Ban Bung	320	320	No feeder system
Phan Tong	2,960	2,960	No feeder system
Phan Tong Extension	3,520	3,520	No feeder system
Tha Lat	20,800	7,850	With feeder system
Bang Pakong Flood Protection and Conservation	10,400	2,730	No feeder system
Coastal River Basin			
Bang Phra	1,360	1,360	With feeder system
Nong Kho	1,200	1,200	No feeder system
Map Prachan	480	480	No feeder system
Khlong Samnak Mamuang	320	320	No feeder system
Rayong River Basin			
Ban Khai	4,800	4,800	With feeder system
Bung Ton Chan	1,280	1,280	No feeder system
Khlong Yai Da	320	320	With feeder system
Total	47,760	27,140	

Data Source: RID

Table 14 SOIL GROUP, SOIL SERIES AND THEIR EXTENSION IN THE KHLONG LUANG SCHEME AREA

Soil Group	Soil Series	Map Symbol	Study Area		Potential Irrigable Area		Scheme Area	
			(ha)	(%)	(ha)	(%)	(ha)	(%)
Soils of Recent Alluvium	Don Muang series (Dm)	11	810	3	220	2	50	-
	Ongkharak series (Ok)	12	80	-	-	-	-	-
	Rangsit series (Rs)	13	1,230	4	190	2	-	-
	Mahaphot series (Ma)	14	2,060	7	800	7	180	2
			4,180	14	1,210	11	230	2
Soils of Semi-recent Alluvium	Chon Buri series (Cb)	16	9,040	30	6,410	55	4,420	57
	Klaeng series (Kl)	18	4,950	16	2,860	24	2,070	27
	Ban Bung series (Bbg)	26	560	2	-	-	-	-
			14,550	48	9,270	79	6,490	84
Soils of Old Alluvium	Sattahip series (Sh)	28	950	3	60	-	70	1
	Satuk, mottled/Ban Bung (Suk-m/Bbg)	30	1,540	5	70	1	70	1
	Satuk, mottled variant (Suk-m)	32	2,630	9	700	6	700	9
	Korat, ironstone deeper subsoil var. (Kt-ird)	35	760	3	200	2	200	3
	Phon Phisai, no mottled clay var. (Pp)	36	190	1	30	-	40	-
	Don Rai series (Dr)	37	540	2	20	-	-	-
	Satuk series (Suk)	38	4,300	14	140	1	-	-
	Mae Rim, clayey skeletal var. (Mr-c.ske)	46	380	1	-	-	-	-
			11,290	38	1,220	10	1,080	14
Soils of Transported Material and Residuum, and Others	Nong Mot series (Nm)	74	180	-	-	-	-	-
	Total		30,200	100	11,700	100	7,800	100

Table 15 SOIL GROUP, SOIL SERIES AND THEIR EXTENSION IN THE BAN KHAI EXTENSION SCHEME AREA

Soil Group	Soil Series	Map Symbol	Study Area (ha)	Study Area (%)	Scheme Area (ha)	Scheme Area (%)
Soils of Beach and Dune Sand	Rayong series (Ry)	1	2,460	6	70	0.8
	Phattaya series (Py)	2	2,190	5	-	-
	Ban Thon series (Bh)	3	2,260	5	810	9.0
	Ban Thon deep phase (Bh-d)	4	560	1	370	4.1
			7,470	17	1,250	13.9
Soils of Recent Alluvium	Wan Phrieng, loamy var. (Wp-1)	6	300	-	270	3.0
Soils of Semi-recent Alluvium	Alluvial soils, poorly drained (Ac-pd)	8	7,150	17	1,620	18.0
	Chonburi series (Cb)	9	290	-	140	1.6
	Klaeng series (Kl)	12	30	-	20	0.2
	Khok Khian series (Ko)	14	5,010	12	2,740	30.4
			12,480	29	4,520	50.2
Soils of Old Alluvium	Ta Sae series (Te)	19	190	-	-	-
	Ta Sae, mottled var. (Te-m)	20	50	-	30	0.3
	Kho Hong & Ta Sae soils (Kh & Te)	21	360	-	10	0.1
	Khlong Chak series (Kc)	27	170	-	-	-
	Ranong series (Rg)	34	-	-	-	-
	Ban Bung series (Bbg)	35	1,700	4	630	7.0
	Sattahip series (Sh)	36	1,480	3	-	-
	Ban Bung & Sattahip soils (Bbg & Sh)	37	1,500	4	260	2.9
			5,450	11	930	10.3
Soils of Transported Material and Residuum, and Others	Thung Wa series (Tg)	39	510	1	200	2.2
	Sattahip & Thung Wa soils (Sh & Tg)	40	170	-	-	-
	Khlong Nok Krathung series (Knk)	41	960	2	-	-
	Chalong, Coarse loamy var. (Chl-co)	42	1,460	3	550	6.1
	Chalong, gravelly var. (Chl-g)	43	20	-	-	-
	Chalong, coarse loamy & Ch (Chl-co & Chl)	44	850	2	-	-
	Huai Pong series (Hp)	46	7,530	18	610	6.8
	Phangnga series (Pga)	48	2,270	5	10	0.1
	Huai Pong/Phangnga asso. (Hp/Pga)	49	790	2	-	-
	Phuket series (Pk)	50	290	-	-	-
	Thai Muang series (Tim)	52	70	-	-	-
	Map Bon & Thai Muang soils (Mb & Tim)	55	80	-	-	-
	Marsh	59	970	2	610	6.8
	Slope Complex (SC)	60	620	1	50	0.6
			16,590	36	2,030	22.6
	Total		42,290	100	9,000	100.0

Table 16 SOIL GROUP, SOIL SERIES AND THEIR EXTENSION IN THE BAN KHAI EXISTING SCHEME AREA

Soil Group	Soil Series	Map Symbol	Study Area (ha)	Study Area (%)	Scheme Area (ha)	Scheme Area (%)
Soils of Beach and Dune Sand	Rayong series (Ry)	1	2,460	6	-	-
	Phattaya series (Py)	2	2,190	5	-	-
	Ban Thon series (Bh)	3	2,260	5	540	10.0
	Ban Thon deep phase (Bh-d)	4	560	1	-	-
			7,470	17	540	10.0
Soils of Recent Alluvium	Wan Phrieng, loamy var. (Wp-l)	6	300	-	-	-
Soils of Semi-recent Alluvium	Alluvial soils, poorly drained (Ac-pd)	8	7,150	17	3,310	61.3
	Chonburi series (Cb)	9	290	-	50	0.9
	Klaeng series (Kl)	12	30	-	-	-
	Khok Khian series (Ko)	14	5,010	12	1,210	22.4
			12,480	29	4,570	84.6
Soils of Old Alluvium	Ta Sae series (Te)	19	190	-	-	-
	Ta Sae, nottled var. (Te-m)	20	50	-	-	-
	Kho Hong & Ta Sae soils (Kh & Te)	21	360	-	-	-
	Khlong Chak series (Kc)	27	170	-	-	-
	Ranong series (Rg)	34	-	-	-	-
	Ban Bung series (Sbg)	35	1,700	4	40	0.7
	Sattahip series (Sh)	36	1,480	3	-	-
	Ban Bung & Sattahip soils (Bbg & Sh)	37	1,500	4	100	1.9
			5,450	11	140	2.6
Soils of Transported Material and Residuum, and Others	Thung Wa series (Tg)	39	510	1	150	2.8
	Sattahip & Thung Wa soils (Sh & Tg)	40	170	-	-	-
	Khlong Nok Krathung series (Knk)	41	960	2	-	-
	Chalong, Coarse loamy var. (Chl-co)	42	1,460	3	-	-
	Chalong, gravelly var. (Chl-g)	43	20	-	-	-
	Chalong, coarse loamy & Ch (Chl-co & Chl)	44	850	2	-	-
	Huai Pong series (Hp)	46	7,530	18	-	-
	Phangnga series (Pga)	48	2,270	5	-	-
	Huai Pong/Phangnga asso. (Hp/pga)	49	790	2	-	-
	Phuket series (Pk)	50	290	-	-	-
	Thai Muang series (Tim)	52	70	-	-	-
	Map Bon & Thai Muang soils (Mb & Tim)	55	80	-	-	-
	Marsh	59	970	2	-	-
	Slope Complex (SC)	60	620	1	-	-
			16,590	36	150	2.8
	Total		42,290	100	5,400	100.0

Table 17 SOIL GROUP, SOIL SERIES AND THEIR EXTENSION IN THE KHLONG THAP MA SCHEME AREA

Soil Group	Soil Series	Map Symbol	Study Area (ha)	Study Area (%)	Scheme Area (ha)	Scheme Area (%)
Soils of Beach and Dune Sand	Rayong series (Ry)	1	2,460	6	290	10.4
	Phattaya series (Py)	2	2,190	5	140	5.0
	Ban Thon series (Bh)	3	2,260	5	190	6.8
	Ban Thon deep phase (Bh-d)	4	560	1	-	-
			7,470	17	620	22.2
Soils of Recent Alluvium	Wan Phrieng, loamy var. (Wp-1)	6	300	-	-	-
Soils of Semi-recent Alluvium	Alluvial soils, poorly drained (Ac-pd)	8	7,150	17	1,640	58.6
	Chonburi series (Cb)	9	290	-	-	-
	Klaeng series (Kl)	12	30	-	-	-
	Khok Khian series (Ko)	14	5,010	12	110	3.9
			12,480	29	1,750	62.5
Soils of Old Alluvium	Ta Sae series (Te)	19	190	-	-	-
	Ta Sae, mottled var. (Te-m)	20	50	-	-	-
	Kho Hong & Ta Sae soils (Kh & Te)	21	360	-	-	-
	Khlong Chak series (Kc)	27	170	-	-	-
	Ranong series (Rg)	34	-	-	-	-
	Ban Bung series (Bbg)	35	1,700	4	10	0.4
	Sattahip series (Sh)	36	1,480	3	10	0.4
	Ban Bung & Sattahip soils (Bbg & Sh)	37	1,500	4	-	-
			5,450	11	20	0.8
Soils of Transported Material and Residuum, and Others	Thung Wa series (Tg)	39	510	1	-	-
	Sattahip & Thung Wa soils (Sh & Tg)	40	170	-	120	4.2
	Khlong Nok Krathung series (Knk)	41	960	2	40	1.4
	Chalong, coarse loamy var. (Chl-co)	42	1,460	3	-	-
	Chalong, gravelly var. (Chl-g)	43	20	-	-	-
	Chalong, coarse loamy & Ch (Chl-co & Chl)	44	850	2	-	-
	Huai Pong series (Hp)	46	7,530	18	220	7.8
	Phangnga series (Pga)	48	2,270	5	-	-
	Huai Pong/Phangnga asso. (Hp/Pga)	49	790	2	30	1.1
	Phuket series (Pk)	50	290	-	-	-
	Thai Muang series (Tim)	52	70	-	-	-
	Map Bon & Thai Muang soils (Mb & Tim)	55	80	-	-	-
	Marsh	59	970	2	-	-
	Slope Complex (SC)	60	620	1	-	-
			16,590	36	410	14.5
	Total		42,290	100	2,800	100.0

Table 18 PRESENT LAND USE IN THE POTENTIAL IRRIGABLE AREA

(1) Khlong Luang Irrigation Scheme

Land Use	Area (ha)	Proportion (%)
Rice field	10,210	87.2
Upland crop field	1,020	8.7
Others	470	4.1
Total	11,700	100.0

(2) Ban Khai Extension Irrigation Scheme

Land Use	Area (ha)	Proportion (%)
Rice field	6,310	70.1
Upland crop field	1,900	21.1
Perennial crop field	580	6.4
Others	210	2.4
Total	9,000	100.0

(3) Ban Khai Existing Irrigation Scheme

Land Use	Area (ha)	Proportion (%)
Rice field	4,800	88.9
Upland crop field	100	1.9
Others	500	9.2
Total	5,400	100.0

(4) Khlong Thap Ma Irrigation Scheme

Land Use	Area (ha)	Proportion (%)
Rice field	1,960	70.0
Upland crop field	650	23.2
Perennial crop field	100	3.6
Others	90	3.2
Total	2,800	100.0

Table 19 NECESSITY OF VEGETABLE CULTIVATION AREA IN THE FUTURE

(1) Population Projection in the Study Area/1 (1,000 persons)

	1981	1991	2001
Chon Buri Province	733	908	1,063
Rayong Province	352	437	513
Total	1,085	1,345	1,576
Increase	-	260	491

(2) Per capita consumption/2: 80 kg/year/person

(3) Increased Consumption in the Future

1991: 80 kg x 260,000 = 20,800 tons
2001: 80 kg x 491,000 = 39,280 tons

(4) Increased Consumption by Current Occupant/2

1991: 20 kg x 1,085,000 = 21,700 tons
2001: 20 kg x 1,085,000 = 21,700 tons

(5) Total Increment

1991: 21,700 ton + 20,800 ton = 42,500 ton
2001: 21,700 ton + 39,280 ton = 60,980 ton

(6) Necessity of Cultivation Area

1991: 42,500 ton ÷ 10 ton = 4,250 ton
2001: 60,980 ton ÷ 10 ton = 6,100 ton

(7) Allocated Area to each Project

(Unit: ha)

	Required Area	Scheme Area	Khlong Luang	Ban Khai Extension	Thap Ma	Ban Khai Existing
2001	6,100	1,560 (26% of total)	610	500	150	300

/1: Refer to Sectoral Report I

/2: Applied the data of the Phase 1 Report on East Coast Water Development Project

Table 20(1) ALTERNATIVE CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(Unit: ha)

	Wet Season	Dry Season	Total
(1) Khlong Luang Irrigation Scheme			
Cropping Pattern 1.5			
Rice - local variety	1,980	-	1,980
- improved variety	7,920	1,140	9,060
Groundnuts	-	2,280	2,280
Mungbeans	-	620	620
Vegetables	-	910	910
Total	9,900	4,950	14,850
(Cropping intensity)	(1.00)	(0.50)	(1.50)
Cropping Pattern 1.4			
Rice - local variety	1,980	-	1,980
- improved variety	7,920	-	7,920
Groundnuts	-	2,430	2,430
Mungbeans	-	620	620
Vegetables	-	910	910
Total	9,900	3,960	13,860
(Cropping intensity)	(1.00)	(0.40)	(1.40)
Cropping Pattern 1.3			
Rice - local variety	1,980	-	1,980
- improved variety	7,920	-	7,920
Groundnuts	-	1,440	1,440
Mungbeans	-	620	620
Vegetables	-	910	910
Total	9,900	2,970	12,870
(Cropping intensity)	(1.00)	(0.30)	(0.30)

Table 20(2) ALTERNATIVE CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(Unit: ha)

	Wet Season	Dry Season	Total
Cropping Pattern 4			
Rice - local variety	1,890	-	1,890
- improved variety	7,560	1,140	8,700
Groundnuts	-	2,280	2,280
Mungbeans	-	620	620
Vegetables	-	910	910
Sugarcane	(450)	450	450
Total	9,450	5,400	14,850
(Cropping intensity)	(0.95)	(0.55)	(1.50)
Cropping Pattern 5			
Rice - local variety	1,890	-	1,890
- improved variety	7,560	-	7,560
Groundnuts	-	2,430	2,430
Mungbeans	-	620	620
Vegetables	-	910	910
Sugarcane	(450)	450	450
Total	9,450	4,410	13,860
(Cropping intensity)	(0.95)	(0.45)	(1.4)
Cropping Pattern 6			
Rice - local variety	1,890	-	1,890
- improved variety	7,560	-	7,560
Groundnuts	-	1,440	1,440
Mungbeans	-	620	620
Vegetables	-	910	910
Sugarcane	(450)	450	450
Total	9,450	3,420	12,870
(Cropping intensity)	(0.95)	(0.35)	(1.30)

Table 20(3) ALTERNATIVE CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(Unit: ha)

	Wet Season	Dry Season	Total
(2) Ban Khai Extension Irrigation Scheme			
Cropping Pattern 1			
Rice - local variety	1,420	-	1,420
- improved variety	5,700	1,120	6,820
Groundnuts	-	2,230	2,230
Vegetables	-	500	500
Fruit trees	(580)	580	580
Total	7,120	4,430	11,550
(Cropping intensity)	(0.92)	(0.58)	(1.50)
Cropping Pattern 2			
Rice - local variety	1,420	-	1,420
- improved variety	5,700	850	6,550
Groundnuts	-	1,730	1,730
Vegetables	-	500	500
Fruit trees	(580)	580	580
Total	7,120	3,660	10,780
(Cropping intensity)	(0.92)	(0.48)	(1.40)
Cropping Pattern 3			
Rice - local variety	1,420	-	1,420
- improved variety	5,700	600	6,300
Groundnuts	-	1,210	1,210
Vegetables	-	500	500
Fruit trees	(580)	580	580
Total	7,120	2,890	10,010
(Cropping intensity)	(0.92)	(0.38)	(1.30)

Table 20(4) ALTERNATIVE CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(Unit: ha)

	Wet Season	Dry Season	Total
(3) Ban Khai Existing Irrigation Scheme			
Cropping Pattern 1			
Rice - local variety	960	-	960
- improved variety	3,840	700	4,540
Groundnuts	-	1,400	1,400
Vegetables	-	300	300
Total	4,800	2,400	7,200
(Cropping intensity)	(1.00)	(0.50)	(1.50)
Cropping Pattern 2			
Rice - local variety	960	-	960
- improved variety	3,840	540	4,380
Groundnuts	-	1,080	1,080
Vegetables	-	300	300
Total	4,800	1,920	6,720
(Cropping intensity)	(1.00)	(0.40)	(1.40)
Cropping Pattern 3			
Rice - local variety	960	-	960
- improved variety	3,840	380	4,220
Groundnuts	-	760	760
Vegetables	-	300	300
Total	4,800	1,440	6,240
(Cropping intensity)	(1.00)	(0.30)	(1.30)

Table 20(5) ALTERNATIVE CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(Unit: ha)

	Wet Season	Dry Season	Total
(4) Khlong Thap Ma Irrigation Scheme			
Cropping Pattern 1			
Rice - local variety	440	-	440
- improved variety	1,880	1,070	2,950
Groundnuts	-	700	700
Vegetables	-	150	150
Fruit trees	(80)	80	80
Total	2,320	2,000	4,320
(Cropping intensity)	(0.97)	(0.83)	(1.80)
Cropping Pattern 2			
Rice - local variety	440	-	440
- improved variety	1,880	820	2,700
Groundnuts	-	700	700
Vegetables	-	150	150
Fruit trees	(80)	80	80
Total	2,320	1,750	4,070
(Cropping intensity)	(0.97)	(0.73)	(1.70)
Cropping Pattern 3			
Rice - local variety	440	-	440
- improved variety	1,880	580	2,460
Groundnuts	-	700	700
Vegetables	-	150	150
Fruit trees	(80)	80	80
Total	2,320	1,410	3,830
(Cropping intensity)	(0.97)	(0.53)	(1.60)

Table 21(1) SOCIO-ECONOMIC SITUATIONS IN THE IRRIGATION SCHEME AREA IN 1981

(1) Khlong Luang Irrigation Scheme

District	Town or Village	No. of House-holds	Popu-lation	Family Size	No. of Farmer's House-holds	Total Area (ha)	Average Farm Size (ha)
Phanat Nikhom	Rai Lak Thong	152	947	6.2	136	650	4.8
	Wat Bot	55	335	6.1	50	200	4.0
	Muang Phanat Nikhom	170	730	4.3	150	300	2.0
	Ban Chang	450	3,024	6.7	400	1,300	3.3
	Na Wang Hin	123	610	5.0	111	450	4.1
	Na Ruk	560	3,600	6.4	500	1,700	3.4
	Tha Bun Mi	630	4,122	6.5	570	3,200	5.6
	Total	2,140	13,368	6.2	1,917	7,800	4.1

Data Source: Estimate on the basis of the data obtained from the Agricultural Extension Office of Amphoe Phanat Nikhom.

(2) Ban Khai Extension Irrigation Scheme

District	Town or Village	No. of House-holds	Popu-lation	Family Size	No. of Farmer's House-holds	Total Area (ha)	Average Farm Size (ha)
Ban Khai	Non Bua	80	470	4.9	70	540	7.7
	Ban But	290	1,770	6.1	270	1,830	6.8
	Ban Khai	710	4,140	5.8	570	790	1.4
	Chak Bok	170	960	5.6	160	970	6.1
	Ta Khan	120	420	3.5	110	450	4.1
Muang Rayong	Na Ta Khwan	110	660	6.0	90	510	5.7
	Ban Laeng	100	610	6.1	80	400	5.0
	Taphong	570	3,460	6.1	480	1,910	4.0
	Phe	360	1,830	5.1	250	420	1.7
	Noen Phra	220	1,290	5.9	200	1,180	5.9
	Total	2,730	15,610	5.7	2,280	9,000	3.9

Data Source: Estimate on the basis of the data obtained from the Amphoe Agricultural Extension Offices related to the Ban Khai Extension Scheme area.

Table 21(2) SOCIO-ECONOMIC SITUATIONS IN THE IRRIGATION SCHEME AREA IN 1981

(3) Ban Khai Existing Irrigation Scheme

District	Town or Village	No. of House-holds	Popu-lation	Family Size	No. of Farmer's House-holds	Total Area (ha)	Average Farm Size (ha)
Ban Khai	Non Lalok	140	840	6.0	120	685	5.8
	Non Ta Plan	240	1,280	5.3	230	1,045	4.5
	Ban But	40	230	5.8	35	236	6.7
	Ban Khai	760	4,430	5.8	640	847	1.3
	Ta Khan	590	2,140	3.6	550	2,270	4.1
Muang Rayong	Na Ta Khwan	40	220	5.5	30	168	5.6
	Noen Phra	30	160	5.3	20	149	7.5
	Total	1,840	9,300	5.1	1,625	5,400	3.3

Data Source: Estimate on the basis of the data obtained from the Amphoe Agricultural Extension Offices related to the Scheme area.

(4) Khlong Thap Ma Irrigation Scheme

District	Town or Village	No. of House-holds	Popu-lation	Family Size	No. of Farmer's House-holds	Total Area (ha)	Average Farm Size (ha)
Muang Rayong	Mata Phut	40	270	6.8	30	70	2.3
	Noeng Phra	240	1,430	6.0	190	1,330	7.0
	Thap Ma	200	1,080	5.4	180	850	4.9
	Nam Khok	210	1,350	6.4	180	550	3.1
	Total	690	4,130	6.0	580	2,800	4.8

Data Source: Estimate on the basis of the data obtained from the Amphoe Muang Rayong Agricultural Extension Office.

Table 22(1) PRESENT CROP PRODUCTIONS IN THE PROPOSED IRRIGATION AREAS

(1) Khlong Luang Irrigation Scheme

Crop	Cropped Area (ha)	Unit Yield (t/ha)	Production (t)
Rice - local variety	3,970	1.8	7,150
- improved variety	2,650	2.3	6,100
Groundnuts	80	1.3	100
Cassava	400	16.0	6,400
Sugarcane	390	43.0	16,770
Total	7,490	-	-

Cropping intensity: 1.0

(2) Ban Khai Extension Irrigation Scheme

Crop	Cropped Area (ha)	Unit Yield (t/ha)	Production (t)
Rice - local variety	3,770	1.8	6,790
- improved variety	2,540	2.3	5,840
Groundnuts	20	1.3	30
Cassava	1,560	16.0	24,960
Sugarcane	320	43.0	13,760
Fruit trees	500	5.0/1	2,500
Total	8,710	-	-

Cropping intensity: 1.0

/1: Average of durian and rambutan

Table 22(2) PRESENT CROP PRODUCTIONS IN THE PROPOSED IRRIGATION AREAS

(3) Ban Khai Existing Irrigation Scheme

Crop	Cropped Area (ha)	Unit Yield (t/ha)	Production (t)
Rice - local variety	2,780	1.8	5,000
- improved variety in wet season	1,860	3.2	5,950
- improved variety in dry season	1,900	3.6	6,840
Cassava	990	16.0	15,840
Vegetables	320	5.0	1,600
Total	7,850	-	-

Cropping intensity: 1.6

(4) Khlong Thap Ma Irrigation Scheme

Crop	Cropped Area (ha)	Unit Yield (t/ha)	Production (t)
Rice - local variety	1,180	1.8	2,120
- improved variety	780	2.3	1,790
Groundnuts	20	1.3	30
Cassava	510	16.0	8,160
Sugarcane	120	43.0	5,160
Fruit trees	60	5.0	300
Total	2,670	-	-

Cropping intensity: 1.0

Table 23(1) PROPOSED CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(1) Khlong Luang Irrigation Scheme

(Unit: ha)

Crop	Wet Season	Dry Season	Total
Rice - local variety	1,320	-	1,320
- improved variety	5,280	-	5,280
Groundnuts	-	1,610	1,610
Mungbeans	-	420	420
Vegetables	-	610	610
Total	6,600	2,640	9,240
(Cropping intensity)	(1.00)	(0.40)	(1.40)

(2) Bankhai Extension Irrigation Scheme

(Unit: ha)

Crop	Wet Season	Dry Season	Total
Rice - local variety	1,420	-	1,420
- improved variety	5,700	850	6,550
Groundnuts	-	1,730	1,730
Vegetables	-	500	500
Fruit trees	(580)	580	580
Total	7,120	3,660	10,780
(Cropping intensity)	(0.92)	(0.48)	(1.40)

Table 23(2) PROPOSED CROPPING PATTERN FOR EACH IRRIGATION SCHEME

(3) Bankhai Existing Irrigation Scheme

(Unit: ha)

Crop	Wet Season	Dry Season	Total
Rice - local variety	960	-	960
- improved variety	3,840	540	4,380
Groundnuts	-	1,080	1,080
Vegetables	-	300	300
Total	4,800	1,920	6,720
(Cropping intensity)	(1.00)	(0.40)	(1.40)

(4) Khlong Thap Ma Irrigation Scheme

(Unit: ha)

Crop	Wet Season	Dry Season	Total
Rice - local variety	440	-	440
- improved variety	1,880	820	2,700
Groundnuts	-	700	700
Vegetables	-	150	150
Fruit trees	(80)	80	80
Total	2,320	1,750	4,070
(Cropping intensity)	(0.97)	(0.73)	(1.70)

Table 24 FUTURE LAND USE

	Present Land Use (ha)	(%)	Future Land Use (ha)	(%)	Increase or Decrease (ha)
(1) Khlong Luang Irrigation Scheme					
Rice field	6,620	84.9	6,600/1	84.6	-20
Upland crop field	870	11.1	890/2	11.4	+20
Others	310	4.0	310	4.0	0
Total	7,800	100.0	7,800	100.0	
(2) Ban Khai Extension Irrigation Scheme					
Rice field	6,310	70.1	7,120/1	79.1	+810
Upland crop field	1,900	21.1	1,090/2	12.1	-810
Perennial crop field	580	6.5	580/3	6.5	0
Others	210	2.3	210	2.3	0
Total	9,000	100.0	9,000	100.0	0
(3) Ban Khai Existing Irrigation Scheme					
Rice field	4,800	88.9	4,800/1	88.9	0
Upland crop field	100	1.9	100/2	1.9	0
Others	500	9.2	500	9.2	0
Total	5,400	100.0	5,400	100.0	0
(4) Khlong Thap Ma Irrigation Scheme					
Rice field	1,960	70.0	2,320/1	82.9	+360
Upland crop field	650	23.2	290/2	10.3	-360
Perennial crop field	100	3.6	80/3	2.9	-20
Others	90	3.2	110	3.9	+20
Total	2,800	100.0	2,800	100.0	

/1: Under irrigated conditions
/2: Under rainfed conditions
/3: Fruit trees under irrigated conditions

Table 25 SUMMARIZED TABLE OF LABOR REQUIREMENTS FOR EACH IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

(Unit: man-day x 103)

Scheme	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
(1) Khlong Luang Irrigation Scheme													
Required labor	5.1	9.7	84.2	75.3	12.7	17.1	42.0	46.6	26.3	5.0	4.6	4.8	333.4
Family labor	110.2	119.8	119.8	115.0	95.9	105.4	124.6	124.6	124.6	110.2	124.6	119.8	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(2) Ban Khai Extension Irrigation Scheme													
Required labor	3.7	10.4	81.5	73.0	16.8	28.2	44.9	53.1	30.4	6.6	6.3	8.7	363.6
Family labor	131.1	142.5	142.5	136.8	114.0	125.4	148.2	148.2	148.2	131.1	148.2	142.5	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(3) Ban Khai Existing Irrigation Scheme													
Required labor	12.7	6.8	59.0	52.8	11.0	18.4	31.5	44.3	52.5	22.2	1.6	26.1	338.9
Family labor	93.4	101.6	101.6	97.5	81.3	89.4	105.6	105.6	105.6	93.4	105.6	101.6	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(4) Khlong Thap Ma Irrigation Scheme													
Required labor	0.6	3.0	25.1	22.4	5.0	8.7	13.8	16.8	9.3	1.9	1.7	2.1	110.4
Family labor	33.4	36.3	36.3	34.8	29.0	31.9	37.7	37.7	37.7	33.4	37.7	36.3	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	

Table 26 SUMMARIZED TABLE OF LABOR REQUIREMENTS FOR EACH PROPOSED IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

(Unit: man-day x 10³)

Scheme	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
(1) Khlong Luang Irrigation Scheme													
Required labor	3.2	13.7	60.8	111.6	21.8	34.3	95.3	43.7	31.4	19.1	15.2	12.6	462.7
Family labor	110.2	119.8	119.8	115.0	95.9	105.4	124.6	124.6	124.6	110.2	124.6	119.8	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(2) Ban Khai Extension Irrigation Scheme													
Required labor	17.8	16.1	66.9	121.6	24.9	38.4	102.0	47.4	50.1	25.5	18.1	33.7	562.0
Family labor	131.1	142.5	142.5	136.8	114.0	125.4	148.2	148.2	148.2	131.1	148.2	142.5	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(3) Ban Khai Existing Irrigation Scheme													
Required labor	7.5	10.0	44.2	81.1	15.8	25.0	68.0	28.2	29.4	13.7	9.0	16.8	348.7
Family labor	93.4	101.6	101.6	97.5	81.3	89.4	105.6	105.6	105.6	93.4	105.6	101.6	
Hired labor	-	-	-	-	-	-	-	-	-	-	-	-	
(4) Khlong Thap Ma Irrigation Scheme													
Required labor	11.0	5.0	21.3	39.7	7.9	12.4	33.7	18.7	29.7	14.5	7.9	21.0	222.8
Family labor	33.4	36.3	36.3	34.8	29.0	31.9	37.7	37.7	37.7	33.4	37.7	36.3	
Hired labor	-	-	-	4.9	-	-	-	-	-	-	-	-	

Table 27 FARMING MATERIAL REQUIREMENTS FOR EACH PROPOSED IRRIGATION SCHEME AREA

Scheme	Materials		Quantity
(1) Khlong Luang	Seed	Rice - local varieties	40 t
		- improved varieties	158
		Groundnuts	48
		Mungbeans	13
		Vegetables	18
	Fertilizers	Compound fert. (N:16, P:20, K:0)	1,680 t
		Compound fert. (N:15, P:15, K:15)	490
		Compound fert. (N:13, P:13, K:21)	220
		Urea	430
	Agro-chemicals	Insecticides, Fungicides	14,245 kg
		Herbicides	16,150 l
		Rodenticides	29,700 kg
(2) Ban Khai Extension	Seed	Rice - local varieties	43 t
		- improved varieties	197
		Groundnuts	52
		Vegetables	10
	Fertilizers	Compound fert. (N:16, P:20, K:0)	2,050 t
		Compound fert. (N:15, P:15, K:15)	570
		Compound fert. (N:13, P:13, K:21)	190
		Urea	540
	Agro-chemicals	Insecticides, Fungicides	16,570 kg
		Herbicides	18,120 l
		Rodenticides	36,300 kg
(3) Ban Khai Existing	Seed	Rice - local varieties	29
		- improved varieties	131 t
		Groundnuts	33
		Vegetables	9
	Fertilizers	Compound fert. (N:16, P:20, K:0)	1,370 t
		Compound fert. (N:15, P:15, K:15)	240
		Compound fert. (N:13, P:13, K:21)	120
		Urea	430
	Agro-chemicals	Insecticides, Fungicides	10,100 kg
		Herbicides	11,940 l
		Rodenticides	24,250 kg
(4) Khlong Thap Ma	Seed	Rice - local varieties	13 t
		- improved varieties	81
		Groundnuts	21
		Vegetables	5
	Fertilizers	Compound fert. (N:16, P:20, K:0)	820 t
		Compound fert. (N:15, P:15, K:15)	140
		Compound fert. (N:13, P:13, K:21)	80
		Urea	220
	Agro-chemicals	Insecticides, Fungicides	6,020 kg
		Herbicides	7,210 l
		Rodenticides	14,650 kg

Table 28 CROP PRODUCTION IN EACH PROPOSED IRRIGATION SCHEME AREA

Crop	Cropped Area (ha)	Unit Yield (t/ha)	Production (t)
(1) Khlong Luang Irrigation Scheme			
Rice - local varieties	1,320	4.0	5,280
- improved varieties, wet season	5,280	4.5	23,760
- improved varieties, dry season	-	-	-
Sub-total	6,600	-	29,040
Groundnuts	1,610	2.5	4,030
Mungbeans	420	1.5	630
Vegetables	610	10.0	6,100
Total	9,240	-	-
(Cropping intensity: 1.4)			
(2) Ban Khai Extension Irrigation Scheme			
Rice - local varieties	1,420	4.0	5,680
- improved varieties, wet season	5,700	4.5	25,650
- improved varieties, dry season	850	5.0	4,250
Sub-total	7,970	-	35,580
Groundnuts	1,730	2.5	4,330
Vegetables	500	10.0	5,000
Fruit trees	580	7.0	4,060
Total	10,780	-	-
(Cropping intensity: 1.4)			
(3) Ban Khai Existing Irrigation Scheme			
Rice - local varieties	960	4.0	3,840
- improved varieties, wet season	3,840	4.5	17,280
- improved varieties, dry season	540	5.0	2,700
Sub-total	5,340	-	23,770
Groundnuts	1,080	2.5	2,730
Vegetables	300	10.0	3,000
Total	6,720	-	-
(Cropping intensity: 1.4)			
(4) Khlong Thap Ma Irrigation Scheme			
Rice - local varieties	440	4.0	1,760
- improved varieties, wet season	1,880	4.5	8,460
- improved varieties, dry season	830	5.0	4,150
Sub-total	3,140	-	14,370
Groundnuts	700	2.5	1,750
Vegetables	150	10.0	1,500
Fruit trees	80	7.0	560
Total	4,070	-	-
(Cropping intensity: 1.7)			

Table 29 FINANCIAL AND ECONOMIC PRICE OF OUTPUTS AND INPUTS COMMODITIES IN THE KHLONG LUANG AREA IN 1990

(Unit: Baht/ton)

Item		Financial Price/1	Economic Price/2
Rice (paddy) - Local variety		3,000	8,430
Rice (paddy) - Improved variety		2,850	8,010
Groundnuts		6,000	10,530
Mungbeans		8,500	15,120
Sugarcane		500	500
Cassava		700	1,250
Vegetables/3		5,400	8,970
Seed/3	- Rice	3,600	9,860
	- Groundnuts	9,000	16,110
	- Mungbeans	10,000	17,900
	- Sugarcane	0.015/set	0.027/set
	- Vegetables	22/kg	36/kg
Fertilizer	- Compound (16:20:0)	6,400	10,640
	- Compound (15:15:15)	6,460	10,740
	- Compound (13:13:21)	6,360	10,570
	- Urea	6,000	9,970
Agro-chemicals/3			
	- Insecticides	70/500 gr	120/kg
	- Herbicides	70/2 ℓ	120/2 ℓ
	- Rodenticides	2.4/kg	4/kg
Wage/4	- Light work	30/day	34/day
	- Heavy work	40/day	45/day

/1: 1982 current price

/2: Price prospected for 1990 in 1982 constant price

/3: Economic prices are prospected by applying the international price index published by World Bank in 1981 based on the current farmgate price in 1982.

/4: Economic price is projected in consideration of probable wage increase due to the improvement of cultivation technology and industrialization in the Study Area.

Table 30 FINANCIAL AND ECONOMIC PRICE OF OUTPUTS AND INPUTS COMMODITIES IN THE RAYONG AREA IN 1990

(Unit: Baht/ton)

Item		Financial Price/1	Economic Price/2
Rice (paddy) - Local variety		2,900	8,360
Rice (paddy) - Improved variety		2,800	7,940
Groundnuts		5,500	10,440
Vegetables/3		4,500	7,520
Durian/3		7,200	11,990
Rambutan/3		5,400	8,970
Seed/3	- Rice	3,600	10,030
	- Groundnuts	8,500	15,220
	- Vegetables	22/kg	36/kg
Fertilizer	- Compound (16:20:0)	6,400	10,640
	- Compound (15:15:15)	6,500	10,800
	- Compound (13:13:21)	6,400	10,640
Agro-chemicals/3			
	- Insecticides	78/500 gr	130/500 gr
	- Herbicides	78/2 ℓ	130/500 gr
	- Rodenticides	2.4/kg	3/kg
Wage/4	- Light work	30/day	34/day
	- Heavy wage	40/day	45/day

/1: 1982 current price

/2: Price prospected for 1990 in 1982 constant price

/3: Economic prices are prospected by applying the international price index published by World Bank in 1981 based on the current farmgate price in 1982.

/4: Economic price is projected in consideration of probable wage increase due to the improvement of cultivation technology and industrialization in the Study Area.

Table 31 ECONOMIC PRICE OF RICE (PADDY) IN THE KHLONG LUANG AREA IN 1990

(Unit: Baht/ton)

FOB Bangkok	Baht 15,230/2 = US$662/1
Quality discount	1,520
Handling charge	150
Storage loss	300
Warehouse cost	60
Transportation cost (Bangkok - Chon Buri)	200
Price of paddy at millgate	8,450
Local transportation cost	20
Farmgate price	8,430

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applied 65% of recovery rate from paddy to milled rice.

Table 32 ECONOMIC PRICE OF RICE (PADDY) IN THE RAYONG AREA IN 1990

(Unit: Baht/ton)

FOB Bangkok	Baht 15,230/2 = US$662/1
Quality discount	1,520
Handling charge	150
Storage loss	300
Warehouse cost	60
Transportation cost (Bangkok - Rayong)	300
Price of paddy at millgate	8,380
Local transportation cost	20
Farmgate price	8,360

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applied 65% of recovery rate from paddy to milled rice.

Table 33 ECONOMIC PRICE OF GROUNDNUTS IN THE KHLONG LUANG AREA in 1990

(Unit: Baht/ton)

CIF Rotterdam (Shelled price)	Baht 15,410/2 = US$670/1
Freight insurance to Bangkok	920
Handling charge	150
Quality discount	660
Storage loss	290
Transportation cost (Bangkok - Chon Buri)	200
Convert to unshelled price	10,550
Local transportation cost	20
Farmgate price	10,530

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applied 80% of recovery rate from unshelled to shelled nuts.

Table 34 ECONOMIC PRICE OF GROUNDNUTS IN THE RAYONG AREA IN 1990

(Unit: Baht/ton)

CIF Rotterdam (Shelled price)	Baht 15,410/2 = US$670/1
Freight insurance to Bangkok	920
Handling charge	150
Quality discount	660
Storage loss	290
Transportation cost (Bangkok - Rayong)/3	300
Convert to unshelled price	10,470
Local transportation cost	30
Farmgate price	10,440

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applied 80% of recovery rate from unshelled to shelled nuts.

Table 35 ECONOMIC PRICE OF MUNGBEANS IN THE KHLONG LUANG AREA IN 1990

(Unit: Baht/ton)

FOB Bangkok	Baht 16,170/2	= US$703/1
Handling charge	150	
Quality discount	320	
Storage loss	300	
Warehouse cost	60	
Transportation cost (Bangkok - Chon Buri)	200	
Local transportation cost	20	
Farmgate price	15,120	

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

Table 36 ECONOMIC PRICE OF SUGARCANE IN THE KHLONG LUANG AREA IN 1990

(Unit: Baht/ton)

FOB Bangkok (Raw sugar)	Baht 8,600/2	= US$374/1
Handling charge	150	
Warehouse loss	150	
Warehouse cost	60	
Transportation cost	200	
Sugar production cost/3	2,810	
Millgate value of sugarcane per ton/4	520	
Transportation cost of sugarcane to factory	20	
Farmgate price	500	

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applying 35% of raw sugar price at factory.

/4: Applying 10% of sugar recovery rate from cane.

Table 37 ECONOMIC PRICE OF CASSAVA IN THE KHLONG LUANG AREA IN 1990

(Unit: Baht/ton)

FOB Bangkok (Pilot)	Baht 5,190/2 = US$226/1
Handling charge	150
Quality discount	420
Warehouse loss	100
Warehouse cost	60
Transportation cost (Bangkok - Chon Buri)/3	200
Pilot production cost (25%)/4	1,080
Millgate value of cassava root (40%)	1,270
Local transportation cost	20
Farmgate price	1,250

/1: Estimate applying the "Price Prospected for Major Primary Commodities" published by the World Bank in 1981, at 1982 constant price.

/2: Baht 23/US$1

/3: Applying 25% of pilot price at factory.

/4: Applying 40% of pilot recovery rate from cassava root.

Table 38 ECONOMIC PRICE OF COMPOUND FERTILIZER IN THE KHLONG LUANG AREA IN 1990

(Unit: ฿/t)

Item	Compound Fertilizer			Urea
	16:30:0	15:15:15	13:13:21	
Price at Bangkok	6,190	6,100	5,770	7,870
Handling Charge	150	150	150	150
Manufacturing Cost	1,590	1,560	1,480	-
Transportation Cost to Chon Buri	200	200	200	200
Local Transportation Cost	20	20	20	20
Miscellaneous Cost	2,490	2,710	2,950	1,730
Farmgate Price	10,640	10,740	10,570	9,970

Table 39 ECONOMIC PRICE OF FERTILIZER IN THE RAYONG AREA IN 1990

(Unit: ฿/t)

Item	Compound Fertilizer			Urea
	16:20:0	15:15:15	13:13:21	
Price at Bangkok	6,210	6,100	3,770	7,870
Handling Charge	150	150	150	150
Manufacturing Cost	1,590	1,560	1,480	-
Transportation Cost to Rayong	300	300	300	300
Local Transportation Cost	20	20	20	20
Miscellaneous Cost	2,420	2,670	2,920	1,730
Farmgate Price	10,690	10,800	10,640	10,070

Table 40 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITHOUT-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety in Wet Season
Production Cost		
Labor	1,768	2,169
Animal	320	280
Machinery	1,694	1,694
Seed	490	490
Fertilizers	-	2,130
Agro-chemicals	-	160
Miscellaneous	210	300
Total	4,482 = 4,480	7,223 = 7,220
Gross Production Value/1	15,170	18,420
Net Production Value/2	10,690	11,200

Rice, local variety

/1: ฿8,430 x 1.8t = 15,170
/2: ฿15,170 - 4,480 = 10,690

Rice, improved variety in wet season

/1: ฿8,010 x 2.3t = 18,420
/2: ฿18,420 - 7,220 = 11,200

Table 41 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITHOUT-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Ground-nuts	Mung-beans	Sugar-cane	Cassava	Vegetables
Production Cost					
Labor	634	915	2,615	1,038	1,819
Animal	120	120	347	80	160
Machinery	1,694	1,694	565	1,694	1,694
Seed	320	540	230	80	720
Fertilizers	-	-	3,220	-	5,370
Agro-chemicals	-	-	250	-	660
Transportation cost (truck)	-	-	680	-	-
Miscellaneous	140	160	233	290	520
Total	2,908 = 2,910	3,429 = 3,430	8,140	3,182 = 3,180	10,943 = 10,940
Gross Production Value/1	13,690	12,100	22,670	20,000	44,850
Net Production Value/2	10,780	8,670	14,530	16,820	33,910

Groundnuts

/1: ฿10,530 x 1.3t = 13,690
/2: ฿13,690 - 2,910 = 10,780

Mungbeans

/1: ฿15,120 x 0.8t = 12,100
/2: ฿12,100 - 3,430 = 8,670

Sugarcane

/1: ฿(2,500 + 21,500 x 2t) ÷ 3 = 22,670
/2: ฿22,670 - 8,140 = 14,530

Cassava

/1: ฿1,250 x 16.0t = 20,000
/2: ฿20,000 - 3,180 = 16,820

Vegetables

/1: ฿8,970 x 5.0t = 44,850
/2: ฿44,850 - 10,940 = 33,910

Table 42 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITHOUT-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety	
		in Wet Season	in Dry Season (Ban Khai Area)
Production Cost			
Labor	1,768	2,129	2,367
Animal	320	320	400
Machinery	1,694	1,694	1,694
Seed	490	490	500
Fertilizers	-	2,130	2,130
Agro-chemicals	-	160	160
Miscellaneous	210	300	370
Total	4,482	7,223	7,621
	= 4,480	= 7,220	= 7,620
Gross Production Value/1	15,050	18,260	28,580
Net Production Value/2	10,570	11,040	20,960

Local variety

/1: ฿8,360 x 1.8t = 15,050
/2: ฿15,050 - 4,480 = 10,570

Improved variety in wet season

/1: ฿7,940 x 2.3t = 18,260
/2: ฿18,260 - 7,220 = 11,040

Improved variety in dry season

/1: ฿7,940 x 3.6t = 28,580
/2: ฿28,580 - 7,620 = 20,960

Table 43 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITHOUT-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Cassava	Vegetables	Fruits
Production Cost				
Labor	634	1,038	1,819	2,027
Animal	120	80	160	-
Machinery	1,694	1,694	1,694	600
Seed	320	80	720	-
Fertilizers	-	-	5,370	1,000
Agro-chemicals	-	-	660	500
Miscellaneous	140	290	520	1,510
Total	2,908 = 2,910	3,182 = 3,180	10,943 = 10,940	5,637 = 5,640
Gross Production Value/1	13,570	20,000	37,600	52,350
Net Production Value/2	10,660	16,820	26,660	46,710

Groundnuts

/1: ฿10,440 x 1.3t = 13,570
/2: ฿13,570 - 2,910 = 10,660

Cassava

/1: ฿1,250 x 16.0t = 20,000
/2: ฿20,000 - 3,180 = 16,820

Vegetables

/1: ฿7,520 x 5.0t = 37,600
/2: ฿37,600 - 10,940 = 26,660

Fruits

/1: ฿10,470 x 5.0t = 52,350
/2: ฿52,350 - 5,640 = 46,710

Table 44 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITH-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety	
		in Wet Season	in Dry Season
Production Cost			
Labor	2,231	2,299	2,762
Animal	400	400	400
Machinery	1,694	1,694	1,694
Seed	300	300	300
Fertilizers	1,600	3,190	3,190
Agro-chemicals	370	500	500
Miscellaneous	330	420	440
Total	6,925	8,803	9,286
	= 6,930	= 8,800	= 9,290
Gross Production Value/1	33,720	36,050	40,050
Net Production Value/2	26,790	27,250	30,760

Local variety

/1: ฿8,430 x 4.0t = 33,720
/2: ฿33,720 - 6,930 = 26,790

Improved variety in wet season

/1: ฿8,010 x 4.5t = 36,050
/2: ฿36,050 - 8,800 = 27,250

Improved variety in dry season

/1: ฿8,010 x 5.0t = 40,050
/2: ฿40,050 - 9,290 = 30,760

Table 45 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITH-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Mungbeans	Sugarcane	Vegetables
Production Cost				
Labor	1,144	1,289	4,410	2,860
Animal	160	120	347	160
Machinery	1,694	1,694	565	1,694
Seed	480	540	230	720
Fertilizers	1,060	1,060	8,590	8,590
Agro-chemicals	210	210	703	840
Transportation (truck)	-	-	1,050	-
Miscellaneous	240	250	477	740
Total	4,988 = 4,990	5,163 = 5,160	16,372 = 16,370	15,604 = 15,600
Gross Production Value /1	26,330	22,680	35,000	89,500
Net Production Value /2	21,340	17,520	18,630	73,900

Groundnuts

/1: ฿10,530 x 2.5t = 26,330
/2: ฿26,330 - 4,990 = 21,340

Mungbeans

/1: ฿15,120 x 1.5t = 22,680
/2: ฿22,680 - 5,160 = 17,520

Sugarcane

/1: ฿(40,000 + 32,500 x 2.0t) ÷ 3 = 35,000
/2: ฿35,000 - 16,370 = 18,630

Vegetables

/1: ฿8,950 x 1.0t = 89,500
/2: ฿89,500 - 15,600 = 73,900

Table 46 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITH-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety in Wet Season	Improved Variety in Dry Season
Production Cost			
Labor	2,231	2,299	2,762
Animal	400	400	400
Machinery	1,694	1,694	1,694
Seed	300	300	300
Fertilizers	1,600	3,190	3,190
Agro-chemicals	370	500	500
Miscellaneous	330	420	440
Total	6,925 = 6,930	8,803 = 8,800	9,286 = 9,290
Gross Production Value/1	33,440	35,730	39,700
Net Production Value/2	26,510	26,930	30,410

Local Variety

/1: ฿8,360 x 4.0t = 33,440
/2: ฿33,440 - 6,930 = 26,510

Improved variety in wet season

/1: ฿7,940 x 4.5t = 35,730
/2: ฿35,730 - 8,800 = 26,930

Improved variety in dry season

/1: ฿7,940 x 5.0t = 39,700
/2: ฿39,700 - 9,290 = 30,410

Table 47 PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITH-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Vegetables	Fruits
Production Cost			
Labor	1,144	2,860	2,237
Animal	160	160	320
Machinery	1,694	1,694	-
Seed	480	720	-
Fertilizers	1,060	8,590	4,220
Agro-chemicals	210	840	450
Miscellaneous	240	740	1,820
Total	4,988 = 4,990	15,604 = 15,600	9,047 = 9,050
Gross Production Value/1	26,100	75,200	73,290
Net Production Value/2	21,110	59,600	64,240

Groundnuts

/1: ฿10,440 x 2.5t = 26,100
/2: ฿26,100 - 4,990 = 21,110

Vegetables

/1: ฿7,520 x 10.0t = 75,200
/2: ฿75,200 - 15,600 = 59,600

Fruits

/1: ฿10,470 x 7.0t = 73,290
/2: ฿73,290 -9,050 = 64,240

Table 48 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITHOUT-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety
Production Cost		
Labor	1,570	1,860
Animal	200	200
Machinery	1,020	1,020
Seed	180	180
Fertilizers	-	640
Agro-chemicals	-	-
Miscellaneous	150	230
Total	3,120	4,130
Gross Production Value/1	5,400	6,560
Net Production Value/2	2,280	2,430

Local Variety

/1: ฿3,000 x 1.8t = 5,400
/2: ฿5,400 - 3,120 = 2,280

Improved variety

/1: ฿2,850 x 2.3t = 6,560
/2: ฿6,560 - 4,140 = 2,420

Table 49 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITHOUT-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Ground-nuts	Mung-beans	Sugar-cane	Cassava	Vegeta-bles
Production Cost					
Labor	530	710	2,427	920	1,550
Animal	75	75	83	50	50
Machinery	1,020	1,020	340	1,020	1,020
Seed	270	300	127	50	440
Fertilizers	-	-	1,940	-	3,230
Agro-chemicals	-	-	-	-	160
Transportation (truck)	-	-	680	-	-
Miscellaneous	95	105	283	100	320
Total	1,990	2,210	5,880	2,140	6,770
Gross Production Value/1	7,800	6,800	22,670	11,200	27,000
Net Benefit/2	5,810	4,590	16,790	9,060	20,230

Groundnuts

/1: ฿6,000 x 1.3t = 7,800
/2: ฿7,800 - 1,990 = 5,810

Mungbeans

/1: ฿8,500 x 0.8t = 6,800
/2: ฿6,800 - 2,210 = 4,590

Sugarcane

/1: ฿(25,000 + 21,500 x 2.0t) ÷ 3 = 22,670
/2: ฿22,670 - 5,880 = 16,790

Cassava

/1: ฿700 x 16.0t = 11,200
/2: ฿11,200 - 2,140 = 9,060

Vegetables

/1: ฿5,400 x 5.0t = 27,000
/2: ฿27,000 - 6,750 = 20,250

Table 50 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITHOUT-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety	
		in Wet Season	in Dry Season
Production Cost			
Labor	1,570	1,860	2,150
Animal	200	200	200
Machinery	1,020	1,020	1,020
Seed	180	180	180
Fertilizers	-	640	640
Agro-chemicals	-	-	-
Miscellaneous	150	230	210
Total	3,120	4,130	4,400
Gross Production Value/1	5,220	6,440	10,080
Net Benefit/2	2,100	2,310	5,680

Local Variety

/1: ฿2,900 x 1.8t = 5,220
/2: ฿5,220 - 3,120 = 2,100

Improved variety in wet season

/1: ฿2,800 x 2.3t = 6,440
/2: ฿6,440 - 4,130 = 2,310

Improved variety in dry season

/1: ฿2,800 x 3.6t = 10,080
/2: ฿10.080 - 4,410 = 5,670

Table 51 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITHOUT-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Vegetables	Fruits
Production Cost			
Labor	530	1,550	1,710
Animal	75	50	-
Machinery	1,020	1,020	600
Seed	270	440	-
Fertilizers	-	3,230	1,000
Agro-chemicals	-	140	140
Miscellaneous	95	320	1,450
Total	1,990	6,750	4,920
Gross Production Value/1	7,150	22,500	31,500
Net Benefit/2	5,160	15,750	26,580

Groundnuts

/1: ฿5,500 x 1.3t = 7,150
/2: ฿7,150 - 1,990 = 5,160

Vegetables

/1: ฿4,500 x 5.0t = 22,500
/2: ฿22,500 - 6,730 = 15,770

Fruits

/1: ฿6,300 x 5.0t = 31,500
/2: ฿31,500 - 4,900 = 26,600

Table 52 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITH-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety	
		in Wet Season	in Dry Season
Production Cost			
Labor	2,040	2,040	2,450
Animal	250	250	250
Machinery	1,020	1,020	1,020
Seed	108	108	108
Fertilizers	960	1,600	1,600
Agro-chemicals	140	140	140
Miscellaneous	230	260	280
Total	4,748 = 4,750	5,418 = 5,420	5,848 = 5,850
Gross Production Value/1	12,000	12,830	14,250
Net Benefit/2	7,250	7,410	8,400

Local variety

/1: ฿3,000 x 4.0t = 12,000
/2: ฿12,000 - 4,750 = 7,250

Improved variety in wet season

/1: ฿2,850 x 4.5t = 12,830
/2: ฿12,830 - 5,420 = 7,410

Improved variety in dry season

/1: ฿2,850 x 5.0t = 14,250
/2: ฿14,250 - 5,850 = 8,400

Table 53 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITH-PROJECT CONDITIONS IN THE KHLONG LUANG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Mungbeans	Sugarcane	Vegetables
Production Cost				
Labor	1,010	1,140	3,930	2,140
Animal	100	100	83	50
Machinery	1,020	1,020	340	1,020
Seed	270	300	127	440
Fertilizers	640	640	5,170	5,170
Agro-chemicals	70	70	100	140
Transportation cost (truck)	-	-	1,050	-
Miscellaneous	160	160	410	450
Total	3,270	3,430	11,210	9,410
Gross Production Value/1	15,000	12,750	39,330	54,000
Net Benefit/2	11,730	9,320	28,120	44,590

Groundnuts

/1: ฿6,000 x 2.5t = 15,000
/2: ฿15,000 - 3,280 = 11,730

Mungbeans

/1: ฿8,500 x 1.5t = 12,750
/2: ฿12,750 - 3,430 = 9,320

Sugarcane

/1: ฿(40,000 + 39,000 x 2.0t) ÷ 3 = 39,330
/2: ฿39,330 - 11,210 = 28,120

Vegetables

/1: ฿5,400 x 10.0t = 54,000
/2: ฿54,000 - 9,410 = 44,590

Table 54 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY RICE VARIETY UNDER WITH-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Local Variety	Improved Variety	
		in Wet Season	in Dry Season
Production Cost			
Labor	2,040	2,040	2,450
Animal	250	250	250
Machinery	1,020	1,020	1,020
Seed	108	108	108
Fertilizers	960	1,600	1,600
Agro-chemicals	140	140	140
Miscellaneous	230	260	280
Total	4,748 = 4,750	5,418 = 5,420	5,848 = 5,850
Gross Production Value/1	11,600	12,600	14,000
Net Benefit/2	6,850	7,180	8,150

Local veriety

/1: ฿2,900 x 4.0t = 11,600
/2: ฿11,600 - 4,750 = 6,850

Improved variety in wet season

/1: ฿2,800 x 4.5t = 12,600
/2: ฿12,600 - 5,420 = 7,180

Improved variety in dry season

/1: ฿2,800 x 5.0t = 14,000
/2: ฿14,000 - 5,850 = 8,150

Table 55 FINANCIAL PRODUCTION COST AND NET PRODUCTION VALUE PER HA BY CROP UNDER WITH-PROJECT CONDITIONS IN THE RAYONG IRRIGATION SCHEME AREA

(Unit: Baht)

Item	Groundnuts	Vegetables	Fruits
Production Cost			
Labor	1,010	2,140	1,930
Animal	100	50	200
Machinery	1,020	1,020	-
Seed	270	440	-
Fertilizers	640	5,170	2,940
Agro-chemicals	70	140	140
Miscellaneous	160	450	1,620
Total	3,270	9,410	6,830
Gross Production Value/1	13,750	45,000	40,950
Net Benefit/2	10,480	35,590	34,120

Groundnuts

/1: ฿5,500 x 2.5t = 13,750
/2: ฿13,750 - 3,270 = 10,480

Vegetables

/1: ฿4,500 x 10.0t = 45,000
/2: ฿42,000 - 9,410 = 35,590

Fruits

/1: ฿5,850 x 7.0t = 40,950
/2: ฿40,950 - 6,830 = 34,120

Table 56(1) TOTAL NET PRODUCTION VALUE IN THE PROPOSED IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Crop	Cropped Area (ha)	Net Production Value per Ha (฿/ha)	Total Net Production Value (฿ x 10^3)	Average /1 (฿/ha)
(1) Khlong Luang Irrigation Scheme				
Rice - local variety	3,970	10,690	42,439	
- improved variety, wet season	2,650	11,200	29,680	
Groundnuts	80	10,780	862	
Cassava	400	16,820	6,728	
Sugarcane	390	14,530	5,667	
Total	7,490	-	85,376	12,936
(2) Ban Khai Extension Irrigation Scheme				
Rice - local variety	3,770	10,570	39,849	
- improved variety, wet season	2,540	11,040	28,042	
Groundnuts	20	10,660	213	
Cassava	1,560	16,820	26,239	
Sugarcane	320	14,530	4,650	
Fruit trees	500	46,710	23,355	
Total	8,710	-	122,348	15,889

/1: Total net production value/Net irrigable area

Table 56(2) TOTAL NET PRODUCTION VALUE IN THE PROPOSED IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Crop	Cropped Area (ha)	Net Production Value per Ha (฿/ha)	Total Net Production Value (฿ x 10³)	Average/1 (฿/ha)
(3) Ban Khai Existing Irrigation Scheme				
Rice - local variety	2,780	10,570	29,385	
- improved variety, wet season	1,860	11,040	20,534	
- improved variety, dry season	1,900	20,960	39,824	
Cassava	990	16,820	16,652	
Vegetables	320	26,660	8,531	
Total	7,850	-	114,926	23,943
(4) Khlong Thap Ma Irrigation Scheme				
Rice - local variety	1,180	10,570	12,473	
- improved variety	780	11,040	8,611	
Groundnuts	20	10,660	213	
Cassava	510	16,820	8,578	
Sugarcane	120	14,530	1,744	
Fruit trees	60	46,710	2,803	
Total	2,670	-	34,422	14,342

/1: Total net production value/Net irrigation area

Table 57(1) TOTAL NET PRODUCTION VALUE IN THE PROPOSED IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

Crop	Cropped Area (ha)	Net Production Value per Ha (฿/ha)	Total Net Production Value (฿ x 10^3)	Average/1 (฿/ha)
(1) Khlong Luang Irrigation Scheme				
Rice - local variety	1,320	26,790	35,363	
- improved variety, wet season	5,280	27,250	143,880	
- improved variety, dry season	-	-	-	
Groundnuts	1,610	21,340	34,357	
Mungbeans	420	17,520	7,358	
Vegetables	610	73,900	45,079	
Total	9,240	-	266,037	40,309
(Cropping intensity: 1.4)				
(2) Ban Khai Extension Irrigation Scheme				
Rice - local variety	1,420	26,510	37,644	
- improved variety, wet season	5,700	26,930	153,501	
- improved variety, dry season	850	30,410	25,849	
Groundnuts	1,730	21,110	36,520	
Vegetables	500	59,600	29,800	
Fruit trees	580	64,240	37,259	
Total	10,780	-	320,573	41,633
(Cropping intensity: 1.4)				

/1: Total net production value/Net irrigable area

Table 57(2) TOTAL NET PRODUCTION VALUE IN THE PROPOSED IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

Crop	Cropped Area (ha)	Net Production Value per Ha (฿/ha)	Total Net Production Value (฿ x 10^3)	Average /1 (฿/ha)
(3) Ban Khai Existing Irrigation Scheme				
Rice - local variety	960	26,510	25,450	
- improved variety, wet season	3,840	26,930	103,411	
- improved variety, dry season	540	30,410	16,421	
Groundnuts	1,080	21,110	22,799	
Vegetables	300	59,600	17,880	
Total	6,720	64,240	185,961	38,742
(Cropping intensity: 1.4)				
(4) Khlong Thap Ma Irrigation Scheme				
Rice - local variety	440	26,510	11,664	
- improved variety, wet season	1,880	26,930	50,628	
- improved variety, dry season	820	30,410	24,936	
Groundnuts	700	21,110	14,777	
Vegetables	150	59,600	8,940	
Fruit trees	80	64,240	5,139	
Total	4,070	-	116,084	48,368
(Cropping intensity: 1.7)				

/1: Total net production value/Net irrigable area

Table 58 TYPICAL FARM BUDGET FOR THE KHLONG LUANG IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Farm size (net area):	1.8 ha		4.5 ha	
Family size:	6.2 persons		6.2 persons	
Workable persons per family:	2.5 persons		2.5 persons	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.95	5,130	2.39	12,910
- improved variety	0.64	4,200	1.59	10,430
Groundnuts	0.02	160	0.05	390
Cassava	0.10	1,120	0.24	2,690
Sugarcane	0.09	2,040	0.23	5,210
Livestock		1,500		1,500
Off-farm income		7,080		-
Total		21,230		33,130
Out-go				
Hired labor		-		3,940
Hired animal		-		500
Hired machinery		1,780		4,430
Seed		330		830
Fertilizers		590		1,460
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		330		820
Living expenses		18,000		18,000
Total		21,230		30,280
Reserve		0		2,850

Table 59 TYPICAL FARM BUDGET FOR THE KHLONG LUANG IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

	1.7 ha		4.3 ha	
Farm size (net area):				
Family size:	6.2 persons		6.2 persons	
Workable persons per family:	2.5 persons		2.5 persons	
Cropping intensity:	1.4		1.4	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.34	4,080	0.86	10,320
- improved variety, wet season	1.36	17,450	3.44	44,140
- improved variety, dry season	-	-	-	-
Groundnuts	0.43	6,450	1.08	16,200
Mungbeans	0.10	1,280	0.26	3,320
Vegetables	0.15	8,100	0.39	21,060
Livestock		1,500		1,500
Off-farm income		-		-
Total		38,860		96,540
Out-go				
Hired labor		1,300		8,800
Hired animal		150		980
Hired machinery		2,430		6,150
Seed		400		1,010
Fertilizers		3,620		9,200
Agro-chemicals		300		750
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		590		1,480
Living expenses		25,000		25,000
Total		33,990		53,670
Reserve		4,870		42,870

Table 60 TYPICAL FARM BUDGET FOR THE BAN KHAI EXTENSION IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Farm size:	1.8 ha		3.2 ha	
Family size:	5.7 persons		5.7 persons	
Workable persons per family:	2.5 per sons		2.5 persons	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.78	4,070	1.39	7,260
- improved variety	0.53	3,410	0.93	5,990
Groundnuts	-	-	0.01	70
Cassava	0.32	3,580	0.57	6,380
Sugarcane	0.07	1,590	0.12	2,720
Fruit trees	0.10	3,150	0.18	5,670
Livestock		1,500		1,500
Off-farm income		3,940		-
Total		21,240		29,590
Out-go				
Hired labor		-		200
Hired animal		-		2,020
Hired machinery		1,750		3,110
Seed		260		460
Fertilizers		580		1,010
Agro-chemicals		10		30
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		440		780
Living expenses		18,000		18,000
Total		21,240		25,910
Reserve		0		3,680

Table 61 TYPICAL FARM BUDGET FOR THE BAN KHAI EXTENSION IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

Farm size:	1.7 ha		3.0 ha	
Family size:	5.7 persons		5.7 persons	
Workable persons per family:	2.5 persons		2.5 persons	
Cropping intensity:	1.4		1.4	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.31	3,600	0.54	6,260
- improved variety, wet season	1.26	15,880	2.22	27,970
- improved variety, dry season	0.19	2,660	0.33	4,620
Groundnuts	0.39	5,360	0.69	9,490
Vegetables	0.10	4,500	0.18	8,100
Fruit trees	0.14	5,320	0.24	9,830
Livestock		1,500		1,500
Off-farm income		-		-
Total		38,820		67,770
Out-go				
Hired labor		1,710		3,990
Hired animal		150		450
Hired machinery		2,300		4,040
Seed		340		600
Fertilizers		3,770		6,680
Agro-chemicals		310		540
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		770		1,370
Living expenses		23,000		23,000
Total		32,550		40,970
Reserve		6,270		26,800

Table 62 TYPICAL FARM BUDGET FOR THE BAN KHAI EXISTING IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Farm size:	1.8 ha		3.2 ha	
Family size:	5.1 persons		5.1 persons	
Workable persons per family:	2.5 persons		2.5 persons	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.64	3,340	1.13	5,900
- improved variety wet season	0.43	2,770	0.76	4,890
- improved variety, dry season	0.43	4,330	0.78	7,860
Cassava	0.23	1,650	0.40	2,860
Vegetables	0.07	1,580	0.13	2,930
Livestock		1,500		1,500
Off-farm income		6,300		600
Total		21,470		26,540
Out-go				
Hired labor		-		2,170
Hired animal		-		220
Hired machinery		1,840		3,270
Seed		310		560
Fertilizers		780		1,410
Agro-chemicals		10		20
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		330		590
Living expenses		18,000		18,000
Total		21,470		26,540
Reserve		0		0

Table 63 TYPICAL FARM BUDGET FOR THE BAN KHAI EXISTING IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

Farm size (net area):	1.7 ha		3.0 ha	
Family size:	5.1 persons		5.1 persons	
Workable persons per family:	2.5 persons		2.5 persons	
Cropping intensity:	1.4		1.4	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.34	3,940	0.60	6,960
- improved variety, wet season	1.36	17,140	2.40	30,240
- improved variety, dry season	0.19	2,660	0.33	4,620
Groundnuts	0.39	5,360	0.69	9,490
Vegetables	0.10	4,500	0.18	8,100
Livestock		1,500		1,500
Off-farm income		-		-
Total		35,100		60,910
Out-go				
Hired labor		1,360		4,010
Hired animal		160		460
Hired machinery		2,430		4,290
Seed		350		630
Fertilizers		3,570		6,320
Agro-chemicals		310		540
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		590		1,050
Living expenses		23,000		23,000
Total		31,970		40,600
Reserve		3,130		20,310

Table 64 TYPICAL FARM BUDGET FOR THE KHLONG THAP MA IRRIGATION SCHEME AREA UNDER WITHOUT-PROJECT CONDITIONS

Farm size (net area):	1.8 ha		4.5 ha	
Family size:	6.0 persons		6.0 persons	
Workable persons per family:	2.5 persons		2.5 persons	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.80	4,180	1.99	10,390
- improved variety, wet season	0.53	3,410	1.31	8,440
Groundnuts	0.01	70	0.04	290
Cassava	0.34	3,810	0.86	9,630
Sugarcane	0.08	1,810	0.20	4,530
Fruit trees	0.04	1,260	0.10	3,150
Livestock		1,500		1,500
Off-farm income		5,100		-
Total		21,140		37,930
Out-go				
Hired labor		-		4,220
Hired animal		-		430
Hired machinery		1,770		4,410
Seed		270		670
Fertilizers		530		1,330
Agro-chemicals		10		10
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		360		890
Living expenses		18,000		18,000
Total		21,140		30,260
Reserve		0		7,670

Table 65 TYPICAL FARM BUDGET FOR THE KHLONG THAP MA IRRIGATION SCHEME AREA UNDER WITH-PROJECT CONDITIONS

	1.7 ha		4.3 ha	
Farm size (net area):				
Family size:	6.0 persons		6.0 persons	
Workable persons per family:	2.5 persons		2.5 persons	
Cropping intensity:	1.7		1.7	
	Cropped Area (ha)	Amount (฿)	Cropped Area (ha)	Amount (฿)
Gross Income				
Rice - local variety	0.31	3,600	0.77	8,930
- improved variety, wet season	1.33	16,760	3.35	42,210
- improved variety, dry season	0.61	8,540	1.55	21,700
Groundnuts	0.49	6,740	1.25	17,190
Vegetables	0.10	4,500	0.26	11,700
Fruit trees	0.05	2,050	0.13	5,320
Livestock		1,500		1,500
Off-farm income		-		-
Total		43,690		108,550
Out-go				
Hired labor		2,260		11,420
Hired animal		250		1,270
Hired machinery		2,900		7,320
Seed		340		780
Fertilizers		4,380		11,110
Agro-chemicals		370		940
Feed for livestock		150		150
Tax, public levies		50		150
Miscellaneous		790		2,010
Living expenses		25,000		25,000
Total		36,490		60,150
Reserve		7,200		48,400