FINAL REPORT

of

IRRIGATED AGRICULTURE DEVELOPMENT PROJECT

1977 – 1985

MARCH 1985

THAI IRRIGATED AGRICULTURE DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

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Foreword

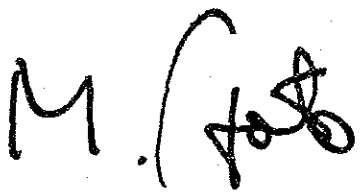
Japan International Cooperation Agency (JICA), the executive organization of the technical cooperation programme, is involved in various governmental activities in this country, and the Thai Ministry of Agriculture and Cooperatives is one of our most important counterpart organizations. Our cooperation covers various fields in connection with the social and economic development of the country of which a major part is being enjoyed by the agricultural sector.

I believe that agricultural development should be the backbone of national economic development, because its stable and increasing production brings about national wealth in the course of development based on the betterment of the farmers' lives.

We are so happy to hear that the yield of the farmers' fields within the Pilot area have increased remarkably year by year since the Project commenced, and that the farmers are enjoying very much their biggest harvests which they have never experienced before. It is evidence that the efforts of the people involved in this project have have concentrated on the correct goals.

The Project is just ending after its 8-year long achievement. I shall bid farewell words to the Japanese experts but the Project itself will forever continue.

This report was made by the Japanese experts with the close cooperation of their Thai counterpart officials, thus comes the gathering of all the results of those activities during the Project period.



March 1985

Mr. Michimoto Goto
Director, Resident-Representative
of Bangkok Office,
Japan International
Cooperation Agency.

Preface

Thai Irrigated Agriculture Development Project (herein after referred to as "the Project") has been carried out for eight years based on the Record of Discussions which was signed on April 8, 1977 between the Thai and the Japanese Governments.

The Project aims at the promotion of integrated rural development including land consolidation, the improvement and extension of technology in agricultural production, the development and strengthening of farmers' organizations and other related activities which will be necessary for increase of rice yield.

The technical cooperation term which was orginally defined on the Record of Discussions was five years from April 8, 1977 to April 7, 1982. This term is called "the first phase" of the Project. During this period, almost all of the physical work was finished. The Project entered the 3-year second phase following the first phase up to March, 1985. In this period, rural development strategies continued to take place. In spite of the fact that Japanese experts and their counterparts had made great efforts during these eight years, it proved difficult for the Project to attain its objectives as originally outlined for many reasons. However, we are all convinced that the Project has made considerable progress with some marked successes.

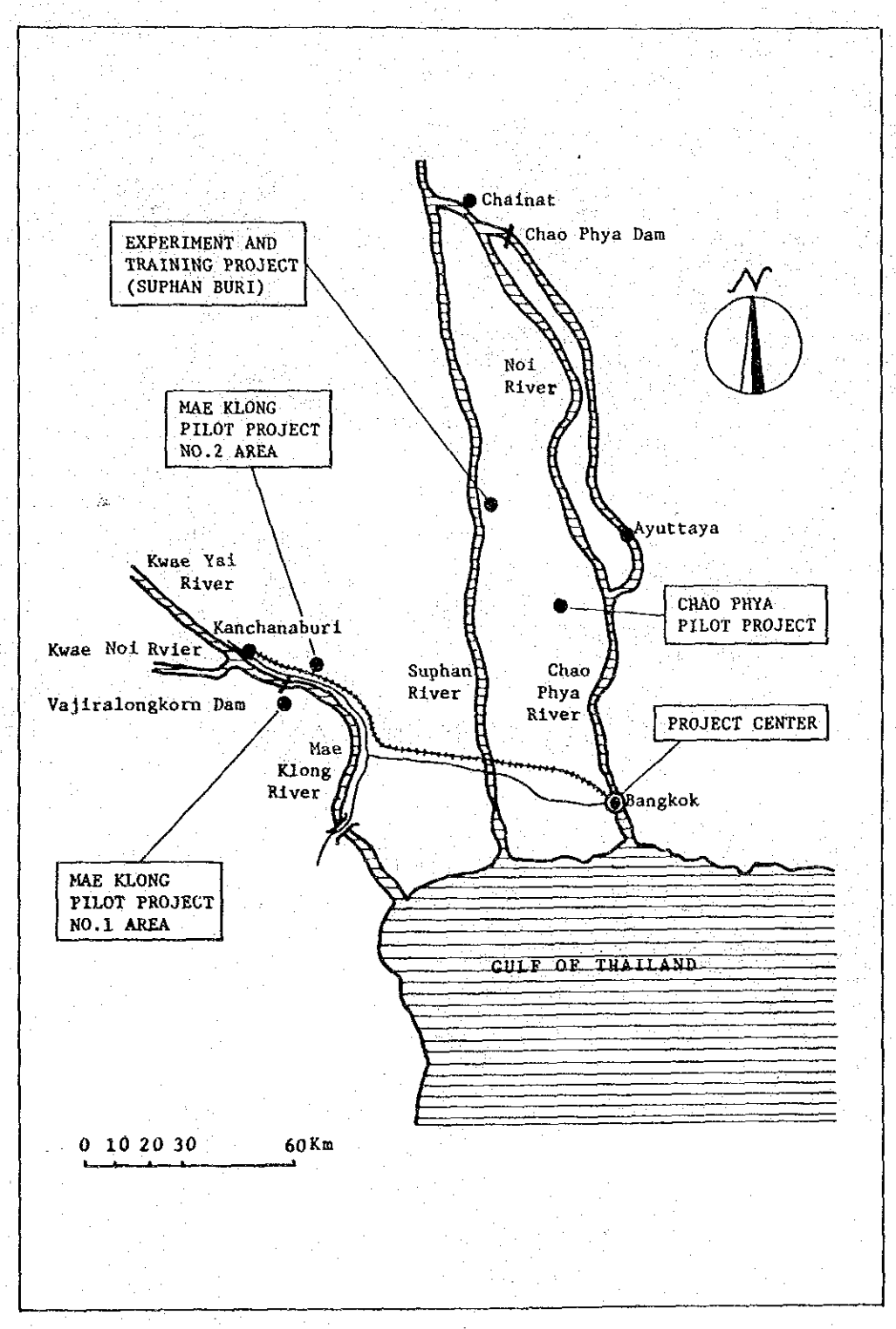
On the occasion of the termination of the whole eight year cooperation, we have briefly compiled out activities that were undertaken during the period. The detailed reports on each field have been seperately published.

Lastly, I would like to express my thanks to the Thai officials concerned and my colleagues for their excellent collaboration in the implementation of the Project.

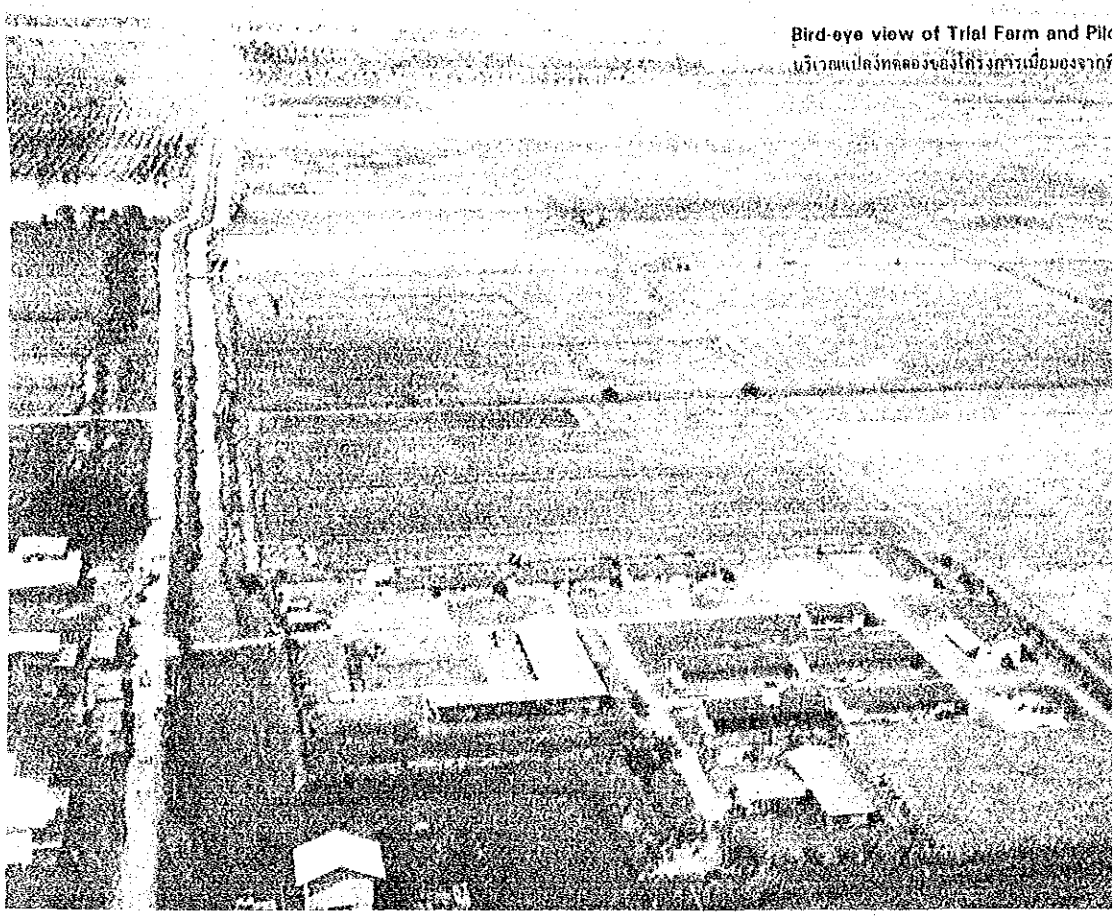
March 1985

Mr. Junichiro Nakajima
Japanese Team Leader of IADP.

PLAN OF IADP

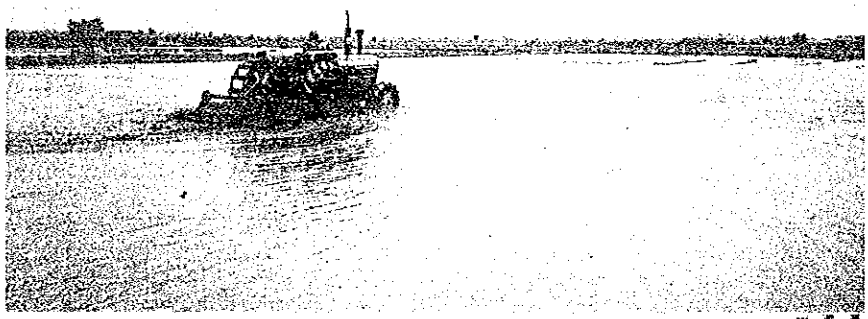

Chainat
Chao Phya Dam
EXPERIMENT AND TRAINING PROJECT (SUPHAN BURI)
Noi River
MAE KLONG PILOT PROJECT NO.2 AREA
Ayuttaya
Kwae Yai River
CHAO PHYA PILOT PROJECT
Kanchanaburi
Kwae Noi Rvier
Suphan River
Chao Phya River
Vajiralongkorn Dam
PROJECT CENTER
Mae Klong River
Bangkok
MAE KLONG PILOT PROJECT NO.1 AREA
GULF OF THAILAND
0 10 20 30 60Km

Pictures of IADP

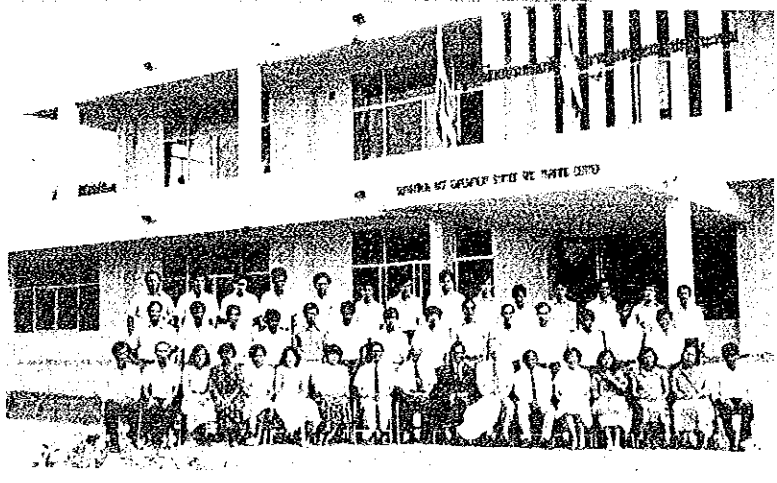


Bird-eye view of Trial Farm and Pil
บริเวณแปลงทดลองและโครงการเบื้องต้น

The Cha
Project a
Trial Far

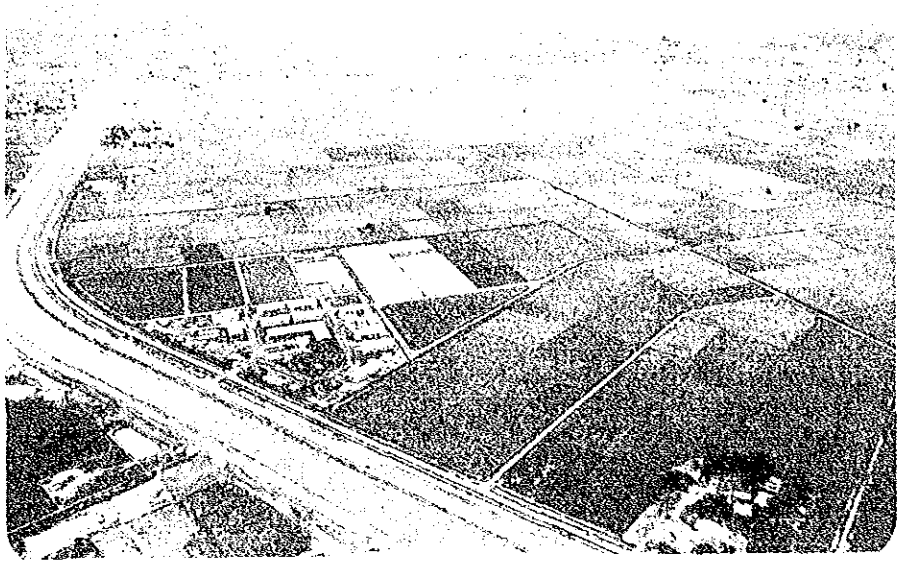


Field prepar
with special
cage-wheels

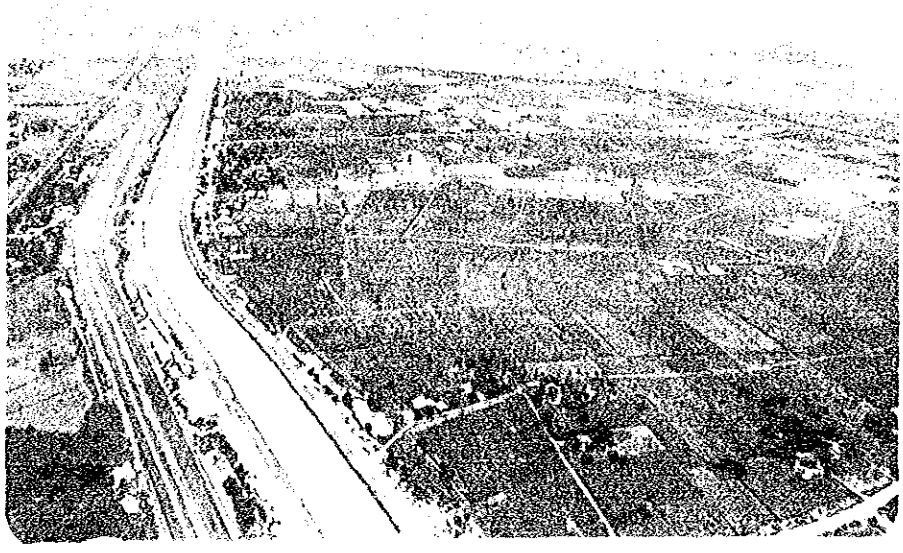


Participants at the
Suphan Buri Experiment
and Training Center

Mae Klong Pilot Project No. 1 and Agricultural Demonstration Centre



Mae Klong Pilot Project No. 2



ABBREVIATIONS AND GLOSSARY

ALRO	:	Agricultural Land Reform Office
CLCO	:	Central Land Consolidation Office
CPPP	:	Chao Phya Pilot Project
DA	:	Department of Agriculture
DTEC	:	Department of Technical Economic Cooperation
IADP	:	Irrigated Agriculture Development Project
JICA	:	Japan International Cooperation Agency
MKPP	:	Mae Klong Pilot Project
MOAC	:	Ministry of Agriculture and Cooperatives
RID	:	Royal Irrigation Department
SBTC	:	Suphanburi Experiment and Training Center

1 rai	=	0.16 ha
Baht		1 baht = 10 yen

Changwat	=	province
Amphur	=	district
Tambol	=	sub-district

CONTENTS

General Outline

I General Outline

I-1 Background and Purpose of the Technical Cooperation

Paddy cultivation in Thailand, which has been carried out in vast paddy fields of about 9.6 million hectares, produces an annual yield of approximately 19 million tons of rice (1984/85 expected figure) and about 3.86 million tons have been exported in 1984 to Southeast Asian countries and other regions.

Thus, as compared which other Southeast Asian countries, Thai agriculture has been maintaining considerably stable-paddy production, which, as the nucleus of its agriculture, is playing a vital role in the national economy, contributing to the improvement of the balance of payments to a great extent.

The latest achievements in the country's rice farming depend on not only the blessed natural conditions but also on the investments made for the infrastructure water use facilities over many years. Particularly, the main irrigation and drainage canals provided by the Royal Irrigation Department have been highly evaluated internationally.

In the 1970s, however, the population of Thailand increased explosively, exceeding three percent of the annual growth rate, which is the same as other Southeast Asian countries attained.
If the population continues to grow of the current rate, the surplus capacity for rice export will cause difficulties in the maintenance of self-sufficiency of rice in the country within less than 10 years.

The 4th National Economic and Social Development Plan (1977-1981) involved a schedule for the diversification and stabilization of exports by farm production increase and multiple cropping so as to offer a countermeasure to future severe economic conditions.

The increase in farm production, particularly in paddy production, will indispensably require a production increase per unit acreage for double cropping.
In order to realize the program, the following measures should perhaps be taken:

a) The high yielding varieties e.g. the RD varieties in Thailand should be introduced to possibly large acreages and land consolidation should be provided so as to carry out proper water management.

b) The irrigation water should be secured for dry season croppings and terminal irrigation facilities should be provided in toto for efficient water utilization.

c) The agriculture supporting services should be positively promoted for improvement and extension of the farming techniques and farmers' organizations along with the above mentioned directives:

As mentioned already, since the end of world war II, the consolidation of main irrigation and drainage facilities has been expendited to produce good results in securing water. Better water utilization, however, has not yet been made due to the absence of on-farm facilities such as secondary and tertiary canals, water-intake systems to the fields and land consolidation.

Then, the Government of Thailand came to recognize the fact that any increase in paddy yield inevitably requires the realization of on-farm development as soon as possible.

Under such circumstances, the Government had formulated a plan of on-farm development, particularly a land-consolidation method as the core of the plan, (so-called Irrigated Agriculture Development), and took necessary legal and institutional measures in the enforcement of the Land Consolidation Act (1974) and the Agricultural Land Reform Act (1975) for the smooth execution of the development program.
The government carried out some administrative reorganization that transferred the Royal Irrigation Department that had previously belonged to the Ministry of the Interior into the Ministry of Agriculture and Cooperatives, and established a new Central Land Consolidation Office in charge of planning and execution of land consolidation projects, and an Agricultural Land Reform Office for the promotion of land reform.

In parallel with those positive measures for irrigated agriculture development, in February 1976, the government of Thailand requested the government of Japan, one of the most advanced countries in on-farm development technology, to extend technical cooperation implementation of the land consolidation program.

The said request of Thailand certainly came from not only its reliance on Japanese advanced technology but from the close contact and mutual good understanding that existed through many symposiums and seminars, and the exchange of related engineers and officers between the two countries.

As Technical cooperation with Japan unfolds in Thailand much card should be taken in following points :

a) Land consolidation technology in Japan, which is highly developed, cannot be applied directly to Thailand, although it could be used as a model.
In view of the economy, special attention should be paid to minimum investment, quick yields and large scale extension activities;

b) As mentioned previously, Thailand, as its national policy, is trying to promote multiple cropping, as well as an increase in paddy production and an increase in the farmers' income as well as the export of agricultural products. In this respect land consolidation would enable them to conduct convertible cropping between paddy and upland.
It is needless to say that the selection of suitable crops for local conditions, as well as the improvement of farming technology are of considerable importance.

The project therefore aims at promoting on-farm development work which will allow an increase in rice production by increase in yield and also the expansion of the paddy areas to be double cropped. It aims at contributing to the improvement and diffusion of farming techniques together with organizing the farmers in order to accomplish the government's target of raising the farmers' living standards.

The Project was initiated as two pilot projects and one training institution;

1) the Chao Phya Pilot Project, 2) the Mae Klong Pilot Project, and
3) the Suphan Buri Experiment and Training Center.

The Project mainly carries out the following activities;

1) To plan and execute improvement work for farmers' plots, farm roads, irrigation and drainage facilities constructed and dikes empoldered in the project area.
2) To advise on technical matters for effective water management
3) To conduct trials on improved agricultural techniques of rice cultivation in the trial farm.
4) To provide the farmers in the project area with training and guidance on improved agricultural techniques, and
5) To foster and strengthen farmers' organisations for water management and agricultural cooperatives in the project area.

I-2 Features of this project-type cooperation

The operational scale of this project is so large compared with conventional technical cooperation in agricultural development so far practised in this country, thus requiring more comprehensive and integrated management with a close relationship with economic cooperation, which might be itemized as follows :

a) Integration between the technical and economic cooperation;
The CPPP is a pilot model for the OECF loan project while The MKPP is linked with the World Bank loan project;

b) Cooperation among agencies and departments concerned:
The Project involves various departments; i.e. CLCO, ALRO, RID and DA. Not only these department but indirectly the Department of Extension and the Department of Cooperatives Promotion are also involved.

c) Good timing of cooperation and consistent planning for project implementation, and

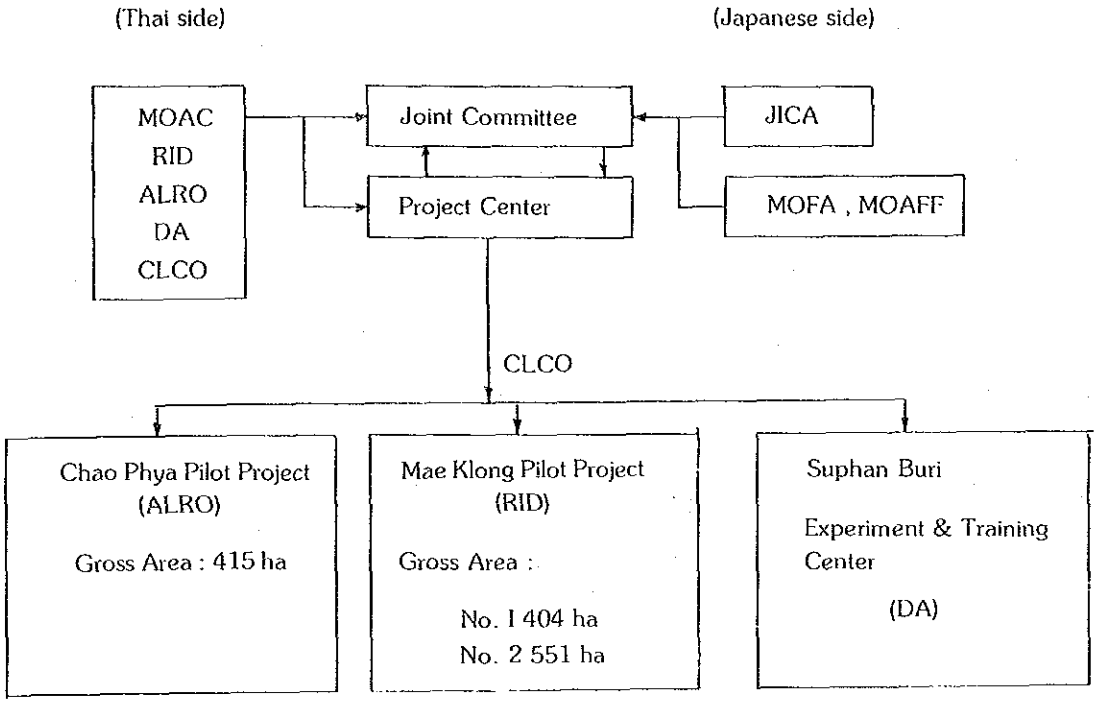
d) Importance of development in socio-economic aspects.

I-3 Organization and Functions

I-3-1 Organization

The purpose of this project is to achieve irrigated agriculture development, especially on-farm development in the Lower Greater Chao Phya Basin and the Greater Mae Klong River Basin.

The project consists of the following



The Joint Committee is defined as having the function of policy decission making. The past records of the Joint Committee meetings are put in a later chapter.

As mentioned before, this Porject involves various departments; mainly 4 departments; CLCO for the Project Center; ALRO for the Chao Phya Pilot Project; RID for the Mae Klong Pilot Project; and DA for the SuphanBuri Center.

I-3-2 Joint Committee

In the Record of Discussions, the Joint Committee is clearly defined as having the function of ensuring the smooth promotion and effective implementation of the Project. During eight years of cooperation, 8 Joint Committee meetings were held as follows;

No.	Date	Main Agenda
1	March 20, 1978	Approval of the annual plan
2	November 20, 1978	Progress of work during the past six months and implementation schedule for 1979
3	October 26, 1979	Progress of work during Dec. 1978 - Sept. 1979 and implementation schedule for 1980
4	October 16, 1980	1. Progress of work and implementation schedule for 1981 2. Information from the Japanese Mission
5	November 18, 1981	1. Progress of work during Oct. 1980 - Sept. 1981 and implementation schedule for 1982 2. The extension of the Project
6	June 28, 1982	1. Progress of work during Oct. 1981 - May 1982 2. Information and recommendation from the Mission 3. Approval of three - year plan
7	September 16, 1983	1. Progress of work during June 1982 - Sept. 1983 2. Information and recommendation from the Mission
8	November 2, 1984	1. Progress of work during 3 years of the extension period 2. Information and recommendation from the Joint Evaluation Team 3. Future Plans of the Project

The latest Thai members of the Committee are defined by the order of MOAC as follows;

1. Mr. Chulanope Snidvongse Na Ayudhya Deputy Permanent Secretary	Chairman
2. Mr. Paitoon Palayasoot Project Director	Committee member
3. Mr. Roongrueng Chulajata Manager, Mae Klong P/P	Committee member
4. Dr. Damkheong Chandrapanya Manager, Suphanburi T/C	Committee member
5. Mr. Tiravee Supanit Manager, Chao Phya P/P	Committee member
6. Mr. Prateep Soampong Project Coordinator	Committee member
7. Representative of Dept. of Agricultural Extension	Committee member
8. Representative of Dept. of Agricultural Cooperatives	Committee member
9. Representative of Land Development Department	Committee member
10. Representative of DTEC	Committee member
11. Representative of National Economics and Social Development	Committee member
12. Representative of Foreign Agricultural Deivision	Committee member and Secretary
13. Mr. Chaiyuth Preungvate CLCO	Committee member and Secretary Assistant

I-3-3 Japanese Experts

At present, 10 Japanese experts work on the Project, i.e. 3 at the Project Center, 4 at the CPPP, 3 at the MKPP, and 1 at SBTC.

Number and speciality of the Japanese experts attached to the project are as follows;

(as of March, 1985)

1) Project Center	Team Leader	J. Nakajima
	Agro - Economist cum Liaison	H. Takama
2) Chao Phya Pilot Project	Irrigation & Drainage expert	M. Fukuda
	Agronomist	T. Shibata
	Extension expert	N. Igichi
	Agro - Machinery expert	M. Numata
3) Mae Klong Pilot Project	Irrigation & Drainage expert	K. Hisamoto
	Agronomist	K. Misawa
	Extension expert	M. Tomitaka
4) Suphan Buri Experiment and Training Center	Agronomist	T. Sugahara

Total 10 experts

I-4 Inputs of the Project from JICA

I-4-1 Dispatch of Japanese experts

Over eight years, JICA dispatched the long - term and short - term experts shwon in Fig -I-4-1 In total 953 man/month experts worked on the Project.

I-4-2 Supply of machinery and equipment by JICA

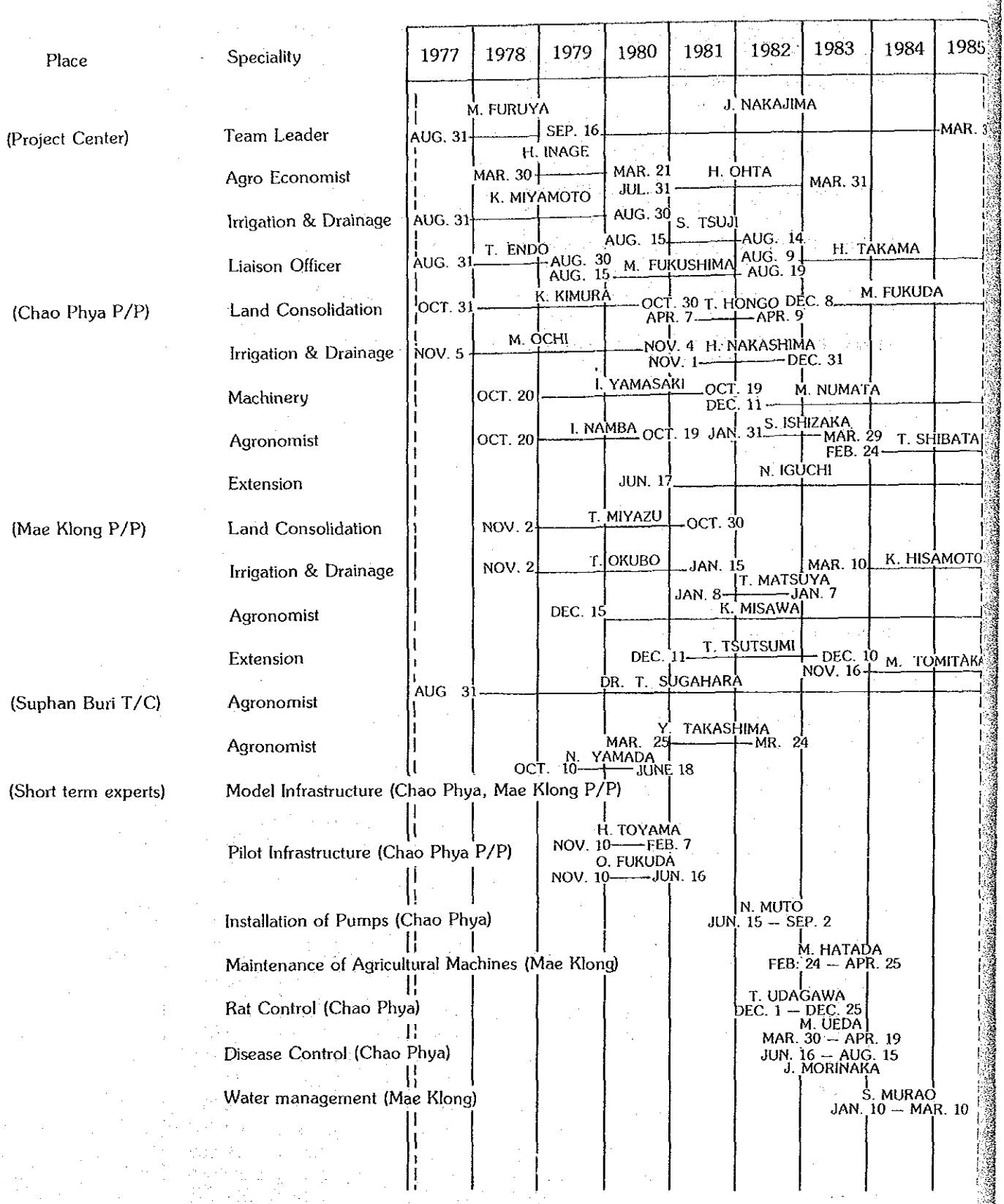
Table -I-4-1 shows the amount is 880 million yen (88 million Baht). The CPPP was allocated the most (57%). This is simply because at the initial period it received a lot of heavy equipment like bull - dozers and trucks.

Table -I-4-1 Supply of machinery and equipment from JICA

unit : 1000 yen

year	PC	CPPP	MKPP	SBTC	Total
1977	0	144,237	0	0	144,237
1978	2,303	103,805	47,231	13,226	166,565
1979	0	132,543	83,712	6,717	222,972
1980	0	44,487	69,595	13,794	127,876
1981	0	18,038	39,590	15,296	72,924
1982	3,642	21,124	28,000	6,004	58,770
1983	0	30,026	28,106	9,441	67,573
1984	0	7,849	7,670	4,150	19,669
Total	5,945	502,109	303,904	68,628	880,586
	(0.68%)	(57.0%)	(34.5%)	(7.8%)	(100.0%)

Fig -I-4-1 Assignment of experts



I-4-3 Special finance from JICA

JICA provided not only equipment but some funds for construction, publishing materials and training expenses. The breakdowns are shown in the following three tables. The CPPP was allocated 7.7 million Baht while the MKPP 8.5 million Baht, the SBTC 1 million Baht. In total 17.155 million Baht were allocated to the Project.

Table -I-4-2.1 Special funds for the CPPP

Work	Cost	Year
Creation of the Trial Farm 6.5 ha	1,900,000 B	1977 - 1978
Pilot infrastructure development 81 ha	4,312,811 B	1979 - 1989
Deep well drilling 120 m	191,000 B	1980
Electric supply and water supply for expert lodging	50,000 B	1980
Electric supply for the rice mill	74,400 B	1981
Laterite pavement for the Trial Farm	127,000 B	1981
Fence for the expert lodging	160,000 B	1981
Rat fence for the Trial Farm	170,000 B	1981
Installation of water treatment equipment	124,000 B	1981
Digging deep well at the Trial Farm	444,000 B	1982
Expenses for making pamphlets	50,000 B	1983
Expenses for publishing a cropping calendar	40,000 B	1984
Total	7,668,211 B	

Table -I-4-2.2 Special Funds for the MKPP

Work	Cost	Year
Creation of the Trial Farm 7.5 ha	2,648,698.4 B	1978 - 1979
Pilot infrastructure development 243.8 ha	4,706,257 B	1980 - 1981
Deep well drilling Ø 200 m/m L=49 m	240,000 B	1980
Temporary pumping station (conc. Box)	217,000 B	1981
Temporary drying shed	231,000 B	1981
Temporary pumping station (conc. Box)	139,700 B	1981
Rat fence for the Trial Farm	57,000 B	1981
Elevated water tank	54,000 B	1982
Expenses for the inauguration	40,000 B	1982
Expenses for making leaflets	64,235 B	1982
Expenses for trial water management	40,000 B	1983
Expenses for publishing a cropping calendar	50,000 B	1984
Total	8,487,890.4 B	

Work	Cost	Year
Expenses for making text book Expenses for Training Expenses for Training	100,000 B 503,000 B 396,000 B	1982 1983 1984
Total	999,000 B	

I-4-4 Fellowship

During the eight-year cooperation period, the Project sent 27 Thai officials to Japan. Out of 27 persons, 19 attended observation or study tours and 8 participated in JICA group training courses as follows;

department	observation/study tour	group training	total
CLCO/MOAC	7	1	8
ALRO	5	4	9
RID	3	2	5
DA	3	1	4
DTEC	1	—	1
total	19	8	27

The names of the participants are listed as follows;

i. 1977

Mr.John Boonlue	: Project Coordinator	observation
Mr.Chamlong Attanatho	: ALRO, Chao Phya P/P	〃
Mr.Sutin Susila	: DTEC	〃

ii. 1978

Mr.Paitoon Palayasoot	: Project Coordinator	Study tour
Mr.Pitipong Pungbun	: ALRO	〃
Mr.Preecha Donsakul	: CLCO	group training

iii. 1979

Mr.Chulanope Snitwongse	: Project Director	study tour
Mr.Sawad Wattanayagorn	: RID	〃

iv. 1980

Mr.Pornarong Siriyothin	: CLCO	observation
Mr.Suthin Mulphruk	: ALRO, Chao Phya P/P	〃
M.L.Pilandh Malakul	: Project Director	study tour
Mr.Paitoon Palayasoot	: Project Coordinator	〃

v. **1981**

Dr.Winit Changsri	: DA	study tour
Mr.Roongrueng Julachart	: RID, Mae Klong P/P	"
Mr.Suravud Isarabhakdi	: ALRO, Chao Phya P/P	observation
Mr.Paiboon Yongpradit	: RID, Mae Klong P/P	"

vi. **1982**

Mr.Wacharin Phanphinya	: RID, Mae Klong P/P	group training
Mr.Samroeng Srichanngam	: Project Director	observation
Mr.Jakri Ramana	: ALRO, Chao Phya P/P	group training
Mr.Pairat Duangpaiboon	: DA, Suphanburi T/C	"

vii. **1983**

Mr.Pnit Suvanajata	: ALRO, Director General	observation
Mr.Vichien Sasiprapa	: DA, Suphanburi T/C	study tour
Mr.Sporn Suwannattana	: ALRO, Chao Phya P/P	group training

viii. **1984**

Mr.Supachai Kaewlumyai	: RID, Mae Klong P/P	group training
Dr.Damkhoeng Chandrapanya	: DA, Suphanburi T/C	study tour
Mr.Prathan Rijana	: ALRO, Chao Phya P/P	group graining
Mr.Somyot Punyabarn	: ALRO, Chao Phya P/P	"

I-4-5. *Dispatch of Missions*

In response to a request from the government of Thailand the government of Japan dispatched a series of missions as follows;

Date	Names of the Missions, etc.
May 1976	Preliminary Survey team
Oct. 1976	Chao Phya feasibility study survey term
Nov. 1976	Preliminary Pilot Project detalied design survey team
Feb. 1977	Chao Phya Bilot Project detailed design survey team
Apr. 1977	The Record of Discussions on Pilot Project signed
Jun. 1977	The Record of Discussions on development survey for Irrigated Agriculture Development Project in Mae Klong River Basin and grant aid for construction of Suphanburi Training Center
July 1977	Preliminary Greater Mae Klong River Basin master plan study survey team
Aug. 1977	Japanese long-term expert team for IADP (project center)
Sep. 1977	Mae Klong Pilot Project detailed design survey team
Nov. 1977	The Greater Mae Klong River Basin master plan study survey team and advisory group
Nov. 1977	Study tour of Thai officers (4)
Mar. 1978	The annual planning survey team for IADP
Apr. 1978	Model infrastructure development for both the Chao Phya and the Mae Klong Pilot Project survey mission
Dec. 1978	Preliminary Kamphang Saen feasibility survey team
Jan. 1979	Kamphang Saen feasibility study survey team
June 1979	Pilot infrastructure development for the Chao Phya Pilot Project survey mission
Nov. 1981	Evaluation mission
Mar. 1982	Both the governments exchanged views on extension of the technical cooperation term for another 3 years (Apr. 1982 - Mar. 1985)
Apr. 1982	The extension of the Project started.
Jun. 1982	Project Consultation Team
Sep. 1983	Technical Guidance Team
Oct. 1984	Evaluation Team

I-5 Results of the Project

The fruits extracted from the Project cannot all be explained in this chapter but a detailed explanation will be made in each chapter subject - wise.

The results herein are briefly explanined and they concentrate on the construction, the paddy yields, the organizing or the farmers, and training performance.

The changing situation of the farmers' economy will be mentioned in the report of the farmers' economic surveys (March, 1985) which were carried out twice in 1982 and 1984.

I-5-1. Construction

The construction of the Chao Phya Pilot Project and the Mae Klong Pilot Project No.1 was finished employing the intensive method of land consolidation while the Mae Klong Pilot Project No.2 employed the extensive method.

The gross areas of each one are as follows,

CPPP	415 ha
MKPP NO.1	404 ha
MKPP NO.2	551 ha

The progressive schedule compared with the original plan and the actual progress in Fig. I-5-1.

Fig. I-5-1 Progressive schedule

-----plan
——actual

PROJECT	WORKS	AMOUNT	1978	1979	1980	1981	1982	1983	1984	1985
Chao Phya Pilot Porject	1. Polder dike & Main Canal	8884m.		70%	30%					
	2. Pumping station									
	Main P/S	1 set								
	Secondary P/S	5 set			--(1)	---(2)	---(2)	Pilot Infrastructure 81.2 ha		
	3. Land Consolidation	471 ha			--(101.7)	--(194.5)	--(155.5)			
	Northern part	376.4 ha			172.5'	195				
	4. Trial Farm	8.87 ha								
	Land Consolidation	6.47 ha	-----							
	Building lot	2.4 ha	-----	----						
	5. Agriculture Supporting Service									
	6. Water Management									
Mae Klong Pilot Project	A) No.1									
	1. Land Consolidation	403.6 ha		---(46)	--(168.4)	--(147.7)				
	2. Trial Farm	9.9 ha		36.9	114.8	234.5				
	Land Consolidation	6.41 ha								
	Building Lot	3.49 ha								
	3. Agricultural Supporting Service									
	4. Water Management									
	B) No.2									
	1. Land Consolidation	557.3 ha				(212.9)	(291.4)			
	2. Agriculture					314.2'	243.1			
	Supporting Service						243.8 ha			
	3. Water Management						70.4			
Suphan Buri T/C	1. Long term training	5 month @ 30	5 month @ 45	5 month @ 45	4 month @ 45					
	2. Short term training	ditto 2 weeks x 6 time x 45 persons	ditto	ditto						

I-5-2. Yield increase

The direct impact of the Project on the farmers is the increased yield as well as the expansion of the cultivated areas by means of double cropping. The yeilds of each crop season revealed remarkable progress, especially dry-season paddy.

The increase of the yeild thoughout the years is thought to be caused by the following reasons,

i. Rice varieties resistant against virus are widely adopted,
ii. Farm inputs are timely supplied to the farmers,
iii. Water management along the ditches is practice in an orderly fashion and
iv. Soil fertility is recovering after land consolidation.

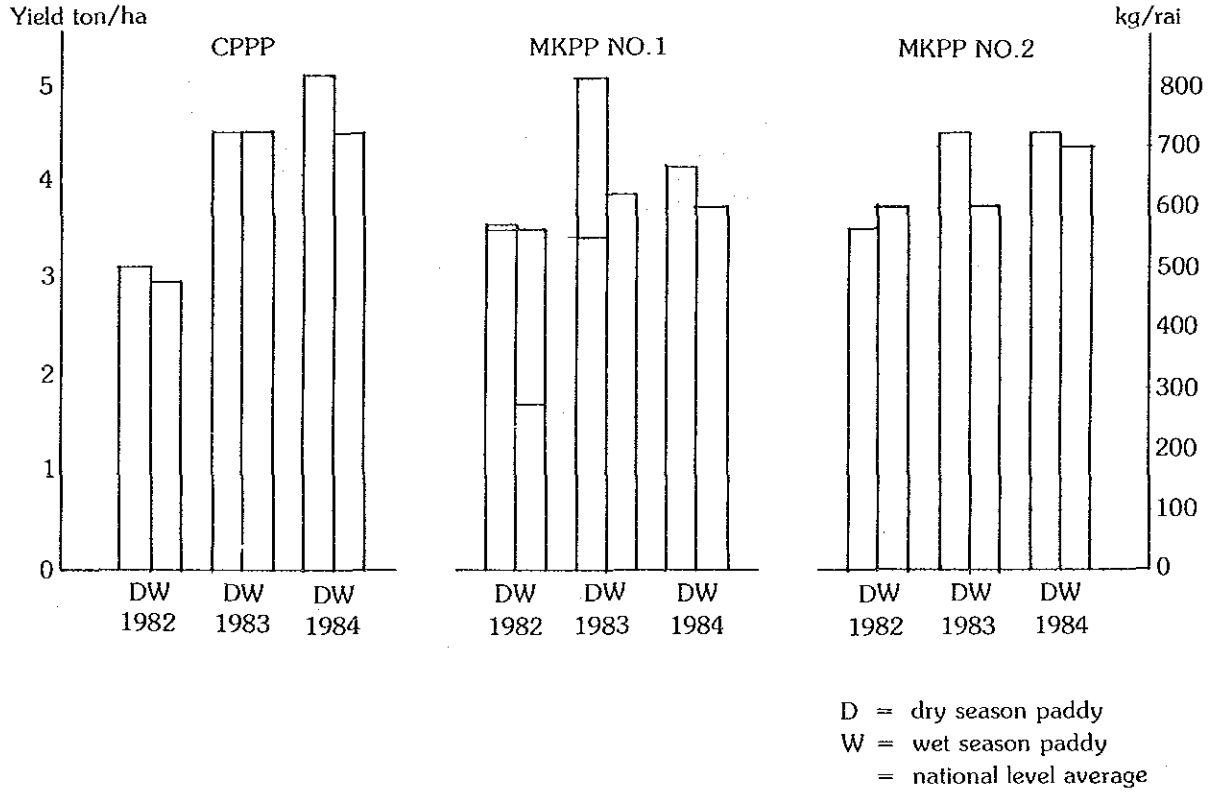
The yields by years which were measured by the crop cutting surveys are as follows,

Table I-5-1 Yields (1982-1984)

Unit : ton/ha

Sub-project	1982		1983		1984	
	dry	wet	dry	wet	dry	wet
CPPP	3.25	3.16	4.47	4.45	5.22	4.56
MKPP NO.1	3.63	3.42	5.25	3.70	4.18	3.68
MKPP NO.2	3.54	3.73	4.49	3.68	4.55	4.37

Fig. I-5-2 Yields (1982-1984)



I-5-3. Organising the farmers

The organising of the farmers is so important that they should use water from a common canal in a cooperative manner and they may have bargaining power against millers and others if they strongly unite together.

In the Chao Phya Pilot Project, they formed the Water Users' Groups and the Cooperatives as follows;

groups	no. of groups	no. of farmers organized
1. Water Users' Groups	24 groups	143 farmers
2. Cooperatives	1 group	170 farmers

In the Mae Klong Pilot Project, the farmers were organized into the Water Users' Groups as follows,

groups	no. of groups	no. of farmers organized
1. KMPP NO.1 Water Users'G.	5 groups	149 farmers
2. KMPP NO.2 Water Users'G.	18 groups	313 farmers

Each member should pay the fee for water, i.e. 80 Baht per rai for one season in the Chao Phya Pilot Project, while the farmers in the Mae Klong No.1 Project and No.2 Project pay yearly, 70 and 40 Baht per rai Respectively.

I.-5-4. Training

Each Pilot Project offered training courses to farmers and extension agents from time to time. The Suphan Buri Experiment and Training Center is a body of the training institution for the Irrigated Agriculture Development Project and it regularly opens various kinds of training courses and seminars. The Center received 1,538 participants for the long-term training courses, 829 for the special courses and 680 for the seminar since 1979. All together 3,047 participants attended the Center.

II Activities

II Activities

II-1 Project Center

The Project center headquarters were established in Bangkok and have 8 functions as follows;

1) To discharge its duties as a control administration center of the three sub-projects to support their activities.
   i) To conduct administrative ad coordinating work for the sub-projects.
   ii) To conduct liaison work among the authorities concerned in Thailand and Japan.
   iii) To make procurement procedures for equipment and machinery to be donated by the Government of Japan.
   iv) To procure equipment and machinery in Thailand using the budget allocated by the Japanese Government.
   v) To coordinate the work among the Japanese experts.
2) To make efforts to expand the effect of the pilot projects. To propagandize the project with the Thai officials concerned
3) To give necessary technical advice for planning and implementing the irrigated agriculture development plan in the Lower Chao Phya Basin (the Chao Phya Irrigated Agriculture Development Project financed by OECF) and the Greater Mae Klong Basin (The Greater Mae Klong Irrigation Project financed by the World Bank)
   i) Run-off analysis for water resource development for the resettlement of Khao Laem Dam requested by EGAT through the Embassy of Japan.
4) Fellowship
   Taking the necessary procedures for counterparts' training in Japan.
5) To offer convenience to missions/persons that will be dispatched by the Government of Japan.
   i) To the missions for agriculture development in Thailand.
   ii) To the sutdy tour groups from Japan.
   iii) To others concerned with the project.
6) Stop-gap aids/Invitation of short term experts for the three sub-projects.
   i) for emergency work.
   ii) for special measures.
   iii) To buoy up insufficient local funds.
7) To collect data in cooperation with the Thai officials concerned. Agricultural civil engineering field.
8) To make preparation for handing over the Project
   Follow-up Services requested by ALRO.

II-2 Chao Phya Pilot

II-2-1 Introduction

The Project area was, in the past, covered with water for the latter part of the rainy season as is the area adjacent to the project at present. Therefore, a polder-dike was built around the area, in order to protect the area from high floods. A main water canals, for the purpose of both raising and draining water were built, and pumping stations were constructed. The function of both of raising and draining was thus completely realized. In addition, roads, branch-waterways for intake and drainage, as well as 2nd pumping station were built, to enable the function of raising and drainage to be completed.

The Project covers about 430 ha. and was set up for the agricultural and rural development of the flood irrigation area in Tambol Phraya Banlue, Amphur Lard Bua Luang, Changwat Ayutthaya.

Acreage	Gross	415 ha
	Net	382 ha

On the other hand, the Project works as a pilot project for CPIADP (Chao Irrigated Agriculture Development Project) covering 12,620 ha. in the west bank track of the Lower Greater Chao Phya Basin.

CPIADP is partly financed by a loan from OECF (Overseas Economic Cooperation Fund) of Japan.

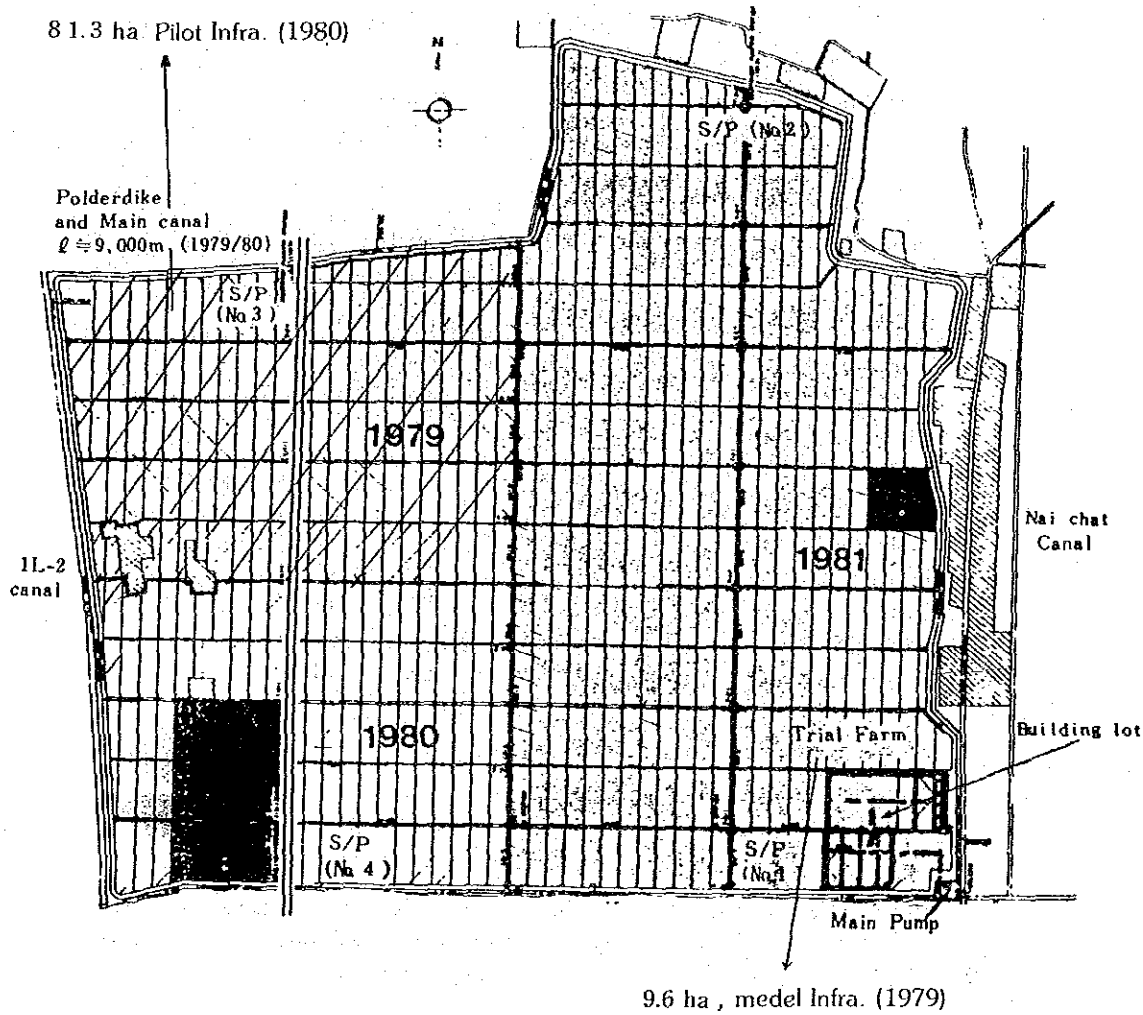
Foreign currency	2,615,000,000 yen
Local currency	413,797,000 baht
	(in early 1981 prices)

The Trial Farm of 6.5 ha, was established in the area where agronomical tests in improved methods of planting had been carried out. This campus will be used as the "Land Reform Training Center" and has provided the officers and farmers with not only various kinds of training but also an institution for land reform services. The Farm's activities started in October 1979 and 12 buildings were eventually constructed.

Land Reform in this province (Changwat) was declared in December, 1975 according to the Land Reform Act.

The ALRO's report said that about half of the farmers in this area were tenants and 10% were landless before the land reform scheme. But now 163 farmer are cultivating under their own management.

Plan of the Chao Phya Pilot Project



II-2-2 Irrigation and Drainage

II-2-2-1 Progress from 1979-1981

(1) Land consolidation

Area on force account	92.9	ha	1980	100 %
Irrigation ditch	4.21	km	1980	"
Drainage ditch	2.46	km	1980	"
Road	4.37	km	1980	"
(construction costs	17,636.54	฿/ha)		
Area by contract	81.3	ha	1980	"
Irrigation ditch	3.01	km	1980	"
Drainage ditch	2.59	km	1980	"
Road	3.17	km	1980	"
(construction costs	34,448.82	฿/ha)		
Area on force account	189.1	ha	1981	"
Irrigation ditch	7.77	hm	1981	"
Drainage ditch	5.44	km	1981	"
Road	8.09	km	1981	"
(construction costs	18,750	฿/ha)		

Total Area	363.3	kh	density (m/ha)
" Irrigation ditch	14.99	km	41.3
" Drainage ditch	10.49	km	28.9
" Road	15.63	km	43.0

(2) Polder dike construction 9.1 km 1980 100

(3) Main canal 9.1 km 1980 "

(4) Building lot filling up (4.67 ha) 30,000 m^3 1980 100 %

(5) Pumping station

Secondary station contract base	No.3	1980	100 %
force account base	No.4	"	"

No.1, No.2 Secondary P/S not yet started

Main pumping station 1980 - continue

(6) Trial farm

Farm construction	6.47	ha	1980 100%
Building construction	12		1981 100%

Others (dry court, car wash court, water supply, sewerage etc 1982 100%

II-2-2-2 *Progress from 1982-1985*

(1) Land consolidation

When the land consolidation work had been roughly finished, irrigation water did not reach many plots. Then land relevelling was carried out in April through July, 1983 and as a result of this work, plots of about 100 ha were improved.

(2) Main pumping station

The construction was completed by contract basis in September, 1982; having overcome such difficulties as inconvenience to transportation, bad foundation soil, conditions slope failure and so on. For the installation, a mechanical engineer and an electrical engineer were invited from Japan.

The specifications for the pump are as follows :

Type	;	Vertical mixed flow pump (700 VSM)
Quanity	;	54.2 cu.m/min
Total head	;	3.0 m
Prime mover	;	3 phase induction motor 45 kw
unit	;	2

(3) Secondary pumping Station

As the secondary pumping station (Nos. 1 and 2) had been operating on a temporary wooden structure, the construction of the stations completed by contract basis in April, 1983.

The specifications for the pumps are as follows :

Type	;	Horizontal mixed flow pump (300 SZR)
Quantity	;	10.2 cu.m/min
Total head	;	2.0 m
Prime mover	;	3 phase induction motor 5.5 kw
Unit	;	1

(4) Miscellaneous construction

Miscellaneous construction was completed in this term, as shown below:

- Access road	;	length 5.5 km, laterite pavement
- Shed for heavy machine	;	in the motor pool 1 unit
- Culvert	;	connecting on-farm road and polder dike, diameter 1.20 m, length 13 m, 1 line.
- Flag pole	;	in the yard, height 12 m 1 unit.
- Title board	;	in front of the gate height 2 m, width 3.5 m, 1 unit.
- Emergency generator	;	in the main pumping station diesel engine driven, 25 KVA 1 unit.
- Electric wiring	;	in the building lot 1 unit.
- Deep-well	;	in the building lot depth 150 m, quantity 3 cu.m/hour 1 unit.
- Improvement of pump station at trial farm	;	The 7.5 kw induction motor replaced the diesel engine driving the irrigation pump on the trial farm. After replacement the operation became simple and the discharge greater.

(5) Operation and maintenance

The civil section has been keeping up the maintenance of the electrical equipment, installed pumping stations, office building and so on. Electricity problems have often occurred especially during the rainy season on account of voltage fluctuation. Much time and money were consumed in repairing this damage.

(6) Water management Experiment

After land consolidation generally was finished over the whole Project area aimed at distributing water properly and solving this problem, the civil section has been engaged in observation and measurement in the field. The activities undertaken were as follows :

1) Spot height survey after levelling

After re-levelling, a spot height survey was carried out in precision of 16 spots per standard plot (80 a).

The results revealed a marginal error of 20 cm. The Pilot Infrastructure development

board had recommended that this value be within 10 cm. However, owing to the characteristics of the soil, to have come to that degree of accuracy in the levelling work would have taken up a great deal of time at considerable expense.

2) Discharge measurement of secondary pumps

After completion of the pump station (No. 1 & No. 2), including, No. 3 & No. 4, the discharge from the pump was measured at each station using current flow meter.

The result showed each discharge to be about 170 liter/min; the pump worked at its rated value.

3) Irrigation stream along the lateral canal

Since the land re-levelling improved a lot of plots the irrigated area expanded. Farmers pointed out the shortage of irrigation water especially at the farthest ditch from the pump station. The discharge at several positions along the lateral canal was measured.

The results proved that conveyance efficiency was less than 90% even under ordinary maintenance; the detail design calculated it as 90%

4) Water requirement

To check the practicability of the irrigation plan dimensions, it was not until phase II that experiments on water requirement were carried out in the Project area.

According to the observed results, the water required for puddling in the dry season was more than 200 mm: the detail design calculated 190 mm for the dry season.

II-2-3 Agronomy

II-2-3-1 Introduction

The Trial Farm of 6.47 ha was established in March 1979, and the agronomic activities of the farm started in October 1979.

Main activities of the farm are :

- Selection of suitable rice varieties and to conduct necessary agronomic trials in order to find out the recommendable technologies suited and adapted to this locality for the farmers.
- Multiplication of promising rice seed varieties and their distribution to farmers in the project area.
- Demonstration of improved farming techniques and mechanized agriculture
- Applicability tests and the structural improvement of farming machines and attachments in heavy and sticky soil conditions.
- Water requirement studies for rice crops.
- Providing the staff and farmers with technical training.

The following exposition describes summarized agronomic activities and abstracted trial results carried out at the Trial Farm.

II-2-3-2 Experiments

1. The first rice crop (October 1979-February 1980)

Even though the field conditions such as levelling, uniformity of soil fertility and plot size were unsatisfactory, the first cropping was started. In crop cultiviation, special stress was laid on rice growth uniformity and improvement of soil fertility by leguminous green manure cultivation in upland fields and the field conditions of each plot were also studied.

On the other hand, simple test trials were also started in paddy fields as mentioned in 1-3. Summarized activities were as follows :

1-1 Demonstration and seed multiplication

As the first crop, 22 rai of paddy (main variety was RD-7) was cultivated but 12 rai of it was heavily damaged by a Stem Borer and 4.6 tons of paddy was harvested from the remaining field of 10 rai.

1-2 In 13.2 rai of upland field, Crotalaria cultivation was started.

1-3 Agronomic Trials

1-3-1 Varietal Trials

To select the suitable rice varieties for this area, RD-7, RD-9 and C-4 were tested but those varieties were seriously damaged by insects and diseases owing to the off-season cultivation in this area.

The yields per rai were 126 kg, 200 kg, 145 kg respectively and indicated no statistical differences in yield due to unevenness of soil fertility.

1-3-2 Trial on the effect of different transplanting dates

Rice was transplanted 3 times on 22, 29 November and 5, December and the results were 403, 520, 587 kg per rai respectively; the results show that later planting produces a higher yield coinciding with less insect and disease damage.

2. Dry Season Crop (March-July 1980)

2-1 Demonstration and Seed Multiplication

Due to the shortage of labourers, only RD-7 was planted in 9.5 rai. However, no grain was harvested due to heavy damage by Rice Ragged Stunt Virus.

2.2 Agronomic Trials

2-2-1 Varietal Tests

These were carried out using five varieties and the results were as below.

Khaimaengda	710 kg/rai
C-4	615 kg/rai
RD-7	601 kg/rai
RD-9	560 kg/rai

2-2-2 Nursery Duration Test

To learn the suitable nursery duration, four sorts of duration were tried and the results indicated no correlation between the nursery duration and the grain yield.

The results were as follows :-

Nursery duration	yield
25 days	492 kg/rai
30 days	448 kg/rai
35 days	412 kg/rai
40 days	544 kg/rai
45 days	391 kg/rai

2-2-3 Basal Fertilizer Test

The timing and amount of basal N fertilizer application were tested using RD-7. Three levels of application amounts of 15, 10 and 5 kg per rai were tested with two application times namely, before and after planting.

The highest yield of 603 kg per rai was given by the highest but no significant difference was observed in different application levels and also no difference in yield between the two application times.

Average yield of this trial was 512 kg. per rai.

2-2-4 Upland Field Cultivation

Mungbean and Cotton were tested to sutdy the viability of diversified farming. But these were damaged by excess soil moisture. Further studies on the techniques of drainage from fields are required.

3. Wet Season Cultivation (August-December 1980)

Due to the shortage of farm labourers, very limited work was carried out. RD-7 was planted by Transplanting Machine in 23 rai of the trial farm and resulted in only 146 kg of yield from the whole cultivation area owing to surprising damage from Rice Ragged Stunt Virus. (hereinafter "RRSV")

4. Dry Season Rice Crop in 1981 (February-August)

4-1 Demonstration and Seed Multiplication

For this purpose 22 rai of RD-9 was cultivated to demonstrate the high yield per unit area and to build up rice double cropping techniques. But even RD-9 which was reportedly highly resistant to RRSV was seriously damaged by it especially at the plots where a 6.5 rai area was sown on February 18th and transplanted between the end of April and beginning of May.

4-2 Agronomic Trials

4-2-1 Varietal Trials

Tests were carried out on 17 varieties with fertilizer application of N. 20 kg, P. 15 kg and K 10 kg per rai to find out the varieties with RRSV resistance to and suited to cultivation in the project area. Through this trial, the yield of 1.1 t/rai was given by RD-23 and its percentage of RRSV damage by counting hills which were planted by single seedling was only 3.1%. On the other hand the damage to RD-7 was 95% and produced only 0.5 ton of yield per rai.

The correlation between yield and percentage of damaged hills was very high. (correlation coefficient : r = 0.925). It was understandable that the rice yield of this trial was determined by the incidence of Virus Disease. The grain-straw weight ratio of high yielding varieties was very high and was indicated as being over one hundred. On the other hand the ratios for low yield varieties were shown to be as low as 30-50 and their productive efficiency was very low.

4-2-2 Fertilizer Trials

These were carried out to learn the degree of soil fertility in the area after consolidation and to discover a countermeasure for preventing Red Burning Symptoms (so-called Akagared Disease).

Method of Test

Fertilizers in kgs. per rai

N	P	K
0	20	20
20	0	20
20	20	0
12	20	20
20	12	20
20	20	12

Observations

Based on yield observation in non-phosphorus plots it was seen to be highly insufficient in growth as well as in non-nitrogen application plots and Red Burning Symptoms were observed.

As a result of this trial, it was confirmed that Red Burning Symptoms occured due to nutrient deficiency.

4-2-3 *Seed Rate Tests in Direct Sowing*

To learn the suitable seed rate per unit area, the test was carried out as follows. Seed rates of 8, 11 and 14 kg/rai were tested and resulted in 822, 789, 763 kg of grain yield per rai respectively. The thinnest sowing plots gave the highest yield.

4-2-4 *Raw Organic Matter Application Tests*

These were carried out to learn the effect of the application of raw organic matter on rice yield.

The application levels and yield results were as below :

Items	Application levels
Fertilizer kgs/rai	N 16, P 16, K 16 (for all plots)
Raw organic matter	- , Weeds, Weeds + Rice straw
kg/m^2	Non, 1.2, 1.2, + 2.0
Yield kg/rai	898, 854, 638

As is shown, the maximum yield was given by non application and its percentage of effective tillering was higher than other treatments and grain colour was also fine. This kind of study is required more with the emphasis on the point of view of saving fertilizer costs as well as maintaining soil fertility.

4-2-5 *The Test for planting method* (square and rectangle) was given up because of the damage by RRSV.

5. Wet season crop in 1981 (August 1981-January 1982)

In view of the results of the varietal trials of last season, RD-23 was cultivated in 8.8 rai at the trial farm as a main Virus Resistant Variety and attempts were made to control the RRSV perfectly by chemical applications.

Satisfactory growth was observed at those fields but the well-grown rice crops were seriously damaged by rats in a very short period between the end of October and the beginning of November, after the primordial stage.
The total damaged area was assessed at about 19 rai.

5-1 Demonstration and Seed Multiplication

RD-9 was planted for this purpose but a considerable area suffered much from rat damage. The results from whole field reaping were as follows :

Field No.	Planting	Sowing	Harvesting	Area	Total	Yield/rai
140	Transplant	Sep. 22	Jan. 26	3.8	1821 kgs	479 kgs
220	Direct	Oct. 2	Jan. 39	4.0	1259 kgs	315 kgs
230	Direct	Sep. 22	Jan. 20	4.0	1920 kgs	480 kgs
240	Direct	Sep. 14	Jan. 13	1.7	428 kgs	252 kgs
Total	—	—	—	13.5	5428 kgs	402 kgs

5-2 Agronomic Trials

5-2-1 *Weed Control*

This was carried out to learn the effect of different control methods on the growth and yield of rice. Treatments were Non control, Traditional control, MO-9 application and Saturn G application. But there was no difference between the yield results owing to the poor soil condition and the low land condition.

5-2-2 *Basal Fertilizer Application Test in Direct Sowing*

This test was carried out to learn the effect of the application time to basal fertilizers such as before sowing, 15 days and 25 days after sowing. The growing conditions of each plot were compared with non fertilization plots. The yield results were not collected due to rat damage but some observations 15 days after sowing were made as follows :

Basal fertilizer application	Before sowing	After sowing
Leaf age	4.4	3.0
No. of tillers	2.5	0.0
Germination	no difference	no difference
Weed growth	more	less

The exfoliation of field surface soil and the growth of germs and algae were controlled considerably by drying the field surface at the first period after sowing. But more weed growth in the plot with fertilizer application before sowing was observed.

5-2-3 *Under-listed trials were given up at the primordial stage owing to rat damage.*

- Yield trials with different planting season,
- Varietal trials.
- Timing tests of field surface drainage.
- Influence tests of No. of seedlings per hill between the planting density and types of spacing possession.
- Fertilizer tests in manual planting.
- Yield trials between direct sowing, mechanical transplanting and manual transplanting.
- Sensitivity tests for nursery durations.
- Compost application tests.

6. Dry Season Crop (December 1981-April 1982)

6-1 Demonstration and seed multiplication

As mentioned in 5., the fields damaged by rats were plowed and replanted between the end of December and the middle of January by manual transplanting with the seedlings raised in the seedling box.

Many advantages were observed as follows :

- Saving the labours of up-rooting.
- Not planted deeply because of using young and short seedlings.
- Less damage by transplanting because of planting with the soil of the seedling box.

Due to the above-mentioned merits, rice growth was accelerated at the initial stage and it drew farmers' attention quickly.

From this season, the rice plants have been protected by rat fences donated by JICA.

In this season Rice Blast Disease was observed on RD-25 and serious damage to leaves and earheads was partially observed. Careful consideration should be taken on countermeasures to control it.

The yields from each plot by whole field harvesting with 14% grain moisture were as follows :

Field No.	Varieties	Area (rai)	Total yield	Yield (kg/rai)	Harvest date	Remarks
110	RD-25	1.4	784	560	Mar.29-31	damage by rats
120	〃	4.1	2573	629	〃	moderately damaged by Rice Blast.
130	〃	4.1	2950	719	〃	slightly damaged by Rice Blast.
150-1,2,4	RD-23	2.9	2687	927	Apr. 26	—
150-3	〃	0.5	364	725	Apr. 10	damaged by rats.
160	〃	3.8	3462	911	Apr. 9-10	partially lodged.
Total		16.8	12820	763 (average)		

6-2 Agronomic Trials

6-2-1 Drainage Test on field water

This was carried out to learn the under-mentioned matters.

- Relation between the timing of field water drainage and grain maturity and yield
- Suitable timing of field water drainage in the use of a combine harvester.

The results were as follows :

Timing of drainage	Heading stage	After heading		
		10 days	20 days	30 days
Yield (kg/rai)	1104	1135	1157	1149

For using a combine harvester in this heavy clay soil area, it is desirable to drain out the field water within 10 days of heading. But a tendency was observed indicating that earlier drainage gives less yield as is shown above.

6-2-2 Fertilizer Test on N. Amount and Its Application Timing

The test was performed to learn of their effect on the rice yield.

The treatments and results were as follows :

Amount of NPK (kg/rai)			Grain yield (kt/rai)
N	P	K	
non	non	non	880
15	20	20	1193
20	20	20	1289
25	20	20	1366

The N fertilizer was applied four times as basal dose, intermediate dose, primordial stage application and heading stage application. As is shown above, the more N application the higher the yield, but a higher dose causes more lodging.

Moreover, the under-mentioned points were also observed.

- Intermediate dose increases the number of panicles but the yield is not always increased
- The effect of N application at the heading stage was observed at the plot with 15 kg N applications.

6-2-3 Application Test on P Fertilizer

As stated before in 6-2-2 it is clear that the soil condition of the Pilot Project area has a deficiency of the P element. In this connection, the test was carried out with four-replication to learn the effect of P fertilizer on the yield and to study countermeasures against Akagare Disease in the area after land consolidation.

Five levels of P fertilizer application i.e. 0, 5, 10, 15 and 20 kg P per rai were tested with constant application of 20 kg per rai of N and K plus 5 kg per rai of N as intermediate fertilizer.

The grain yield of non P treatment was not much lower than the treatment with P even poor growth of rice plants with less tillering and lower plant height was observed at the initial stage in comparison with the plots with P.

7. Wet Season Crop in 1982

7-1 Demonstration and Seed Multiplication

The rice seed varieties multiplied at the Trial Farm were RD-23 and RD-21. Since both varieties were found to be highly resistant to Brown Plant Hopper (insect vector of RRSV).

The introduction of those varieties was quite successful in minimizing the problem of RRSV.

However, no grain was harvested due to heavy damage by field rats in some plots.

7-2 Agronomic Trials

7-2-1 Drainage Time Trials in Relation to Mechanical Harvesting

No significant yield reduction was observed when surface water was drained at 10 or more days after full heading stage.

In this regard, water can be drained from the field at around 10 days after full heading stage for the smooth operation of combine harvesters.

7-2-2 Seedling Age Sensitivity Tests

Premature heading was observed when seeding age reached more than 50 days with a notable reduction in grain yield.

20-30 day seedlings were determined as suitable for transplanting.

7-2-3 Deep Water Rice Cultivation Trials

When a field was flooded to 70 cm from most active tillering stage to full heading, a yield reduction of 47% was observed in comparison with normal water level in the case of RD-23 whereas RD-19 was well adapted to deep water conditions since no significant yield reduction was found between normal level and 70 cm flooding treatment.

7-2-4 Fertilizer Rates in Relation to Green manure and Compost Application Trials

The mean grain yield of the control was 323 kg/rai whereas green manure (sesbania 3.2 t/rai) without fertilizer was 635 kg/rai (96% increment).

This yield was equivalent to the yield of 634 kg/rai obtained from the treatment of 15 kg NPK/rai.

However, the effect of compost was not recognized in this trial.

7-2-5 Fertilizer Rates, Application Methods and Green manure Application Trials under Double Cropping of Rice Fields.

A grain yield of 522 kg/rai was produced from no fertilizer treatment whereas 803 kg/rai was harvested from complete fertilizer treatment (15 kg NPK/rai).

The effects of green manure was not observed clearly due probably to an excess amount of sesbania incorporated in the soil.

7-2-6 Varietal Comparative Trial

Due to heavy damage by field rats, it was given up.

8. Dry Season Crop in 1982-83

8-1 Demonstration and Seed Multiplication

RD-23 has been widely accepted and planted by farmers in the project area, RD-23 was mainly multiplied at the Trial Farm together with RD-21. Due to low air temperatures during the planting season, the rice crop was badly injured especially the rice planted in October.

8-2 Agronomic Trials

8-2-1 Fertilizer (Nitrogen) Rate Comparative Trials

The Nitrogen responc to grain yield was notable. However lodging was observed in accordance with the increase in the nitrogen level.

The effects of top dressing at the heading stage was observed when the nitrogen total was 15 kg/rai, but top dressing at the tillering stage tended to increase non-productive tillers.

8-2-2 Fertilizer (Phosphorus) Rate Comparative Trials

Poor growth at the early stage was observed when phosphorus was absent, but recovered gradually along with the progress of growth though the heading stage was 4 days behind that of the treatment with phosphorus.

The effect of phosphorus on grain yield was not very high (15% yield increment).

8-2-3 Drainage Time Trials in Relation to Mechanical Harvesting

Similar results to those described in 7-2-1 were obtained.

8-2-4 Seedling Age Sensitivity Tests

A similar tendency was observed with that of the last Wet Season shown in 7-2-2.

8-2-5 Fertilizer Rates and Time of Application Trials (Direct Sowing)

Ten times more weeds appeared when fertilizer was applied before sowing seeds in comparison with no fertilizer applied before sowing. There was a tendency that a higher grain yield could be expected when fertilizer was applied at 15-20 days after sowing if the same quantity of fertilizer was used.

8-2-6 Deep Water Rice Cultivation Trials

The normal water depth at 30 cm, 50 cm and 70 cm were compared using the RD-23 variety.

The above depth of water was maintained from 35 days after transplanting until the mid-ripening stage.

The grain yield at normal water level was 6.0 t/ha whereas 3.4 t/ha was produced from the 50 cm treatment (44% yield reduction).

Less panicles, smaller panicle size and more lodging were the main causes of low yield when the water depth was deeper.

9. Wet Season Crop (April-September 1983)

9-1 Demonstration and Seed Multiplication

The RD-23 variety has become quite popular among farmers in the project area. Naturally, the farmers' demand for the RD-23 seed has increased rapidly.

The seeds multiplied at the Trial Farm were :

Field No	Planted area (rai)	Variety	Planting method	Production (kg)	Yield (t/ha)
110	2.89	RD-23	Direct Sowing	2151	4.65
120	4.06	RD-21	Transplanting	2557	3.99
130	4.13	RD-21	Transplanting	2887	4.38
140	3.78	RD-23	Direct Sowing	4218	6.97
150	4.52	RD-21-3	Direct Sowing	3491	4.83
160	3.97	RD-23	Direct Sowing	3425	5.39
220	1.86	RD-23	Transplanting	1869	6.26
230	3.94	RD-23	Direct Sowing	2739	4.28
240	2.05	RD-23	Transplanting	1611	5.03
Total/Mean	31.20	—	—	24948	5.00

The average grain yield of 712 kg/rai (4.45 t/ha) in this Wet Season was recorded as a result of a crop cutting survey in the farmer's field within the Pilot Project.

9-2 Agronomic Trials

The following agronomic trials were conducted at the Trial Farm in order to improve recommendable technology suitable and adaptable at the farmers' level in the project area.

9-2-1 Trial No. 1 Planting Method Comparative Study

The three different planting methods i.e. mechanical, manual transplanting and direct sowing were studied to compare their productivity and economy RD-23 was used in this trial.

The results indicated that the mean grain yield of the direct sowing method was significantly lower than that of the mechanical and manual transplanting method even at 1% level of significance, whereas no difference was observed between mechanical and manual transplanting.

From the economic point of view, either mechanical or manual trasnplanting methods were found to be more profitable than the direct sowing method even if additional variable cost is required.

9-2-2 Trial No. 2 Varietal Comparative Study (Transplanting)

To study the performance and productivity of different varieties and entries under the project area conditions, 14 varieties/entries were tested in RCBD with 3 replications.

The grain yield was very much influenced by the incidence of RRSV (Rice Ragged Stunt Virus).

The yield of RD-23 was second highest next to IR-46 among 14 varieties. It is safe to conclude that the most popular variety (RD-23) among farmers in the project area is recommendable at the present stage with high productivity and a satisfactory level of resistance to virus diseases.

The grain yield of RD-7 was significantly lower than that of any other varieties mainly due to susceptibility to both the virus diseases; RRSV and RGSV (Rice Grassy Stunt Virus).

Varieties RD-7, RD-9-14 and KDML 105 were found to be very susceptible to RRSV, and RD-7, BKNBR-1141 and RD-9-14 were susceptible to RGSV and/or RGSV-2.

The mean grain yield and RRSV infection (% of infected hills) was highly correlated ($r = 0.777^{**}$)

9-2-3 Trial N. 3 Seedrate x Variety Trial (Direct Sowing)

A seedrate of 8, 12, and 16 kg/rai were compared using two varieties, namely RD-23 and RD-21 using a Split Plot Design.

A differing amount of seed (8 kg, 12 kg and 16 kg/rai) did not influence significantly the grain yield.

The grain yield of RD-23 was significantly superior to that of RD-21 at any of the seedrate levels.

From the economic point of view 12 kg/rai of RD-23 seed was found to be the best economically.

9-2-4 Trail No. IV. Fertilizer Rate and Time of Application Trails (Direct Sowing)

Different amounts of nitrogen with the different application times (7 combinations) were compared in RCBD with 4 replications using the RD-23 variety.

As for the results, no significant differences were observed in the mean grain yield of different quantities of Nitrogen (5 kg N, 10 kg N and 15 kg N/rai) and different times of application due probably to high soil fertility in the trial site.

Though statistically there was no difference among the treatments, 10 kg Nitrogen/rai (5 kg N/rai at 15 days after sowing and 5 kg N/rai at panicle initiation stage) recorded the highest net benefit with a reasonably high marginal rate of return.

9-2-5 Trial No. V Nitrogen x Phosphorus Fertilizer Trial (Transplanting)

Four levels of nitrogen (0, 6, 12, 18 kg N/rai) and three levels of phosphorus (0, 5, 10 kg/rai) were tested with RCBD factorial. (Variety: RD-23)

The grain yield was significantly increased by nitrogen application even at a 1% level of significance, whereas no significant effect from phosphorus was observed.

The results of Marginal analysis indicated that the minimum level of nitrogen (6 kg N/rai) without phosphorus was found to be profitable under trial site conditions.

9-2-6 Trial No. VI Nitrogen source Comparative Trial (Transplanting)

This was carried out to find the best fertilizing method for profitable and economical rice production. Two nitrogen sources i.e. Urea and GML (Glutamic Mother Liquor, Containing 4.6% N) of different amounts were compared (9 treatments, RCBD with 4 replications). RD-23 was used.

When the rice was planted without nitrogen, the yield was significantly lower than the treatment with nitrogen even at 1% level of significance. However, no difference was observed between different levels of nitrogen application. Also, the grain yield of GML (Glutamic Mother Liquor) and Urea regardless of the amount did not differ statistically.

From the economic point of view, the greatest increment of net benefit over control (no nitrogen) was recorded in treatment 2 (6 kg N/rai applied before transplanting as a form of GML).

A further increase of net benefit over treatment 2 was obtained from treatment 6 (12 kg N/rai applied before transplanting as a form of GML).

Since the cost of GML is lower than Urea, application of GML was observed to be more profitable than Urea.

Note: For detailed information, refer to:
"SUMMARY OF THE AGRONOMIC TRIALS"
in Wet Season 1983, Conducted at the Trial Farm of The Chao Phya Pilot Project

10. Dry Season Crop (December 1983 - April 1984)

Introduction of the resistant rice variety (RD-23) against brown planthopper contributed to minimizing the problem of RRSV with a satisfactory level of yield potentiality. Actually, this non-photosensitive variety has been accepted and planted in both dry and wet seasons in the project area. A Grain yield of 835 kg/rai (5.22 t/ha) in this season was obtained as a result of a crop cutting survey in the farmers' fields.

Field rats have been an important hindrance to rice production together with RRSV in this area. Complete control of rats seems impossible, however it has been found that the problem can be greatly reduced by planting time adjustment together with timely flooding and the application of poison bait.

10-1 Demonstration and Seed Multiplication

In the Trial Farm, RD-23 is the major variety multiplied this season. Rat fences were not used because of said attempt. 28.5 rai of RD-23 and 0.6 rai of Apple Thong were planted for the purpose of demonstration and seed multiplication (below)

Field No	Planted area (rai)	Variety	Planting method	Production (kg)	Yield (t/ha)
110	2.89	RD-23	Direct Sowing	2289	4.95
120	1.97	RD-23	Transplanting	1303	4.58
130	4.13	RD-23	Transplanting	3554	5.14
140	1.75	RD-23	Direct Sowing	1154	4.12
150	4.52	RD-23	Transplanting	2979	4.12
160	3.97	RD-23	Transplanting	3534	5.56
220	3.96	RD-23	Direct Sowing	3534	5.58
230	3.94	RD-23	Direct Sowing	4327	6.86
	0.70	RD-23(F)	Transplanting	699	6.24
240	0.42	RD-23	Direct Sowing	305	4.54
	0.60	Apple Thong	Transplanting	627	5.49
Total/Mean	28.85	—	—	24205	5.24

10-2 Agronomic Trials

The agronomic trials were organized and managed by the Agronomy Section in collaboration with other related sections in the project.

The variety of RD-23 was used for the trials except in the Varietal Comparative Study since this variety has been successfully accepted by an overwhelming majority in the project area.

The Trials carried out were as follows.

10-2-1 Trial No. I Varietal Comparative Study (Transplanting)

15 varieties/ entries were compared in order to selcet suitable varieties in this locality. RCBD with 3 replications.

The results indicated that the grain yield of RD-21 was significantly higher than the that of other RD-varieties. (5% level) RD-21 and RD-23 produced significantly better grain yield than RD-9-7, RD-19, RD-25 at 5% level of significance.

10-2-2 Trial No. II Nitrogen Source Comparative Trial (Transplanting)

Three nitrogen sources i.e. GML (Glutamic Mother Liquor), HSC (Humus Soil Conditioner) and Ammonium Sulphate with different doses (0, 6, 12, 18 kg N/rai) were compared to study for profitable rice production. RCBD with 3 replications.

The results show that the amount of nitrogen was significantly associated with the grain yield. However, the nitrogen source (types of nitrogen) did not influence the yield. (no period) period statistically. Split application of nitrogen was found to be better than basal only for yield and economic responses.

10-2-3 Trial No. III Nitrogen X Phosphorus Fertilizer Trial (Transplanting)

In order to assess the effects of nitrogen and phosphorus fertilizer on growth and yield, this trial was conducted with 4 nitrogen levels (0, 6, 12, 18 kg N/rai with ammonium sulphate) and 3 phosphorus levels (0, 5, 10 kg P/rai with TSP) arranged as RCBD factorial.

The abstracted findings were:

The nitrogen response to grain yield was remarkable whereas no phosphorus effect was observed. Significant differences were observed between mean grain yield of all nitrogen levels. A total of 18 kg/rai was applied as split dose without phosphorus and this appeared to be the most profitable of the treatments. Grain yield and nitrogen levels were highly correlated ($r = 0.985$)

10-2-4 Trial No. IV Planting Method Comparative Study

Since the Direct Sowing method had been widely practiced among farmers in the area, 3 different planting methods i.e. direct sowing, mechanical and manual transplanting were compared to study their productivity and economy. The opposed results were obtained in comparison with the last Wet Season.

The results show that the grain yield by the direct sowing method was significantly superior to the transplanting method-both mechanical and manual. Judging from the study results, direct sowing was found to be much more profitable than the transplanting method with the distinct advantge of cost saving. However, more cost factors needed to be considered regarding planting methods.

10-2-5 Trial No. V Seedrate x Nitrogen Trial (Direct Sowing)

In order to find out the optimum seedrate level in relation to the amount of nitrogen fertilizer, seedrates of 8, 12, 16 kg/rai with nitrogen levels of 0, 5, 10, 15 kg N/rai) were studied by applying split plot design with 3 replications.

The resuts indicate that the grain yield was significantly increased along with the increment of nitrogen levels. The Correlation coefficient between the grain yield and nitrogen levels was 0.984^{**}, whereas no significant differences were observed between the grain yield of different seedrate levels. 8 kg of dry seed with 15 kg N/rai appeared to be the most economical level.

10-2-6 Trial No. VI Fertilizer (Nitrogen) rates and Times of Application Trial (Direct Sowing)

To compare the yield responses due to different nitrogen rates and the time of application, 3 nitrogen levels (5, 10, 15 kg N/rai) with different application times and proportions were studied. RCBD 8 treatment with 4 replications.

The abstracted results were as follows. The higher doses of nitrogen tended to produce a higher grain yield. Top dressing of nitrogen at the panicle initiation stage seemed to have a good effect on grain yield since the number of grains/panicle was greatly increased by top dressing at this stage. Basically, basal application of nitrogen at 15 days after sowing plus top dressing at the panicle initiation stage appeared to be a good combination.

10-2-7 Trial No. VII Seedrate x Nitrogen Fertilizer Trial (Direct Sowing. Cooperative Trial of IADP)

This trial was conducted at the three sites of the Sub-Project of IADP i.e. the Chao Phya Pilot Project, the Mae Klong Pilot Project and the Suphan Buri Training Center. Experimental design of L_{27} (3 Factors × 3 Levels) was used at this trial to clarify the effects of different seedrates and different quantities and times of nitrogen application to the growth and yield.

The summarized results obtained from the Chao Phya Pilot Project were as follows.

Statistically no significant differences were observed between/among the grain yield of different seedrate levels, different times and proportions of nitrogen application for basal and top dressing (the same amount of nitrogen applied).

However, a seedrate of 16 kg/rai with 6 kg N/rai applied 15 days after sowing plus another 6 kg N/rai applied at the panicle initiation stage appeared to produce the

higher grain yield and it was found to be the most profitable among the treatments compared.

Note: For detailed information, refer to "SUMMARY OF THE AGRONOMIC TRIALS" Conducted at Trial Farm in Dry Season 1983-84.

11. Wet Season Crop (June - November 1984)

11-1 Demonstration & Seed Multiplication

The variety of RD-23 covered nearly all of the farmers' fields in the project area. The direct sowing method has been widely practiced and even weeds have become an important problem especially for this method.

Though depending on a single variety may cause risk from pests, diseases or natural calamities, RD-23 was still the main variety multiplied and distributed to farmers since seed demand for this variety dominated others.

Rat fences were not used since the last dry season because the incidence of rat damage became much less than before. Slight damage by rice gall midge was observed this season.

In Wet Season 1984, seed multiplication and demonstrantion carried out at the Trial Farm were as follows.

Field No	Planted area (rai)	Variety	Planting method	Production (kg)	Yield (t/ha)
110	2.89	RD-23	Transplanting	1303	2.82
120	2.03	RD-21		1407	4.33
	2.03	Apple Thong	Transplanting	1407	3.75
130	4.13	RD-23	Direct Sowing	2568	3.87
140	3.78	RD-23	Transplanting	2629	4.35
150	2.52	RD-23	Transplanting	1796	4.45
160	2.18	RD-23	Direct Sowing	1448	4.15
220	3.96	RD-23	Transplanting	2800	4.42
230	1.94	RD-23	Trasnplanting	1400	4.51
	0.55	RD-23		400	4.55
240	0.52	RD-21	Transplanting	355	4.27
	0.45	Apple Thong		253	3.51
Total/Mean	26.98	—	—	17576	4.07

11-2 Agronomic Trials

The following agronomic trials were conducted in order to select suitable varieties and to find out recommendable cultural practices for rice cultivation in this locaality.

11-2-1 Trial No. I Varietal Comparative Study (Transplanting)

Based on the past trials, varieties and promising lines were compared. (15 treatments with 3 replications, RCBD)

The Occurrence of RRSV was not much even to the very susceptible variety of RD-7 this season

The yield results indicated that there were no statistical differences among the upper yields of the 12 entries.

Though the difference was not significant, SPR75007-16-3-1 recorded the highest mean yield (879 kg/rai).

The yield of RD-23 came second (872 kg/rai) and RD-21 was the third highest (870 kg/rai).

The mean yield of RD-25 (629 kg/rai) was the lowest and it was significantly inferior to other RD-varieties.

11-2-2 *Trial No. II Nigrogen x Phosphorus Fertilizer Trial* (Transplanting, RD-23)

This was conducted to study and discover the economically best fertilizing method, 4 levels of nitrogen (0, 6, 12, 18 kg N/rai) and 3 levels of Phosphorus (0, 5, 10 kg P/rai) were tested with the factorial arrangement of RCBD.

The yield results show that the effect of nitrogen on the grain yield was very clear whereas no significant effect from phosphorus was observed.

Significant differences were seen in-between the mean grain yield of all nitrogen levels. The yield increased along with the increment of nitrogen levels.

Investment in nitrogen fertilizer was found to be profitable.

11-2-3 *Trial No. III Planting Methods Comparative Study*

The three different planting methods i.e. direct sowing, mechanical and manual transplanting were tested in RCBD with 3 replications. RD-23 was used.

Though no statistical differences were found among the mean grain yield of planting methods at 5% level, transplanting by either mechanial (840 kg/rai) and manual (845 kg/rai) methods were observed to give a higher grain yield than that of direct sowing method (738 kg/rai) in this wet season. The greater number of grains/panicle was the main reason of higher yielding of transplanting method even number of panicles/unit area was less than the direct sowing method.

11-2-4 *Trial No. IV Green Manure Application Trail* (Transplanting, RD-23)

In consideration of soil fertility and fertilizer cost, this trial was conducted to study the effect of green manure crop (Sesbania) in relation to different amounts of nitric chemical fertilizer.

The four levels of green manure application (0, 1.0, 2.0, 3.0 t/rai) and four levels of nitrogen (0, 5, 10, 15 kg N/rai with Ammonium Sulphate) were arranged as RCBD factorial.

The results of statistical analysis show that the significant effect of green manure on the mean grain yield was observed at 5% level of significance. The yield of non-green manure treatment was significantly lower than the treatment with green manure regardless of nitrogen levels. But different amouns of green manure (1, 2, 3 t/rai) had no significant influence.

The significant effect of nitrogen was observed even at the 1% level regardless of green manure levels. The heavier nitrogen produced a higher grain yield.

An Economical study of green manure has been omitted from this column.

11-2-5 *Trial No. V Seedrate and Nitrogen Fertilizer Trial* (Direct Sowing : Cooperative Trial of IADP)

In order to clarify the optimum amount of seed and the adequate time and split dose of the nitrogen fertilizer, this trial was conducted at three sites of the sub-project of IADP.

3 levels of seedrate (4, 8, 16 kg/rai), 3 levels of basal nitrogen (0, 4, 8 kg N/rai) and a top dressing of nitrogen at the panicle initiation stage and heading stage (4-0, 8-0, 4-4 kg N/rai) were tested by L_{27} design (3 Factors × 3 levels). RD-23 was used.

The grain yield results obtained at the Chao Phya Pilot Project were as follows:

Among seedrate levels, a seedrate of 4 kg/rai produced a significantly lower mean grain yield than that of the other two levels.

The heavier level of basal nitrogen recorded a higher mean yield and the differences were significant.

In the case of top dressing, treatments with 8 kg N/rai produced a significantly better yield than with a kg N/rai. No significant interactions were observed between/among factors on the grain yield.

11-2-6 *Trial No. VI Nitrogen Source × Dose Comparative Trial* (Direct Sowing, RD-23)

Three nitrogen sources were compared with nitrogen levels of 6, 12, 18 kg N/rai.

The Nitrogen sources were: GML (Glutamic Mother Liquor : 4.6%N)
OSC (organic Soil Conditioner : 2.9%N)
Ammonium Sulphate (21%N)

Split plot design was applied for this trial (main plot-sources, sub-plot-N levels) with 3 replications.

The results of the mean grain yield indicated that no significant differences were found among the 3 nitrogen sources regardless of nitrogen levels, whereas higher nitrogen levels produced a significantly higher mean grain yield regardless of nitrogen sources. In a word, the source did not influence the yield but the amount did.

11-2-7 *Trial No. VII Variety x Production Inputs Trial*

This trial was conducted to discover yield responses for various production inputs i.e. Variety, Nitrogen, Insecticide and Herbicide and to identify critical production factors or combinations of factors for direct sowing.

This trial was arranged as 2^4 RCBD factorial with 2 replications (4 factors × 2 levels)

The abstracted yield results were as follows:

(1) Significant differences were observed between 2 levels of every factor.
(2) RD-23 produced significantly better grain yield than Apple Thong and its mean response was 93 kg/rai.
(3) 371 kg of grain yield/rai were produced from non-nitrogen, whereas 605 kg/rai were obtained from 12 kg N/rai when it was applied.
(4) When insecticide (Furadan 2 times) was applied, the yield was 543 kg/rai but without insect control the yield was 434 kg/rai.
(5) Weed control was found to be the biggest factor among the four factors for direct sowing, since the yield when there was no weed control was 330 kg/rai whereas 646 kg/rai was produced from treatments applied with herbicide.

Of the four factors, the order of importance was weeds, nitrogen, insects and variety. However, all of the 4 factors were found to be very important for the direct sowing method trial site conditions.

No significant interaction was observed.

Note: For detailed information, refer to "SUMMARY OF THE AGRONOMIC TRIALS" Conducted at Trial Farm in Wet Season 1984.

12. Dry Season Crop (December 1984 - April 1935)

Due to planting time and period of cooperation, harvest results are not described in this report. The following activities are being carried out in the Trial Farm.

12-1 Demonstration & Seed multiplication

As was mentioned last season, some other promising rice varieties suitable for the project area are vitally needed in order to minimize the risk of dependence on the single variety of RD-23.

Though RD-23 is still the main variety multiplied this season, some of the new lines are also planted for the purpose of seed multiplication and demonstration as mentioned below. Those new lines are to be adapted in this locality from the observation of growth and productivity of varietal comparative trials conducted at the Trial Farm.

Field No.	Planted area (rai)	Variety	Planting method	Date of sowing
110	2.89	RD-23	Direct S. (manual)	Dec. 17
120	4.06	RD-21	Direct S. (manual)	Dec. 17
130	4.13	SPR77205-3-2-1-1	Transplanting (mechanical)	Dec. 19
140	2.00	RD-23	Direct S. (manual)	Dec. 20
150	4.52	RD-23	Direct S. (mechanical)	Dec. 20
160	3.97	RD-23	Direct S. (mechanical)	Dec. 20
	1.96	SPR75001-68-2-2	Transplanting (mechanical)	Dec. 19
220	2.00	SPR75055-352-2-1		
230	2.34	RD-23	Transplanting (manual)	Jan. 24
240	1.19	RD-23 (F)*	Transplanting (manual)	Dec. 19
240	0.47	RD-23 (F)*	Transplanting (manual)	Dec. 19
Total	29.53			

- up land crops (soy bean, mung bean) are planted in field No. 210
- Agronomic Trials are conducted in field No. 140 & 230

* F : Foundation Seed

12-2 Agronomic Trials

The double cropping of rice with a considerably high level of grain production has been obtained to ensure greater benefits for the rice growers in the project area.

Because of the popularity of the direct sowing method mainly practiced by the farmers, the emphasis has been placed on agronomic trials especially as regards the appropriateness and fitness of the varieties, the production inputs and the cultural practices of the direct sowing method.

The following trials have been designed and conducted at the Trial Farm.

12-2-1 Trial No. I Varietal Comparative Trial (Direct Sowing)

Because of said reasons, this trial is being conducted using the direct sowing method from this season on.

The Selection of promising varieties is an urgent need in addition to RD-23 and RD-21 for the farmers in the area. The 10 varieties lines were planted in an experimental design of RCBD with 3 replications.

12-2-2 Trial No. II Weed Control Comparative Trial (Direct Sowing)

Due to the continuous cropping of direct sowing and the vigorous growth of weeds, weed control became a serious problem especially for direct sowing.

In order to discover effective and economical countermeasures suitable for direct sowing at the farmers' level in the project or similar circumstances, various locally available herbicides are being compared.

(9 treatments, RCBD with 4 replications)

12-2-3 Trial No. III Production Input Comparative Trial (Direct Sowing)

Last season, variety, nitrogen, insect control and weed control were determined to be very critical factors for the direct sowing method.

In this dry season, combinations of seedrate, weed control, phosphorus fertilizer and insect control are being tested so as to find out the effects of those inputs on the growth and yield of the germinated direct sowing method with a 2^4 RCBD factorial arrangement.

12-2-4 Trial No. IV Planting Method Comparative Trial

In order to study the productivity and profitability of different planting methods in the area, this trial has been conducted continuously for several seasons. The three planting methods are being studied by RCBD with 4 replications.

ABSTRACTED FINDINGS AND GENERAL RECOMMENDATIONS ON RICE CULTIVATION

There were more than sixty agronomic trials conducted during the cooperation period, but results were obtained from forty-nine of them due to severe damage by field rats or Rice Ragged Stunt Virus.

The following abstracted findings and general recommendations were derived as a result of the agronomic conducted at the Trial Farm of the Chao Phya Pilot Project with the consideration of socio-economic and agro-climatic conditions in the project area or similar circumstances.

- RD-23 is the most popular rice variety in the area and has been proven a suitable and recommendable variety with a high yield and good resistance to RRSV.
- The varieties susceptible to RRSV should not be recommended in the area.
- Nursery duration of 18-30 days appeared to be adequate age for transplanting.
- Degree of susceptibility to RRSV was found to be very important in selecting varieties since the grain yield was closely accociated to this.
- "Red Burning Symptoms" may partially occur where land has just been consolidated. But it would be recovered by the application of either nitrogen or phosphorus.
- Significant yield reduction was not observed when surface field water was drained at 10 or more days after the full heading stage.
- Significant effects and good economic responses by Nitrogen fertilizer were observed in most trials.
- Effects of Phosphorus fertilizer were not significant in most cases in the trial farm.
- Relationship between grain yield and deep water conditions was very much dependent on the varieties. RD-23 was not adapted to deep water conditions.
- Significant effect of green manure (Sesbania) on the grain yield was observed.
- Basal nitrogen application at around 2 weeks after sowing was found to be better than the application before sowing for the yield and weed control of direct sowing method.
- Dry seed of 12-16 kg/rai appeared to be the recommendable seed rate level.
- Grain porduction by direct sowing in the Wet Season was observed to be inferior to the transplanting method. But in the dry season, it was equal or even better than the transplanting method either mechanical or manual.
- Varieties of RD-7, RD-9 and KDML 105 were found to be very susceptible to RRSV.
- Different nitrogen sources did not significantly influence the grain yield, but the amount of nitrogen was closely correlated.

- Top dressing of nitrogen at the panicle initiation stage should not be neglected in general conditions.
- Low cost of GML (Ami Ami) was found to be advantageous especially for the transplanting method. Effective weed control measures should be associated with the direct sowing method.
- Total nitrogen of 11-13 kg N/rai appeared to be the safest and most profitable level with split doses of basal and top dressing at the panicle initiation stage. Greater profits can be obtained with heavier application if all aspects of management are properly conducted.

AGRONOMIC ACTIVITIES DURING EXTENDED PERIOD

Chao Phya Pilot Project

Items \ Year / Month	1982-83				1983-84				1984-85			
	456	789	101112	123	456	789	101112	123	456	789	101112	123
1. Trials and Tests:												
1). Trials on rice cultivation												
(1). Varietal Comparative Study			T			T		T		T		D
(2). Fertilizer rate Comparative trial (Nitrogen)		D										
(3). Drainage Time Comparative Studies	T		T									
(4). Seedling Age Sensitivity Tests	T		T									
(5). Fertilizer rates and Application Times		T	T			D		D				
(6). Deep water Rice Cultivation Trials	T		T									
(7). Green manure Cultivation										T		
(8). Fertilizer rates, Green manure and Compost Application Trials			T			D						
(9). Seedrate x Variety Trial						T		T		T		
(10). Nitrogen x Phosphorus Trials						T		T		D		
(11). Nitrogen Source Comparative								D				
(12). Seedrate x Nitrogen Levels								D		D		
(13). Seedrate x Nitrogen Applications										D		D
(14). Variety x Production Inputs												D
(15). Weed Control Comparative Trial												
(16). Production Input Comparative Trial												
2). Associated Trials												
Planting Method Comparative Trials			TD			TD		TD		TD		TD
Field Rats Control Trials												
2. Training :												
Rice cultivation techniques												
Applied research system												
Agronomic Data Analysis												
Formulation of Recommended technology												
3. Supporting activities:												
1). Demonstration												
2). Seed Multiplication												
3). Others												

Note: T indicates Transplanting Method
D indicates Direct Sowing Method

II-2-4 Extension

As was mentioned before, the field construction of the Pilot Project area was extended through the two years of 1980 and 1981 and the first rice cultivation in these area was started in February and August, 1981 respectively.

In the beginning, the irrigation water was supplied by diesel engine pumps which were borrowed from RID due to there being no electricity supply but later on those engine pumps were replaced by electric pumps in July 1981 for secondary station No. 3 and No. 4 and in March 1982 for stations No. 1 and No. 2 respectively.

The rice yield in the farmers' fields has reached the project target of 8 tons per year per rai even though the rice plants in the farmers' fields suffered from serious damage due to Ragged Stunt Virus and Rats at the initial stage of the project. The farmers' rice cultivation has been guided by the cultivation schedule of the project.

The rice cultivation controlled by the project office through the procurement of input materials based on technology guidance.

The activities of the farmers' organizations have also been introduced and are very useful in improving the farmers' economic situation.

As a result of the project activities, the farmers' debts have been much decreased.

II-2-4-1 Farmers organizations

(1) Cooperatives

These have been organized as Lad Bua Luang Land Reform Cooperatives in 1980 and consist of four groups with a total of 170 members owning 937 shares.

The main functions are the procurement of input material and production selling for members and these have been operating since the dry season of 1983.

a. Procurement and distribution of input materials

Fertilizers and agricultural chemicals have been supplied to members at a cheaper price than the local market one.

The distribution amounts are as follows:

-Fertilizers-

Year	1983		1984	
Cultivation	Dryseason	Wet season	Dry season	Wet season
16-20-0	90.6ton	90.0ton	75.0ton	91.8ton
21-0-0	45-3	45.0	20.0	38.05
			235000 litres	147,000 litres

-Chemicals-

Year	1983		1984	
Cultivation	Dry season	Wet season	Dry season	Wet season
Amount in B	54,955	336,287	354,650	423,905

* The credits were mostly supplied by materials and reimbursed by cash through the cooperative after the rice was harvested

* Credit source

1983 Dry and Wet season	
1984 Dry season	Land Reform Fund
1984 Wet season	BAAC

A part of the credit for the chemicals were supplied by the chemical company

b. Production selling

The selling price of the farmers' produce was agreed upon by bidding and negotiation between the farmers and the buying agency.

The Selling amounts for each season are as follows:

Year	1983		1984	
Season	Dry	Wet	Dry	Wet
amount in tons	843.4	815.2	1,360.0	897.5
Price in B	2,743,189	2,449,076	2,973,651	2,515,412

c. Machinery service

The machinery service by the project for the farmers was initiated in the wet season of 1982 free of charge. After this testing period, related affairs have been transferred to the cooperatives and the services have continued with the cooperative now being charged for them.

(2) Water management group

The original group was organized as a part of the cooperatives in October 1982 and reorganized as the "Water users' association" in October 1983.

With this separation it meant their activities began operating as an independent organization.

The group consists of 143 farmers and 24 irrigation groups

a) Water management activities

At first, a study was made by project staff to learn the general conditions of water supply and its problems.

Based on this studys' results, the farmers were organized accordingly and started their own activities from October 1982 with the intensive guidance of project staff.

During the second phase period (extended period) the following matters have been improved.

- Completed secondary pumping station (No. 1, No. 2)
- Field relevelling was applied in unleveled fields
- Water supply method was changed

For field preparation, irrigations water was supplied through the drainage networks by raising the water level of the main canal (by gate operation in the dry season to take in the water by gravity and by main pump operation in the wet season).

- The motors of the secondary pumps at stations No. 1 and 2 were replaced by one powerful

b) Irrigation fees

At first 30 kg of paddy per rai was collected as the irrigation fee but this has been changed to 80 baht per rai from the next cultivation season.

The fee is collected at the harvesting time of each season.

(3) 4H club

Number of groups	2
Members	18 and 20

(4) Home economic groups

Number of groups	2
Members	23 and 32

II-2-4-2 Technical extension

(1) Varieties recommended

In the initial period, RD-9 was recommended to the farmers as an emergency measure to avoid the damage of Ragged Stunt Virus after confirmation of its varietal characters.

During the two years of 1982 and 1983 RD-9 was gradually replaced by RD-23.

(2) Seed distribution

Since 1982 the following amounts of rice seeds were distributed to the farmers in the project area

	Season and Varieties (in tons)	
Year	Wet	Dry
1982	6.0 RD-9, 21, 23, 25	9.8 RD-21, 23, 25
1983	11.5 RD-23, 21	15.2 RD-23
1984	17.11 RD-23	13.0 RD-23

On the other hand, the multiplication of the pure seed of RD-23 has been from its foundation seed and searching for promising new varieties to diversify the risks of relying on RD-23. The purified new seed will be distributed to farmers to partially replace RD-23.

(3) Training

The farmers' training has been carried out practically and theoretically at the trial farm, at their fields and at the farmers' centers which have been built in a central location in the eastern and western areas of the pilot project.

Two or three farmers' training courses were given every year in a lecture room in the project site office. The training was cooperated in by DAE, DA, CPD and the chemical company.

On the other hand some technical information has also been given to farmers on the occasion of farmers' meetings and by posted notices on information boards. During the extended period, two farmers' training sessions were held by the Suphan Buri Training Center. Twenty farmers at the first session and ten 4H club members for the second session were sent to the above mentioned center.

(4) Demonstrations

Demonstrations at the model farmers' field have been conducted since 1981. In this period, the yield of the model farms has increased as follows. (ton/ha)

	1982		1983		1984
No. of field	Dry	Wet	Dry	Wet	Dry
1	3.94 (T)	4.02 (T)	5.72	6.03	5.78
2	4.03 (T)	3.05	5.70	4.83	5.93
3	3.06 (T)	3.46 (T)	6.50 (T)	5.11	6.07
4				6.11 (T)	5.90
Average	3.68	3.51	5.97	5.52	5.92

(T : Transplanting)

As a result, the yield level in the farmers' fields reached the project target. In this connection the role of the model farm has been changed to that of cultivation trial plots such as seed rate trials and herbicide application trials from the wet season of 1984.

(5) Preparation of guidance notes

The original note was prepared before starting wet season cultivation in 1982 and subsequently partially modified.

At the initial stage, it was recommended to apply 50 kg/rai of Ammophos (16-20-0) and 50 kg/rai of Ammonium Sulphate (21-0-0) to cultivate in unfertile soil condition after land consolidation works. Through the fertilizer trials and changing of field soil conditions, the recommendation of fertilization has been changed to apply 30-40 kg/rai of Ammophos and 25 kg/rai of Ammonium Sulphate to minimize the production cost and to promote the safe rice cultivation in the farmers' fields.

(6) Crop cutting

This has been done in every harvesting season based on one sample field per farmer.

The results are as follows.

Year	Dry season	Wet season (ton/ha)
1982	3.25	3.16
1983	4.47	4.45
1984	5.22	4.56

(7) Rat control

The farmers' cooperation works have been designed with the control of rats prominent. The poison bait (Klerat) for rat control was supplied by DAE.

Through continual rat control by the Chao Phya method, rat damage in the project area has been greatly minimized.

At present merely very small damage has been observed in the pilot project area.

2-8 Observation for the outbreak of insects and diseases

The observation was carried out by cooperation between staff of the Project and DAE every Wednesday and Thursday in the farmers' fields to learn the extent and development of diseases and insect damage. Employing the observation results, the farmers in the project area were guided on "How to control the existing insects and diseases" every week by observation news.

- Field observation

Six farmers' fields were selected as observation fields and ten sample hills along a diagonal line were observed in each field.

- Light trap observation

A light trap was placed in the trial farm and counted the number of adult insects.

II-2-4-3 Coordination

To promote project activities the following coordination works have been done by counterparts.

with DAE	for :	Farmers' training Plant protection Planning the extension activities in Project area
DA	for :	Farmers' training Seed procurement for farmers Information collection
CPD	for :	Farmers' credit Production selling
BAAC	for :	Farmers' credit Production selling
MOF	for :	Production selling
Dealing agencies	for :	production selling
Chemical company	for :	Procurement of agricultural chemicals

II-2-4-4 Farmers' survey

There are two purposes, as follows.

- To learn of any change in the farmers' economic situation in the pilot project

- To evaluate the effect of project development between the Project area and areas outside the project.

As regards the first one, all the farmers who were farming in the pilot area in July and August 1984 were contacted and the survey results are compared with the results of the same survey made in 1981-1982.

For this survey 143 cultivation farmers were interviewed by ALRO staff and the secretaries of Japanese experts. After the filling in of a questionnaire, a reinterview was carried out to confirm and correct their replies.

As regards the Second purpose, it is to collect the necessary data from the same 40 farmers who were selected by their farm size at the time of the survey in 1981-1982 to know the effect of project activities.

On the other hand 40 farmers from 2 areas outside the project (20 farmers from each area) also were selected and comparative data between the project area and the area outside the project have been collected in the same way as the first one.

The results to be reported from the Survey report:-

Through the survey of the farmers' this year, it is clear that the farmers' economic situation is changing for the better.

The main points in change are as follows.

(1) Farmers' understanding of the change in their own economic situation.

Most of the farmers replied that their economic situation has been much improved from before as follows

Economic situation	No. of farm family	%
Much improved	52	36.4
Improved	85	59.4
Same	6	4.2
Worse	0	0
Total	143	100%

(2) Bank Accounts

That farmers had bank accounts was reported in the report of the same survey made in 1982 but it has been reported in this year's survey that 9 farmers have bank deposits totalling 107,900 B.

Deposits	No. of farmers	%
Making bank deposits	9 (107,900 B)	6.3
Making no deposits	134	93.7
Total	143	100%

(3) Change in the amount of the farmers' debts

At the end of July 1984 it was reported in the following charts.

The total amount and total number of cases of debt has decreased by 40% and the amount from each source also decreased in comparison with the survey report of 1982.

1) By number of cases from each source

	1981-1982		1983-1984	
	No. of cases	**%**	**No. of cases**	**%**
Cooperatives	106	40.45	62	39.49
Farmers' groups	10	3.82	5	3.18
BAAC	45	17.17	35	22.29
Commercial Bank	6	2.29	4	2.55
Middleman	9	3.44	0	0
Merchant	46	17.56	20	12.74
Relatives	22	8.40	14	8.92
Neighbours & Friends	18	6.87	17	10.83
Total	262	100%	157	100%

2) By amount from each source (average per family)

	1981-1982		1983-1984	
	Amount	**%**	**Amount**	**%**
Cooperatives	4,024.0	17.4	2,761.0	19.1
Farmers' groups	335.7	1.5	184.6	1.3
BAAC	7,081.9	30.8	5,594.4	38.6
Commercial Bank	909.1	4.0	790.2	5.4
Middleman	753.7	3.3	0	0
Merchant	6,600.2	28.7	2,342.0	16.1
Relatives	1,172.7	5.1	830.1	5.7
Neighbours & Friends	2,118.9	9.2	2,001.4	14.8
Total	22,996.3	100%	14,503.7	100%

(4) Change in holding percentage of furniture and appliances

On the other hand, the farmers' living conditions have also been improved as shown in the following chart.

Change in holding percentage of furniture and appliances

	1981-1982			1983-1984		
No. of sample farmers	73			173		
	Total Number	No. of holding family	% of holding family	Total number	No. of holding family	% of holding family
Car	1	1	1.4	1	1	0.7
Refrigerator	1	1	1.4	2	2	1.4
TV colour	-		0	10	10	7.0
B/W	11	11	15.1	55	55	38.5
Radio	65	59	80.8	110	98	68.5
Cassette & Stereo	-	-	0	17	17	11.9
Electric rice cooker	-	-	0	15	15	10.5
Electric fan	10	8	11.0	69	62	43.4
Electric iron	0	0	0	4	4	2.8
Generator	7	7	9.6	6	6	4.2
Battery	2	2	2.7	12	12	8.4
Sewing machine	20	18	24.7	32	30	21.0
Motor cycle	4	4	5.8	12	12	8.4
Bicycle	68	52	71.2	139	107	74.8
Cupboard						
Show case	88	55	75.3	210	114	79.7
Wardrobe						
Gas range	-	-	0	14	14	9.8
Others	-	-	-	4	4	2.8

Others: Tables 2, Mattresses 1, Electric pots 1

II-2-5 Farm Machinery

II-2-5-1 Re-leveling work on trial farm

When I was assigned here, all the plots at the trial farm were still in an under uneven-leveled condition as the leveling extent was about (±) 10^{cm} to 20^{cm}, although the consolidation work had been finished a long time ago.

Under these circumstances, all trial work such as field preparation, water management, improved rice cultivation techniques were not so smoothly carried out.

In order to fulfill the improved rice cultivation, the ideal basis of field-level should be made under (±) 5^{cm} of leveling extent. Therefore, the re-leveling work was carried out in the dry season of 1982 and 1983 by agrimotor equipped with paddy wheels, rotary plow, and drive-harrow etc., alternately in dry soil conditions and in standing water conditions in the field. This was because the soil moving capacity of the agrimotor is very much less than by construction machinery such as bulldozers.

At the end of the dry season of 1983, the re-leveling work of all the plots of the trial farms had been finished. And the leveling extent was less than (±) 5^{cm}. Therefore, the plots of the trial farm were ready for the fulfillment of the improved rice cultivation.

II-2-5-2 Observation and study of the running condition of the tractor in the paddy fields attached with:

a. Float rag wheels.
b. 3 Kinds of different type of paddy wheels.
c. High rag tire only.
d. Plowing by rotary in dry conditions and in wet conditions.
e. Plowing by rotary in standing water conditions.
f. Leveling and planking by wooden leveler.
g. Leveling and planking by drive-harrow.

Through the above study, the heavy-weight tractors were not smoothly and running were sinking in a certain plot some parts were deep mud soil.

II-2-5-3 Making the improved paddy wheels of tractor and power tiller.

According to the above study, it was understood that mechanized rice cultivation could not be performed in this particular soil without improved paddy wheels for the tractor and power tiller. Therefore, in 1982, the project had tried to make improved paddy wheels which would make for the smooth running of the tractor in this particular soil conditon.

The improved paddy wheels which were first tried were quite good in preventing the sinking of the tractors, but we had not been completely satisfied with the smooth running of the tractors on any conditions of the field. After several reforming trials, final modification of paddy wheels had been done on Nov. of 1983 and it was much more effective than the former one; this meant that the form of wheels-rag was against the soil adhering to the wheels and could prevent the sinking of tractors in muddy places.

Moreover, it helped the smooth running of the tractors in paddy field operation although the field was un-leveled and heavily sticky with deep mud soil.

II-2-5-4 Adaptability and practicability test

(1) Field preparation work by heavy tractor.

Plowing work by 75 HP, 72HP, 33HP, 65HP tractors attached with Rotavater.

Puddling work by 75HP, 33HP, 65HP tractors attached with Rotavater and drive-harrow.

Leveling and planking works by 75HP, 65HP, 33HP tractors attached with drive-harrow and wooden-harrow.

The improved paddy wheels which were modified by the project were attached to the tractors when doing the above test work in standing water conditions.

In the wet season and the dry season of 1982, the adaptability test of plowing, puddling and leveling work was carried out by 75HP and 33HP, tractors.

In the case of the 33HP tractor, it was sometimes overloaded by the work in dry conditions and in standing water conditions due to the heavy clay soil.

In the case of the 75HP tractor, it sunk even though it was equipped with the first modified paddy wheels at a certain part where there was deep mud and heavily sticky soil. So, the running of the tractor was not so smooth in this particular soil.

Therefore, in parallel with having repeatedly modified the paddy wheels, the project had tried to dry up the fields completely as 5^{cm} of soil crack in dry season for enhancement of the soil bearing capacity, and procured an improved tractor which was a 65HP, 4 wheel-drive type, suitable for paddy field work.

In the dry season and the wet season of 1983, the field preparation work in the trial farm by heavy tractor was progressing very smoothly, because of the use of the second modified paddy wheels and the enhancement of soil bearing capacity by drying the field up.

In November of 1983, the improved paddy wheels were reformed thrice again to obtain the smooth running of the tractor and power tiller in this particular condition of the field such as heavily sticky and deep muddy soil. That was the reason why the project reached the goal of fulfillment in smooth progression of systematically mechanized rice cultivation.

(2) Rice transplanting by planter

On January 1982, the first adaptibility test of a rice transplanter (S-400 walking type) was carried out one month after I had been assigned here, but the rice transplanter (S-400 walking type) could not run in these particular soil conditions except in a certain place in the plot where a few parts were shallow soil.

In 1983, we found out a way of field management to be used with the rice transplanter in this particular soil after several trials had been done.

The way of field management was : the water was kept at 10^{cm} to 15^{cm} depth for about 6 or 7 days continuously after the field preparation work had been finished. During this period of standing water in the field, the melted and colloidal soil precipitated and settled down in the bottom of the field; then the membranous matter grew on the soil's surface in the field in the form of microbes and algae. With this process, it would turn the sticky and muddy soil into a suitable condition for using the rice transplanter.

Water was drained from the field so that the water depth was about 5^{cm} after finding the membranous matter which was covering the surface of the soil, then the transplanter could work smoothly except at 25^{cm} depth of soft and muddy soil.

In parallel with the above trial, the project tried to procure the improved rice transplanter which was 4 wheel drive, double wheel and riding type to be suitable for using in the soft and muddy soil. The project procured the improved rice transplanter (PL-500W) in the middle of 1982.

In order to get better results for transplanting rice by machines in this particular area, a good soil condition would be obtained if the field were kept for at least 6 or 7 days with standing water from the finished date of field preparation work to the transplanting date.

(3) Direct sowing by tractor equipped with broadcaster MBC-2610

With the intention of finding out the mechanized direct sowing method, the project procured an MBC-2610 broadcaster at the beginning of 1983 as one work of all mechanized rice cultivation work.

The mechanical rice direct sowing trial was carried out according to past experiences, and was in consideration of:

- Uniform density of sowing seeds
- The protection of seeds from spoiling by deep sowing.
- To encourage a uniform growth of paddy at the beginning stage.

For the fulfillment of the above important points, the preparations were as follows:

First of all, fields were prepared 4 days before sowing and were kept in standing water of about 15^{cm} depth until colloidal soil settled down at the bottom of the field resembling something like jelly cake. This was meant to protect the seeds from going into deep soil.

Second, the field was kept in standing water of about 15^{cm} depth when sowing by machine. The depth of water played the role of buffer and helped to give uniform density to the sowing seeds as they sank through the water down to the soil.

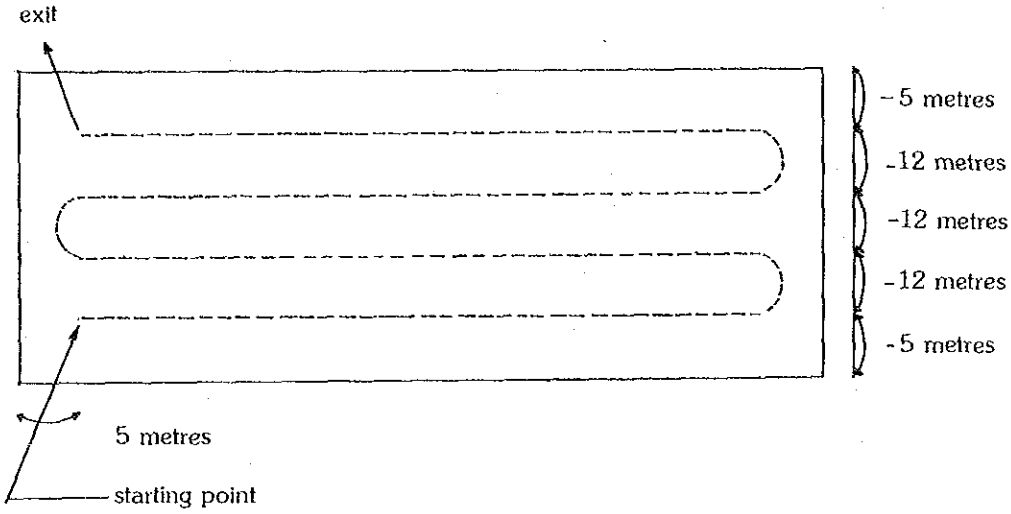
Third, used seeds were being germinated. The roots of the protected seeds went deep into the soft soil itself and helped the growing paddy at the beginning stage.

Working method of paddy broadcaster by Tractor, YM-330 DT

Prior to starting the work, it is better to divide the field as in the following picture and adjust the machine as follows:

1. Tractor speed : 1st. gear, high position
2. Engine rpm. : 1,800
3. Outlet index of broadcaster : No.7
4. P.T.O. rpm. : Low speed position (about 877 rpm.)

(The way of work as shown in below)



Remarks: Used paddy seeds are germinated to a root length of 15 mm. to 20 mm., and dried for 6-10 hours in the shade; do not dry them under direct sunlight.

Quantity of paddy seeds used are about 12 kg/rai (RD-23) in the case of the above mentioned conditions such as items 1, 2, 3, 4.

Other varieties of seeds shall be adjusted (the index number of the shutter opening position and P.T.O. speed etc.) according to the size of seeds or the condition of the germinating seeds.

(4) Harvesting work by combine harvester

In the dry season and the wet season of 1982, the project had tested the adaptability of a combine harvester, TC-200 type, in several conditions in the fields and through this observation, it was understood that the working ability of a normal type combine harvester in soft soil was higher than 0.25 kg/cm^2 of the soil bearing capacity in 10 cm. depth for TC-2000D and HL-1800 of combine harvester.

In order to get enough bearing capacity of soil to use the combine harvester, it was necessary to dry the field for about 15 days before harvesting in the dry weather of the harvesting stage. And in wet weather, the field was dried for more than 20 days before the harvesting day. But it was not certain that there would be enough bearing capacity of the soil to use the combine harvester. It depended on the quantity of rainfall in this period.

In November, therefore, the project procured an improved combine harvester, TC-3500, for swamp-use type, and tried it in the soft soil field. The adaptability and efficiency of this machine were much better than the normal type of combine harvester that was able to work in the softer soil of the field than another one even if it recieved rainfall except for extremely heavy rain during the field drying period.

(5) Threshing work by local made semi-auto feeding thresher.

In 1982 and 1983, a practicability and efficiency test of threshing work by a local made semi-auto feeding thresher, 4'type and 5'type was carried out.

Both threshers had been functioned smoothly even though the paddy was not sufficiently dried. The threshing capacity between the bumper crop and the poor crop was very different, and the machine efficiency of the 5 feet type thresher seemed to have double the capacity of the 4 feet type thresher.

II-2-5-5 *Efficiency test and estimation of machinery utilization costs.*

5.1 Field preparation work by tractor (plowing, puddling, planking)
5.2 Rice transplanting by transplanter (S-400, PL-500W)
5.3 Direct sowing by tractor with broadcaster.
5.4 Threshing work by 4'type semi-auto-thresher.
5.5 Harvesting work by combine harvester (TC-2000, HL-1800, TC-3500)

As mentioned, the above records showed that the efficiency test and the estimation of machinery utilization costs had been made as a guide to mechanized rice cultivation plans in the future in the vicinity of the project.

II-2-5-6 *Trial of knowing in advance the trafficability of the soil in the trial farm.*

In parallel with the propagation of farm mechanization, it is considered very important to know before hand the trafficability of the soil and accordingly choose the suitable type of farm mechanization for the field in question

In connection with the project mechanization and the future of the vicinity's area mechanization, the Chaophya Pilot Project has repeatedly tried to observe machine running tests in various field conditions, and tried to measure the soil resistance in different field conditions in particular.

Upon the strength of the above mentioned trial results, knowing in advance what you are dealing with has been presumed in the trafficability of soil, and in the depth of the standing water in the field for smooth and efficient use of the machinery in this area.

Simplified knowing in advance method of the trafficability of soil by corn penetration index and sinkage depth of rectangular plates in this area (by SR-II soil tester)

sinkage depth of rectangular plate vertical load 30 kg. in cm.	cone index av. 25 cm. depth in kg/cm^2	depth of foot mark in cm.	rate of trafficability (A)	(B)	(C)
0 - 10	over 2.0	0 - 6	very good	very good	very good
10 - 15	2.0 - 1.5	6 - 12	good	good	good
15 - 20	1.5 - 1.33	12 - 17	quite good	little hard	little hard
20 - 25	1.33 - 1.25	17 - 23	little hard	hard	hard
25 - over	1.25 - 0	over 23	hard	impossible	impossible

* Each tractor is attached with improved paddy wheels and there is 10 cm. to 15 cm. depth of standing water in the field.

Working equipment used for puddling and planking work are the Rotavater and the Driveharr

* The size of the rectangular plate is 10 cm. × 25 cm.
* The base area of the cone is 6 cm^2

II-2-5-7 *Relation between the time of drainage and the trafficability of the soil for using combine harvesters on paddy harvest.*

In consequence of the drainage time trial and soil resistance observation, it could be presumed that the working ability of a combine harvester (TC-3500 swamp type) in the limit of soil softness was over $0.25^{kg}/cm^2$ in 20 cm. depth of soil by the compenetration results, or less than 20 cm. depth of the rectangular plate ($25^{mm.} \times 100^{mm.}$) sinkage at the 10 kg. vertical load.

On the one hand, the normal type combine harvester the low-crawler type-was able to work over $0.25^{kg}/cm^2$ in 10 cm. depth of soil by corn penetration results or less than 10 cm. depth of rectangular plate ($25^{mm.} \times 100^{mm.}$) sinkage at the 10 kg. vertical load.

That is, the most suitable day for draining water from the field was about 15 days before harvesting day for swamp type combine harvesters. And for normal type combine harvesters, it was necessary to drain the water from the field more than 20 days before harvesting day in the wet weather of the project area.

The harvesting season came in dry weather, the necessary time for draining water from the field was about 10 to 15 days before harvesting day for swamp type combine harvesters. And for normal type combine harvesters it was more than 15 days before harvesting day.

The date of drainage should be determined by whether the draining tendency of the plot is easy or otherwise.

II-2-5-8 *General work on rice double cropping in the trial farm.*

All work on rice cultivation was carried out using mechanization except in the special trial plots.

8-1 Field preparation work by tractor (Plowing, Puddling, Planking)
8-2 Transplanting work by rice transplanter (S400, PL-500W)
8-3 Direct sowing by tractor with broad caster (MBC-2610)
8-4 Pest and insect control by carpet sprayer and mist-duster
8-5 Harvesting work by combine harvester and thresher.
8-6 Irrigation work by vertical pump Ø 8" (full season)

Mechanized work on double cropping rice cultivation in the trial farm as mentioned above had been carried out and the systematic management of mechanized work has been improving.

II-2-5-9 *Raising the technique of machinery operation, maintenance and repairing; planning of operation and management of mechanized work to the persons who are engaged in this field.*

Until recently, the most important reasons in obstructing mechanized rice cultivation in this area seemed to be immaturity, lack of mechanical knowledge, lack of management and maintenance of machinery. Besides, the soil conditions in this area were very heavy and sticky deep mud.

With a view to training the personnel to be experts in machinery and farm mechanization, the project had the following activities for banishing the above mentioned problems and fulfillment of the project implementation program.

1. Guidance and training

a) To systematize the duties

b) To train the operators for proper handling and effective operation of machinery.
To guide the mechanics for taking more responsibility towards their duties, and raising more techniques to maintain the machinery for displaying the maximum output always, also to attain the maximum durability of the machinery.

d) Following manuals and pamphlets have been published and are being used. (in Thai)

* Mechanics' and drivers' hand book.
* Proper handling and maintenance manual for batteries.
* Adjustment of the number of seedlings and a maintenance manual for the rice transplanter.
* Guide-lines for maintenance and trouble-shooting of agricultural machinery.
* How to handle tractor to ensure good soil preparation for rice cultivation.
* Proper handling and maintenance of transplanter.
* Operation manual for combine harvester.
* Trial of knowing in advance the trafficability of the soil in the trial farm.
* Relation between the time of drainage and the trafficability of soil for using the combine harvester.

Through the observations made during the period, it seemed that the mechanics and operators who are engaged in this field had made rapid advances in their techniques and knowledge about the operation of mechanized rice cultivation, and proper maintenance of modern machinery for rice cultivation.

Furthermore, they had acquired the effective and systematized management of mechanized work on rice double cropping that is essential for smooth mechanization work and the raising of paddy productivity.

V-2-5-10 Advice and consultation for management of machinery service to farmers

In alliance with the farm machinery section and the agro-extension section, the mechanized work of field preparation and rice transplanting by machine were displayed at the model farmer's field, and at the 4H club's field.

And we had an observation study of the machinery at work at the 120 rais of the area's demonstration plan and 165 rais of a farmer's field in the pilot area directed by the project: This was to ascertain whether its adaptability was suitable for performing the modernized technology of rice double cropping and; whether it was acceptable to the farmers.

In 1983, we tried the joint use of farm machinery to be managed by the co-operative with the aim of strenthening the co-operative and, seeing whether it was more acceptable and suitable than the above way to the farmers.

After consideration of the above results in their social environment, it was felt the best method was the joint use of farm machinery managed by the co-operative as this would increase productivity and allow the establishment of rice double-cropping in the area.

II-2-5-11 Supporting services to the farmers in the pilot area.

(1) Field preparation work by tractors was carried out as follows:
In 1982, 165 rais (includes re-leveling work of fields)
In 1983, 412 rais (plowing, puddling, planking)
In 1984, 404 rais (plowing, puddling, planking)

In 1984 especially the work was progressing very nicely because the farmers had dried the field completely to enhance the soil bearing capacity under the project directions.

(2) Pest and insect control

In 1983, 389 rai of the farmers' fields were controlled by the carpet sprayer and obtained good results.

(3) Transportation of the product

In 1983, 111.5 of paddy was carried to the rice-mill in Bang-na and Lad-bua-luang in order to promote the associated marketing program of the project.

(4) Harvesting work.

In 1984, 255.2 rais of farmers' field were done by combine harvester, TC-2000, TC-3500, and HL-1800.

After the middle of 1983, the above supporting services were carried out in collaboration with the co-operative to promote the joint use of farm machinery and to encourage co-operative activities.

II-2-6 Effects of the CPPP

The first field survey was conducted in 1982, focusing on 1981 wet and 1982 dry paddy crops. At that time land consolidation and other works had just been completed and so this survey was characterized as a bench-mark. In the survey, a total of 249 farmers in both Chao Phya and Mae Klong Projects were selected.

The second survey has been carried out since July this year and the work of analysis is not yet finished. In this paper, the essence of the results of the Chao Phya Pilot Project is discussed especially for the Evaluation Team. The discussion is made in comparison with the results of the first survey.

For the sake of evaluation, the following indexes are picked out:

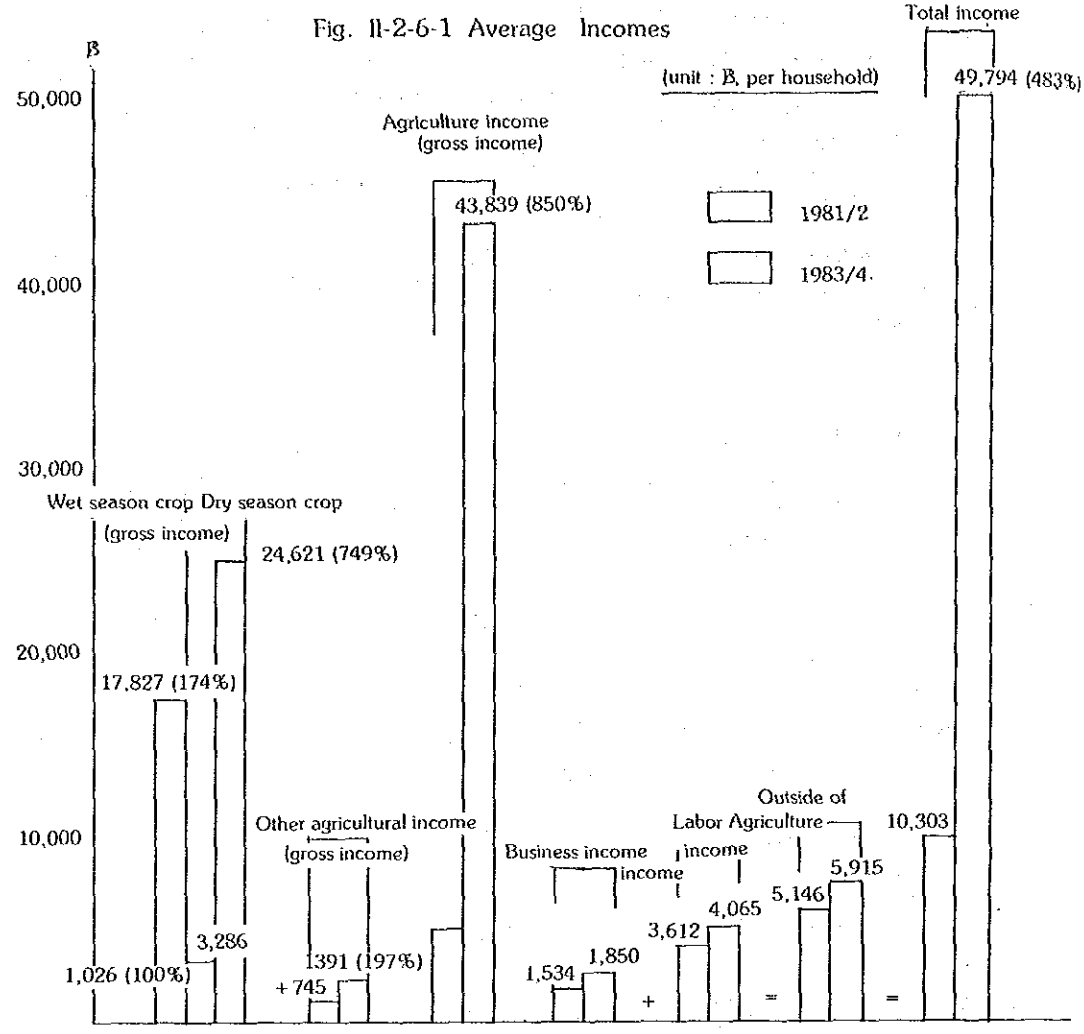
1) Agricultural, non-agricultural incomes and debts
2) Production
3) Farm mechanization
4) Farm inputs, and
5) Standard of living

II-2-6-1 Agricultural, non-agricultural incomes and debts

The following figure shows average income and debt in two different years. From this, the following facts may be derived as a result of the comparison.

1) The agricultural income derived from rice and other crops expanded by 8.5 times, by yield increases,
2) On the contrary, non-agricultural income increased by a small amount,
3) As a result, the total farmers' income increased 483% and
4) Although the debts increased, the debts in 1981/2 were shared 164% out of the total incomes but they were only 28% at present.

Fig. II-2-6-1 Average Incomes



Agricultural incomes derived from rice were shown in Table II-2-6-1. For wet paddy agricultural income per-farmer expanded 13.5 times and for dry paddy 6.5 times, and wet paddy on the basis of per rai expanded by 8.3 times and dry paddy 6.1 times. This is simply because the yield increased and the cost that occurred was constant.

Table II-2-6-1 Income comparison

Unit : ฿

Year	wet paddy		dry paddy	
	per-farmer	per-rai	per-farmer	per-rai
1981/2	1,323	123	3,762	202
1983/4	17,827	1,022	24,621	1,243

II-2-6-2. Production

The following Table II-2-6-2 shows the difference between yield averages and its standard deviations. For wet paddy, the yield expanded by 2.64 times and for dry paddy 2.27 times. In terms of their standard deviations, for both paddies, the yields are quite stable while the means are much higher. The standard deviations, which are the barometers of bias, are getting so small in comparison with their means that the guide from the Pilot Project and the constant irrigation supply tend to make the farmers management more stable.

Table II-2-6-2 Productivity

year	wet season yield			dry season yield		
	mean	S.D.	n	mean	S.D.	n
	Kg/rai			Kg/rai		
1981/2	243 (100)	119	28	321 (100)	115	31
1983/4	641 (264)	128	40	728 (227)	99	40

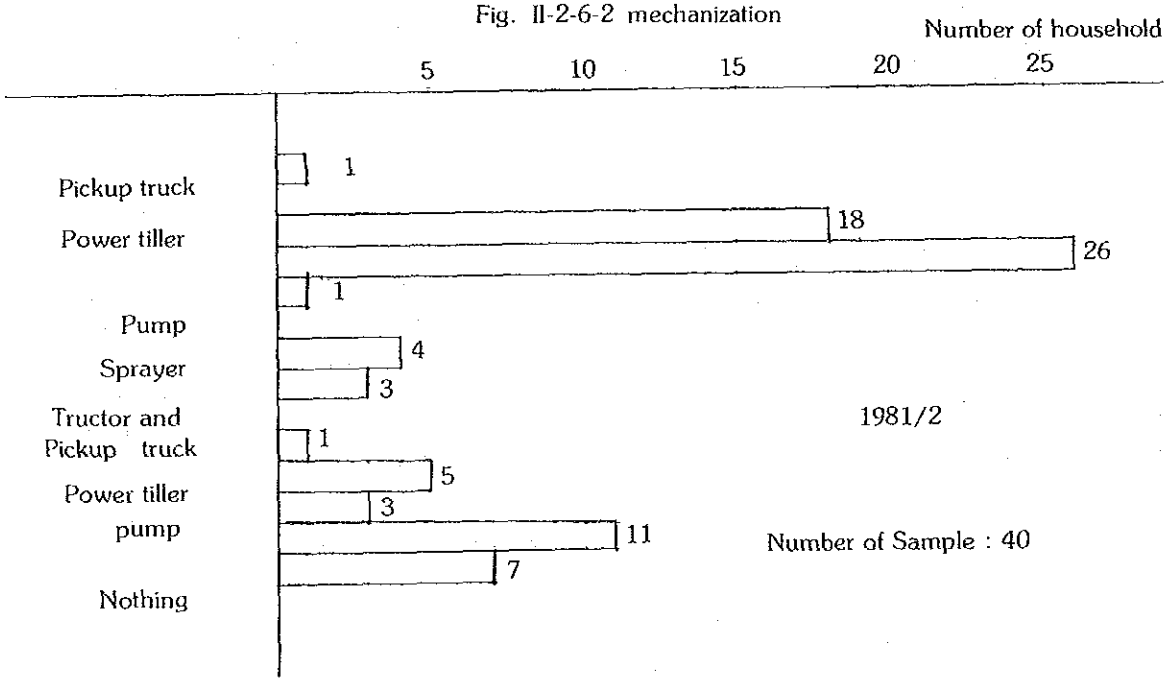
( ) = %

II-2-6-3. Agricultural Mechanization

The mechanization is in progress in two ways in this region. One is holding machines for each farmer and another way is to rent machines with their operators for puddling and threshing.

The following figures (fig II-2-6-2) show the holding situation of machines in 1981/2 and 1983/4. The members of the farmers who own two-wheel tractors increased from 23 to 29, but those who have not any machines decreased from 11 to 7. One farmer with a 4 wheel-tractor and pickup truck emerged.

Fig. II-2-6-2 mechanization



The following table shows the average, and standard deviation of machine rents on the per-rai basis

Table II-2-6-3 Standard deviations of machine rents

year	wet season	dry season
1981/2	13 (7.8)	17 (8.2)
1983/4	86 (95)	89 (97)

Unit = ฿
( ) : standard deviation

In 1981/2, 31 farmers paid for this item in the wet season, 35 in the dry season out of 40 farmers. However, in 1983/4, 39 farmers in the wet and 38 in the dry.

The number of farmers and the amount for using rental services increased significantly but the standard deviations show that the extent differs from one farmer to another.

II-2-6-4. *Farm inputs*

Table II-2-6-4 and II-2-6-5 show per-rai based production costs for wet and dry paddy respectively. In total for wet, the cost increased by 18% and for dry by 4%. Some items increased but some did not. It is spectacular that seed and fertilizer costs are decreasing the moreover their standard deviations were depressed significantly as the following table shows (Table II-2-6-6). This fact means that the guidance from the Project has been thoroughly conducted, because it is evident that the differences among the farmers have been lessened.

Table II-2-6-4 Production costs of wet paddy

wet season	machine rental	fuel	repair	seeds	ferti-lizers	chemicals	Total
1981/2	13	49	0	65	271	98	494
	(2.6)	(10.0)	(0)	(13.1)	(54.6)	(19.8)	(100)
1983/4	83	48	22	58	220	154	585
	(14.2)	(8.2)	(3.8)	(9.9)	(37.6)	(26.3)	(100)

Tble II-2-6-5 Production costs of dry paddy

dry season	machine rental	fuel	repair	seeds	ferti-lizers	chemicals	Total
1981/2	17	59	0	70	307	115	568
	(3.0)	(10.4)	(0)	(12.3)	(54.0)	(20.2)	(100)
1983/4	84	46	12	58	230	163	593
	(14.2)	(7.8)	(2.0)	(9.8)	(38.8)	(27.5)	(100)

Table II-2-6-6 Standard deviations of seed & fertilizers costs

	Seed costs		fertilizer costs	
	wet	dry	wet	dry
1981/2	24.08	26.88	137.43	135.22
1983/4	9.05	7.74	50.54	60.51

II-2-6-5. *Standard of living*

The best index to measure the standard of living may be the degree of holding consumer durables. We gave the items the following points.

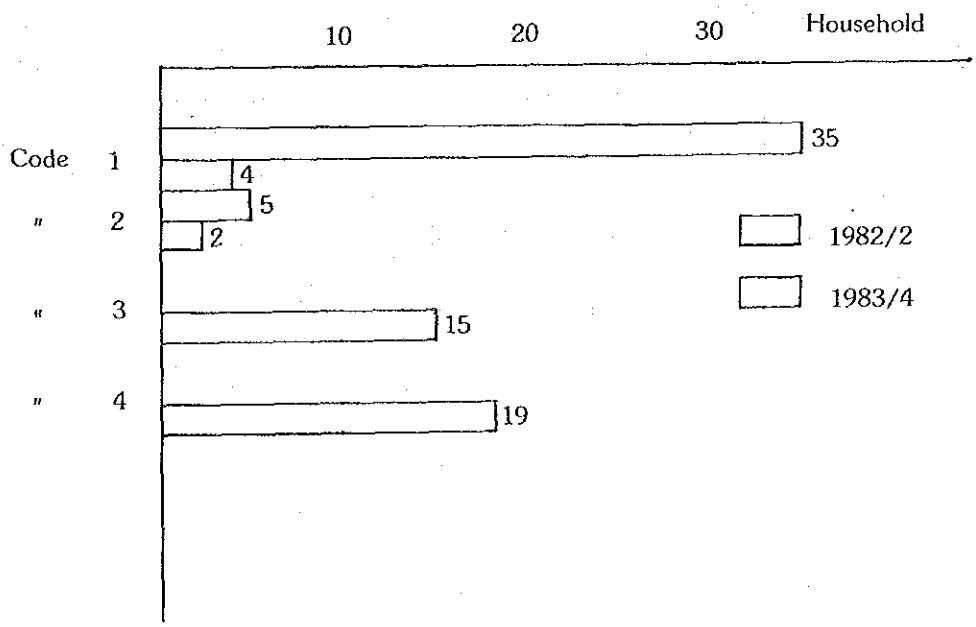
bicycle = 1	fan = 1	radio = 1
radio cassette = 2	B/W T.V. = 2	rice cooker = 1
sewing machine = 2	bike = 3	gas table = 3
ref. = 4	generator = 4	color T.V. = 5
pick-up = 8		

Based on these points, we set up the codes as follows

code 1	0 - 4	points
code 2	5 - 8	points
code 3	9 - 12	points
code 4	13 -	points

The following graph shows the situation of holding consumer durables based on the code numbers. A significant change can be observed.

Fig. II-2-6-3 Consumer Durables



Noe: Code 1 : 0 - 4 points
2 : 5 - 8 "
3 : 5 - 13 "
4 : 14 "