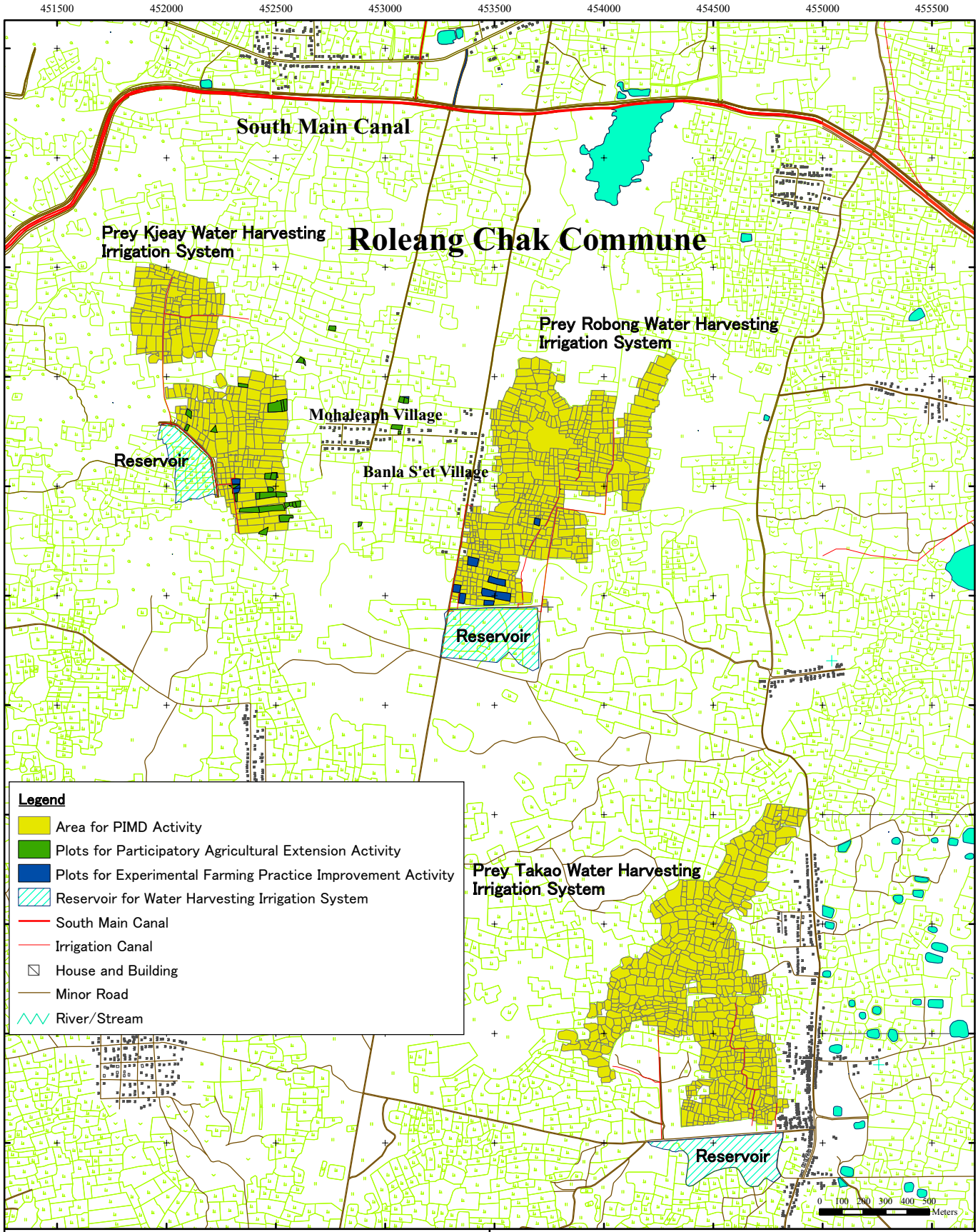
PART-C

PILOT PROJECTS (2007/2008)

Section-II

Irrigated Agriculture On-farm Technology Improvement Pilot Project in Zone-3

Experimental Plot in Banla S'et Village
(Experimental Farming Practice Improvement Activity in Zone-3)



The Study on Comprehensive Agricultural Development of Prek Thnot River Basin in the Kingdom of Cambodia	Location Map of Zone-3 Pilot Project
Japan International Cooperation Agency	

PART-C: PILOT PROJECTS (2007/2008)

Section-II

Irrigated Agriculture On-farm Technology Improvement Pilot Project in Zone-3

Chapter CII-1 Framework of the Project

CII-1.1 Objective

This is mentioned in section BII-1.1.

CII-1.2 Project Area

The area for the project activities was proposed as follows (see the location map of pilot project area in Zone-3).

CII-1.2.1 Area for Participatory Irrigation Management and Development Activities

There were 49 water harvesting irrigation systems in Zone-3 according to the inventory survey of irrigation systems conducted in the master plan study. From these systems, the Prey Robong water harvesting irrigation system in Banla S'et village was selected for the participatory irrigation management and development activities in Zone-3 in the previous year. In the rainy season of the previous year, however, rainfall was less so that the reservoir was almost empty and so the activities could not be satisfactorily conducted. To prevent such unexpected situations, the Prey Kjeay water harvesting and Takao water harvesting irrigation system, in addition to the Prey Robong water harvesting irrigation system, were taken up as additional targeted systems for the activities through discussions with the Kampong Spue PDOWRAM. Thus, the participatory irrigation management and development activities were carried out for three water harvesting irrigation systems.

CII-1.2.2 Area for Participatory Agricultural Extension Activities

As a continuation of the previous year's activities, the participatory agricultural extension activities were carried out for the territorial area of Mohaleaph village in Samraong Tong district. There were five selected plots for low inputs SR . Out of the five, two plots were selected for both low inputs SRI and traditional farming for easy comparison of results.

CII-1.2.3 Area for Experimental Farming Practice Improvement Activities

Experimental farming practice improvement activities were conducted in Banla S'et village in Samraong Tong district together with the participatory irrigation management and development activities.

CII-1.3 Schedule

The three activities under the pilot project were carried-out by February 2008, although the major field activities were finished by January 2007. This section highlights the pilot project activities in Zone-3 conducted from May 2007 to January 2008.

Implementation Schedule of Pilot Project in Zone-3

Activities	2006									2007											2008		
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
(1) Baseline Survey			■																					
(2) Kick-off Seminar			■																					
(3) Participatory Irrigation Management and Development				■	■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	
(4) Participatory Agriculture Extension				■	■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	
(5) Experimental Farming Practice Improvement				■	■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	
(6) Evaluation																							■	

CII-1.4 Project Design Matrix (PDM),Version 2

Based on the results of the pilot project activities in Zone-3 conducted from June 2006 to February 2008, the Project Design Matrix (PDM) was modified. The modified items were as follows:

Outputs

- "1 Irrigation water is distributed with minimum loss of water by model organization" should be changed into "1 Irrigation water is released from reservoir by FWUC considering growing stages of paddy" since irrigation water could not be distributed due to the lack of distribution facilities.

Activities

- "1-1 To prepare preliminary landholding maps" should be added since these maps are indispensable for collection of ISF and O&M of the existing irrigation facilities.
- "1-1 To prepare water use maps" should be changed to "1-2 To prepare water use maps since "1-1 To prepare preliminary landholding maps" was newly added as mentioned above.
- "1-2 To prevent water loss" should be deleted since irrigation facilities will not be constructed due to unconfirmed situations on the storage of rain water in the reservoir.
- "1-3 To establish the FWUCs based on existing irrigation management groups" was added since FWUC is essential for proper water management and O&M of the existing irrigation facilities.
- "1-4 To clarify the reservoir capacity" was added since available reservoir water for irrigation should be grasped.
- "1-5 To prepare the Irrigation Service Plan" should be added since proper water management and O&M for the existing irrigation system should be realized.
- "1-4 To educate the irrigation management groups on proper water use" was included in "1-6 To train the FWUCs on water management" since these practices will be conducted in the same manner.
- "1-4 To construct on-farm irrigation facilities in simple way" was deleted since irrigation facilities will not be constructed due to unconfirmed situation on storage of rain water in reservoir.
- "1-5 To train irrigation management group on water management" would be changed to "1-6 To train the FWUCs on water management" since FWUCs will be established for proper water management and O&M for the existing irrigation facilities..
- "3-3 To conduct farmers' acceptability survey for confirming the possibility to introduce the improved farming practices by seeing the results of the first year from technical and economical viewpoints" was added since the farmers' response to the pilot project activities should be known.

Objectively Verifiable Indicators, Outputs

- "1-1 Irrigation water is distributed with minimum loss of water by model organization by year 2007" should be changed to "1-1 Irrigation water is released from reservoir by FWUC considering growing stage of paddy by February 2008 " since irrigation water could not be distributed due to the lack of distribution facilities.

Objectively Verifiable Indicators, Project Purpose and Outputs

- "1-1 Result of …….by year 2007" and "2-1 A total of 50 farmers……by year 2007" should be changed to "1-1 Result of …….by February 2008" and "2-1 A total of 50 farmers……by February 2008" since some activities such as collection of

ISF, interview to farmers on improved farming practice were postponed until February 2008.

Objectively Verifiable Indicators, Inputs

- "Construction cost of model irrigation facilities" should be deleted since irrigation facilities will not be constructed due to unconfirmed situations on storage of rain water in reservoirs.

Important Assumptions, Outputs

- "Reservoir is filled with rainfall water" should be added since water management could not be made if the reservoir has no or less water.

Project Design Matrix (PDM), Version 2

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Agricultural productivity centering on rice is improved in the target area	1-1 Agricultural productivity in the target area is improved as proposed in the master plan by year 2015	1-1 Agricultural statistics	
Project Purpose Good model of on-farm irrigated agriculture improvement in Zone-3 is established	1-1 Result of the pilot project is evaluated as being an applicable model for Zone-3 by stakeholders by February 2008	1-1 Questionnaire to the stakeholders	- All the proposed activities in the master plan in the post-project stage are implemented as scheduled - No significant climatic change - No severe damage to the irrigation facilities by natural disaster
Outputs 1 Irrigation water is released from reservoir by FWUC considering growing stage of paddy. 2 Low inputs SRI is disseminated by farmer-to-farmer extension 3 Target yield of the Mater Plan is achieved by applying SRI based improved farming practice	1-1 Irrigation water is released from reservoir by FWUC considering growing stage of paddy by February 2008 2-1 A total of 50 farmers in the model villages apply low inputs SRI by farmer-to-farmer extension by February 2008 3-1 Yield of improved farming practice in experimental plots is higher than the target yield of the master plan	1-1 Record of water release from reservoir 2-1 Monitoring surveys 3-1 Crop yield surveys	- Responsibility of each stakeholder in water management is not changed within the project period - Reservoir is filled with rainfall water.
Activities (1. Participatory Irrigation Management and Development) 1-1 To prepare preliminary landholding maps 1-2 To prepare water use maps 1-3 To establish the FWUCs based on existing irrigation management groups 1-4 To clarify the reservoir capacity 1-5 To prepare the Irrigation Service Plan 1-6 To train the FWUCs on water management (2. Participatory Agriculture Extension) 2-1 To organize study tour 2-2 To conduct village training 2-3 To carry out inter-village training 2-4 To hold farmers' field day (3. Experimental Farming Practice Improvement) 3-1 To conduct verification test to confirm effectiveness of SRI based on improved farming practices 3-2 To conduct small scale	**Inputs** Donors Experts Transportation Equipment for monitoring irrigation water distribution Cost of study tour	Cambodia <u>Irrigation Management Organization</u> Organization members <u>Provincial government</u> Counterparts from PDOWRAM and PDA <u>Central government</u> Counterparts from MOWRAM and MAFF <u>NGO</u> Facilitators	- Continuous involvement of related government agencies and model FWUC during the project period - No severe natural disaster within the project period **Preconditions** - High need for irrigated agriculture in the target area - Good understanding of the master plan by related organizations - Basic irrigation facilities are provided in the project area

	adaptability trials for further improvement of the farming practice		
3-3	To conduct farmers' acceptability survey for confirming the possibility to introduce the improved farming practices by seeing the results of the first year from technical and economical viewpoints.		

Chapter CII-2 Participatory Irrigation Management and Development Activities

CII-2.1 Objective

This is mentioned in section BII-2.1.

CII-2.2 Institutional Set-up

This is mentioned in section BII-2.2.

CII-2.3 Situation before Starting Pilot Project Activities

CII-2.3.1 General

As mentioned in sub-section CII-1.2.1, the following water harvesting irrigation systems were selected as the area of participatory irrigation management and development activities, taking into consideration the risk that the reservoir could not be sufficiently stored with water since the reservoir of Prey Robong water harvesting irrigation system had less water due to severe drought in the previous year:

Administrative Information of Three Water Harvesting Irrigation Systems

Water Harvesting System	Village	Commune	District
(1) Prey Robong	Banla S'et	Roleang Chak	Samraong Tong
(2) Prey Kjeay	Mohaleap	Roleang Chak	Samraong Tong
(3) Ta Kao	Mohalumpeang Ti Muoy Mohalumpeang Ti Pir	Roleang Chak	Samraong Tong

Out of three water harvesting irrigation systems mentioned above, the "situation before starting the pilot project" of Prey Robong and Prey Kjeay water harvesting irrigation systems, was already explained in the interim report (2) as well as the progress report (2). In this section, therefore, an explanation was given for the Takao water harvesting irrigation system only.

CII-2.3.2 Method of Baseline Surveys

This is mentioned in sub-section BII-2.3.2.

CII-2.3.3 Agriculture

This is mentioned in sub-section BII-2.3.3.

CII-2.3.4 Irrigation and Drainage / Water Management

CII-2.3.4.1 Irrigation System

The irrigation facilities available in the Ta Kao are i) reservoir; ii) intake for left bank canal; iii) culvert for right canal; iv) right canal (719m); v) middle canal (138m); and vi) left canal (732m). The existing canals were unlined and were not provided with any division structure.

CII-2.3.4.2 Drainage System

There was no drainage facility in the irrigation system.

CII-2.3.4.3 Water Management

Water in the Ta Kao reservoir was generally released by a village committee member twice in paddy cultivation; the first time was for rice sowing to transplanting stage, and second time was for panicle initiation to the flowering/heading stage, if enough rain was not available at these stages. The village chief mentioned that farmers mostly suffered from the shortage of irrigation water due to insufficient rain. In case of less water in the reservoir, in principle, the village committee did not allow the extraction of the reservoir

water to keep it for human and livestock.

There was no rule on water distribution to paddy fields mainly because of the lack of control structures. However, the committee sometimes decided that a priority on water distribution be given to paddy fields which were located relatively far from the reservoir because these had less chance to receive water than the paddy fields located close to the reservoir.

There were minor water conflicts among farmers. These concerned the turns and quantities of receiving water. In these cases, the village chief acted as mediator.

CII-2.3.4.4 Facility Maintenance

The village chief said that seasonal inspections were carried out for the facilities by the village chief, committee members, and villagers although they have never received training from the government so far. As for the damaged portions found, the villagers voluntarily conducted the repairs using the soils/stones carried from the nearby mountains. The villagers also removed the sediments in front of the intake and in the canals.

CII-2.3.5 Organizations

CII-2.3.5.1 Ta Kao Irrigation Management Group

(a) Background

All farmers of Mahalumpaing Ti Mouy and Mahalumpaing Ti Pir had considered the need for a farmers' group whose aim was proper use of reservoir water. Thus, a farmers' group was informally formed in 2001. The group was composed of village chiefs, deputy village chiefs, commune councilor, and one villager living close to the reservoir. In 2003, the SEILA program set out to improve the Ta Kao reservoir including the construction of intake structure, and the village chief of Mahalumpaing Ti Mouy and commune councilors were appointed as responsible persons for the O&M of these facilities, which was provisionally referred to as "Ta Kao irrigation management group" since the group had no name at that time.

(b) Committee

As mentioned above, the Ta Kao irrigation management group was managed by four persons appointed under the SEILA program. The roles of each committee member are indicated in the table below.

Roles of Each Committee Member

Position	Roles
Chief (village chief of Mahalumpaing Ti Mouy)	1) Explain to the farmers about water use
	2) Manage general matters regarding maintenance works, irrigation and drainage activities, gate opening, settlement of conflict, fund contribution.
	3) Organize meetings by gathering members to discuss O&M of reservoir.
Deputy chief (commune councilor)	1) Make decisions with Chief on water distribution and O&M work.
	2) Prevent villagers from catching fish using net and/or electrical means.
Secretary (Ex-deputy village chief)	1) Share ideas and strategies to manage the reservoir water and facility.
	2) Call farmers to meetings on the rehabilitation of facility and water distribution
Gate operator	1) Execute water distribution and O&M for gate.
	2) Inform chief of damaged parts of facilities.
	3) Raise funds by conducting ceremonies for community.

Source: Interview with the chief of Ta Kao irrigation management group in 2007

All farmers could have access to the reservoir water freely but they should inform and ask permission from the chief of the group in advance.

(c) Irrigation Service Fees

Ta Kao irrigation management group did not receive any money directly from the farmers. Instead, when they need money to rehabilitate the facilities, they asked the pagoda commission or the head of monks. In reply to this solicitation, the monk and pagoda commission received money from the villagers' contribution during the performing ceremony.

CII-2.3.5.2 Community Organizations

(1) Commune Council

The Maha Lumpaing Ti Mouy and Tipi villages are located in the Sen Dey Commune, Samraong Tong Disrict. The Commune Council of Sen Dey was elected on April 4, 2007. There were nine elected members of the commune council. The major roles of the commune council are i) dissemination of village development; ii) making of important decisions and recommendations to the village chief.

(2) Small Round Basket Hand Craft Community

To improve their standard of living, there is small round basket hand craft community consisting of 50 members. US$750 was donated to the community. Members can borrow money from the community at an interest of 2.5%. The money is kept by the accountant of the community.

CII-2.4 Identified Constraints for Participatory Irrigation Management and Development Activities

CII-2.4.1 Irrigation and Drainage / Water Management

The following problems related to irrigation and drainage/water management in Takao were identified by the baseline survey and site inspection:

- Water resources of the water harvesting irrigation system were so limited that the farmers in the area could not receive water from the irrigation system as required, especially for vegetable cultivation during the dry season.
- There was no written water distribution schedule.
- There were no control structures to distribute water properly.

CII-2.4.2 Irrigation Management Group

The following problems related to the Takao village committee were identified by the baseline survey and site inspection:

- The committee members who were in charge of water management had never received any training from the government/donor so far, so that they did not know how to implement water management properly.
- The committee do not have written regulations regarding water management and O&M.
- The committee do not have the basic data necessary for water management and O&M, such as land holding maps and lists of beneficial recipient farmers and their areas.
- The recipient farmers located relatively far from the reservoir did not have any intention to take part in maintenance work because they had less chance to access water from the reservoir.
- There was no financial source for proper O&M activities for the irrigation facilities since no irrigation service fee was collected from the farmers concerned.

CII-2.5 Activities Conducted for Improvement

CII-2.5.1 General

In order to conduct the water management activities for three water harvesting systems, Prey Robong, Prey Kjeay and Ta Kao, the following practices similar to those for Zone-1, were carried out:

- Preliminary landholding map preparation practices
- Water use map preparation practice
- FWUC establishment practice
- Reservoir capacity clarification practice
- Irrigation service plan preparation practice
- Water management training practice

The object, actions taken and results for respective practices are reported hereinafter.

CII-2.5.2 Implementation of Improvement Practices

CII-2.5.2.1 Preliminary Land Holding Map Preparation Practice

(1) Objective

The objective of the practice was to identify owner farmers and their farm plot size mainly for the purpose of water management and ISF collection.

(2) Actions Taken

Prey Robong Water Harvesting Irrigation System

In the previous year, the preparation of a preliminary landholding map failed due to the lack of support from the farmers. The same activities were tried again by the PDOWRAM and JICA study team through adequate discussions with farmers concerned in advance. Consequently, the preparation of a preliminary land holding map was successfully conducted in the following participatory manner.

- Necessity of the activities and procedures for preparing paddy plot resource maps was explained by PDOWRAM staff to the farmers concerned including the village chief.
- The village chief and farmers concerned supported the JICA study team and PDOWRAM in the preparation of the the paddy plot resource map which showed all the paddy plots receiving water from the irrigation system.
- The survey data for each field plot was obtained by GPS.
- The JICA study team, in cooperation with PDOWRAM, prepared a preliminary land holding map using the GIS software and on the basis of the survey data obtained.

Prey Kjeay Water Harvesting Irrigation System

The same activities with the Prey Robong water harvesting irrigation system were taken by the PDOWRAM and JICA study team in preparing the preliminary land holding map.

Ta Kao Water Harvesting Irrigation System

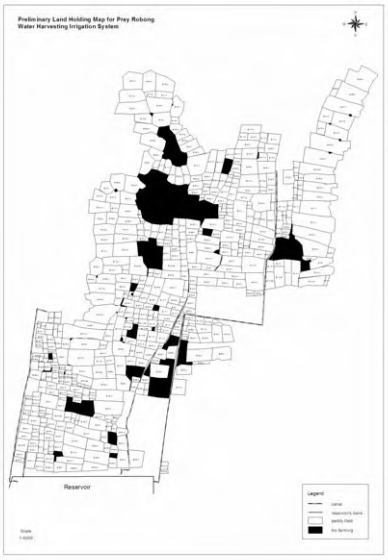
In the Ta Kao water harvesting irrigation system, the same activities with the Prey Robong water harvesting irrigation system were taken by PDOWRAM and JICA study team in preparing the preliminary land holding map.

(3) Results and Observations

Prey Robong Water Harvesting Irrigation System

A preliminary land holding map was successfully prepared by the JICA study team in cooperation with the PDOWRAM staff. The prepared map is shown in the right. The estimated irrigation area of the system was 44.58 ha. From this map, the recipient farmers from the reservoir and their areas were clarified. There were 73 recipient farmers.

Collection of waypoint data by GPS together with farmers



Land Holding Map for Prey Robong

Prey Kjeay Water Harvesting Irrigation System

A preliminary land holding map was prepared by the JICA study team and PDOWRAM staff similar to the Prey Robong water harvesting irrigation system. The village committee members provided the PDOWRAM and JICA study team with their kind cooperation to obtain the waypoints by GPS survey.

Collection of information from village committee members and farmers

Land Holding Map for Prey Kjeay

Based on the waypoint data obtained and using the GIS software, a preliminary land holding map was prepared as shown below. There were 73 recipient farmers. The map showed the 39.41 ha of irrigation area.

Ta Kao Water Harvesting Irrigation System

Since the Ta Kao water harvesting irrigation system also had no land holding map, it was prepared for water management activity in the manner mentioned above. The map indicated the 59.73 ha of beneficial area.

Collection of information from village committee members and farmers

Land Holding Map for Ta Kao

CII-2.5.2.2 Water Use Map Preparation Practice

(1) Objective

The objective of the practice was to confirm the canal layout and water supply method of the water harvesting irrigation systems.

(2) Actions Taken

A water use map showing the canal layout and irrigation supply method was needed to know the present irrigation condition and to execute the proper water management and O&M of the system. The following actions were taken by PDOWRAM and the JICA study team for the preparation of water use map.

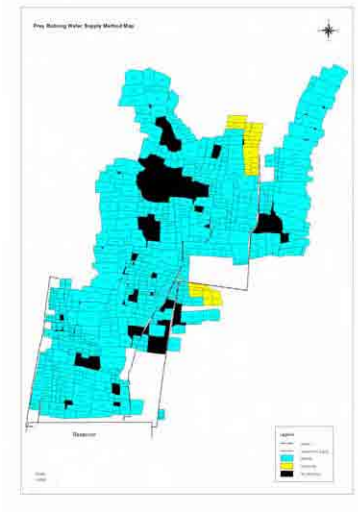
- Coordinates of canal routes were surveyed by PDOWRAM using a handheld GPS.
- Surveyed data was transferred from GPS to computer, and canal routes were digitized using GIS software.

(3) Results and Observations

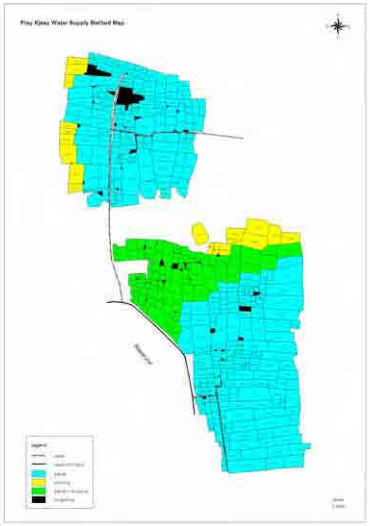
The length of canals and the canal layout were confirmed by the survey. The canal layout was presented on the map which was prepared for clarifying land holding.

The existing irrigation facilities and water supply method in the Prey Robong, Prey Kjeay and Takao water harvesting irrigation systems are given below:

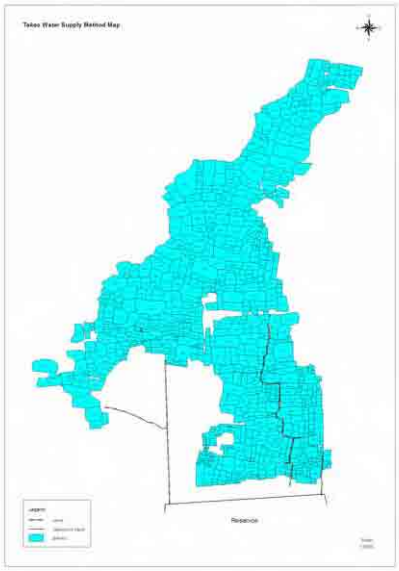
Prey Robong Water Harvesting Irrigation System

System Conditions	Water Use Map
(1) Reservoir: 1 no. Effective storage : About 53,000 m3 for 1 m water depth (See CII-2.5.2.4) (2) Canal Type: Unlined Right canal: 1,900 m Left canal: 600 m (3) Structures Intake for right canal: 1 no. Staff gauge in front of intake gate: 1 no. (4)Water supply method By gravity: 42.93 ha. By pump: 1.65 ha By both: 0.00 ha Total 44.58 ha	

Prey Kjeay Water Harvesting Irrigation System

System Conditions	Water Use Map
(1) Reservoir: 1 no. Effective storage : About 40,000 m3 for 1 m water depth (See CII-2.5.2.4) (2) Canal Type: Unlined Right canal: 362 m Left canal: 1,075 m (3) Structures Intake for right canal: 1 no. Intake for left canal: 1 no. Staff gauge in front of intake gates: 2 nos. (4)Water supply method By gravity: 29.79 ha. By pump: 3.02 ha By both: 6.60 ha Total 39.41 ha	

Ta Kao Water Harvesting Irrigation System

System Conditions	Water Use Map
(1) Reservoir: 1 no. Effective storage : About 170,000 m3 for 1 m water depth (See CII-2.5.2.4) (2) Canal Type: Unlined Right canal: 719 m Middle canal: 138 m Left canal: 732 m (3) Structures Intake for left canal: 1 no. Culvert: 1 no. Staff gauge in front of intake gates: 1 no. (4)Water supply method By gravity: 59.73 ha. By pump: 0.00 ha By both: 0.00 ha Total 59.73 ha	

CII-2.5.2.3 FWUC Establishment Practice

(1) Objective

The objective of the practice was to establish FWUC which will execute the water management and O&M for water harvesting irrigation system.

(2) Actions Taken

According to the government policy, the FWUC should be responsible for water management and O&M of the irrigation system below the secondary canal. This means that the FWUC should be established and activated for every irrigation canal system. For this practice, the activities taken were as follows:

- Election of committee members.
- Preparation of regulations.
- Registration to MOWRAM

(3) Results and Observations

Prey Robong Water Harvesting Irrigation System

An election of FWUC committee members were conducted by 39 farmers on June 12, 2007. The opening address by the representative of commune chief started the election. Prior to the election, the PDOWRAM staff explained the election guidelines prepared by the government. At first, eight candidates were selected by the village chief, and then the votes were cast for them. Finally, the four persons listed below were selected as FWUC committee members. The committee positions were determined based on the number of votes polled.

- Chief of committee : Mr.Im Bun
- 2nd Chief of committee : Mr.Sat Vun
- 3rd Chief of committee : Mr.Men Sombat
- Accountant : Mr.Men Chantha

Voting by Farmers

Elected Committee Members

After election, the selected committee members made a short speech one by one. The chief of committee emphasized the need for the proper operation of the reservoir together with farmers.

Explanation of Regulations by PDOWRAM

On October 16, PDOWRAM explained the regulations for FWUC, which included the responsibilities of the committee, the amount of irrigation service fee, fines, revenues, expenditures, etc. These contents were fully accepted by all attendees. According to the regulations, the FWUC committee member should have the following duties:

- Chief of committee : General management
- 2nd Chief of committee : Preparation of O&M plan and its execution
- 3rd Chief of committee : Water supply distribution
- Accountant : Financial activity

Prey Kjeay Water Harvesting Irrigation System

The PDOWRAM staff explained to the attendees the need to establish the FWUC for proper water management and O&M for existing facilities such as embankments for reservoirs, intake gates and canals. In response to this explanation, the village chief nominated ten candidates. On October 30, 2007, an election was held and the following four committee members were elected from among the nominated ten candidates by 45 attendees who voted.

- Chief of committee : Mr.Phat Oudom
- 2nd Chief of committee : Mr.Om Sav
- 3rd Chief of committee : Mr.Sork Sim
- Accountant : Mr.Mao Savat

Explanation by PDOWRAM staff

Voting by farmers

Most of farmers expected the FWUC to use the limited water resources wisely. In particular, the village chief keenly desired to establish the FWUC to manage the existing reservoir and irrigation system well because many farmers were not satisfied with the present water distribution which led to water conflicts.

The PDOWRAM staff informed the FWUC members about the regulations on December 4, 2007. The regulations contain the responsibilities of the committee, the amount of irrigation service fee, fines, revenue, expenditures, etc. Thereafter, the FWUC members reviewed the regulations and finally agreed to them. The regulations were examined and approved by the director of PDOWRAM, the commune chief, the district chief, and the provincial governor.

Ta Kao Water Harvesting Irrigation System

On May 30, 2007, the election of FWUC committee members was conducted by 58 attendees from Moha Lumpeang Ti Muoy village and Moha Lumpeang Ti Pir village. After the opening address by the representative of the commune counselor, the PDOWRAM staff explained the election guidelines prepared by the government. The village chief nominated 15 candidates and the four persons listed below were elected as the FWUC committee members:

- Chief of committee : Mr.Keo Sarun
- 2nd Chief of committee : Mr.Pich Khen
- 3rd Chief of committee : Mr.Chieap Chin
- Accountant : Mr.Say Peouk

Voting by farmers

Elected committee members

Many farmers took part in the election of the FWUC committee members. This meant that they highly expected the FWUC to properly use the reservoir water and related facilities, since the reservoir was an important facility not only for water storing for irrigation, but also for domestic use and flood protection.

PDOWRAM staff informed the FWUC members of the regulations on October 17, 2007.

The regulations covered the responsibilities of the committee, the amount of irrigation service fees, fines, revenues, expenditures, etc. The FWUC members accepted the regulations. The regulations were examined and approved by the director of PDOWRAM, the commune chief, the district chief, and the provincial governor.

CII-2.5.2.4 Reservoir Capacity Clarification Practice

(1) Objective

The objective of the practice was to determine the effective storage volume for irrigation through the survey of reservoir.

(2) Actions Taken

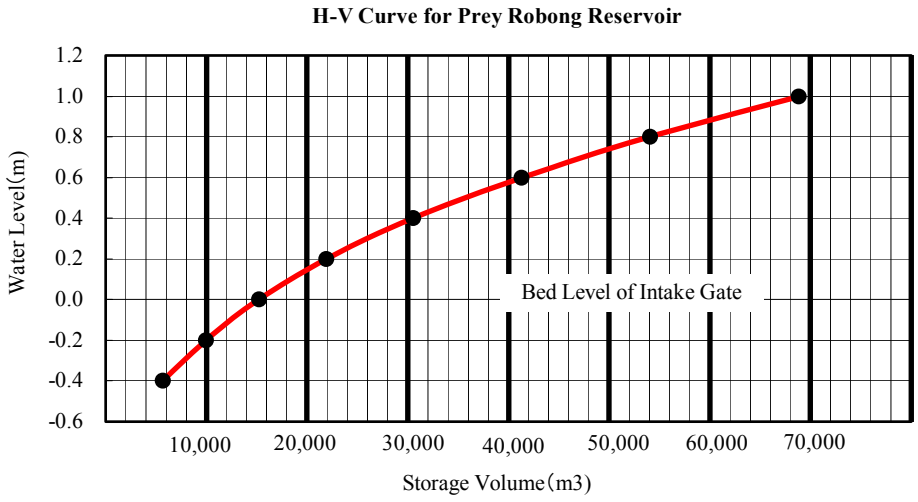
The following actions were taken by PDOWRAM and JICA study team for clarifying the effective storage volume.

- Leveling survey was carried out for the reservoir area using leveling instruments, GPS, measuring tapes, and poles.
- The surveyed data were put into the computer and contour lines were drawn. From contour lines, an H-V curve was prepared.

(3) Results and Observations

An H-V curve for reservoir was prepared based on the survey results obtained in the aforementioned procedure.

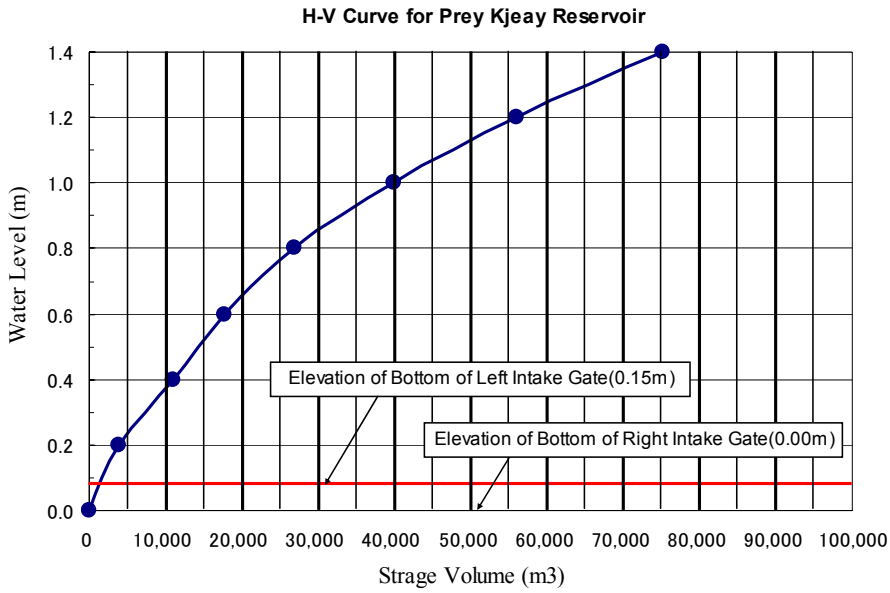
<u>Prey Robong Water Harvesting Irrigation System</u>



Prey Robong Reservoir

Leveling survey

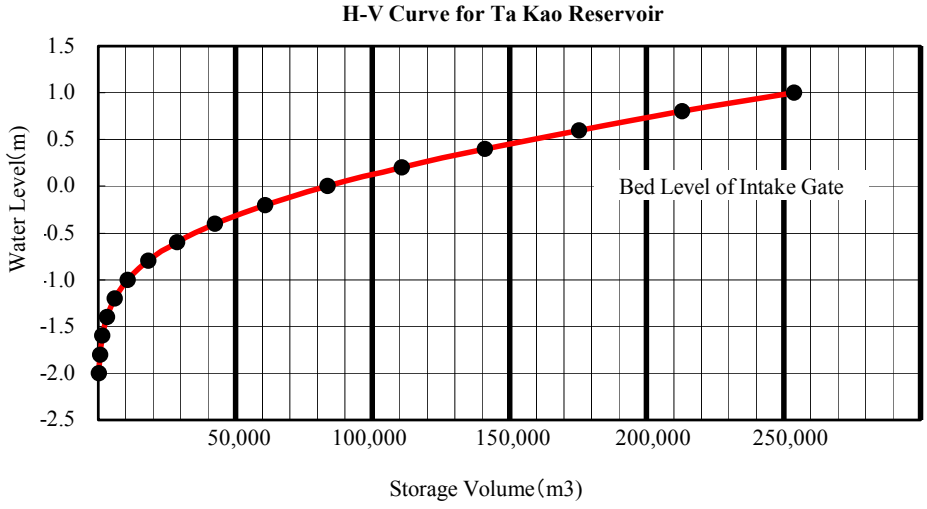
Prey Kjeay Water Harvesting Irrigation System



Prey Kjeay Reservoir

Leveling Survey

Takao Water Harvesting Irrigation System



Ta Kao Reservoir

Leveling survey

CII-2.5.2.5 Irrigation Service Plan Preparation Practice

(1) Objective

The objective of the practice was to support the corresponding FWUCs in Zone-3 in the preparation of an irrigation service plan. According to the "Training Manual for Participatory Irrigation Management and Development, MOWRAM, 2003", it should be prepared by FWUC. However, the FWUCs in Zone-3 had just been recently established under the study and were not adequately equipped to prepare it by themselves only. Thus, it was required to provide proper support for them on the preparation of irrigation service plan.

(2) Actions Taken

As for this practice, actions taken were as follows:

- Preparation of draft irrigation service plan by JICA study team (English and Khmer version)
- Review of draft irrigation service plan by PDOWRAM
- Explanation of draft irrigation service plan by PDOWRAM to FWUC committee

(3) Results and Observations

The water harvesting irrigation system was taken up in a concept of effective use of rainfall, since the government promotes its development in the rainfed area in the National Water Resources Policy. The water harvesting irrigation system also needs the simple water management from the viewpoint of effective use of limited water resources although it was totally different with the ordinary one. The irrigation service plan contains the location, land use, physical features, preliminary land holding map, water delivery schedule, storage capacity of reservoir, irrigation method, maintenance, and collection of irrigation service fee. From these, the irrigation method to be applied is as follows:

Since the storage capacity of the reservoir is small, water release for irrigation will be carried out taking into consideration the physiological characteristic of the paddy. According to this physiological characteristic, the following periods require water indispensably:

- About ten days after transplanting for rooting
- About ten days at panicle initiation stage before ±65 days before harvesting (around 20 to 30 of September in case of sowing on July 16)
- About ten days at flowering/heading stage before ±30 days before harvesting (around 5 of October to 5 of November in case of sowing on July 16)

In case of Prey Kjeay water harvesting irrigation system, water release from the reservoir will be done for the following two cases, by observing the staff gauge installed in front of the intake gate:

(a) Case-1: Sufficient water is available in the reservoir at transplanting time and rainfall suitable for growing paddy is insufficient.

If sufficient water is available in the reservoir at transplanting time, water release from the reservoir is planned for the following three times if sufficient rainfall does not occur at these stages.

1st gate opening at transplanting stage

Water equivalent to 70% of water depth could be released gradually.

2nd gate opening at panicle initiation stage

Water equivalent to 40% of water depth could be released gradually.

3rd gate opening at flowering/heading stage

Remaining water could be released gradually.

(b) Case-2: Sufficient water is not available in the reservoir at transplanting time.

If the sufficient water in the reservoir is not available at transplanting time, water release from the reservoir should be considered for the panicle initiation stage and flowering/heading stage only. In particular, it should be noted that the flowering/heading stage has the highest demand for water, and then the panicle initiation stage follows.

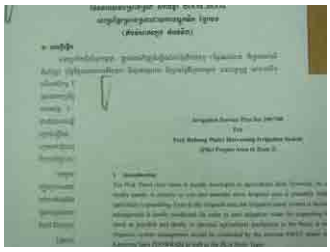
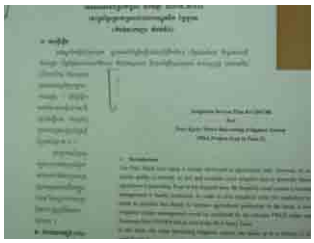
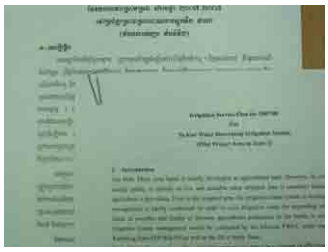
In view of the above, the water release from the reservoir should be made twice, say the critical periods mentioned above if sufficient rainfall suitable for growing paddy does not occur at these stages.

1st gate opening at panicle initiation stage

Water equivalent to 40% of water depth could be released gradually.

2nd gate opening at flowering/heading stage

The remaining water in the reservoir could be gradually released until it reaches the bed level of intake gate.

		
Irrigation Service Plan Prey Robong	Irrigation Service Plan Prey Kjeay	Irrigation Service Plan Ta Kao

The PDOWRAM discussed with the respective FWUC members this irrigation service plan. All FWUC members agreed to it.

CII-2.5.2.6 Water Management Training Practice

(1) Objective

The objective of the practice was to train FWUC members on how to release water from reservoir in consideration of available storage water.

(2) Actions Taken

Actions taken for this practice are as follows:

- Installation of staff gauge

- Discussion of gate operation based on irrigation service plan and staff gauge

(3) Results and Observations

In order to know the water level in the reservoir, a staff gauge was installed in front of the intake gate. The staff gauge was so installed as to become 0 m at bed of intake gate.

		
Prey Robong Reservoir	Prey Kjeay Reservoir	Ta Kao Reservoir

Based on the irrigation method mentioned in the irrigation service plan, PDOWRAM discussed with the FWUC committee the gate operation and its record form.

CII-2.6 Specific Findings in Zone-3 Participatory Irrigation Management and Development Activities

As mentioned in the PDM, the output of the Zone-3 participatory irrigation management and development activities is that irrigation water be released from the reservoir considering the growing stage of paddy. Regrettably, this output could not materialize because of inadequate volume of stored water caused by less rainfall for Prey Robong and Ta Kao reservoirs throughout the paddy cultivation period, and enough water at paddy field at water supply time for Prey Kjeay water harvesting irrigation system. However, experiences obtained through activities undertaken were deemed to be valuable for the coming successful water harvesting irrigation system. These experiences are explained below.

(1) Need of Rainfall Data in Catchment Area

Rainfall pattern in Cambodia is generally characterized by locality. Notably, the Zone-3 area shows a more distinct tendency of locality mainly due to topographic conditions where there are hills nearby. Examining the possibility of water storage by predicting the annual rainfall pattern would be difficult because of this, unless the data observed at rainfall station located in the corresponding catchment area is available. Thus, it is necessary to observe rainfall in the catchment area for grasping the possibility of water storage and also proper use of water stored in the reservoir.

(2) Water Supply well-fitted to Physiological Characteristic of Paddy

In the water harvesting irrigation system, even if the reservoir is full, the volume of stored water is generally not enough for one cultivation season of paddy because the storage volume is restricted by topographic constraints at the reservoir site. In the water management for the water harvesting irrigation system, therefore, a different approach should be taken into consideration. For paddies, the following periods require water indispensably if appropriate rainfall does not occur:

- About ten days after transplanting for rooting
- About ten days at panicle initiation stage around 65 days before harvesting
- About ten days at flowering/heading stage around 30 days before harvesting

Of the three stages mentioned above, the panicle initiation stage requires a larger volume of water. Water supply should be thus made in consideration of such physiological characteristics of paddies since the water resources were originally limited.

(3) Minimum and Simple Facilities in response to Less Return

As mentioned above, the water harvesting irrigation system does not ensure adequate water resources, so that it is so difficult to expect high and stable crop production. This means that return on investment would be low. From this viewpoint, the cost of the facility to be provided for the water harvesting irrigation system should be minimized. In addition, the facility should be simple as much as possible taking into account the ease of O&M.

(4) Consideration of Multi-Use of Reservoir Water

In general, reservoir water in the water harvesting irrigation system is used not only for irrigation, but also for domestic and livestock purposes, since there are no other suitable water resources nearby. Water use from the reservoir should be therefore planned considering such multi-use of reservoir water. It might be said that water below the bed level of the intake gate is almost all considered for domestic and animal use during the dry season.

(5) Strict Control of Water Abstraction by Pump

The farmers who own lands close to the reservoir have the topographic advantage of freely extracting the reservoir water by pump. If this water extraction by pump is allowed, the principle that water should be evenly supplied to all farmers is defied. In this sense, such water abstraction should be strictly controlled or forbidden and should be stipulated in the regulations for FWUC.

Chapter CII-3 Participatory Agricultural Extension Activities

CII-3.1 Objective

This is mentioned in section BII-3.1.

CII-3.2 Institutional Set-up

This is mentioned in section BII-3.2.

CII-3.3 Situation before Starting Pilot Project Activities

This is mentioned in section BII-3.3.

CII-3.4 Identified Constraints on Agricultural Extension Activities

This is mentioned in section BII-3.4.

CII-3.5 Activities Conducted for Improvement

CII-3.5.1 Preparation of Improvement Plan

A system similar to the Zone-1 pilot project for the farmer-to-farmer agriculture extension system was selected for Zone-3 as well. For the farmer-to-farmer agricultural extension framework, see sub-section BI-3.5.1.

CII-3.5.2 No Use of Reservoir Water for Irrigation in Year 2007

The reservoir of the Prey Kjeay water harvesting irrigation system was filled-up with rain water up to a certain water level around the end of the rainy season in 2007. However, the paddy fields also had rainfall at that time. Thus, the reservoir water was not used for irrigation in this season. The newly-established FWUC committee said that reservoir water should be used for domestic and animal drinking purpose during the coming dry season.

Storage condition of reservoir

CII-3.5.3 Farmer-to-farmer Low Inputs SRI Extension Practice

CII-3.5.3.1 Initial Guidance in 2007/08

Initial guidance (village general meeting) on SRI extensions were held at Mohaleaph village on June 13, 2007. There were 52 farmers, including 39 women, who joined the guidance meetings (it should be noted that there were a total of 65 families in this village, according to a baseline survey in 2006). There might be a few several reasons for the poor attendance rate: i). miscommunication between village chiefs and villagers; ii). farmers were busy in starting wet season rice; and iii). farmers were busy working. The 12 principles of SRI were explained to all villagers by staff and also by the farmer promoter who lives in this village, Mrs. Mav Sinon. The farmers who were interested in SRI were motivated to apply principles as much as possible by considering their field situations. As a result, most of participants were interested in SRI and 31 of them said that they wanted to apply SRI this season and three farmers showed strong willingness to be experimental farmers.

CII-3.5.3.2 Study Tour

The study tour of Andong Rorveang Village and Stok Kavas Village, Bor Re Bor and Rolear Baear District, Kampong Chhnang province was organized by CEDAC on July 9 and 10, 2007 for the purpose of learning SRI practice on site, the advantages of saving group, and ecological chicken raising. From eleven pilot project target villages, 31 farmers who were interested in SRI practice joined the tour. For details of the study tour, see clause CI-3.5.2.2.

Participants visited SRI plot of host village farmer.

CII-3.5.3.3 Village Training

Village training was given to the farmers' group of Mohaleaph village. The village training provided the following activities related to SRI.

Major Activities on SRI in Village Training

No.	Date	Major Activities	No. of Participants
1	July 21, 2007	- Share information of the study tour - Prepare experimental plots	15
2	August 10, 2007	- Discuss emergent problems and give advice for the problems	5

The farmers' group members in Mohaleaph village were concerned with transplanting based on the principles of SRI. Because the reservoir water was not sufficient, they could not conduct water supply adequately. Transplanting was thus postponed until September 2007.

CII-3.5.3.4 Inter-village Workshop

An inter-village workshop related to SRI was held by CEDAC twice in 2007. There were six farmers who participated in these workshops. Major activities conducted for SRI in the inter-village workshops are as follows:

Major Activities on SRI in Inter-village Workshop

No.	Date	Major Activities	No. of Participants
1	June 25, 2007	- Share experiences, problems and solutions related to SRI practice (ex. Selection of rice seed, preparation of nursery, uprooting of rice seed, transplanting). - Analyze traditional agricultural practice. - Select experimental farmers who want to apply SRI practice.	2
2	August 14, 2007	- Review what participants had learned in the last training. - Share information of progress of SRI experimentation. - Discuss emergency problems and their countermeasures.	4

In the inter-village workshop on June 25, 2007, the reasons why farmers hesitate to apply SRI practice were discussed among participants based on the results of the comparison of SRI with traditional cultivation. clause CI-3.5.2.4 shows the details of the discussion in the workshop. In the workshop on August 14 2007, two weeding tools were provided to farmers. Thereafter they conducted weeding using these tools 2 or 3 times a season. The farmers believed in the weeding tools' usefulness and

CEDAC explained the objectives of inter-village workshop.

ease of use.

CII-3.5.3.5 Supporting and Monitoring to Experimental Farmers

Supporting and monitoring activities were conducted for ten experimental farmers. Major matters conducted in the above mentioned supporting and monitoring activities were as follows.

Major Matters on Supporting and Monitoring to Experimental Farmers

No.	Date	Major Activities
1	June 19, 22 and 27, 2007	- Measure the land area of experimental farmers
2	July 5, 13 and 18, 2007	- Measure the land area of experimental farmers - Help farmers to prepare the experimental plots - Advise how to prepare plots and find emergent problems and solution
3	August 17, 2007	- Monitor and support emergent problems on experimental plots - Give some advice to solve problems - Collect data of experimental plots
4	September 7, 12, 17, 20 and 25, 2007	- Monitor and support emergency problems on experimental plots - Give some advice to solve problems - Collect data of experimental plots
5	October 5 and 23, 2007	- Monitor and support emergency problems on experimental plots - Give some advice to solve problems - Collect data of experimental plots - Explain how to pure nice seeds
6	November 7, 2007	- Monitor and support emergency problems on experimental plots - Explain how to purify rice seeds
7	December 19, 2007	- Remind how to select rice seeds

Experimental farmers did not always keep records of rice plants related to SRI. Since this record was so important for monitoring of SRI, it was necessary to train them on how to keep records.

In November 2007, rice stalks did not grow well because of localized torrential rainfall. Even if farmers want to apply SRI, they could not do so due to poor drainage conditions. From this fact, it was recognized that a drainage system, as well as an irrigation system, were important for paddy cultivation.

CII-3.5.3.6 Village General Meeting

A village general meeting was conducted at the end of the pilot project activities in the target villages. In the meeting, the progress of the pilot project activities was confirmed. Participants could share the results and experiences which the farmers had obtained.

Major Activities at Village General Meeting

No.	Date	Major Activities	Nos. of Participants
1	January 18, 2007	- Confirm the progress of the pilot project - Share the results and the experiences obtained through applying SRI and ecological chicken raising and joining saving group	9

CII-3.5.3.7 Results

As mentioned in clause CI-3.5.2.7, the indicators of the results could be summarized as follows:

- Number of farmers who applied SRI (the most important indicator)
- Number of cooperative farmers or members of farmers' group (indicator for possibility of future dissemination of the innovation)

- Participatory yield comparison between SRI and traditional farming

(1) Number of Farmers who Applied SRI

In the previous year, 16 farmers, including four experimental farmers, applied low inputs SRI in Mohaleaph village. The number of farmers applying SRI increased to 41 in the Molaleaph village. It was found that they recognized the advantages of SRI and managed to conduct their farming with SRI.

(2) Total Area of SRI Applied Paddy Plots

In the previous year, SRI was applied on a total of 1.67 hectares of 22 paddy plots. The total plot area applying SRI was 38.05 hectares.

(3) Farmer-based Yield Comparison of Traditional Farming with SRI

The project implementation team instructed the experimental farmers to divide their paddy plot into two, aiming to compare SRI and traditional farming practice. When the farmers harvested the paddy, they were requested to compare the yields of the two different methods. As a result, the yield of SRI was 4.0 ton/ha, while that of traditional farming was 3.7 ton/ha.

CII-3.5.4 Farmer-to-farmer Ecological Chicken Raising Extension Practice

CII-3.5.4.1 Study Tour

For the purpose of understanding chicken raising and other activities on site, a study tour of Andong Rorveang Village and Stok Kavas Village, Bor Re Bor and Rolear Baear District, Kampong Chhnang province was organized by CEDAC on July 9 and 10, 2007. From eleven pilot project target villages, 31 farmers joined the tour. Of these, one farmer came from Zone-3.

For two days, the participants visited two villages and learned advanced activities. The host village farmer who was successfully executing ecological chicken raising explained the technical method and his experience. For detail of the study tour, see clause CI-3.5.3.2.

CII-3.5.4.2 Village Training

Village training was given to the farmers' group of Mohaleaph village at their village. The following activities were conducted in the village training:

Major Activities about Chicken Raising in the Village Training

No.	Date	Major Activities	Nos. of Participants
1	November 11, 2007	- Explaining how to give feed and water to chicken and prepare feed	5

In the village training in 2007, farmers tried to apply ecological chicken raising based on 13 principles which had been introduced by the advanced farmer of ecological chicken raising. Farmers who attended the village training were interested in how to give feed and water to chicken. Through the training, they came to know that the method of feeding was so important to avoid sickness and death of their chicken.

CII-3.5.4.3 Result

In the Mohaleaph village, several farmers expressed their intention to apply ecological chicken raising but it was financially difficult for them to conduct it using the 13 principles because bamboo and timber cages or fences for chicken are required. It is not necessary, however, for farmers to apply all of the 13 principles. If they learn the proper method of giving feed and water to chicken, they can reduce frequencies of sickness and death of their chicken. As a result, CEDAC discussed with them some of principles which

they could easily apply.

CII-3.5.5 Farmers' Group Strengthening Practice

CII-3.5.5.1 Importance of Farmers' Group

An active farmers' group is the key to a successful farmer-to-farmer agricultural extension. It is also important to strengthen the farmers' capacity on planning and management of their farming practice and their various social activities. A summary of the benefits of an active farmer's group and rural development is shown in clause CI-3.5.4.1.

CII-3.5.5.2 Study Tour

The study tour of Andong Rorveang Vilage and Stok Kavas Village, Bor Re Bor and Rolear Baear District, Kampong Chhnang province was organized by CEDAC on July 9 and 10, 2007 for the purpose of learning SRI practice on site, the advantages of saving group, and ecological chicken raising. From eleven pilot project target villages, 31 farmers who were interested in SRI practice joined the tour. Only one farmer from Zone-3 attended the tour. The Mohaleaph experimental farmers were impressed with the advanced farmers' group activities in the host village. For details of the study tour, see clause CI-3.5.4.2.

CII-3.5.5.3 Village Training

Village training was given to farmers' group twice at Mohaleaph village in 2007. The following activities were conducted in the village training:

Major Activities about Farmers' Group in the Village Training

No.	Date	Major Activities	Nos. of Participants
1	July 31, 2007	- Share the results of the study tour - Discuss benefit of saving group	12
2	August 15, 16 and 23, 2007	- Discuss problems of saving group	5

It was found that farmers were interested in establishing farmer's group or saving group and most members of the saving group declared that they wanted to continue the activities even after finishing the pilot project.

CII-3.5.5.4 Inter-village Workshop

An inter-village workshop was held at Kampong Speu by inviting farmers who were interested in establishing a saving group. Attendees of the inter-village meeting came from the Mohaleaph village. Major activities conducted for establishing a saving group were as follows:

Major Activities on SRI in the Inter-village Workshop

No.	Date	Major Activities	Nos. of Participants
1	June 25, 2007	- Discuss problems about establishing saving group	2
2	August 14, 2007	- Share results of the study tour - Discuss a concept of saving group and why farmers are willing to establish saving group	4

CII-3.5.5.5 Results

As a result, 3 farmers' groups were organized as a saving group in Mohaleaph village consisting of 30 farmers. The total amount collected was Riel 1,826,900. The saving group is expected not only to share information related to saving money but to discuss SRI techniques. If farmers can strengthen their unity through the activities of the saving group, it can be also expected to disseminate SRI techniques. In Zone-3, there were 41 farmers who applied SRI. Most members of saving groups applied SRI. In the activities

of the saving group, they discussed SRI techniques and shared information about farming practices.

CII-3.6 Specific Findings in Zone-3 Participatory Agriculture Extension Activities

The following were the findings obtained through the participatory agricultural extension activity in Zone-3.

(1) Effective Farming Practice against Severe Weather Condition

As compared with Zone-1, water resources were extremely limited in Zone-3. Many farmers were eager to find an effective farming method even under severe weather conditions. They were confident of the merits of SRI because they could realize the farming practice of SRI through their activities. The farmers considered that SRI was one of the effective farming methods and recognized that SRI had tolerance against drought.

(2) Willingness of Applying Innovation and New Techniques of Farming Practice

Farmers acknowledged that they could not use enough water to supply their paddy fields in Zone-3 due to limited water resources. As mentioned in item (1), they found an effective agricultural method which was tolerant of severe weather conditions. Thus, they were willing to apply whatever was a useful method as innovation or new techniques of farming practice. From these findings, it could be considered that it would not be so difficult to introduce and disseminate innovations or new techniques of farming practice to them.

(3) Expectation to Saving Group

Farmers were obliged to postpone transplanting due to no timely rainfall. Also, they suffered from deep water stagnation due to localized torrential rainfall.. Under such severe natural conditions, they cultivated the paddy, being afraid of the result of harvesting. This brought about some farmers' interest in establishing a farmer's group, especially saving group because they realized that helping was necessary for their welfare.. They already organized a saving group and planned to continue the saving group activities in the future. This fact showed that they considered the saving group's contribution in giving them opportunities to help each other.

Chapter CII-4 Experimental Farming Practice Improvement Activities

CII-4.1 Programs and Program Descriptions

The programs of the pilot project in 2007/08 and their descriptions are shown below.

Program Descriptions of Programs in 2007

Verification on	Program	Objectives	Target Area
Improved medium rice farming practices/Rainfed condition 1/	Small scale adaptability test on medium variety	Simple trial on alternative farming practices (variety, planting method etc.)	Zone-3
	Verification test on medium variety	Verification/demonstration of improved farming practices	Zone-3
Farmer training & extension activities	Workshop & mass guidance, extension activities (by PDA etc.)		All zones

CII-4.2 Implementation Arrangement

The demonstrators, operators, provisions of farm inputs, and other arrangements for the implementation of the programs under the agricultural pilot project were similar to the ones employed in 2006/07 except for the land preparation cost borne by farmers in 2007/08 as explained in the following table:

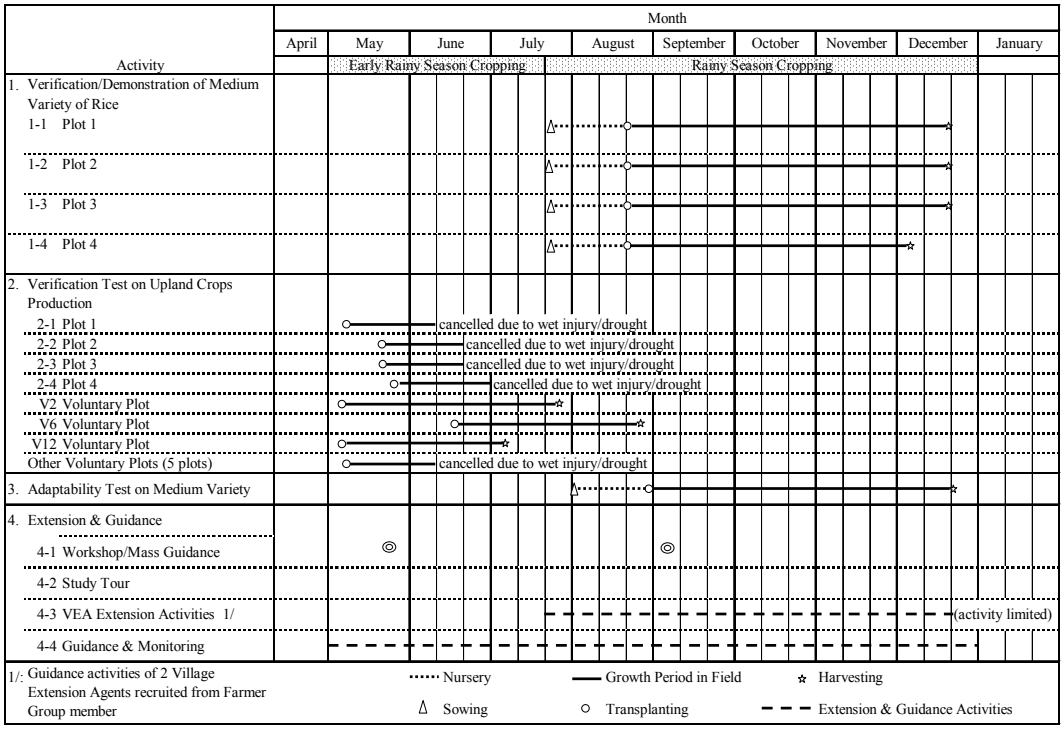
Arrangements for Programs Implementation

Program	Operator	Seed Supply 1/	Fertilizer Supply 1/	Land Prep. 1/
Verification test	Farmer	Improved variety: by project Local variety: by farmer	Compost: by farmer Fertilizer: by project	By farmer
Adaptability test	IP team	By project	By project	By project

1/: By whom costs are borne

CII-4.3 Proposed Project Activities in 2007/08

The farming pilot project practices in 2007/08 in Zone 3 were composed of: i) verification test during the early rainy and rainy season; ii) small scale adaptability test during the rainy season; iii) farmers' acceptability survey; and iv) field guidance activities. The overall features and schedules of the activities are illustrated in the following figure.



CII-4.3.1 Verification Test

The purpose of the verification test was to confirm that the target yields of the master plan were achievable by introducing improved farming practices. The proposed rice farming practices for verification in 2007/08 had been formulated based on the results and findings of the verification tests in 2006/07 and drafted as "Proposed Rice Farming Practices for Verification/Demonstration in 2007/08, PDA & the JICA study team, February, 2007". Required agricultural inputs such as fertilizer and seeds were supported by the project, whereas demonstrators were requested to adopt the improved farming practices.

The verification tests conducted in 2007/08 are illustrated in Table CII-4.1 and summarized as follows:

Verification Tests Implemented in 2007/08 in Zone-3

Season/Activities	No.	Period	Remarks
Early rainy season			
- Verification test on upland crops	4 plots	May ~ July	Mungbeans
- Voluntary plot on upland crops	8 plots	May ~ Aug.	Mungbeans & white corn (1 plot)
Rainy season rice			
- Verification test on medium variety	4 plots	July. ~ Dec.	Group nursery prepared

CII-4.3.2 Small Scale Adaptability Test

The trial activity carried out in the zone included a small scale adaptability test (simple trial) on medium variety of rice as shown in the following table.

Trial Activities Implemented in 2007/08 in Zone-3

Activities/ Trial Components	Period	Implementation by
Small scale adaptability test on medium variety - Variety trial - Planting density - Planting method - Direct sowing	Aug. ~ Dec.	Implementation team for Zone 3
- Dry seedbed (upland nursery)	Aug.	

CII-4.3.3 Farmers' Acceptability Survey

For the preliminary assessment of the adaptability of the proposed farming practices introduced in the verification plots, simple interview surveys with the demonstrators and the farmer group members were carried out.

CII-4.3.4 Field Guidance Activities

For the preliminary activities assessment of the adaptability of the proposed farming practices introduced in the verification plots, simple interview surveys with the demonstrators and the farmer group members were conducted.

(1) Field Guidance

The field guidance was conducted twice for demonstrators and farmer group members: 1st guidance during the early rainy season and 2nd during rainy season. The objectives, activities, and topics/subjects are as shown below.

Objectives, Activities and Materials Used in Field Guidance

Guidance	Objectives/Subject Farming Practices	Activities
1st Guidance (May 22)	- Monitoring on early rainy season activities (mungbeans)	- Monitoring growth of mungbeans
	- Technical guidance on: land preparation for mungbeans cultivation, vegetable Cultivation	- Selection of demonstrators for rainy season
		- Field check of target fields
		- Field visit & guidance
	- Selection of target farmers/fields for rainy season activities	- Provision of vegetable & corn seeds
2nd Guidance (Sep. 6)	- Progress reporting on rainy season activities	- Reporting on progress of rainy season activities
	- Explanation of simple trial activities	- Explanation of simple trial plots & objectives of trials
	- Guidance on newly introduced transplanting method (simple line planting)	- Providing guidance on: simple line planting, regular planting using line marker
	- Insect outbreak in Kp. Speu	
		- Reporting insect outbreak in Kp. Speu

The time schedules and number of participants of the guidance are as follows:

Schedule and Participants of Field Guidance

Guidance	Date	Participants
1st guidance	May 22	Group members 20 out of 20 (male 9 & female 11)
2nd guidance	Sep. 6	Group members 18 out of 20 (male 9 & female 9)

(2) OJT on Farming Practices

OJT on farming practices carried out consisted of OJT on mungbeans cultivation, ground nursery preparation, raised seed bed preparation, simple line plating, and fertilization. The activities of the implementation team are practical training of demonstrators on the main proposed farming practices as shown below.

Objectives and Activities of OJT on Farming Practices

Guidance	Objectives/Subject Farming Practices	Activities
OJT on mungbeans cultivation	- Providing practical guidance on: - land preparation & ridge formation - fertilization & planting	- Providing guidance to demonstrators & assisting their practices
OJT on raised seed bed preparation	- Providing practical guidance on: - seed selection with salt water - preparation of raised seed bed - seeding density for nursery & sowing	- Providing guidance to demonstrators & assisting their practices
OJT on simple planting	- Providing practical guidance on: - uprooting seedlings by shovel - simple line planting	- Providing guidance to demonstrators & assisting their practices

The time schedules of OJT are as shown in the following table.

Schedule of OJT on Farming Practices

OJT	Early Rainy Season	Rainy Season
On mungbeans cultivation	May 3 ~ June 18	-
On raised seed bed preparation	-	July 22 (group nursery)
On simple line planting	-	Aug. 20 ~ Aug. 22

(3) Field Visit by the Implementation Team and the JICA Study Team

Provisions of field guidance to demonstrators were carried out from May to December by the implementation team members during their field visits. Furthermore, the JICA study team also provided guidance during their visit to verification fields.

CII-4.3.5 Implementation Team Technical Meeting

The technical meetings of the implementation team was held nine times at PDA The objectives of the meetings include: i) to share information on the pilot project activities, ii) to provide technical guidance, iii) to exchange opinion, iv) to have technical discussion and v) to supervise the activities of the team members.

CII-4.4 Verification Test during the Early Rainy Season

CII-4.4.1 Objective

The objective of the verification test during the early rainy season was the verification of the possibility of upland crops (mungbeans) cultivation in the season. The target yield set in the master plan is as follows;

Early Rainy Season Upland Crop	Mungbeans: 0.7 ton/ha

CII-4.4.2 Verification Plots

The verification tests on upland crops (mungbeans) were carried out in four plots (see location map for Zone-3 pilot project area) during the early rainy season. In addition, trial cropping of the crop was conducted in eight voluntary plots as shown in the following table:

Verification Test Plots in Early Rainy Season in 2007/08

Activity	Plot No.	Plot Size	Variety	Demonstrator
Verification test on mungbeans	Plot 1	10.0 a	KK2	Sat Vuth (M)
	Plot 2	10.0 a	KK2	Nov Chany (F)
	Plot 3	10.0 a	KK2	Rin Chantha (M)
	Plot 4	10.0 a	KK2	Phat Sokhom (M)
Trial cropping of mungbeans (voluntary plots)	8 plots	5 a/plot	KK2	8 farmers

CII-4.4.3 Growth History and Key Farming Practices

(1) Overall Features

The progress report of the verification plots is presented in the following table:

Rice Farming Records in Verification Test Plots (Early Rainy Season)

Practice	Time	Remarks
Land preparation	May 3 ~ May 24	By draft animal
Basal dressing	May 3 ~ May 24	15-15-15 50 kg/ha
Planting	May 3 ~ May 24	20 x 50 cm; 2-3 grains/hole & broadcasting
Flowering	Early June	2 voluntary plots
Harvesting	Early/middle July & end July	2 voluntary plots

Note: Dates indicate: date in the earliest plot - date in the last plot

Four verification plots and eight voluntary plots were operated in the zone.

(2) Growth History and Key Farming Practices

The growth of mungbeans in the verification and voluntary plots suffered from excessive rainfall, inundation for short periods, and occasional water shortages during the growing periods. Most of the plots were plowed for land preparation for rice cultivation due to poor growth or dying from wet injury or moisture deficiency except for two voluntary plots. The rainfall distribution in the early to middle growing period of June 16 to July 6 was 231 mm in the project site. Flowering started at around 50 days after planting and harvesting was carried out from the beginning to the middle of July in 2 voluntary plots.

Farming practices applied in the test are similar to the ones adopted in zone 1 and at low input level as no upland crops are cultivated in paddy fields in the pilot project area. Key farming practices adopted are as follows:

Key Farming Practices

Practices	Practices Adopted
Land preparation	- 1 plowing & harrowing by draft animal
Variety	- KK2 (seeds multiplied by Kbal Koh Exp. Station, DAALI)
Seeding rate	- 35 kg/ha
Planting method	- Line planting on ridge prepared by draft animal (partly)
Planting method	- Broadcasting followed by harrowing (mostly)
Fertilization	- 15-15-15 50 kg/ha

Line planting

52 days after sowing

Harvests

CII-4.4.4 Results

The result of a crop cut survey in a voluntary plot indicated the lower yield level of 0.55 ton/ha compared with the master plan target of 0.7 ton/ha, which might be attributed mainly to wet injury due to heavy rains, inundation for short periods in the initial growth stage, and occasional water shortage during the growth period.

As the use of paddy fields under rainfed conditions in the early rainy season was essential for the improvement of land use intensity and crop diversification in the zone, the introduction of upland crops in the season should better be envisaged. For the successful introduction of upland crops in the season, improved farming practices discussed in CI-4.4.4.2 should be adopted. Further trials for technology development and dissemination of upland crops cultivation in the season should be continued by PDA and CARDI in collaboration.

CII-4.5 Verification Test in Rainy Season

CII-4.5.1 Objective

The objective of the verification test in the season was the verification and demonstration of the improved farming practices for the medium variety of rice. The target yields set in the master plan are as follows;

Rainy season rice	Medium variety: average 2.8 ton/ha 3.0 ton/ha & 2.5 ton/ha at 1/2 dependability

CII-4.5.2 Verification Plots

The verification tests on medium rice were carried out in four plots during the rainy season (see location map for Zone-3 pilot project area) as shown below:

Verification Test Plots for Rainy Season Rice in 2007/08

Activity	Plot No.	Plot Size	Variety	Demonstrator
Verification test on medium variety	Plot 1	16.9 a	Riang Chey	Nov Chany (F)
	Plot 2	21.0 a	Riang Chey	Phat Sokhom (M)
	Plot 3	9.0 a	Riang Chey	Rin Chantha (M)
	Plot 4	19.0 a	Chung Kong Mon	Men Sambat (M)

CII-4.5.3 Growth History and Key Farming Practices

(1) Overall Features

The progress report for each plot is presented in the following table:

Rice Farming Records in Verification Test Plots

Practice	Time or No. of Practices	Practice	Time or No. of Practices
Nursery (group nursery)		Fertilization	
- Seedbed preparation	July 22	- Basal dressing	Aug. 20 - Aug. 21
- Sowing	July 22	- 1st top dressing	Sep. 22 – Sep. 23
Final land preparation	Aug. 20 - Aug. 21	- 2nd top dressing	Oct. 17
Transplanting	Aug. 20 - Aug. 23	Panicle initiation	±Oct. 3 - Oct. 14
Irrigation in field	1 time at land preparation	Flowering	±Nov. 8 - Nov. 19
Weeding	2 times	Harvesting	Dec. 4 - Dec. 20

Note: Dates indicate: date in the earliest plot - date in the last plot

(2) Growth History

The Zone-3 was blessed with better rainfall distribution during the rainy season in 2007 compared with the same in 2006. The total rainfall from July 14 to October at the project village was 476 mm and 570mm, respectively in 2006 and 2007 as shown below:

Monthly Rainfall in 2006 and 2007 in Zone-3

Year	May	June	July 1/	August	September	October	November	Total 2/
2006	n.a.	n.a.	45	182	184	65	45	476
2007	71	150	36	242	112	180	n.a.	570

1/: Rainfall from July 14 to July 31 2/: Total of July 14 to October Source: JICA Study Team

Reflecting the better rainfall distribution, the growth of rice plants in the village and in the verification plots were generally better than those in 2006/07, although dates of transplanting in the plots were delayed for about ten days from the schedules due to the infestation of insects (leaf tick) in the group nursery prepared in 2007/08.

The growth performances differed among plots. It was fairly good in Plots 2, 3 and 4 and fair to poor in Plot 1. No serious problems like droughts were experienced in 2006/07, except for the infestation of neck blast and planthopper in Plots 1 and 2 after flowering, and water shortage in the later growth stage in Plots 1 and 3. Harvesting was carried out in the beginning up to the middle of December.

(a) Plot 1

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 22	Aug. 21~22	± Oct. 10	± Nov. 15	Dec. 18~19 (150~151 days)


Rice cultivation in the plot was conducted under rainfed conditions after transplanting. The plot suffered from water shortage in the later growth stage because of the distribution of soils with high permeability. Furthermore, uneven growth of rice plants was obvious between the flat and higher portions. Harvesting was carried out at around 150 days after sowing or 120 days after transplanting.

(b) Plot 2

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 22	Aug. 21~23	± Oct. 14	± Nov. 19	Dec. 18~20 (150~152 days)


The plot showed fairly uniform and favorable growth throughout a growing season, although rice cultivation was conducted under rain fed conditions after transplanting. Some unripened panicles were noticed at harvest due to the infestation of neck blasts and planthoppers after heading. The plot did not experience any serious water shortage because of the lower permeability of soils in the plot compared with Plot 1 and 3. Harvesting was at around 150 days after sowing or 120 days after transplanting.

(c) Plot 3

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 22	Aug. 20~21	± Oct. 14	± Nov. 19	Dec. 18~19 (150~151 days)


Rice cultivation in the plot was conducted under rainfed conditions after transplanting. As is the case in Plot 1, the plot suffered from water shortage in the later growth stage because of the distribution of soils with high permeability. Uneven growth of rice plants between flat and higher portions in the plot was more evident compared with that in Plot 1. Harvesting was carried out at around 150 days after sowing or 120 days after transplanting.

(d) Plot 4

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Chung Kong Mon	July 22	Aug. 20~22	± Oct. 3	± Nov. 8	Dec. 5~8 (137~140 days)


The plot showed fairly uniform growth throughout a growing season, although rice cultivation was conducted under rainfed condition after transplanting. The plot did not experience any serious water shortage. Harvesting was at around 140 days after sowing or 110 days after transplanting.

(3) Key Farming Practices

The improved farming practices adopted in the verification tests were similar to the tests in 2006/07 as presented in the following table.

Practices	Farming Practices Adopted	Current Prevailing Practices in the Zone 1/
1. Nursery		
- Seed/variety	- medium variety (demonstrators option)	- medium variety (local) - medium variety (improved)
- Seed source	- self multiplied seed - commercial seed	- self multiplied seed
- Seed selection	- selection with salt water	- not practiced
- Incubation	- 1 day	- 1 - 2 days
- Seedbed preparation	- raised semi-wet/dry bed	- flat semi-wet to wet bed
- Seeding rate	- 30 kg/ha	- 84.5 kg/ha
- Seeding density	- 40 g/m2	- denser than 60 g/m2 2/
2. Land Preparation	- 2 times 2 plows + 2 harrowing/leveling	- 2 times 2 plows + 2 harrowing/leveling 2 plows + 1 harrowing/leveling
3. Transplanting		
- Planting density	- 25 x 25 cm	- 25 x 25 cm ~ 20 x 20 cm
- No. of plants/hill	- 3 plants/hill	- 5.8 plants/hill
- Age of seedling	- ±20 days	- 45 days
- Planting method	- simple line planting	- random planting
4. Fertilization		
- Basal: compost/manure	- depending on farmers practice (2 plots applied; 2 plots not applied)	- applied
- Basal: chemical fertilizer	- applied: 15-15-15 & DAP (15-15-15 75kg & DAP 25kg)	
- 1st top dressing	- applied: urea (40kg)	- applied: urea or DAP or both
- 2nd top dressing	- applied: urea (30kg)	- seldom applied
- Total doses (kg/ha)	- Basic:170 kg/ha	- depending (avg. 111;10～334kg/ha)
5. Weeding	- 2 times/season	- 2 times/season
6. Irrigation	- depending on farmers practice (pumping irrigation only once at land preparation)	- pumping irrigation fields under rainfed conditions due to shortage of fund for pumping
7. Harvesting/post harvesting		
- Harvesting	- demonstrators current practices	- manual
- Threshing	- demonstrators current practices	- manual threshing (threshing board or table)
- Winnowing	- demonstrators current practices	- engine winnower/manual
- Drying	- sun drying	- drying in field

1/: Interview survey with Agricultural Pilot Project Farmer Group members (20 farmers) in the zone
2/: field observation

Among the practices, key farming practices of nursery preparation, transplanting and

fertilization adopted in the verification tests and pumping irrigation done by farmers options are explained below:

(a) Nursery

In the Zone-3, the preparation of a group nursery of demonstrators was introduced to save pumping irrigation water required for the nursery period and to synchronize rice cropping calendars in the verification plots. Main improved practices for nursery adopted in the test plots were similar to those adopted in the verification tests in 2006/07 in comparison with prevailing practices as shown in the following table:

Improved Farming Practices Adopted in Verification Test Plots

Practices	Practices Adopted	Current Prevailing Practices
Variety & seed source	Commercial or self-multiplied seed 1/	Self-multiplied improved seed
Seed bed	Raised semi-wet/dry seed bed	Flat semi-wet to wet seed bed
Seeding rate/density	30 kg/ha & 40 g/m2	60 kg/ha & > 60 g/m2

1/: 3 plots: improved commercial seed, 1 plot self-multiplied seed

Preparation of seedbed

Raised seed bed prepared

Group nursery (distant view)

The group nursery suffered from the serious infestation of insects (leaf ticks) at around 10 days after sowing and water shortage in the initial growth stage. To control insect infestation, spraying of chemicals (BASSAN 50 EC) was carried out 17 days after sowing. The nursery started to recover from the infestation at around 26 days after sowing. Because of the insect infestation, the dates of transplanting were postponed for about ten days from the schedules and transplanting of 31 to 32 days old seedlings was practiced in all the verification plots. The main cause of the infestation might be attributed to the complete inundation of the nursery which occurred after germination.

(b) Transplanting

To improve the efficiency of transplanting, simple line planting was adopted in all the verification plots as in the case in Zone-1 as follows;

Transplanting Method Adopted in Verification Test Plots

Practices Adopted	Current Prevailing Practices
Planting density: 25 x 25cm	Random planting
Simple line planting	
3 plants/hill & 31 ~ 32 days seedling 1/	2-5 plants/hill & 20 ~ 25 days seedling

1/: Transplanting delayed due to infestation of insects

The adoption of simple line planting was accepted by all the demonstrators because of its improved transplanting efficiency compared with planting using planting strings or line markers. Farmers soon became accustomed to the simple line planting method.

		
Land preparation	Simple line planting	8 days after planting

(c) Fertilization

Fertilizer doses were basically determined in accordance with the proposed farming practices and the application of basal dressing and two top dressings were practiced. However, based on reported volumes of manure applied by demonstrators and farmers' fertilization doses in the previous year, some modifications in fertilizer volumes were made. According to the results of the interview with the demonstrators, all of them reported increased doses of fertilization from the previous year. The fertilizer doses applied in the plots are indicated in the following table:

Fertilizer Doses in Pilot Projects and Comparison with Farmers Practices

Plot	Fertilizer Doses (kg/ha)				Elements (kg/ha)			Changes 1/
	15-15-15	DAP	Urea	Total	N	P_2O_5	K_2O	
1	75	25	70	170	48	23	11	increased
2	75	25	70	170	48	23	11	increased
3	75	25	70	170	48	23	11	increased
4	75	25	70	170	48	23	11	increased
5	75	25	70	170	48	23	11	increased

1/: Results of interview with demonstrators by asking: increased, decreased & almost same

The basal dressing of chemical fertilizers and the top dressing of urea at about 30 days after transplanting and at the panicle formation stage were carried out. Two demonstrators reported the application of manure.

The total volume of fertilizers in elements was similar to those applied in 2006/07 as shown in the following table:

Comparison of Fertilizer Amount in the Rainy Season in 2006/07 and 2007/08

Variety	Fertilizer	2006/07 1/	2007/08 2/
Medium variety	NPK (in elements)	81 kg/ha	82 kg/ha
	Manure	applied/not applied	applied/not applied

1/: 2006/07: average of five plots; manure applied in three plots & not applied in two plots
2/: 2007/08: average of four plots; manure applied in two plots & not applied in two plots

(d) Irrigation

Irrigation was practiced only once during land preparation and transplanting in all the plots. Because of favorable rainfall distribution compared with 2006, rice plants in all plots grew under rainfed conditions and under better moisture conditions than the previous year, in which two to three pumping irrigations in fields were utilized. However, Plots 1 and 3 suffered from water shortage in the later growth stage due to the distribution of more permeable soils in the plots.

CII-4.5.4 Yield and Production of Verification Plots

In the zone, blessed with favorable rainfall distribution, rice production in 2007/08 was better compared with that of the drought year of 2006/07. The results of crop cut survey and yield survey of whole plots are presented in Table CII-4.1 and are discussed by plot in the following:

(a) Plot 1

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment 1/	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	2.9 - 4.5	3.5	2.8 t/ha	446 kg	1.4 t/ha	Increased

1/: Assessment by a demonstrator; roughly estimated yield of 2005

The plot suffered from water shortage because of poor leveling of the field and the distribution of permeable soils. The yield level attained under rainfed conditions after transplanting is considered satisfactory. Proper land leveling and irrigation will be essential in order to attain a higher yield level.

(b) Plot 2

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment 1/	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	4.7 - 5.0	4.8	3.0 t/ha	638 kg	-	increased

1/: Assessment by a demonstrator; roughly estimated yield of last year

The growth of rice plants was the best among the verification plots in the zone because it was fairly uniform and matured well although the plot was infested with neck blasts and planthoppers after flowering. The yield level of the whole plot was lower than expected from the growth of rice plants during a growing period and field observation at harvesting time, which might be attributed to the increase of unripened panicles caused by the infestation of pests & diseases after flowering.

(c) Plot 3

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	3.8 - 4.7	4.2	3.1 t/ha	266 kg	-	decreased

The plot suffered from water shortage because of poor leveling of field and the distribution of permeable soils. The growth of rice plants was not uniform and these matured unevenly. The yield level attained under rainfed conditions after transplanting was considered satisfactory. Proper land leveling and irrigation will be essential in attaining higher yield level.

(d) Plot 4

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Chung Kong Mon	3.8 - 4.7	4.2	3.1 t/ha	561 kg	2.5 t/ha	increased

The growth of rice plants was fairly uniform and plants matured fairly well at harvest time. The yield level attained without irrigation after transplanting was considered satisfactory. Proper land leveling and irrigation will be essential in obtaining a higher yield level.

CII-4.5.5 Results

(1) Target Yields

Yields of four verification plots are presented in comparison with the target yield of the master plan as follows.

Yield Comparison with the Master Plan Target (ton/ha)

Category of Variety	Variety	Plot No.	Target Yield	Verification Yield	Difference
Medium variety	Riang Chey	Plot 1	2.8	2.8	-
	Riang Chey	Plot 2	2.8	3.0	+0.2
	Riang Chey	Plot 3	2.8	3.1	+0.3
	Chung Kong Mon	Plot 4	2.8	3.1	+0.3
Average			2.8	3.0	+0.2
Farmers Field 1/	Chung Kong Mon	2 plots	-	2.1	-

Target yield: Master plan target yield

1/: Crop cut survey(2x2m) results of fields showing average growth around the verification plots

As shown in the table, all the verification plots attained yield levels equal or slightly higher than the target of the master plan. The average yield increased by 0.8 ton/ha from the average yield of 2.2 ton/ha in the verification plots in 2006, which might be attributed to the better rainfall distribution in 2007 (570mm) compared with that in 2006 (476mm) as stated earlier in Sub-section CII-4.5.3.

However, the irrigation status of the pilot project site was poorer than expected in the Zone 3 water harvesting area where irrigation water supply throughout the growing period was ensured at 50% dependability. In the master plan, the yield level of the zone was estimated at 3.0 ton/ha in a fully irrigated year and 2.5 ton/ha in a supplementally irrigated year. As the irrigation water in the verification plots in 2007/08 was only supplied once at land preparation and rice plants were grown under rainfed condition after transplanting, the irrigation status of 2007/08 was worse than the supplemental irrigation. Accordingly, the yield level of 3.0 ton/ha was considered more than satisfactory under the irrigation status of 2007/08. The results of crop cut survey in farmers field around the verification plots indicated that the yield level of fields of average growth was around 2.1 ton/ha and the same in a field of good growth was 2.7 ton/ha as shown in Table CII-4.1.

CII-4.6 Small Scale Adaptability Test

CII-4.6.1 Objective

The general objective was to establish a trial field for the implementation team members to carry out trials on alternative farming practices. Another important side objective was to demonstrate alternative farming practices and responses of rice growth to the alternatives to farmers are explained below:

Objectives of Adaptability Test in Zone-3 in 2007/08

Trial	Objective
- Variety trial	- Variety adaptability test
	- Demonstration of growth differences among varieties
- Planting density	- To test effects of planting density on growth & yield
- Planting method	- To test effects of number of plants/hill on growth & yield
- Direct sowing	- To test adaptability of direct sowing under rainfed conditions
	- Demonstration of line planting for direct sowing
- Dry seedbed	- To test adaptability of dry seedbed under rainfed conditions

CII-4.6.2 Trial Design

The trial designs of the test in the zone are as shown in the following table:

Design of Adaptability Test in Zone-3 in 2007/08

Trial	Treatment
Variety trial	Six varieties: Phka Rumchak, Phka Rumduol, Sen Pidao, Riang Chey, Chung Kong Mon, Nieng Om
Planting density	Three treatments (variety: Riang Chey) - 20 x 20, 25 x 25 & 30 x 30cm
Planting method	Five treatments (variety: Riang Chey) - 1 plant/hill ~ 5 plants/hill
Direct sowing	Three varieties (Phka Rumduol, Riang Chey & Chung Kong Mon)
Dry seedbed (upland nursery)	One variety (variety: Riang Chey)

CII-4.6.3 Key Farming Practices and Growth History

The trials were carried out with high input levels (fertilizer doses) compared with the verification plots in order to obtain data on potential yields. Other key farming practices adopted in the individual trials were basically similar to those adopted in the verification plots as explained in the trial design.

Similar to the group nursery for the verification plots, the nursery for the trial field suffered from the infestation of insects (leaf ticks). Also, the date of transplanting was about one week behind schedule due to the wait for uprooting of seedlings of the group nursery prepared in the trial field. However, the growth of rice plants in all the sub-plots was generally favorable throughout the growing season. Harvesting was carried out from the middle of November up to the end of December intermittently depending on the varieties cultivated. The growth histories of the individual plots are summarized in the following table:

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	Aug. 2	Aug. 29	± Oct. 15	± Nov. 20	Dec. 21~22 (142~143 days)
Variety Trial	Aug. 2	Aug. 29	±Sep. 21~Oct. 20	±10/21~11/20	Nov. 21~Dec. 22

Note: Riang Chey: planting method & planting density trials

CII-4.6.4 Results

Despite the delay in transplanting, rice plants in all the trial plots, except for the direct sowing plot, had satisfactory growth after planting up to the flowering stage. However, the plants were infested with neck blasts and planthoppers after flowering and a number of unripened panicles were observed during harvest time. The direct sowing plot suffered from inundation after germination and water shortage in the later growth stage because it was located at the higher part of the trial field. The results of the tests are presented in Table CII-4.1 and summarized in the following table:



Results of Trial for Medium Variety in Zone-3

Trial/Variety	Treatment/ Variety	Crop Cut Yield
Variety trial	Phka Rumchak	3.4 t/ha
	Phka Rumduol	4.1 t/ha
	Sen Pidao	4.5 t/ha
	Riang Chey	4.6 t/ha
	Chung Kong Mon	4.0 t/ha
	Nieng Om	4.7 t/ha
Planting density (Riang Chey)	20 x 20 cm	3.5 t/ha
	25 x 25 cm	3.6 t/ha
	30 x 30 cm	3.2 t/ha
Planting method (Riang Chey)	1 plant/hill	3.9 t/ha
	2 plants/hill	3.2 t/ha
	3 plants/hill	3.7 t/ha
	4 plants/hill	3.7 t/ha
	5 plants/hill	3.6 t/ha
Direct sowing	Phka Rumduol	3.9 t/ha

Crop cut survey: One sample per treatment; random sampling of 1m^2 (16 hills)

(1) Variety Trial


Satisfactory growth and moderate potential yield of Nieng Om, Sen Pidao and Riang Chey was attained in the trial. Chung Kong Mon, Phka Rumchak, Phka Rumduol and Nieng Om matured earlier at around 120 days after sowing than Riang Chey which matured at around 140 days after sowing. Nieng Om is a variety provided by the Prey Pdao Experimental Station and is newly introduced in the pilot project in 2007. Further tests of the variety should better be conducted continuously to examine its adaptability. Riang Chey is a variety introduced in the verification tests in 2006 and 2007 and it became a popular variety in the zone.

The introduction of the early variety (Sen Pidao) will present chances to avoid droughts in the zone. Further trials and demonstrations will have to be carried out to promote the cultivation of the the variety in the zone.

The Chung Kong Mon (a variety common in Zone-3) indicated adaptability to the conditions in the zone. On the other hand, Phka Rumchak and Phka Rumduol suffered more from neck blasts compared with other varieties.

(2) Planting Density Trial


No clear differences among treatments were observed. However, in the 30x30 cm plot, the number of panicles per m2 was only 119 compared to that of over 150 in the 20x20cm and 25x25cm plots. Further tests on planting density of photosensitive varieties should be carried out to examine the effects of the number of seedlings per hill and the dates of sowing to the growth and yield of the rice plant.

(3) Planting Method Trial

No clear differences among treatments were observed except for a treatment of two plants/hill. The poor growth of the treatment might be attributed to other factors than the number of seedlings per hill.


(4) Direct Sowing Trial

The direct sowing sub-plot suffered from inundation after germination and drought during the growth period because the sub-plot was located in the highest portion of the test field. However, the potential yield (3.9 ton/ha) of a sample taken at a spot showing normal growth indicated the possibility of the introduction of direct sowing in the drought prone Zone-3. Further tests of direct sowing should better be conducted continuously to examine its adaptability in the zone.


(5) Dry Seedbed

The nursery trial was conducted to test the adaptability of dry seedbed or upland nursery and seedlings raised under rainfed condition in the test field. Dry seeds were sown and the seedbed was covered with dry soils after sowing without watering for nursery preparation. The growth of seedlings in the nursery was uniform and mostly satisfactory although the nursery suffered from water shortage during the nursery period. The adaptability of the dry seedbed was successfully demonstrated to farmers. Further tests required will be the preparation of nurseries in upland fields as practiced in Zone-4.


CII-4.7 Farmers' Acceptability Survey

CII-4.7.1 Objective

The farmers' acceptability survey was carried out with the objective of a preliminary assessment of the adoptability of improved farming practices introduced in the verification plots by farmers through the simple interview surveys with the demonstrators and the farmer group members.

CII-4.7.2 Methodology

The acceptability survey was carried out by employing the same methodology discussed in CI-4.7. Major inquiries made to the interviewees are as follows;

Major Inquiries for Farmers Acceptability Survey

Subject	Inquiry	Target Group
Improved farming practices	- Assessment, reasons, comments on elements improved farming practices	Demonstrators
	- Comparison of paddy production in verification plot	
Mungbeans cultivation	- Reasons for failure in mungbeans cultivation	Demonstrators
	- Intention to grow upland crops in paddy field	
Farmers' farming practices	Changes in farming practices (before/after pilot	Farmer group

	project) - Planting method & density, method of transplanting, age of seedlings, seedbed preparation, seeding rate & etc.	members

The interview survey was carried out by the implementation team members in the following schedules.

Implementation Schedules of Farmers Acceptability Survey

Activity/Subject	Schedule	Target Group
Verification test during the early rainy season - Verification test on upland crops (mungbeans)		6 members 1/
Verification test during the rainy season - Verification test on medium variety	January, 2008	3 demonstrators
Farmers' farming practices	January, 2008	16 group members

1/: 4 demonstrators & 2 voluntary plot farmers

CII-4.7.3 Results

(1) Rice Demonstrators Interview

All the demonstrators (four demonstrators) assessed as "good" or "proper rate" the improved farming practices adopted, except for variety, seeding rate, planting density and fertilization. Demonstrators' major comments on such practices assessed unfavorably were: i) not tolerant to disease (one farmer), ii) excessive seeding rate of 30 kg/ha (one farmer), iii) proper planting density of 20 x 20cm in stead of 25 x 25cm (one farmer) and iv) excessive basal dressing (one farmer). All the demonstrators assessed positively the simple line planting newly introduced in the season.

Three demonstrators reported yield increase of paddy from the previous year. Their reasons for yield increase include: *good variety, more rainfall and improved farming practices*. One demonstrator reported yield decrease because of infestation of disease & insect and water shortage.

When asked whether they will follow the proposed practices in the next season, all the demonstrators responded that they will follow seed selection, seeding density in nursery, number of seedlings/hill and simple line planting. However, rather negative responses to raised seedbed preparation and fertilization (too many & not enough) were reported.

(2) Farmer Group Members Interview

The interview was carried out to assess the extension effects of the pilot project activities to non-demonstrator group members through questioning changes in their farming practices before and after the pilot project operation. The findings of the survey indicate the excellent extension effects of the pilot project for the adoption of improved farming practices by the group members as follows;

- All the target members (16 members) reported that they reduced number of plants/hill, age of seedlings and seeding rate/ha in their farming practices in 2007/08 as follows;

Results of Farmers Acceptability Survey

Practices	Before (2005)	After (2007)
No. of plants/hill	6.1 ~ 6.5	2.4 ~ 3.1
Age of seedlings for transplanting (days)	47.5	22.2
Seeding rate/ha (kg/ha)	64.1	32.5

- The efforts to introduce line planting were reported by all the members and changes in planting methods from random planting to random line planting (line planting without using planting strings or line markers) were also reported by all. Furthermore,

the adoption of raised seedbed (simple raised seedbed with more drains and with less bed width compared with traditional flat seedbed; not the same as the bed introduced under the pilot project) was also reported by all members.

- In addition, some changes adopted in land preparation and fertilization practices after the pilot project (2007/08) were reported by almost all the members.
- Intentions of almost all members for the introduction of upland crops or vegetables cultivation in paddy fields in early rainy season appear to be high in the zone. The members also anticipated extension programs of the PDA such as training & demonstration on other crops than rice, IPM, compost preparation, fish culture and livestock programs.

The findings indicated that the farmers' intentions for improving rice productivity through the adoption of improved farming practices appear to be very high in the project area as the area is a drought prone area and the livelihood of the villagers is very hard. The same also indicated that practices such as the reduced number of seedlings/hill, planting of younger seedling and reduced seeding rate were easily accepted by farmers and will be disseminated quickly with demonstration and timely provision of guidance as evidenced in the area. To meet such farmers' expectations, the deployment of extension staff having sufficient practical skills should be envisaged and the operation of field programs such as the pilot project should be continued.

CII-4.8 Evaluation and Proposed Approaches for Improvement of Rice Farming

CII-4.8.1 Evaluation of Verification Tests

The evaluation of the overall results of the verification tests on the adaptability of the agricultural development plants of the master plan was made by zone based on target yields, cropping patterns, and net farm incomes from paddy fields set in the plan.

(1) Target Yields

The yields of seven verification plots operated in 2006/07 and 2007/08 in Zone-3 are presented in comparison with the target yields of the master plan as shown in the following table:

Yield Comparison with the Master Plan Target (ton/ha)

Variety		Target Yield	No. of Plots	Yield Range	Average Yield	Difference
Medium	Riang Chey Local Variety	3.0	7	2.5 ~ 3.2	3.0	+ 0.2

All the verification plots, except one plot which yielded 2.5 ton/ha, attained a yield level slightly higher than the target of the master plan. The average yield of the verification plots was 0.2 ton/ha higher than the target.

The irrigation status of the pilot project site was poorer than expected in the Zone-3 water harvesting area where irrigation water supply throughout a growing period was ensured at 50% dependability. In the master plan, the yield level of the zone was estimated at 3.0 ton/ha in a fully irrigated year and 2.5 ton/ha in a supplementally irrigated year. As the irrigation status of the zone was worse than the supplemental irrigation, the yield level of 3.0 ton/ha was considered more than satisfactory under the irrigation status in the zone.

(2) Cropping Pattern

The adoptability of the proposed cropping patterns for Zone-3 in the master plan consisting of a single cropping of medium variety of rice was verified through the implementation of the verification tests in 2006/07 and 2007/08. The possibility of introducing upland crops cultivation in the early rainy season was also confirmed. However, further technology development and guidance activities on the same are

essential for the extension of such farming activities in the zone.

(3) Net Farm Income from Paddy Field

The possibility to attain the net farm income from paddy fields estimated in the master plan was examined by crop budget analyses on rice production in the verification plots as shown in the following tables.

Results of Crop Budget Analysis: Net Farm Income from 1 Ha of Paddy Field

Condition	Income per Ha (1,000 riel)
Master plan estimate 1. Without project condition	1,042
2. With project condition	1,437
Verification tests results 3. Improved farming practices	1,593
Balance (3 – 1)	156

Note: Costs & prices are updated to 2007/08 level

Financial Crop Budget of Rice per Ha under Master Plan and Results of Verification Test: Zone-3 1/

Items	Unit	Unit Price (Riel l000)	Master Plan Estimates 2/ Medium Vafriety Q'ty	Master Plan Estimates 2/ Medium Vafriety Value (Riel l000)	Medium Vafriety Q'ty	Medium Vafriety Value (Riel l000)	Results of Verification Tests Medium Vafriety 3/ Q'ty	Results of Verification Tests Medium Vafriety 3/ Value (Riel l000)
1. Gross Return								
Paddy								
Unit Yield	(ton/ha)		2.10		2.80		3.00	
Unit Price	(Riel.000/t)			800		800		800
Gross Return of Paddy	(Riel.000)			1,680		2,240		2,400
By Product (straw) 4/	(Riel.000)			84		112		120
Gross Return	(Riel.000)			**1,764**		**2,352**		**2,520**
2. Production cost				**722**		**915**		**927**
2-1. Farm Inputs				285		379		377
Seed 5/	(kg)	1.60	80	64	40	64	30	48
Fertilizers				217		305		329
- Urea	(kg)	1.60	60	96	80	128	68	109
- DAP	(kg)	1.80	60	108	50	90	25	45
- KCl	(kg)	1.55		0	40	62	0	0
- 15-15-15	(kg)	1.60		0		0	78	125
- Compost 6/	(ton)	25.0	0.5	13	1.0	25	2.0	50
Agro-chemicals				4		10		0
- Agro-chemicals	(lit)	10.0	0.4	4	1.0	10		0
2-2. Labour Costs				160		168		176
Labour Requirements 7/								
- Hired Labor	(man-day)	8.0	20	160	21	168	22	176
- Family Labor	(man-day)		77		84		88	
Total	(man-day)		97		105		110	
2-3. Land Preparation								
- Draft Animal	(per ha)		1	180	1	240	1	240
2-4. Transportation	(Riel.000/t)	30	2.10	63	2.80	84	3.00	90
- By Ox Cart								
2-5. Miscereaneous Expenses (2-1 ~ 2-4 x 5%)	(L.S.)			34		44		44
3. Net Return	Riel l.000			**1,042**		**1,437**		**1,593**
	%			***59***		***61***		***63***

1/: Results of verification tests in 2006 & 2007
2/: Crop budgets estimated under the Master Plan
3/: Average yields of 7 verification test plots
4/: By products/straw: assumed to be 5% of gross return of paddy
5/: Commercial seeds for with project & verification tests
6/: Average doses applied in case of verification tests
7/: Hired Labor Requirements --- assumed to be 20% of total labor requirements

The results indicated that the anticipated farm income estimated from the results of the verification tests was slightly higher than the same estimated for the with-project condition in the plan as summarized below.

CII-4.8.2 Proposed Approaches for Improvement of Rice Farming

(1) Proposed Approaches for Improvement of Rice Farming

On the results and findings of the pilot project and the preliminary assessment of adaptability discussed in Section CII-4.7, the approaches for improving rice farming were proposed in two steps as presented in the following table.

Proposed Approaches for Improving Rice Farming

1st Step	To attain uniform growth of rice plants in an entire field: - To make a field flat before cultivation (land leveling) - To keep soil fertility in a field uniform (manure/fertilizer) - To plant uniform & healthy seedlings (strong & stout seedlings) To adopt improved practices acceptable without increase of cash input or with limited increase of cash input - Younger seedling, fewer number of seedling/hill & other practices

Practice	Improved Practices
Land leveling	Gradual land leveling works year by year during off-season
Nursery	
- Seed	Pure seed
	Full and heavy grains (seed selection with salt water)
- Seeding rate	Reduced seeding rate
- Seeding density	40 g/m2 (in seedbed)
Transplanting	
- Planting density	Early: 20 x 20 cm Medium: 25 x 25 cm
- No. plants/hill	Reduced number of plants/hill: 2 ~ 3 plants/hill
- Uprooting	To avoid damages to roots of seedlings (use shovel for uprooting)
- Transplanting	Simple line planting
	(or initially random line planting & gradually adopt simple line planting)
	Planting uniform & healthy seedlings (strong & stout seedlings)
	Shallow planting to promote tillering
Fertilization	No change in fertilizer doses
	- Improve application method
	- Proper kind
	- Proper timing
- Manure application	Spread evenly and every year
	Apply more in part where rice growth poor and top soils removed in land leveling
- Fertilizer application	
Basal Dressing	Before plowing & mixed well with soils
	In case when volume limited, apply after taking root
1st top dressing	Urea (not DAP)
	Early: at panicle formation stage
	Medium: about 30 days after transplanting
2nd top dressing	Urea (Not DAP)
	Medium: at panicle formation stage
Weeding	Timely weeding
	(when weeding delay, need more labor & result in poor weeding)
	- To use weeding rake at proper timing
Water Management	Shallow irrigation (irrigated field)

2nd Step:	To envisage increase in yield & productivity through intensification of farming To introduce practices you can afford and gradually after simple test; - through simple field testing such as done in the verification plots in 2006

Practice	Improved Practices
Fertilization	
- Manure application	Increase as basal dressing, if available
- Fertilizer application	Increase as basal dressing and/or top dressing
Weeding	Intensify weeding
Water Management	Shallow irrigation
	Flooded & drained field surface intermittently
Harvesting	Improvement of harvest & post-harvest practices
	- timely harvesting
	- threshing in paddy fields to reduce grain losses during transportation
	- proper sun drying & winnowing

(2) Technology Development Required

One of the development strategies of the master plan was the improvement of land use intensity and crop diversification in paddy fields and the introduction of upland crops (mungbeans) during the early rainy season.

For the successful introduction of upland crops in the season, improved farming practices such as: i) cultivation in elevated fields without inflow of drainage water from surrounding fields, ii) planting as early as possible after the start of the early rainy season, iii) planting on ridge prepared by draft animal, iv) proper fertilization including application of manure and v) introduction of variety tolerant to wet jury and drought; should be adopted. Further trials for technology development and dissemination of upland crops cultivation in the season should be continued through the collaboration of the PDA and CARDI.

The technology development required for rice production includes the purification of promising local varieties popular among farmers and multiplication of improved or pure seeds.