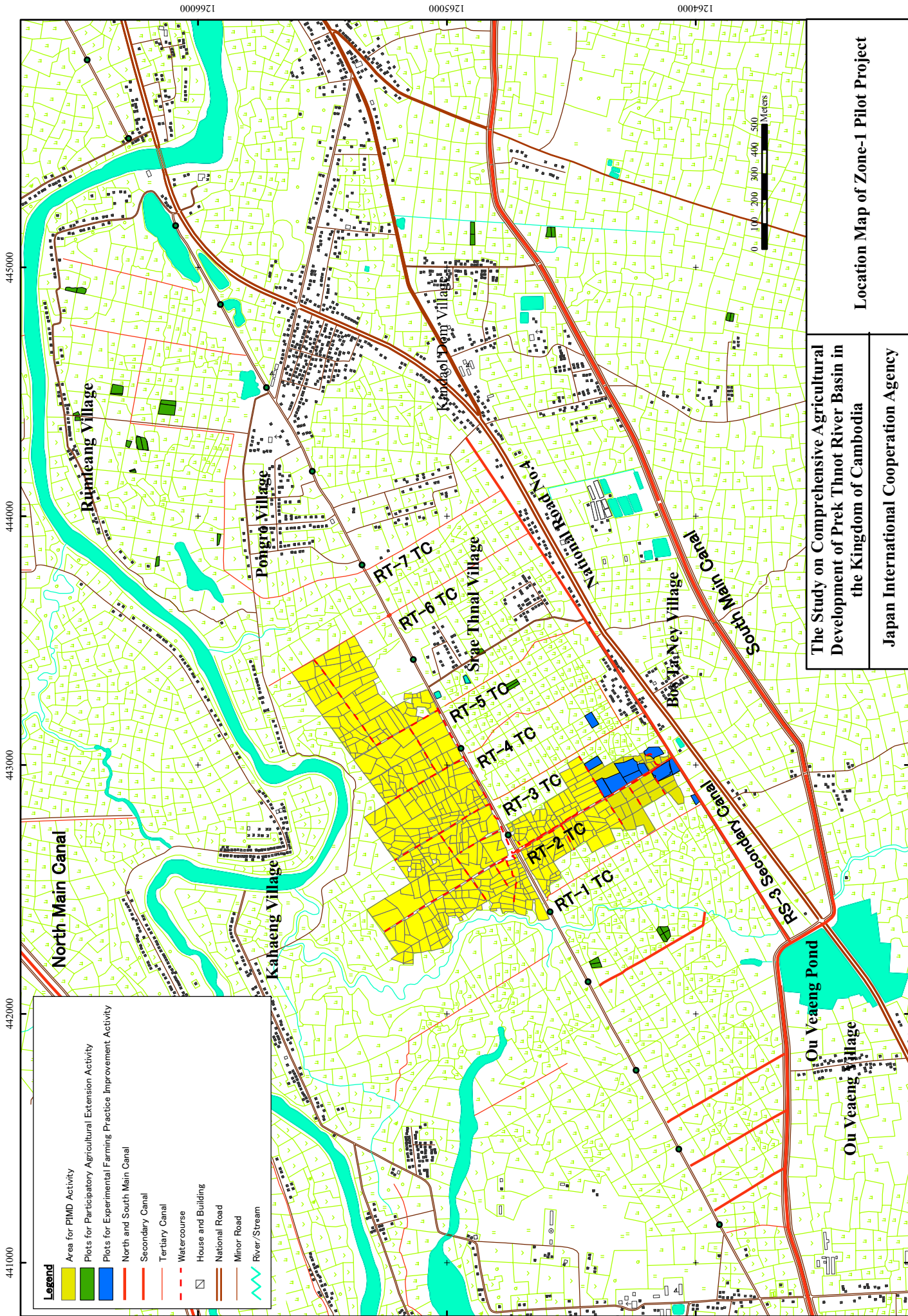


PART-C
PILOT PROJECTS (2007/2008)

Section-I
Irrigated Agriculture On-farm
Technology Improvement Pilot Project
in Zone-1



Water Management at RT-2 Canal
(Participatory Irrigation Management and Development Activities in Zone-1)



Legend

- Area for PMD Activity
- Plots for Participatory Agricultural Extension Activity
- Plots for Experimental Farming Practice Improvement Activity
- North and South Main Canal
- Secondary Canal
- Tertiary Canal
- Watercourse
- House and Building
- National Road
- Minor Road
- River/Stream

**The Study on Comprehensive Agricultural
 Development of Prek Thnot River Basin in
 the Kingdom of Cambodia**
 Japan International Cooperation Agency

Location Map of Zone-1 Pilot Project

441000 442000 443000 444000 445000

1264000 1265000 1266000



PART-C: PILOT PROJECTS (2007/2008)

Section-I

Irrigated Agriculture On-farm Technology Improvement Pilot Project in Zone-1

Chapter CI-1 Framework of the Project

CI-1.1 Objective and Types of Project Activities

These are mentioned in section BI-1.1.

CI-1.2 Project Area

The areas for the three activities mentioned above are shown in the location map. The area for Activity-1 was the same with the previous one, but the areas for Activity-2 were increased aiming at the extension of the SRI. Plots for Activity-3 were mostly changed from the previous ones, to widely verify the effect of the proposed farming practice. The selected areas/plots for the three activities are summarized below:

Administration of Selected Areas/Plots for Three Activities in Zone-1

Province	District	Commune	Village	Activity-1	Activity-2	Activity-3
Kampong Speu	Samraong Tong	Kahaeng	Bos Ta Ney	○		○
			Kahaeng	○	○	
			Ou Veang	○		
	Chbar Mon	Kandaol Dom	Srae Thnal	○	○	
			Pongro	○		
			Kandaol Dom		○	
			Rumleang		○	
		Trapeang Preah		○		

CI-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 states the pilot project activities in Zone-1 conducted from May 2007 to January 2008.

Implementation Schedule of Pilot Project in Zone-1

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																										■	

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

Based on the results of pilot project activities in Zone-1 conducted from June 2006 to February 2008, the Project Design Matrix (PDM) was modified. The modified matters are as follows:

Activities

- “1-1 To prepare cadastral maps” should be changed to “1-1 To prepare preliminary landholding map” since the cadastral map should be officially prepared by the Ministry of Land Management, Urban Planning and Construction.

- “1-3 To prevent water loss” should be changed to “1-3 To minimize water loss” since it was found that water loss could not be prevented physically due to the existing canal and structure conditions.
- “3-3 To conduct farmers’ acceptability survey for confirming the possibility of introducing the improved farming practices by seeing the results of the first year from technical and economical viewpoints” should be added since the farmers’ response to the pilot project activities should be known.

Objectively Verifiable Indicators, Project Purpose and Outputs

- “1-1 Result ofby year 2007”, “1-1 Irrigation water is....by year 2007” and “2-1 A total of 50 farmers.....by year 2007” should be changed to “1-1 Result ofby February 2008”, “1-1 Irrigation water is....by February 2008” and “2-1 A total of 50 farmers.....by February 2008” since some activities such as interview of farmers on improved farming practice were postponed until February 2008.

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-1 is established	1-1 Result of the pilot project is evaluated as being an applicable model for Zone-1 in the target area by stakeholders by February 2008	1-1 Questionnaire to the stakeholders	<ul style="list-style-type: none"> - All the proposed activities in the master plan in post-project stage were implemented as scheduled - No significant climatic change - No severe damage to the irrigation facilities by natural disaster
Outputs 1 Irrigation water is distributed based on the actual water demand by a model FWUC 2 Low input SRI is disseminated by farmer-to-farmer extension 3 Target yield of the master plan is confirmed to be achieved by applying SRI based improved farming practices	1-1 Irrigation water is distributed based on the actual water demand by a model FWUC by February 2008 2-1 A total of 50 farmers in the model villages apply low input SRI by farmer-to-farmer extension by February 2008 3-1 Yield of improved farming practices in experimental plots is higher than the target yields of the master plan	1-1 Record of water distribution 2-1 Monitoring surveys 3-1 Crop yield surveys	<ul style="list-style-type: none"> - Responsibility of each stakeholder in water management is not changed within the project period
Activities (1. Participatory Irrigation Management and Development) 1-1 To prepare preliminary landholding maps 1-2 To prepare water use maps 1-3 To minimize water loss 1-4 To establish FWUC sub-groups 1-5 To educate FWUC on proper water use 1-6 To prepare irrigation service plan 1-7 To construct on-farm irrigation facilities 1-8 To construct water courses 1-9 To improve FWUC administration 1-10 To construct FWUC meeting building 1-11 To train FWUC in water management (2. Participatory Agriculture Extension) 2-1 To organize study tours	Input Donors Experts Transportation Equipment for monitoring irrigation water distribution Cost of study tours Construction cost of model irrigation facilities	Cambodia <u>FWUC and FWUGs</u> FWUC and FWUG members <u>Provincial government</u> Counterparts from PDOWRAM and PDA <u>Central government</u> Counterparts from MOWRAM and MAFF <u>NGO</u> Facilitators	<ul style="list-style-type: none"> - Continuous involvement of related government agencies and model FWUC during the project period - No severe natural disaster within the project period <p>Precondition</p> <ul style="list-style-type: none"> - 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

<p>2-2 To conduct village training</p> <p>2-3 To carry out inter-village training</p> <p>2-4 To hold farmers' field days</p> <p>(3. Experimental Farming Practice Improvement)</p> <p>3-1 To conduct verification tests to confirm effectiveness of SRI based improved farming practices</p> <p>3-2 To conduct small scale adaptability trials for further improvement of the farming practices</p> <p>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.</p>		
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Chapter CI-2 Participatory Irrigation Management and Development Activities

CI-2.1 Objective

This is mentioned in section BI-2.1.

CI-2.2 Institutional Set-up

This is mentioned in section BI-2.2.

CI-2.3 Situation before Starting Pilot Project Activities

This is mentioned in section BI-2.3.

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

This is mentioned in section BI-2.4.

CI-2.5 Participatory Irrigation Management and Development Activities Conducted for Improvement

CI-2.5.1 General

In the previous year, the Ou Veang FWUC water management improvement was discussed among FWUC members and PDOWRAM staff under the facilitation of the JICA study team, based on the results of the study tour to the advanced FWUC and subsequent review workshop. Consequently, the following improvement plan consisting of 11 practices was elaborated as mentioned in clause BI-2.5.1.2.

Elaborated Ou Veang FWUC Water Management Improvement Plan

- 1) Preliminary land holding map preparation practice
- 2) Water use map preparation practice
- 3) Water loss identification and minimization practice
- 4) FWUC sub-group establishment practice
- 5) FWUC administration improvement practice
- 6) Proper irrigation water use education practice
- 7) Irrigation service plan preparation practice
- 8) On-farm irrigation facility construction practice
- 9) Watercourse construction/rehabilitation practice
- 10) Water management training practice
- 11) FWUC meeting building construction practice

Out of 11 practices, the practices completed in 2006/07 were 1) Preliminary land holding map preparation practice, 2) Water use map preparation practice and 8) On-farm irrigation facility construction practice. The remaining 8 practices are on-going and/or untouched, and thus are targeted for 2007/08.

CI-2.5.2 Kick-off Seminar for 2007/08

Prior to the commencement of the targeted 8 practices, a kick-off seminar was held at Wat Chommar on May 31, 2007. In the seminar, the PDOWRAM staff explained the schedule between them and 24 farmers from 5 villages. All farmers who attended fully understood and agreed to this explanation. In addition, it was decided that the cleaning of RT-2 would be carried out on June 4, 2007 under “Proper Irrigation Water Use Practice” before starting the early rainy season paddy



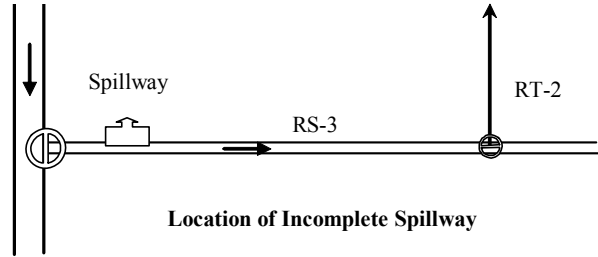
Kick-off Seminar for 2007/08

cultivation.

CI-2.5.3 Water Loss Identification and Reduction Practice

(1) Objective

The objective of the practice is to minimize ineffective water in the pilot project area by identifying water loss. In addition, it is important to make FWUC members understand the importance of their efforts for minimizing water loss.



(2) Actions Taken

In order to effectively deliver canal water to each paddy field commanded by RT-2, two constraints had been found: one was an incomplete spillway located downstream from RS-3 intake and the other was the existence of lots of illegal pipes and mouse holes in RT-2.

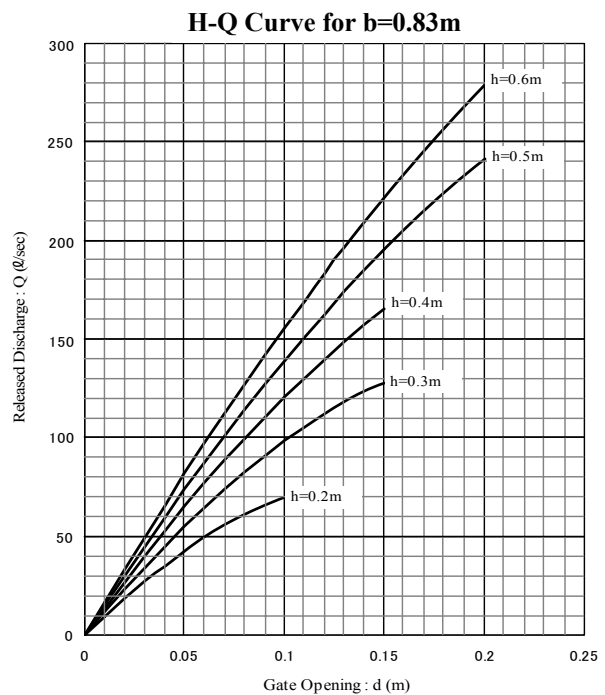
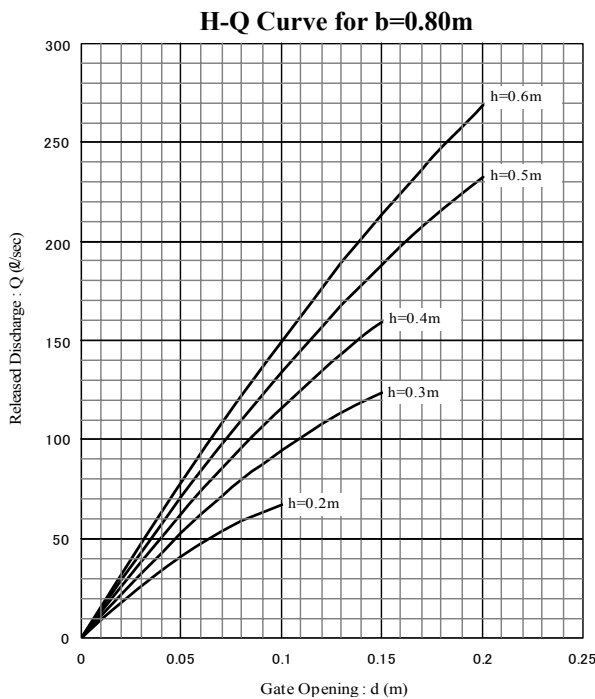
Incomplete Spillway

This constraint was settled by providing two slide gates and concrete wall for the spillway. As a result, it became possible to control the discharge to be released in consideration of the water demand of a paddy field of about 44 hectares. The discharge control was conducted using a staff gauge and a H-Q curve as shown below:



Improved Spillway

$$Q = 0.6 \times b \times d \times \sqrt{19.6 \times (h_1 - d)}$$



Illegal Pipes and Mouse Holes

There are many illegal pipes under RT-2 and also mouse holes in its embankment. Due to these, much water was lost on the way, and the planed water amount could not be delivered to downstream fields accordingly. The water loss measurement showed that about 60% of intake discharge was lost for about 640 m between RT-2 Intake and FO-1. From this result, the FWUC key staff, the WUG leaders, and PDOWRAM decided to remove the illegal pipes and to repair the mouse holes, to minimize the water loss. Such removal and repair works were carried out by farmers on October 5, 2007. The farmers who attended were only those who have their paddy fields at the downstream area since they suffered from shortage of water at any time, but upstream farmers were not interested in this matter. This situation should be improved, if not, proper water management could not be realized.



Water loss measurement at upstream of RT-2

Removal of illegal pipes

(3) Results and Observations

Incomplete Spillway

After the provision of two slide gates and concrete wall, the FWUC could control the released discharge through the spillway at least. This means that if FWUC controls the spillway gates based on the water demand properly, the water loss at the spillway could be minimized.

Illegal Pipes and Mouse Holes

After the removal of pipes and repair of mouse holes, water loss for the same distance was reduced to 16% only. From this result, it was noted that the care should be given to removed and/or repaired portions, to minimize water leakage. The simple hand compactor was used for compaction under the supervision of PDOWRAM.

FWUC should avoid the installation of illegal pipes through frequent discussions with the farmers concerned, and also repair mouse holes through daily inspections.

This practice attained a large reduction of the water loss including wasteful water, which had occurred before its execution.

CI-2.5.4 FWUC Sub-group Establishment Practice

(1) Objective

The objective of the practice is to organize active sub-groups of the FWUC based on the canal layout. The expected functions of the sub-groups are water distribution, construction and maintenance of the watercourse, and irrigation service fee collection.

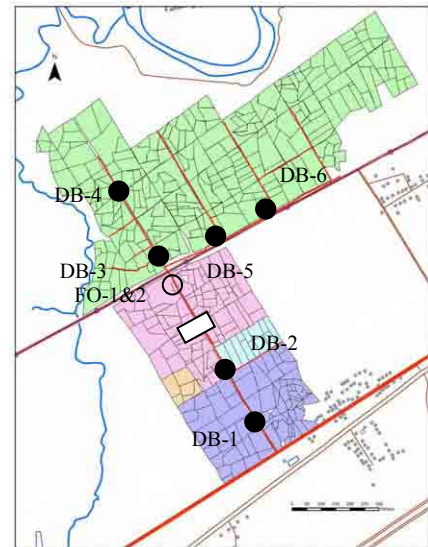


Explanation of need of WUGs

(2) Actions Taken

In the previous year, six division boxes, two field outlets, and one cross drain were constructed under the “On-farm Irrigation Facility Construction Practice”. In this regard, the formation of sub-groups based on canal layout, was conducted for the pilot project, aiming to achieve the expected functions mentioned above.

- Explanation of the need for the formation of Water Users Groups (WUG) along watercourses and Sub-Farmers Water Users Group (Sub-FWUG) along RT-2 as sub-groups of Ou Veang FWUC.
- Determination of responsibilities and qualifications of leaders of WUGs and Sub-FWUG.
- Election of leaders of WUGs and Sub-FWUG.



Location of Provided On-farm Irrigation Facilities

● Division box, ○ Field Outlet, □ Cross drain

(3) Results and Observations

Formation of WUGs

The following 7 WUGs were decided to be formed for the RT-2 Tertiary Canal based on division boxes and field outlets.

- WUG 1(Division Box 1) : 6.96 ha
- WUG 2(Division Box 2) : 5.96 ha
- WUG 3(Field Outlets 1 and 2) : 4.77 ha
- WUG 4(Division Box 3) : 8.38 ha
- WUG 5(Division Box 4) : 12.27 ha
- WUG 6(Division Box 5) : 9.30 ha
- WUG 7(Division Box 6) : 20.44 ha

Election of Leaders of WUGs

The leaders of each WUG were elected by the farmers related to their respective WUGs. Prior to the election of the WUG leaders, PDOWRAM explained to the farmers the responsibilities and qualifications of the leaders which are mentioned below:

(a) Responsibilities of the leader

- Distribute water to the watercourse
- Provide and collect water request forms
- Request farmers to maintain and repair the watercourse
- Settle water conflicts along the watercourse
- Inform farmers of any activities of FWUC executed

(b) Qualification of leaders

- To be more than or equal to 18 years old
- To be literate
- To be active
- To be healthy
- To be a respectable person

As the result of the elections, the following farmers were elected as leaders of WUG:

- WUG 1: Mr.Som Bot



Voting by Farmers to elect WUG Leader

- WUG 2: Mr.Soun Sophon/Mr.Soy Sopha*
- WUG 3: Mr.Yon Tha
- WUG 4: Mr.Im Teon
- WUG 5: Mr.Men Chin
- WUG 6: Mr.Nou Doeun
- WUG 7: Mr.Sot Vooun

*: WUG 2 covers two villages, therefore two leaders were elected from each village.

Formation of Sub-FWUG

After the formation of seven WUGs and the determination of each WUG leader, a meeting was held for the formation of the sub-FWUG and the election of the Sub-FWUG leaders among PDOWRAM, NGO(CEDAC), JICA study team, Ou Veang FWUC committee members, WUGs' leaders, village sub-group leaders, at the conference room of PDOWRAM. In the meeting, it was decided that the role of Sub-FWUG was to operate and maintain the RT-2 Tertiary Canal, to distribute water timely to each Division Box and Field Outlet on the area basis, and to settle water conflict among WUGs. It was also decided that the members of Sub-FWUG were the seven WUGs leaders.

Election of Sub-FWUG Leader

In succession, the election of leader of Sub-FWUG was carried out through voting of the Ou Veang FWUC committee members, the seven WUG leaders and the village sub-group leaders. Mr. Som Bot was elected as the leader of Sub-FWUG.

This practice thus fulfilled the establishment of FWUC sub-groups such as Sub-FWUG for RT-2 and WUGs or division boxes/field outlets.



Elected Leader of Sub-FWUG

CI-2.5.5 FWUC Administration Improvement Practice

(1) Objective

The objective of the practice is to improve the administrative capability of FWUC, such as meeting arrangements and accounting.

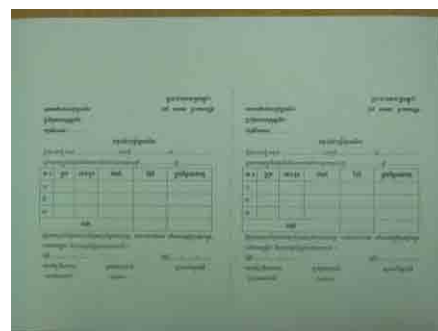
The main obstacle of FWUC was revealed to be their insufficient capacity to hold meetings among themselves. If they do not organize their own meetings, no activity can be sustainable. It was found that the FWUC committee did not keep account records. This could be one of the reasons for their low rate of irrigation service fee collection. If the FWUC committee does not keep account records, farmers do not believe them and do not want to pay irrigation service fees any more.

(2) Actions Taken

Allocation of Irrigation Service Fee (ISF) to be Collected

This practice had been started from the irrigation service fee collection (Riel 40,000/ha). At first, items and expenditures of the Ou Veang FWUC in the previous year were explained by the chief of FWUC. The expenditures reported were allocated as follows:

- 13 % for ISF collectors (village leaders)
- 12 % for FWUC committee members
- 5 % for administration works



Water Request Form

- 70 % for O&M for facilities

The major expenditure items are the committee members' and ISF collector's salaries, meeting costs, copies of documents, purchase of stationeries, fuel for motorbikes, repair of canals, purchase of keys and chains for gates, repair of gates, labor charges, purchases of concrete pipe for RT-3, and purchases of plastic bags. By making reference to the actual expenditures, and the change of ISF rate from Riel 40,000/ha to Riel 30,000/ha, it was decided that the allocation of ISF to be collected were as follows:

- Target amount to be collected:
Riel 1,728,780
- New allocation of ISF to be collected
 - 10 % for administration works
(= Riel 172,880)
 - 60 % for O&M for canals
(= Riel 1,037,260)
 - 15 % for ISF collectors (= Riel 259,320)
 - 10 % for FWUC committee members
(= Riel 172,880)
 - 5 % for transportation (= Riel 86,440)



Training WUG Leaders for Filling in Form

Training of Filling in Water Request Form

The FWUC expert (CEDAC) trained all FWUC committee members and WUG leaders in filling in the water request form based on the land holding map.

(3) Results and Observations

After training, all WUG leaders requested the member farmers to fill in the water request form and collected it. In the training, all WUG leaders eagerly tackled filling in the form, so that they could understand it in a short time.

All WUG leaders submitted the completed forms to the chief of FWUC. The collection of ISF was carried out with the following schedule:

Activities Required for Collection of Irrigation Service Fee

Activities	Scheduled Time
(a) Confirmation of paddy field area and ISF to be paid and information to farmers of same	Oct. 26 – Nov. 10, 2007
(b) Information to farmers of schedule of collection of ISF	Nov. 11 – Nov. 30, 2007
(c) Collection of ISF	Dec. 15, 2007 – Jan.15, 2008
(d) Preparation of list of farmers who paid ISF	Jan.16 and 17, 2008
(e) Holding of seminar on collection condition of ISF	Jan. 18 – Jan.25, 2008
(f) Notice to farmers on collection result of ISF	Jan. 26 – Jan.31, 2008

For collection of ISF, a further detailed schedule was discussed among FWUC, PDOWRAM and JICA study team to heighten the collection rate of ISF and eventually determined the following:

Actions to be taken	Scheduled Time
(a) Farmers should carry ISF to leader of each WUG.	Dec.15 – Dec. 22, 2007
(b) Leader of WUG should visit houses of farmers who did not pay ISF	Dec.23 – Dec. 31, 2007
(c) FWUC committee member should visit houses of	Jan.01 – Jan.08, 2008

farmers who did not yet pay ISF.	
(d) Commune chief and FWUC committee member should visit houses of farmers who did not still pay ISF.	Jan.09 – Jan.15, 2008
(e) Water for the next cultivation would not be supplied to fields of farmers who refused to pay the ISF.	-

On December 19, 2007, the PDOWRAM and the JICA study team monitored the collection of ISF, and they came to know that only six out of 152 member farmers had paid the ISF as of that date. The WUG leaders explained that such small collection of ISF were mainly due to the lack of money on hand before the harvesting of paddy.

On December 28, 2007, PDOWRAM and CEDAC monitored the condition of ISF collection in the Pongro village. The commune council also attended the monitoring meeting and reminded the attendees of the importance of the ISF collection for the sustainability of the irrigation system. The PDOWRAM and CEDAC later met the representatives of Srae Thnal village, Kahaeng village and Bos Ta Ney village to monitor the same matter. At the end of the meeting, nine farmers in Srae Thnal village and ten farmers in Bos Ta Ney village paid Riel 60,300 and Riel 76,400, respectively.

On January 8, 2008, PDOWRAM and CEDAC met and asked the village chief of Pongro to extend his cooperation for the ISF collection. They also discussed with the FWUC committee and WUG leaders the promotion of ISF payment to farmers.

On January 18, 2008, PDOWRAM, CEDAC and JICA study team had a meeting with the FWUC committee and the WUG leaders to validate the collected amount of ISF so far. The total collected amount was Riel 1,300,200 which was equivalent to about 75% of expected total.

On January 29, 2008, the PDOWRAM, CEDAC and JICA study team had a final meeting with the FWUC committee and WUG leaders on the collection of ISF. The collected amount and the number of farmers who had paid were Riel 1,495,110 and 215, respectively. These are broken down as follows:

Collected Amount and Number of Paid Farmers

WUG	Farmers			ISF Amount		
	Paid	Total	Ratio (%)	Collected	Expected	Ratio (%)
1	23	24	96	185,900	208,000	89
2	40	40	100	167,610	178,710	94
3	19	19	100	118,900	125,900	94
4 - 7	133	138	96	1,022,700	1,216,170	84
Total	215	221	97	1,495,110	1,728,780	86

A collection rate of 86 % was attained from a low of 30 % due to the participatory irrigation management and development activities. It could be said that this high rate of ISF collection was duly the fruit of the participatory irrigation management and development activities by PDOWRAM, CEDAC and JICA study team.

The reasons for the difference in the collected and expected amounts of ISF were as follows:

- Aged farmers sold his/her lands so the new owner could not be traced.
- Some farmers refused the payment of ISF which were calculated based on the measured areas without any evidence of their land areas.
- Some farmers did not pay the full amount of ISF because their lands were not fully irrigated topographically.

During the collection of the ISF, the FWUC committee and WUG leaders faced the following problems:

- Confusion by payment request by different persons

Some farmers who have their lands inside and outside of the pilot project area or in different WUG, were confused in their payment of ISF due to the request by different persons. For the following year, the ISF collection will be made on a per village basis, not on a per WUG basis.

- Different opinions on areas
Some farmers protested the measured area of their lands because of the lack of official evidence. For the following year, the FWUC committee will request cadastral officers to measure the areas officially.

CI-2.5.6 Proper Irrigation Water Use Education Practice

(1) Objective

The objective of the practice was to make the FWUC members understand the necessity and importance of proper irrigation water use.

(2) Actions Taken

In the kick-off seminar for 2007/08 held on May 31, 2007, the pilot project implementation team explained the eight practices which should be completed in 2007/08. As a result, the WUC decided that the RT-2 tertiary canal would be cleaned before the commencement of the rainy season paddy.

In order to let all FWUC members know the activities it conducted, the Ou Veang FWUC magazines were published on a bi-monthly basis during the previous year. The following slogans were carried on the magazine to heighten the FWUC members' awareness of the FWUC's activities:

- Let's use canal water effectively and evenly.
- Let's maintain the project facilities well.
- Let's avoid unauthorized water abstraction.
- Let's pay irrigation service fee for proper FWUC activities.
- Let's observe regulation of FWUC.

(3) Results and Observations

Prior to the cultivation of the rainy season paddy, the cleaning of RT-2 was carried out on May 31, 2007 by 33 farmers from four villages. Simultaneously, minor repairs were also conducted by them. The canal water thus flowed smoothly and effectively. Seeing the smooth flow in the canal made the farmers understand the need for its regular maintenance. From such activities, it was deemed that awareness would be gradually implanted in the FWUC members.

As part of the activities of the FWUC, the pilot project implementation team prepared and distributed the Ou Veang FWUC magazines to the FWUC member farmers. These magazines informed the member farmers of the kind of activities that were conducted by the FWUC committee.



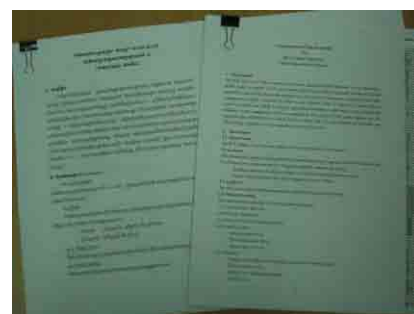
CI-2.5.7 Irrigation Service Plan Preparation Practice

(1) Objective

The objective of the practice was to determine the irrigation method and water demand through the preparation of the irrigation service plan by FWUC under full support of PDOWRAM and the JICA study team. The preparation of the irrigation service plan by the FWUC was recognized to be one of the most important activities in the “Training Manual for Participatory Irrigation Management and Development (MOWRAM, 2003)”. However, preparation of the plan was difficult for the FWUC; therefore, proper support from the government was required.

(2) Actions Taken

At first, the JICA study team prepared the draft irrigation service plan, which consisted of water delivery schedules, discharge control at turnout from RS-3 to RT-2, discharge control at division box, control of released discharge at spillway, drainage, maintenance of facilities and collection of irrigation service fee. In the water delivery schedule, irrigation water requirement was estimated using the percolation rate measured for the past year. The draft irrigation service plan was translated into the Khmer language and was reviewed by the PDOWRAM staff. The FWUC committee members and WUG Leaders agreed to the irrigation service plan after the PDOWRAM staff explained it to them.



Irrigation Service Plan (Khmer & English)

(3) Results and Observations

Based on the water delivery schedule, the gate operation at RT-2 intake was conducted for the rainy season paddy. In addition, rotational water supply was carried out as proposed in the irrigation service plan. These activities were reported in detail in the “Water Management Training Practice”. Furthermore, the RT-2 canal was cleaned again due to the overgrowth of grass in the canal.

CI-2.5.8 Watercourse Construction/Rehabilitation Practice

(1) Objective

The object of this practice was to clarify the farmers’ plots governed by each watercourse by constructing or rehabilitating the watercourses from division box and/or field outlet to the tail end field of about ten are. Watercourses are essential for proper water management by FWUC for the smooth water delivery to the tail end fields.

(2) Actions Taken

The pilot project implementation team explained to the FWUC committee and the WUG leaders the need for watercourses. They understood this explanation and agreed to its construction and/or rehabilitation. The construction and/or rehabilitation of watercourses were carried out using the following procedures:

- Routes of watercourses were determined by joint inspections of FWUC committee members, WUG leaders and pilot project implementation team.
- Leveling survey was executed for the determined routes by PDOWRAM.
- The required canal slope and canal section were determined based on survey results and the water demand.
- Construction and/or rehabilitation were made based on the required canal slope and

canal section. In particular, the required canal section was checked at site using the wooden frames prepared in advance for some types.

- After construction and/or rehabilitation of watercourses, these were checked whether water flows on it or not.
- Installation of PVC pipes on watercourses.

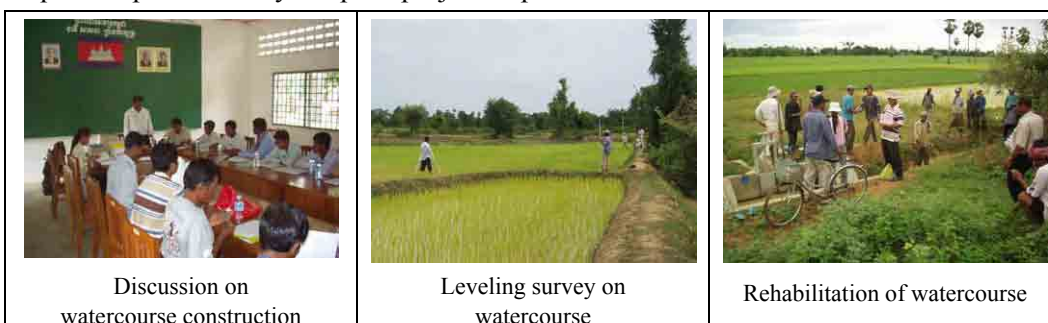
(3) Results and Observations

This practice was started from the rehabilitation of the right watercourse of DB-2 in July 2007. The completed watercourses by January 2008 are shown below:

List of Completed Watercourses

Name	Watercourse	Length (m)	Remarks		
			New (m)	Rehabilitated (m)	Completed (m)
DB-1	L-1	129	129	-	129
	R-1	100	100	-	100
DB-2	L-1	106	-	-	-
	R-1	169	-	169	169
FO-1	R-1	183	-	-	-
	R-2	27	-	27	27
FO-2	L-1	126	126	-	126
DB-3	L-1	225	-	225	225
	L-2	105	-	105	105
	R-1	184	-	-	-
	R-2	305	-	305	305
DB-4	L-1	107	-	107	107
	R-1	217	-	-	-
DB-5	L-1	344	-	344	344
	R-1	209	-	209	209
DB-6	L-1	261	-	261	261
	L-2	216	-	216	216
	R-1	507	-	507	507
Total		3,520	355	2,475	2,830

It was worthwhile noting that these construction and rehabilitation of watercourses were made by FWUC members without any incentive. It was deemed that such valuable activity was carried out under the full understanding of the FWUC members through frequent explanations by the pilot project implementation team.



After the construction of watercourses, the FWUC requested the farmers to install the PVC pipes on watercourses to easily control water from the watercourses to the fields. The criteria for the installation of PVC pipes are mentioned below, although minor adjustments of position to be installed should be made at site through discussions with farmers concerned.

- PVC pipe will be installed on watercourse in principal.
- Location of PVC pipe to be installed will be upstream side of paddy field facing to watercourse

- Command area by one pipe will be about 0.4 ha. By the end January 2008, the total length of PVC pipes installed was approximately 60m against a total length of 176m. The reason for the low rate of installation was due to the start of paddy cultivation. In order to promote the installation of PVC pipe, PDOWRAM issued an official letter to the FWUC. In reply to this letter, FWUC promised that the remaining pipes would be installed prior to the commencement of the next paddy cultivation.



Installation of PVC pipe

CI-2.5.9 Water Management Training Practice

(1) Objective

The object of this practice was to make proper water distribution by training the gate operator so as to enable him to operate the gates of the intake of RT-2 based on the water demand.

(2) Actions Taken

Prior to the training of the gate operator, the pilot project implementation team explained the need for water management. This was held on June 19, 2007. On this date, the agricultural expert joined the pilot project implementation team in explaining that proper water management would contribute to the increase of paddy production because farmers, especially upstream farmers, were not interested in water management only.



Discussion on need of water management for increase of paddy production

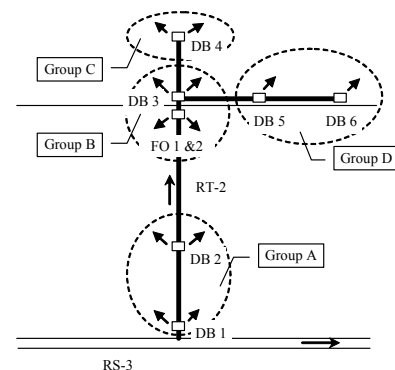
In succession, the JICA study team explained the water distribution method by showing the irrigation service plan. A rotational irrigation method was proposed so as to deliver water to the downstream area. This is explained as follows:

The rotation block for pilot project area is planned as shown on the diagram at the right.

The area of each rotation block is as follows:

Rotation Block			
Group	Structure	Area (ha)	Total Area (ha)
A	DB 1	6.96	12.92
	DB 2	5.96	
B	FO 1	2.89	13.15
	FO 2	1.88	
C	DB 3	8.38	12.27
D	DB 4	12.27	29.74
	DB 5	9.30	
	DB 6	20.44	68.07
Total			68.07

Rotation Blocks in Pilot Project



Example:

The water supply for each rotation block was calculated as follows:

- (a) Interval: 5 days
- (b) Irrigation water demand: 1.8 lit/sec/ha x 68.07 ha = 123 lit/sec at head of Tertiary Canal

(c) Water supply duration:

Group A: $5 \text{ days} \times 24 \text{ hours/day} \times 12.92/68.07 = 23 \text{ hours}$, say one day

Group B: $5 \text{ days} \times 24 \text{ hours/day} \times 13.15/68.07 = 23 \text{ hours}$, say one day

Group C: $5 \text{ days} \times 24 \text{ hours/day} \times 12.27/68.07 = 22 \text{ hours}$, say one day

Group D: $5 \text{ days} \times 24 \text{ hours/day} \times 29.74/68.07 = 52 \text{ hours}$, say two days

Example of Rotational Water Supply

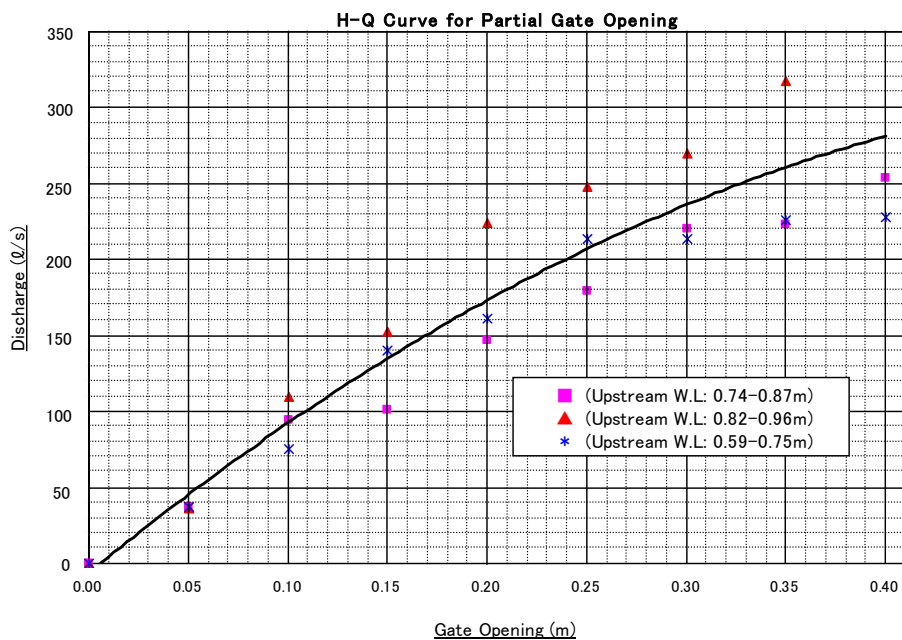
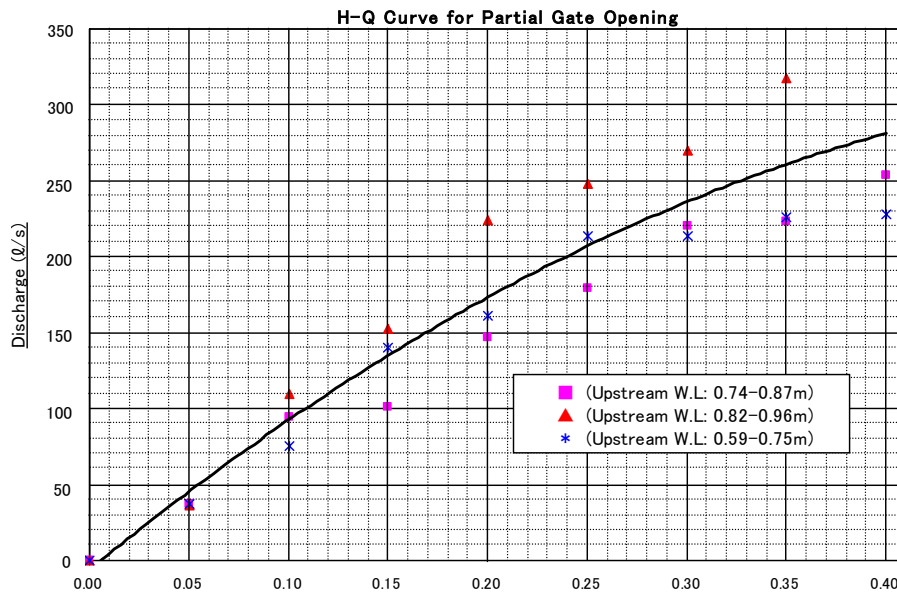
Group	Days									
	1	2	3	4	5	6	7	8	9	10
A	■	■				●	●			
B		■	■				●	●		
C			■	■				●	●	
D				■	■	■	■			●

■ : First water supply
 ● : Second water supply



Training of gate operation

In addition, discharge abstracted from RS-3 to RT-2 was calibrated using the H-Q curves which were prepared based on the results of frequent discharge observations. The Sub-FWUG leader who was in charge of gate operation was trained in the measurement method and the rotational system.



(3) Results and Observations

Mr. Som But, the leader of Sub-FWUG, was in charge of the operation of the RT-2 intake gate. He carried out gate operation for 2.5 months from October to December 2007 based on water demand which was mentioned in the Irrigation Service Plan. The gate operation records are shown on the next page.

As can be seen in this record, the actual water supply was generally larger than the water demand. This was mainly due to the large canal loss as described in CI-2.4.3 Water Loss Identification and Reduction Practice.

Record of Water Supply to RT-2

Recorded by: Mr. Som But
Year: 2007

Description	October																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed
(1) Water Demand (l/s)	50															80								100							
(2) Gate Opening (cm)	15	15	15	15	15	15	15	15	15	-	-	-	-	-	-	-	-	-	-	-	10	10	13	13	-	-	-	-	-	-	
(3) Intake Discharge (l/s)	150	150	150	150	135	150	150	150	150	-	-	-	-	-	-	-	-	-	-	-	100	130	130	-	-	-	-	-	-	-	
(4) Rotation Group	A																														
A					O					X					X					X					X					X	
B				O					O												X										
C			O					O					X							X					O						
D	O	O				O	O									X	X				X	X				X	X				

Description	November																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri
(1) Water Demand (l/s)	100															110														
(2) Gate Opening (cm)	15	-	-	-	15	15	15	-	-	15	15	15	-	-	-	-	-	-	-	-	10	10	-	-	10	15	15	15	10	-
(3) Intake Discharge (l/s)	150	-	-	-	150	150	150	-	-	150	150	150	-	-	-	-	-	-	-	100	100	-	-	90	150	150	150	150	90	-
(4) Rotation Group	A																													
A				X					X						X					X					O					O
B			X					X						X						X					X					O
C		X					O					O							X					X					O	
D	O				O	O			O	O						X	X					O	O			O	O			X

Description	December																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
(1) Water Demand (l/s)	110										65							35													
(2) Gate Opening (cm)	-	-	-	-	-	-	-	-	-	-	8	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(3) Intake Discharge (l/s)	-	-	-	-	-	-	-	-	-	-	80	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(4) Rotation Group	A																														
A				*					*					*	*																
B																															
C		X												O																	
D	X					X	+			O	*																				

Remarks

Water demand is based on the Irrigation Service Plan.

O : Supply of water

X : Skip of water supply due to rain

+ : No water in RS3

*

: Skip of water supply due to no demand

In this record, the “X” mark means that there was no water supply to RT-2 mainly because there was enough water at paddy fields due to rain. Such water release control creates water savings because water which was not released to RT-2 could be used for the downstream area along the secondary canals. If water management was not systematically carried out by FWUC based on the water supply schedule, water would surely be unnecessarily supplied to paddy fields, and abandoned to drainage streams.

In addition, rotational irrigation method was applied so as to supply water to the downstream area as scheduled, since the upstream farmers took much water from the canal so that less water flowed to the downstream area. According to interviews with the downstream farmers, they stated that the rotational irrigation method delivered more water to their fields than before.

Based on the results of the water management training practice, it could be said that its objective was attained since the gate operator undertook the gate operation of intake of RT-2 based on water demand.

CI-2.5.10 FWUC Meeting Building Construction Practice

(1) Objective

The objective of this practice was to support the administrative activities of FWUC by constructing the FWUC office.

(2) Actions Taken

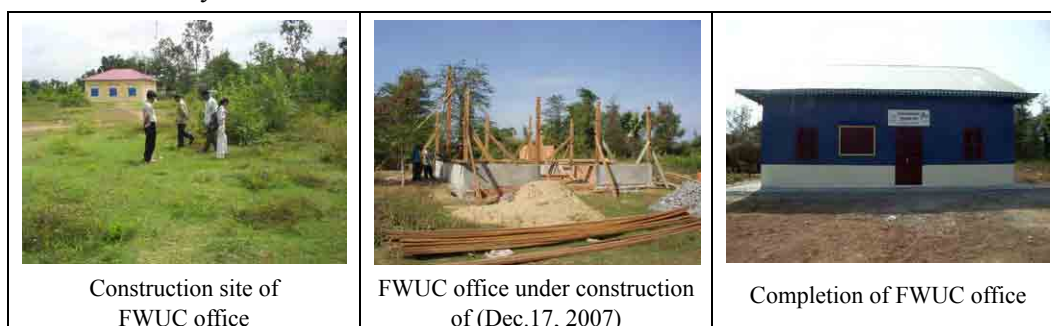
In the previous year, the meetings were often disrupted due to bad weather conditions

since the Ou Veang FWUC had no office. This brought about the planning of the construction of the Ou Veang FWUC office. The construction of the Ou Veang FWUC office was carried out using the following procedures:

- Determination of the office location through discussions among FWUC committee, PDOWRAM and JICA study team.
- Determination of office size based on the examples of the MOWRAM projects.
- Calculation and procurement of required quantities of construction materials.
- Construction of office by direct management of PDOWRAM under the direction of the JICA study team.

(3) Results and Observations

The location of the FWUC office was determined through discussions among FWUC committee, PDOWRAM and JICA study team. This was to be constructed in the government land where the Kahaeng commune office is located,. The office design was patterned after other FWUC offices which had been constructed by MOWRAM. The construction of the office was carried out by PDOWRAM under the direction of the JICA study team. The JICA study team also supplied the necessary construction materials. The construction period required 1.5 months from the beginning of December 2007 up to the middle of January 2008.



From the completion of the FWUC office construction, it was concluded that the administrative activities could be easily carried out by FWUC.

CI-2.6 Specific Findings in Zone-1 Participatory Irrigation Management and Development Activities

(1) Lack of awareness and leadership of Ou Veang FWUC Committee

Through many meetings and discussions with the Ou Veang FWUC committee members, it was found out that they lacked the awareness and leadership toward fulfilling their responsibilities although the situation had gradually improved. They did not show the spontaneous attitude for O&M of irrigation facilities and always relied on us. For example, when PDOWRAM requested them to clean the RT-2, they pestered us to provide incentives like snacks. Besides, they never came out with the work which they could do by themselves. This was mainly due to the fact that the FWUC had been only organized without any training.

(2) Need of Transparency on Account

As per the request of NGO (CEDAC), the Ou Veang FWUC committee showed the breakdown of expenditures of the fund collected as ISF. However, the breakdown was not clear and was not backed-up with any evidence such as receipts. Although the farmers accepted such inaccurate expenditure reports, it was necessary to prepare a proper balance sheet and open it to farmers. The ISF collection could not be done smoothly without this proper documentation in the past.

(3) Difficulty in Compaction Work by Farmers

The problems encountered in the RT-2 canal were leakage and illegal tapping. Because of these problems, the planned water amount could not reach the downstream areas. Such unsuitable situation was discussed among the FWUC, the PDOWRAM, and the JICA study team. Eventually, it was decided that pipes for illegal tapping should be removed and holes should be repaired by the farmers. Following this decision, the farmers carried out such activities. After that, loss measurements were made by the PDOWRAM staff. The result was about 16% of loss and this magnitude was still high. One of reasons for the high canal loss was the insufficient compaction of the repaired/removed portions. The JICA study team made a hand compactor and handed it over to the farmers. In general, farmers could make excavations easily, but they could not do the compaction work. This matter should be taken into account in planning the participatory work.

(4) Formation of Farmers' Groups on the Canal Basis

In the preceding year, canal layout based farmers' groups could not be organized because the water distribution method did not materialize. In order to materialize the water distribution, it is essential to construct the water distribution facilities in advance. Without it, concrete discussions on the formation of farmers' groups on the canal basis could not be made among the FWUC, the PDOWRAM, and the JICA study team. Six division boxes and two field outlets were planned and constructed on the RT-2 under the supervision of PDOWRAM. After the construction, farmers' groups such as WUGs and Sub-FWUGs, were easily organized. From this fact, it could be said that it was difficult to organize canal layout based farmers' groups without the existence of the water distribution structures.

(5) Need for Long Periods for the Preparation of the Irrigation Service Plan by FWUC

According to the "Training Manual for Participatory Irrigation Management and Development in Cambodia" published by MOWRAM in 2003, an irrigation service plan will be prepared by the FWUC with the help of the FWUC support team. The required contents of the plan were i) description of irrigation service objectives, standards and criteria; ii) service specifications for water delivery and drainage; iii) service specifications of maintenance; iv) obligations for cost sharing; and v) administrative obligations. The preparation of such sophisticated plan is, however, so difficult or rather impossible for the present Ou Veang FWUC even with the assistance of the FWUC support team. The Ou Veang FWUC is so weak institutionally and does not understand even their purpose and responsibilities. It might take long time for the FWUC to prepare the plan even after training them.

(6) Positive Attitude of Downstream Farmers for Construction of Watercourse and Installation of Pipes

PDOWRAM frequently requested the farmers to construct the watercourses and to install the pipes on watercourses because these were surely needed for smooth water distribution. In answer to this request, the farmers started the construction of watercourses and the installation of pipes. The most enthusiastic farmers for this work were the farmers who came from the downstream areas. It is deemed that the downstream farmers highly expect proper water management. The downstream farmers showed more aggressive attitude than upstream ones even during the cleaning of RT-2. This attitude of the downstream farmers show that they are not satisfied with the present water distribution and they keenly want to improve it.

(7) Possibility of Application of Rotational Irrigation

As for water supply, rotational irrigation system was applied along RT-2 in order to

achieve an even water distribution. Generally, rotational irrigation method is more complicated than the continuous irrigation method. However, the leader of the Sub-FWUG, who was trained by the JICA study team, conducted the gate operation based on water demand. From this fact, it was found that farmers could manage the rotational irrigation method at the tertiary canal level.

Chapter CI-3 Participatory Agricultural Extension Activities

CI-3.1 Objective

It is mentioned in section BI-3.1.

CI-3.2 Institutional Set-up

It is mentioned in section BI-3.2.

CI-3.3 Situation before Starting Pilot Project Activities

CI-3.3.1 Area for the Activities

For participatory agricultural activities in Zone-1, the pilot project covered five target villages, two communes, and two districts in Kampong Speu province. These are Rumlaeng, Trapaing Preah, Srae Thnol, and Kandaol Dom villages in Kandaol Dom commune, Chbar Mon district, and Kahaeng village in Kahaeng commune, Somrong Tong district.

CI-3.3.2 Method of Baseline Surveys

It is mentioned in sub-section BI-3.3.2.

CI-3.3.3 Agriculture

It is mentioned in sub-section BI-3.3.3.

CI-3.3.4 Irrigation and Drainage System

It is mentioned in sub-section BI-3.3.4.

CI-3.3.5 Organizations

It is mentioned in sub-section BI-3.3.5.

CI-3.4 Identified Constraints on Participatory Agricultural Extension Activity

The areas for the activities in 2007/08 are not the same with that in 2006/07, but are located closely to that in 2006/07. Therefore, the identified constraints in agriculture and farmers' group are the same with those in 2006/07.

CI-3.5 Activities Conducted for Improvement

CI-3.5.1 Preparation of Improvement Plan

This is mentioned in section BI-3.5.1.

CI-3.5.2 Farmer-to-farmer Low Inputs SRI Extension Practice

CI-3.5.2.1 Initial Guidance

Initial guidance on low inputs SRI extensions were held at six villages such as Pong Ror, Rumlaeng, Trapaing Preah, Srae Thnol, Kandaol Dom and Kahaeng villages on June 08, 11, 14, 15, 21 and 28, 2007. There were 223 farmers, including 172 women, who joined the guidance meetings (it is to be noted that in all the target villages, there were a total of 672 families, according to the baseline survey in 2007). There might be a few reasons for the poor attendance rate: (i) miscommunication between village chiefs and villagers; (ii) farmers were busy in starting the wet rice season; and (iii) farmers were busy working. The CEDAC and the farmer promoter from Kahaeng village of Kahaeng commune explained to all the villagers the 12 principles of the SRI. The farmers who were interested in the SRI were motivated to apply the principles as much as possible by considering their field situation.

Information on farmers who attended the guidance meetings in Zone-1

No	Villages	Population (families)	date of guidance	Participants		Interested farmers	Experimental farmers
				Total	Women		
1	Rumlaeng	140	June 14, 2007	31	24	12	3
2	Trapaing Preah	119	June 15, 2007	47	36	15	1
3	Srae Thnol	83	June 21, 2007	11	10	7	1
4	Kandaol Dom	122	June 28, 2007	49	33	18	2
5	Pong Ror	116	June 11, 2007	40	29	0	0
6	Kahaeng	92	June 08, 2007	45	40	32	3
Total:		672		223	172	84	10

In the initial guidance, the following points were explained to address the farmers' concern regarding the introduction of SRI.

Recommended Way of Introducing Low Inputs SRI by Farmers

- 1) Farmers should divide the plots into two parts and compare low inputs SRI and traditional farming practice by themselves
- 2) Farmers should start applying low inputs SRI on a micro-scale
- 3) Farmers should start to apply low inputs SRI without additional agricultural inputs, such as fertilizers and seeds

As a result, most of the participants were interested in SRI and 84 of them said that they wanted to apply SRI this season while ten farmers showed their interest as experimental farmers.

CI-3.5.2.2 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 NGO (CEDAC) on July 9-10, 2007 for the purpose of learning the SRI practice on site, the advantages of saving group, and ecological chicken raising. From eleven pilot project target villages including Zone-3 and -4 villages, 31 farmers who were interested in SRI joined the tour.

On the first day, host village farmers, who were successfully applying SRI, explained their process of establishing the agriculture association and present situation after arriving at the hosting villages. After their discussion, all participants were requested to ask questions on the discussion, if any. In the study tour, major Q&A raised between the host village farmers and the participants were as follows.

Major Q&A Raised between Host Village Farmers and Participants

Questions from participants of Study Tour		Answers from host village farmers	
Q1	Though many villagers were interested in SRI and saving group, they would not attend the meeting. Considering this situation, how it was better to disseminate the techniques of SRI or new information of the saving group?	A1	Our community had three promoters to stimulate our activities. Out of the three persons, one or two persons would join in a CEDAC training to obtain new information and techniques. After returning to their villages, they invited all leaders of groups to the meeting and shared the new information and techniques obtained. Each leader relayed them to the members of each group.
Q2	Did you know a good idea for destruction of insects or pests?	A2	Based on experience, it was better to apply non-chemical methods, such as spreading ash and local plants to the paddy fields and soaking your seed with local plants or in hot water mixed with salt.
Q3	What were the differences between	A3	When rice was transplanted in line, it could

transplanting in line and traditional planting?	get enough sunlight without shade and air was provided sufficiently. It could be easier for us to purify the seed.
---	--

The host village farmers discussed the comparison between applying SRI and the traditional farming practice as follows:

- SRI: Seed (30 kg/ha) and Yield (1.7 ton/ha)
- Traditional Farming Practice: Seed (152 kg/ha) and Yield (1.0 ton/ha)

Field inspections of SRI farming plots were made after the discussion and the host village farmers' replies to questions raised by the participants.

On the second day, a reflection workshop was held to confirm what the participants learned in the study tour. All participants were divided into 12 groups to form discussion groups.. Out of the 12 groups, 11 groups were formed based on their villages and one group for PDA staff. All participants discussed the following three subjects:

- Impressions of the study tour
- Knowledge you learned from the study tour
- Lessons or techniques which you want to transfer to your village people after returning to your village



Discussion of SRI practice by the host village farmer

After the discussion, representatives of each group presented the results of the discussion.

Representatives' Presentation

They appreciated the study tour. They could learn interesting and new techniques for SRI, ecological chicken raising, fish cultivation and flog raising, saving group, and multi-purpose garden. They could learn lots of matters from actual situations and activities on the process of establishing associations, preparing ecological chicken raising farms, and fish cultivation farms. Most of them wanted to initiate these when they returned to their villages.



Participants presented their opinion each other

PDA staff's Speech

He said that he gained knowledge and techniques from the study tour and would try to explain or disseminate them to farmers in Kampong Speu.

Commune Chief's Speech

The commune chief of Kampong Speu appreciated host village farmers expressing their experience to the participants. He wanted to apply the techniques and methods he obtained through the study tour.

Most farmers who came from Kampong Spue were interested in SRI, ecological chicken raising, and establishing saving groups. From their discussion, it was found that they were eager to apply the methods and techniques learned through the study tour. The study tour was a very effective training venue in learning actual situations and activities which the host village farmers had tackled. Seeing actual things could encourage all participants to execute lessons which were learned through the study tour.



CI-3.5.2.3 Village Training

Village training was given to farmers' group of Rumleang, Kaheang, Srae Thnol and Trapaing Preah village. The following activities related to SRI were conducted in the village training:

Major Activities on SRI in Village Trainings

No.	Date	Major Activities	Nos. of Participants
1	July 4, 2007	- Sharing information of the study tour - Preparing experimental plots	11
2	August 15, 16 and 23, 2007	- Discussing emergent problems and giving advice for the problems	34
3	September 1, 3, 9, 10 and 2007	- Sharing information of progress	83
4	October 1, 3, 7 and 14, 2007	- Sharing experiences related to SRI	72
5	November 1, 3, 15, 18 and 27, 2007	- Sharing experiences related to SRI practice and progress of SRI - Discussing benefits of pure rice seeds, a method of selecting pure rice seed - Explaining how to select and keep pure rice seeds	86

The farmers' group members in Rumleang, Kaheang, Srae Thnol and Trapaing Preah village were concerned with problems caused by mice and diseases. Brown hoppers and stem borers caused destruction on some of the stalks from the experimental plots. Mice caused damage to rice. CEDAC gave the following advice and solutions to these problems to farmers.

For brown hoppers:

Apply a botanical pesticide made from bamboo shoots. The botanical pesticide was made by mixing fresh water in which cut bamboo shoots were soaked with soap powder.

For stem borers:

To recommend that farmers soak rice seeds in water mixed with neem. Neem is a fast-growing tree, native to Bangladesh, India, Myanmar, and Pakistan, which grows in tropical and semi-tropical regions. In India, neem is variously known as "Heal All", "Nature's Drugstore" and "Village Pharmacy". Products made from it have proven medicinal properties, being anthelmintic, antifungal, anti diabetic, antibacterial, antiviral, anti-infertility, and sedative. The unique feature of neem products is that they do not directly kill the pests, but alter the life-processing behavior in such a manner that the insect can no longer feed, breed or undergo metamorphosis.

For mice:

Putting a leaf of banana in paddy fields was advised since mice will think it is a snake and avoid it. However, this method could not be applied repeatedly since, eventually, the mice will know it is not snake.

The Rumeleang farmers also faced problems caused by crabs in paddy fields. Since crabs cut young seedlings, farmers were afraid of transplanting young seedlings. CEDAC advised farmers to put pieces of chopped siam weed and horse dung in paddy fields. It was easy for the crabs to cut roots and stems of rice plants immediately after transplanting. After rice plants grew to a certain extent, the damage of rice plants caused by crabs could not be found in paddy fields.



Crabs damaged young seedlings.



Farmers caught crabs in their paddy field.

Farmers would eat crabs which they caught.

CI-3.5.2.4 Inter-village Workshop

An inter-village workshop related to SRI was held 4 times. Major activities conducted for SRI in the inter-village workshop were as follows:

Major Activities on SRI in Inter-village Workshops

No.	Date	Major Activities	No. of Participants
1	June 25, 2007	<ul style="list-style-type: none"> - 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 practices - Select experimental farmers who want to apply SRI practice 	8
2	August 14, 2007	<ul style="list-style-type: none"> - Review what participants had learned during training - Share information on progress of SRI experimentation - Discuss emergent problems and methods to resolve them 	11
3	October 18, 2007	<ul style="list-style-type: none"> - Share information related to SRI practice and progress - Discuss advantages of SRI practice and why farmers hesitate to apply SRI practice - Explain how to purify/select rice seeds 	17
4	December 18, 2007	<ul style="list-style-type: none"> - Conduct evaluation of pilot project <ol style="list-style-type: none"> 1) Remind last training and the principles of SRI 2) Summarize the progress of farmers' activities 3) Discuss problems and solutions 4) Reflect activities conducted by farmers 	20

In the inter-village workshop in October of 2007, the advantages of SRI over traditional cultivation and the reasons why farmers hesitate to apply SRI practices were discussed among the participants. The advantages of SRI and the reasons why the farmers would not apply SRI were as follows.

Advantages of SRI

- 1) Stalk of SRI was higher.
- 2) Stalk shape of SRI was better.
- 3) Rice color of SRI was better.
- 4) SRI was more adaptable to drought.
- 5) It took less time to sow seeds and transplant.
- 6) It was easier to maintain SRI.



Inter-village workshop

The reasons why farmers hesitate to apply SRI

- 1) Farmers were afraid of crab cutting their seedlings due to one seedling.
- 2) It was more difficult to maintain SRI.
- 3) Labor and times were needed to maintain SRI.
- 4) They have to control water and fertilization strictly.
- 5) They were afraid of lack of SRI technique and knowledge.

In the inter-village workshop, experiences and progress of SRI dissemination at three villages were presented for comparison purposes. This system motivated experimental farmers to disseminate SRI more.

CI-3.5.2.5 Supporting and Monitoring to Experimental Farmers

Supporting and monitoring activities were executed to the 10 experimental farmers of 5 villages in advising techniques related to SRI, sharing progress of SRI, solving some problems, and collecting data of rice plants. Major activities conducted in the supporting and monitoring were as follows.

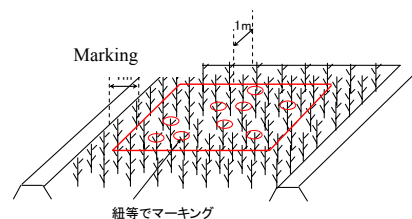
Major Activities about Supporting and Monitoring of Experimental Farmers (10 farmers)

No.	Date	Major Activities
1	June 8, 14, 15, 18, 20, 21, 22 and 27, 2007	- Measure the land area of experimental farmers
2	July 4, 6, 11, 17, 19, 20, 24, 26 and 31, 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 solutions
3	August 2, 8, 9, 15, 16, 22, 23 and 31, 2007	- Monitor and support emergent problems on experimental plots - Collect data of experimental plots
4	September 1, 3, 4, 7, 9, 10, 12, 17, 18, 19, 24, 25 and 27, 2007	- Monitor and support emergency problems on experimental plots - Collect data of experimental plots
5	October, 4, 5, 19, and 24, 2007	- Monitor and support- emergency problems on experimental plots - Collect data of experimental plots - Examine measures which experimental farmers took against problems
6	November 6, 7 and 13, 2007	- Monitor and support emergency problems on experimental plots - Collect data of experimental plots - Discuss water management at their plots
7	December 13, 2007	- Remind how to select rice seeds

In supporting and monitoring the experimental farmers in December of 2007, the method of selection of rice seeds was explained as follows.

- To prepare sphere about one meter from ridge of paddy field in order to avoid mixture of other rice seeds.

- To select good rice plants within the above mentioned sphere and put a mark with string. (Refer to right figure)
- To collect the selected rice plants and keep them as rice seeds for next cultivation.



The method of selecting rice plants

The method of keeping rice seeds also was explained to experimental farmers as follows.

- To dry rice seeds under the sun after harvesting.
- To thresh with stepping (avoid being beaten on a board). If farmers beat rice plants on a board to thresh, rice seeds are broken and would not grow well.
- To remove some dusts from rice seeds to clean them.
- To dry rice seeds under the sun again before keeping them.

CI-3.5.2.6 Village General Meeting

Village general meetings were conducted at the end of farmer's activities in target villages. In the meetings, the progress of the pilot projects was confirmed. Participants shared the results and experiences obtained.

Major Activities at Village General Meeting

No.	Date	Major Activities	Nos. of Participants
1	January 2, 11, 15, and 27, 2008	- Confirming the progress of the pilot project - Sharing the results and the experiences which farmers applying SRI had obtained	71

CI-3.5.2.7 Results

The results could basically be evaluated in a participatory manner. This means that the farmers decide for themselves whether they want to continue to apply SRI or not. Normally, farmers in the project area rely heavily on paddy farming, so they evaluate the results of their farming severely. They do not change their farming practices without rational reasons such as the increase of their financial benefits. In other words, if farmers want to continue to apply an innovation, it is because they have judged the innovation to be useful. They did not receive any physical incentives such as fertilizers, seeds, etc. but they evaluated that the innovation can improve their farm budgets. It can be considered that the results of the participatory agriculture extension could be evaluated through the change in the number of farmers who applied the innovation. Yields obtained from SRI were also an important evaluation factor but they were easily affected by weather or soil conditions, so the yields were only used as a supporting factor of the evaluation. Indicators of the result could be summarized as follows.

- Number of farmers who applied SRI (the most important indicator)
- Number of cooperative farmers or member of farmers' groups (indicator for possibility of future dissemination of information regarding the innovation)
- Participatory yield comparison between SRI and traditional farming

(1) Number of Farmers who Applied SRI

It was decided that if farmers apply more than three principles of low inputs SRI, those farmers were recognized as applying SRI. This criterion was commonly used by CEDAC. In 2007, farmers who applied SRI gradually increased based on the result of farmers' activities such as study tours, village training, and inter-village workshops. The number of farmers applying SRI eventually reached 82 as shown in the following table.

Number of Farmers and Total Area Applying SRI in Zone-1

Village	Nos. of Farmers Applying SRI	Area Applied with SRI
Srae Thnol	6	0.61 ha
Rumleang	11	1.87 ha
Trapaing Preah	15	11.47 ha
Kandaol Dom	18	7.47 ha
Kahaeng	32	10.04 ha
Total	82	31.46 ha

Number of farmers applying SRI was higher than the target one (50 farmers).

(2) Total Area of SRI Applied Paddy Plots

Area of plot applying SRI was preliminarily surveyed by handheld GPS under assistance of the JICA study team. It should be noted that accuracy of this survey was not very good since survey was conducted by handheld GPS, but it must be enough to know overview of SRI dissemination in the village. Total area of plots applying SRI reached 31.46 ha which was described in the above table. As compared with Zone-3 and-4, total area applying SRI in Zone-1 was not so large for considering the number of farmers applying SRI. It was found that farmers applied SRI carefully though they understood the advantages of SRI through the study tour, the village training, the inter-village workshop and the supporting and monitoring.





(3) Number of Cooperating Farmers (Members of Farmers' Group)

All experimental farmers who applied SRI this season were willing to continue SRI in the next season. According to them, they would expand the SRI area by reducing the traditional farming area. In fact, they had continued to apply SRI since the last season and had expanded their plots for SRI in this season based on their strong intention on SRI mentioned below.

Farmers' Intention on continuing to apply SRI

- SRI brings higher yield.
- SRI requires less input such as seeds, fertilizer, and labor.

In the previous season, only four farmers applied SRI. However, this season, the number of farmers applying SRI reached 82 as mentioned above. From this fact, it could be expected that the number of farmers applying SRI would be increased in the next season if farmer-to farmer dissemination will be carried out successfully.

Comparison of number of plant per hill		Comparison of root system	
			
Traditional practice	SRI practice	Traditional practice	SRI practice

(4) Participatory Yield Comparison between SRI and Traditional Farming

The project implementation team instructed the experimental farmers to divide their paddy plots into two and compare SRI and traditional farming practices. When the farmers harvested the paddy, they were requested to compare the yield of two different practices. It was necessary for farmers to understand that the purpose of the comparison was not to obtain accurate yield data but to recognize the effects of SRI due to

comparison of yield from the SRI plot and the traditional farming plot. To make them confident with SRI, crop cutting and comparisons were carried out by the farmers themselves. They were willing to confirm yield of SRI because they already knew that yield of SRI was higher than that of traditional farming last year. It should be noted that these data should not be compared with other plots, since farmer-based crop cutting might contain some errors. However, it was important that they concluded that the yield of SRI was always higher than that of traditional farming by conducting crop cutting themselves. As a result, the yields of SRI were higher than those of traditional farming as shown in the following table. The experimental farmers could confirm the advantages of SRI again.



The experimental farmer conducted crop cutting.

Farmer-based Yield Comparison of Traditional Farming with SRI in Zone-1

Village	Number of farmers	Yield (ton/ha)		Balance
		SRI	Traditional	
Rumleang	3	4.8	4.1	+0.7
Kandoul Dom	2	3.4	2.7	+0.7
Trapaing Preah	1	3.3	1.8	+1.5
Srae Thnal	1	3.7	3.3	+0.4
Kahaeng	3	5.2	4.3	+0.9
Average		4.1	3.2	+0.8

CI-3.5.3 Farmer-to-farmer Ecological Chicken Raising Extension Practice

CI-3.5.3.1 Trigger of Starting the Activities

After harvesting the rainy season paddy, there were no intensive activities relating to SRI except the training on compost preparation. However, it was very important for the farmers' groups to continue some activities, otherwise their commitment to the activities would become weak. After discussion between farmers and facilitator in the previous year, it was concluded that ecological chicken raising was more attractive for farmers. Cultivation of beans and vegetables were not accepted by the farmers due to the following reasons:

- There was not enough rain
- Farmers were busy in other businesses such as i) preparation of Khmer noodles; ii) work on construction sites; iii) work in factories; and iv) finding bees in the forest in the dry season.

CI-3.5.3.2 Study Tour

For the purpose of understanding chicken raising and other activities on site, a study tour of Andong Rorveang Vilage and Stok Kavas Village, Bor Re Bor and Rolear Baear District, Kampong Chhnang province was organized by the NGO on July 9 and 10, 2007. From eleven pilot project target villages, 31 farmers joined the tour.

For two days, the participants visited two villages and learned advanced activities. The host village farmer who was successfully executing ecological chicken raising discussed the technical methods and his experiences. After their discussion, all participants were requested to ask questions on the discussion. In the study



Ecological Chicken Farm (feeding)

tour, Q&A raised between the host village farmer and the participants were as follows:

Questions from participants of Study Tour		Answers from host village farmers	
Q1	He applied ecological chicken raising but his chicken was dead. He requested for a solution to this problem.	A1	<p>It was better to prepare medicine as follows.</p> <p><u>Dry season:</u> The medicine is amixture of local plants such as neem, boraphed, lemon grass, or the skin of local plants and water. This was effective in preventing chicken's sickness.</p> <p><u>Rainy season:</u> The medicine is a mixture of local plants such as pepper, onion or ginger and water. This was effective in preventing chicken's sickness.re The above mentioned medicines were to be changed every two or three days.</p>

The host village farmers explained the process of establishing the association and advised all participants on how to apply ecological chicken raising, plus some techniques and ideas related to it. The advice for ecological chicken raising were as follows.

Advice for ecological chicken raising
<ol style="list-style-type: none"> 1) Discuss applying ecological chicken raising with your families because it takes money to start it. 2) Construct an ecological chicken farm at high lands, near water sources, and at your house to make it easier to take care of chicken. 3) Build a fence to protect chicken and small cages where chicken may sleep and lay their eggs. 4) Prepare big pots for food and water respectively for proper feeding of the chicken. 5) Prepare a medicine using lemon grass, chili, pepper and sugar to control chickens' temperature according to season. 6) Change drinking water for chicken every two or three days. It will smell bad after more than three days and it might bring harm to the chicken.. 7) Check chicken farm everyday and clean it two or three times a week. 8) Prepare firstly ten to twelve female chickens and two or three male chickens. A chicken farm fence with a size of 30m x 29m had to be designed. 9) Prepare compost to breed worms which could be fed to the chicken. 10) Prepare mixing bran with water to prevent chocking as feed for small chicken and to prepare feed mixing bran and water grass for big chicken. 11) Prepare feed of chicken in the morning and in the afternoon.

CI-3.5.3.3 Village Training

Village training was given to farmers' group of Rumleang, Kandaol Dom, Trapaing Preah and Srae Thnal village in 2007/08. The following activities were conducted in the village training:

Major Activities about Chicken Raising in the Village Training

No.	Date	Major Activities	No. of Participants
1	August 15, 16 and 23, 2007	- Analyze traditional chicken raising and bad habits which should be improved	34
2	September 1, 3, 9, 23 and 25, 2007	- Share emergent problems with ecological chicken raising - Explain methods of selection of chicken parents, preparation of cages and yards, feeding, and so on	83
3	October 1, 3 and 8, 2007	- Explain methods of selection of chicken parents, preparation of cages and yards, feeding, and so on	72
4	November 1, 3, 12, 15, 18 and 27, 2007	- Share information on progress of ecological chicken raising	86

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 because they knew that the method of feeding was very important to avoid sickness and death of their chicken.

13 Principles of Ecological Chicken Raising	
1)	Select good breeds with non-disease carrier and avoid inbreeding
2)	Keep chickens in suitable yard with fence
3)	Keep favorable micro-climate condition in the yard by growing bush/fodder trees
4)	Build suitable houses for chickens
5)	Provide clean water to chickens regularly
6)	Provide good quality feed 2-3 times per day
7)	Make chicken compost to keep insect/larva for feeding chickens
8)	Apply traditional medicine by soaking them in drinking water or mixing them with feed
9)	Prevent mites and bugs from chicken nests by putting neem leaf, lemon grass, or custard apple leaves under the nest.
10)	Control eggs during hen sitting by rotating them to maintain appropriate temperature
11)	Brood chicks with hen after hatching for 15 days at least.
12)	De-worm chickens monthly by using betel nut or ipil seed
13)	Clean chicken yard, house and tools everyday

CI-3.5.3.4 Inter-village Workshop

An inter-village workshop was held at CEDAC Kampong Speu office by inviting farmers who were interested in ecological chicken raising. Participants of the inter-village meeting came from 5 target villages such as Rumleang, Srae Thnol, Trapaing Preah, Kahaeng, and Kandaol Dom. Major activities conducted about ecological chicken raising in the inter-village workshop were as follows:

Major Activities about ecological chicken raising in the Inter-village Workshop

No.	Date	Major Activities	No. of Participants
1	December 18, 2007	- Conduct evaluation of pilot project 1) Remind last training and the principles of ecological chicken raising 2) Summarize the progress of farmers' activities 3) Discuss problems and solutions 4) Reflect activities conducted by farmers	20

In the inter-village workshop in October 2007, the importance of feeding chicken was discussed. CEDAC compared the manner of feeding chicken with the manner of raising a child. Participants learned that disease and death of chicken were caused by the inappropriate method of feeding. Participants articulated that they had to cure their chicken based on the method of feeding which they learned in the inter-village workshop. As a result of the inter-village workshop, two experimental farmers built chicken yards and cages with bamboo. Four farmers tried the method of giving feed to chicken. They gave unhusked rice which was soaked in water to chicken as feed instead of giving unhusked rice which was dried according to the appropriate method of feeding.

CI-3.5.3.5 Village General Meeting

A village general meeting was conducted at the end of the farmer's activities in target villages. For details of the village general meeting, see clause CI-3.5.2.6.

CI-3.5.3.6 Results

At first, there were three farmers who built cages, yards, and houses for ecological chicken raising. As a result, 11 farmers started to improve traditional chicken raising through applying the ecological chicken raising innovation as shown in the table on the right.

Furthermore, there were 15 farmers who were interested in applying ecological chicken raising. CEDAC encouraged them to start it through follow-up training.

Village	No. of farmer applying the ecological chicken raising
Rumleang	2
Srae Thnol	1
Trapaing Preah	3
Kahaeng	3
Kandoul Dom	2
Total Zone-1	11

CI-3.5.4 Farmers' Group Strengthening Practice

CI-3.5.4.1 Importance of Farmers' Group

An active farmers' group is the key to successful farmer-to-farmer agricultural extension. It is also important to strengthen the farmers' capacity on planning and management of their farming practices and also for various social activities. Benefits of an active farmers' group in agriculture and rural development could be summarized as follows.

- Farmers who want to apply innovations could share the knowledge from advanced farmers in the farmers' group.
- By enhancing farmer-to-farmer extension in the group, the government can reduce the cost of extension.
- Existence of a farmers' group motivates farmers to think and improve their situations by themselves. Farmers who can think, decide, and improve by themselves would further improve SRI practices by themselves. This means that farmers' groups have a strong relationship with the empowerment of farmers.
- Farmers' group activities may potentially be expanded in the future and further benefit group members. For example, the group might start group procurement and group shipping activities in the future.

CI-3.5.4.2 Study Tour

On July 9 and 10, 2007, the study tours were conducted at Andong Rorveang Village and Stok Kavas Village, Bor Re Bor and Rolear Baear District, Kampong Chhnang province. During the two study tours, the host village farmers explained their process of establishing the agriculture associations and their present situations. In the study tour, Q&A raised between the host village farmers and the participants were as follows:

Questions from participants of Study Tour		Answers from host village farmer	
Q1	His village also had saving group and informed the members to attend a meeting, but they never did. What was the best thing to do in solving this problem?	A1	There were three ideas. The 1st one was to prepare the regulations/rules for absentees at the meetings. The 2nd one was to persuade them to attend the meeting demonstrating new techniques or information of SRI, etc. The third one was to proceed to the meeting even if attendees were not enough. Attendees should inform the absentees of the discussion matters in the meeting.
Q2	Did you have any rules for members who wanted to leave from a saving group?	A2	In case members requested to leave from the saving group for the reason that they had to move to another village, their money could be returned to them with interest. They couldn't get interest, however, if they had a problem related to money in saving group.

In the host village, various activities were conducted by the groups consisting of the following numbers of families:

- SRI: 45 families
- Preparing Dry Compost: 3 families
- Preparing Wet Compost: 3 families
- Preparing Natural Fertilizer: 50 families
- Ecological Chicken Raising: 12 families
- Frog Raising: 7 families
- Fish Raising: 7 families
- Multi purpose Garden: 35 families

CI-3.5.4.3 Village Training

Village training was given to farmers' group at their village basically once in a month. 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	<ul style="list-style-type: none"> - Discuss concept of establishing a saving group based on the following four questions: <ul style="list-style-type: none"> i) What is the purpose of establishing a saving group? ii) Why do we need to form a saving group? iii) What is a benefit of establishing a saving group? iv) How do we save money? - Establish a saving group - Discuss criteria of a saving group - Elect a leader, a secretary, an accountant, and a treasurer of the saving group 	11
2	August 15, 16 and 23, 2007	<ul style="list-style-type: none"> - Discuss the concept of establishing a saving group based on the following four questions: <ul style="list-style-type: none"> i) What is the purpose of establishing a saving group? ii) Why do we need to form a saving group? iii) What is a benefit of establishing a saving group? iv) What is analysis of cash flow? v) What is the difference between a bank and a saving group? vi) What is the analysis of poverty cycle? - Prepare regulations of a saving groups 	34

3	September 1, 3, 9, 23 and 25, 2007	- Review and revise regulations of a saving group which were made by farmers - Share regulations of saving groups with each other - Save money	83
4	October 1, 3, 7 and 14, 2007	- Review regulations of saving groups which were made by farmers - Evaluate regulations of saving groups by participants individually and revising them - Save money	72
5	November 1, 3, 15, 18 and 27, 2007	- Share information of saving groups' activities - Save money	86

The number of participants of village training related to the saving group gradually increased as the training went on. The majority of participants of the training were women who were eager to learn how to save their money and practice it.

CI-3.5.4.4 Inter-village Workshop

An inter-village workshop was held at CEDAC Kampong Speu office by inviting farmers who were interested in establishing a saving group. Participants of the inter-village meeting came from 3 target villages such as Rumleang, Trapaing Preah, Kahaeng, and Kandaol Dom. Major activities conducted about establishing a saving group in the inter-village workshop were as follows:

Major Activities about SRI in the Inter-village Workshop

No.	Date	Major Activities	No. of Participants
1	August 14, 2007	- Discussing a concept of saving group and why farmers are willing to establish a saving group	11

In the inter-village workshop in August of 2007, farmers were asked to analyze the concept of a saving group through brain-storming. Farmers discussed the following 11 key questions:

- 1) What is a saving group?
- 2) Why do they need to establish a saving group?
- 3) What are the benefits of a saving group?
- 4) What is the difference between a bank and a saving group?
- 5) How do they establish a saving group?
- 6) How do they prepare the structure of a saving group?
- 7) What are the criteria of farmers who can join as saving group members?
- 8) What is the main role of a saving group member?
- 9) How do they set up regulations of a saving group?
- 10) What is cash flow?
- 11) What is poverty cycle?

Farmers could recognize the meaning of saving group through the discussion mentioned above, and learn the significance or purpose in conduct activities of the saving group. Farmers who attended the inter-village workshop found that an activity of the saving group was effective in improve their livelihood and useful in avoiding cash flow out.

CI-3.5.4.5 Village General Meeting

A village general meeting was conducted at the end of the farmers' activities in the target villages. For details of the study tour, see clause CI-3.5.2.6.

CI-3.5.4.6 Results

- (1) Formation of Farmers' Group

As a result, 16 farmers' groups were organized as saving group at 5 target villages in Zone-1. The number of participants and their enthusiasm for the village training indicated the farmers' concern with saving money. In activities of saving group, they are expected not only to share information related to saving money but also to discuss SRI. If farmers can strengthen their unity through the activities of the saving group, it can be expected to disseminate SRI techniques. In Zone-1, the number of farmers who applied SRI totaled 82. Considering the increase of the number of farmers applying SRI and the saving group, it was considered that the activities of the saving group contributed to the dissemination of SRI techniques.

Number of Saving Group and Saving Amount in Zone-1

Village	Saving group			
	No. of Group	No. of Member	No. of Female	Saving Amount (Riel)
Rumleang	3	99	31	1,319,500
Srae Thnol	1	23	18	555,500
Trapaing Preah	4	45	25	2,134,600
Kahaeng	7	112	77	15,532,700
Kandaol Dom	1	25	20	423,100
Total Zone-1	16	304	171	19,965,400

(2) Formation of Saving Sub-group

Rumleang farmers had organized a saving group last year and the members elected four leaders. In training for the activities of the saving group, the farmers had organized a saving group and prepared rules of the saving group as follows.

- Borrower has to return the money within five months.
- Property of borrower would be confiscated if they do not return the money
- If there is a valid reason, the group would decide to wait more than five months for repayment.

Farmers who joined the activities of the saving group increased and prepared rules to operate their activity of saving money based on experiences that they had obtained in the previous year. They already reviewed their rules of saving money a few times among themselves. It could be expected that they continued their activities based on their rules.

CI-3.6 Baseline Survey

On 20 and 26 of July 2007, a baseline survey was conducted to collect data related to agricultural production as follows.

- Rice production
- Chicken production
- Vegetable production
- Usage of natural fertilizer

In the baseline survey, it was found out that farmers used 150 kg of chemical fertilizers per year. After conducting farmers' activities such the village training and the inter-village workshop related to SRI, farmers applied natural fertilizers according to the principles of SRI and used only 75 kg of chemical fertilizer per year.



CEDAC explained how to conduct baseline survey with questionnaire.

CI-3.7 Specific Findings in Zone-1 Participatory Agriculture Extension

The following were the findings specially found in the participatory agricultural extension activity in Zone-1.

- (1) High Impact on SRI Dissemination by Explanation of Experienced Farmers

In Zone-1, many farmers already came to know the advantages of SRI well by seeing or hearing SRI practice from the facilitator. However, they would not always apply SRI immediately. The discussion of the facilitator was not enough to give them intensive impression on SRI practice. They are generally so conservative in introducing new farming practices. They need practical information based on experience. In this sense, the discussion of experienced farmers brought about a high impact to the farmers who hesitated to apply SRI.

(2) Identification of Difficult Principles on Applying SRI

In the farmers' activities, they found it difficult to apply the following principles out of the 12 SRI principles.

- 1) Transplant seedlings in shallow depth and keep the roots horizontally (Water Management)
- 2) Transplant seedlings in line (Transplanting)
- 3) Weeding at least 2-4 times in one season (Weeding)

For the principle of water management, it was not easy for them to improve it because water management was dependent on the availability of irrigation and drainage systems and topographic conditions (high land or low land). On the other hand, transplanting seedlings in line and weeding require more labor force than traditional ones. From this fact, farmers hesitated to apply these three principles.

(3) Effectiveness of Practical Trial for Dissemination of SRI Techniques

Even if farmers already knew the effectiveness of weeding and prepared weeding tools, they could not conduct weeding properly because they do not have much time to conduct weeding due to their other farming practice or business. They also did not know how to use a weeding tool. Through practice, they came to know how to use it effectively. It was found that practical trial was so useful in disseminating new farming techniques.

(4) Identification of Principles Accessible to Farmers

Although farmers were interested in ecological chicken raising, it was difficult for them to start it based on 13 principles. If they apply the 13 principles of ecological chicken raising, they need a certain amount to build cages or fences made of bamboo and timber for chicken raising. Most farmers could not afford to purchase these materials. Even if they can not afford to purchase some materials for chicken raising, they can apply some of the 13 principles such as the proper method of giving feed and water. Farmers realized that if they start to apply some principles, they could obtain good results to some extent.



Farmers prepared the fence to avoid that chicken got disease from neighbor chicken

(5) Importance of Introducing Easy and Inexpensive Techniques for Farmers

Many farmers were always interested in new farming practices to increase the crop production but they could not afford to apply it due to another business. In addition, they had reservations about new farming practices.

Therefore, it was preferable that the easy and inexpensive method be introduced to them through the pilot project activities such as the village training, the inter-village workshop and the study tour. It was found out that the method which farmers could afford to apply should be easy and inexpensive. Farmers considered the following principles easy and inexpensive ones for SRI and ecological chicken raising.

For SRI

- Select purified and dense seeds for sowing
- Transplant one plant per hill

For ecological chicken raising

- Provide clean water to chickens regularly
- Provide good quality feed 2-3 times per day

(6) Important Role of Farmer's Group in Dissemination of New Farming Practice

In the village general meeting as one of pilot project activities, farmers could understand the results and the advantages of SRI, ecological chicken raising and the saving group. However, after finishing the pilot projects, it was difficult for farmers to obtain practical information. Nobody will provide training or activities with practical experiences to farmers. But since they had already established farmers' groups, they could share information on farming practices and techniques. The farmers' group could provide a chance to share information and discuss problems among themselves. It was therefore deemed that farmers' groups would play an important role to support them.

Chapter CI-4 Experimental Farming Practice Improvement Activities

CI-4.1 Programs and Program Descriptions

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

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

1/: Verification tests were conducted nearly under rainfed condition

CI-4.2 Implementation Arrangement

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

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

CI-4.3 Proposed Project Activities in 2007/08

The farming pilot project activities in 2007/08 in Zone 1 were composed of: i) verification test in early rainy season and rainy season; ii) small scale adaptability test (simple trial) during the rainy season; iii) farmers' acceptability survey; and iv) field guidance activities. In addition, Implementation Team Technical Meetings were held for guidance and managerial purpose of the activities.

The proposed project activities in 2007/08 are illustrated in the figure and table on the next page.

CI-4.3.1 Verification Test

The purpose of the verification test was to confirm that the target yields and cropping pattern of the master plan were achievable by introducing improved farming practices. 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, PDA & 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.

Implementation Schedule for Pilot Project Activities in 2007/08: Zone 1

Activity	Month										
	April	May	June	July	August	September	October	November	December	January	
1. Verification/Demonstration of Double Cropping of Rice	Early Rainy Season Cropping					Rainy Season Cropping					
1-1 Plot 1		Δ	○	early variety		Δ	○	medium variety			
1-2 Plot 2		Δ	○	early variety		Δ	○	early variety			
1-3 Plot 3		Δ	○	early variety		Δ	○	early variety			
1-4 Plot 4		Δ	○	early variety				early variety			
				early variety				(rainy season cropping cancelled)			
2. Verification/Demonstration of Medium Variety of Rice											
2-1 Plot 4					Δ	○					
2-2 Plot 5					Δ	○					
3. Verification Test on Upland Crops Production											
3-1 Plot 2 (Plot 1 cancelled)		○									
4. Adaptability Test on Medium Variety					Δ	○					
5. Adaptability Test on Early Variety 1/					Δ	○					
6. Extension & Guidance											
6-1 Workshop/Mass Guidance			⊙					⊙			
6-2 Study Tour											
6-3 VEA Extension Activities 2/											(activity limited)
6-4 Guidance & Monitoring											
7. Farmers' Acceptability Survey											

1/: Implemented at Prey Pdao Station, DAALI, MAFF
 2/: Guidance activities of 2 Village Extension Agents recruited from Farmer Group member

..... Nursery — Growth Period in Field ☆ Harvesting
 Δ Sowing ○ Transplanting - - - - - Extension & Guidance Activities

Verification Tests Implemented in 2007/08 in Zone 1

Season/Activities	No.	Period	Remarks
Early rainy season			
- Verification test on early variety/rice	4 plots	Apr. ~ Aug.	
- Verification test on upland crops	1 plot	May ~ July	Mungbeans
Rainy season rice			
- Verification test on early variety	2 plots	Aug. ~ Dec.	Double cropping (early – early)
- Verification test on medium variety	1 plot	July ~ Dec.	Double cropping (early – medium)
- Verification test on medium variety	2 plots	July ~ Dec.	Single cropping

CI-4.3.2 Small Scale Adaptability Test

The trial activities carried out in the zone include a small scale adaptability test (simple trial) on medium variety in RT2 operated by the implementation team for Zone 1 and the same for early variety implemented in and by the Prey Pdao experimental station of DAALI, MAFF located at Samraong Tong District as shown in the following table.

Trial Activities Implemented in 2007 in Zone-1

Activities	Trial Components	Period
Small scale adaptability test		
- Adaptability test on medium variety	- Planting method	July ~ Dec.
	- On-farm water management	
	- Fertilization Trial	
- Adaptability test on early variety	- Planting method	July ~ Nov.

CI-4.3.3 Farmers' Acceptability Survey

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

CI-4.3.4 Field Guidance Activities

The field guidance activities provided to demonstrators and farmer group members under the pilot project include: i) field guidance, ii) OJT on farming practices, iii) crab catch campaign and iv) field visit by the implementation team and the JICA study team.

(1) Field Guidance

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



Objectives, Activities and Materials Used in Field Guidance

Guidance	Objectives/Subject Farming Practices	Activities
1 st Guidance (May 25)	- Monitoring on early rainy season activities (rice & mungbeans)	- Monitoring growth progress & providing guidance to demonstrators
	- Technical guidance on: weeding by rotary weeder; prevention of washing away of seeds due to heavy rain	- Demonstration of rotary weeder
	- Selection of target farmers/fields for rainy season activities	- Selection of demonstrators for rainy season - Field check of target fields
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/on-farm water management
	- Technical guidance on on-farm water management	- Visit to simple trial plot & provision of guidance
	- Field visit to simple trial plot	- 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 25	Group members 19 out of 20 (male 9 & female 10)
2nd Guidance	Sep. 6	Group members 15 out of 20 (male 8 & female 7)

(2) OJT on Farming Practices

OJT on farming practices was the most important and appealing guidance activities employed in the pilot project and consist of OJT on raised seed bed preparation, regular planting, simple line planting and fertilization. Activities of the Implementation Team are practical training of demonstrators on the main proposed farming practices as shown in the following table.



Objectives and Activities of OJT on Farming Practices

Guidance	Objectives/Subject Farming Practices	Activities
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 regular planting	- Providing practical guidance on: - uprooting seedlings by shovel - regular planting using planting line &	- 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 raised seed bed preparation	April 27 ~ May 18	July 19 ~ Sep. 1
On regular planting	May 14 ~ May 27	-
On simple line planting	-	Aug. 4 ~ Sep. 18

(3) Crab Catch Campaign

Aiming at mitigating damages caused to younger plants by crabs (crab cut), the Crab Catch Campaign at the village level was carried out in paddy fields around the verification plots as follows;



Crab Catch Campaign

Date	Participants	Total Catch	Max. Catch/Household
Aug. 13	23 farm households	3,269 crabs	491 crabs

Even though about 3,300 crabs were caught in total by the campaign, substantially serious crab cut damages were observed in Plot 4 after transplanting on August 14, which indicates the necessity of periodical operation of crab catch campaigns for reducing the crab population in Zone 1.

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

Provisions of field guidance to demonstrators were carried out from April to December by the Implementation Team members during their visits to the verification fields. Further, the JICA study team also provided guidance at their visit to the verification fields.



CI-4.3.5 Implementation Team Technical Meeting

The technical meeting of the implementation team was held for nine times at the PDA. The objectives of the meeting 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.



CI-4.4 Verification Test in Early Rainy Season

CI-4.4.1 Objective

The objectives of the verification tests during the early rainy season were: i) verification

and demonstration of the improved farming practices of the early variety of rice; and ii) verification of the possibility of upland crops (mungbeans) cultivation in the season. The target yields set in the master plan were as follows;

Early rainy season rice	Early variety 3.3 t/ha
Early rainy season upland crop	Mungbeans: 0.7 ton/ha

CI-4.4.2 Verification Plots

The verification tests carried out in the early rainy season include: i) test on early variety of rice in four plots and ii) test on upland crop (mungbeans) in one plot (see location map for Zone 1 pilot project area) as shown in the following table:

Verification Test Plots in Early Rainy Season in 2007

Activity	Plot No.	Plot Size	Variety	Demonstrator
Verification test on early variety of rice	Plot 1	21.0 a	IR 66	Mokk Dara (M)
	Plot 2	31.5 a	IR 66	Som Bot (M)
	Plot 3	16.8 a	IR 66	Som Hearng (M)
	Plot 4	11.8 a	IR 66	Mov Pha (M)
Verification test on mungbeans	Plot 5	10.0 a	KK2	Tong Kin (M)

CI-4.4.3 Verification Test on Rice

CI-4.4.3.1 Growth History and Key Farming Practices

(1) Overall Features

The progress reporting of the pilot project for each plot are presented in the following table.

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

Practice	Time or No. of Practices	Practice	Time or No. of Practices
Nursery		Fertilization	
- Seedbed preparation	Apr. 27 - May 17	- Basal dressing	May 13 - May 25
- Sowing	Apr. 27 - May 18	- 1st top dressing	May 29 & June 10
Final land preparation	May 13 - May 25	- 2nd top dressing	June 15 - June 29
Transplanting	May 14 - May 27	Panicle initiation	± June 5 - June 20
Irrigation in field	4 to 5 times	Flowering	± July 10 - July 25
Weeding	2 times	Harvesting	Aug. 6 - Aug. 29
		Threshing	Aug. 8 - Aug. 31

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

(2) Growth History

The main incident during the project activities in the early rainy season was the infestation of Tungro disease in and around the verification plots. The infestation was first observed at around the middle of June. The infestation was substantially serious in Plot 3 and 4. The growth of infested rice plants recovered from the disease at around the flowering stage, around the middle of July, although certain adverse effects to yield are predicted due to the disease. Except for the Tungro infestation, no other serious problems were observed and no water supply problems were encountered. All the verification plots matured and were harvested in the middle to end of August.

(a) Plot 1

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
IR 66	Apr. 27	May 15/16	± June 10	July 15	Aug. 13 (109 days)

Note: DAS - days after sowing

The plot showed an excellent uniform growth and the infestation of Tungro was not so serious compared with the surrounding farmers' fields.



(b) Plot 2

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
IR 66	May 13	May 26/27	± June 20	July 25	Aug. 25-29 (105-108 days)

The lower part of the plot suffered from damages caused by crabs (crab cut) after transplanting. Furthermore, uneven growth of rice was noticed, possibly attributed to the poor land leveling because of the large size of the plot which was about 0.3 ha.



(c) Plot 3

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
IR 66	Apr. 28	May 14	± June 5	July 10	Aug. 6 (101 days)

The plot was flat and regular planting using line marker was adopted in the plot. The growth of rice plants was excellent and uniform, although the infestation of the Tungro disease in the middle of the growth stage was substantial. Uniform maturing was attained in the plot.



(d) Plot 4

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
IR 66	Apr. 29	May 16	± June 10	July 15	Aug. 13 (107 days)

The plot suffered from the infestation of the Tungro disease in the middle of growth stage.

However, the growth recovery was attained at around the flowering stage and a fairly uniform maturing was attained at harvest.



(3) Key Farming Practices

The improved farming practices adopted in the verification tests were similar to those adopted in the verification plots in 2006 as presented in the following table:

Basic Farming Practices for Verification Plots: Zone-1 Early Variety

Practices	Farming Practices Adopted	Current Prevailing Practices in the Zone 1/
1. Nursery		
- Seed/variety	- improved variety (Sen Pidao/IR66)	- improved variety (IR 66)
- Seed source	- commercial seed	- self multiplied seed
- Seed selection	- selection with salt water	- not practiced
- Incubation	- 1 day	- 1 - 2 days
- Seedbed preparation	- raised semi-wet bed	- flat semi-wet to wet bed
- Seeding rate	- 25 ~ 30 kg/ha	- 62 kg/ha 2/
- Seeding density	- 40 g/m ²	- denser than 60 g/m ² 4/
2. Land Preparation	- 2 times 2 plows + 2 harrowing/leveling 2 plows + 1 harrowing/leveling	- 2 times 2 plows + 2 harrowing/leveling 2 plows + 1 harrowing/leveling
3. Transplanting		
- Planting density	- 20 x 20 cm ~ 20 x 25 cm	- \geq 20 x 20 cm 4/
- No. of plants/hill	- 2 ~ 3 plants/hill	- 2 ~ 5 plants/hill
- Age of seedling	- 15 ~ 20 days	- 21 ~ 25 days
- Planting method	- regular planting/simple line planting	- random planting
4. Fertilization		
- Basal: compost/manure	- applied (depending on farmers practice)	- applied
- Chemical fertilizer (kg/ha)	- applied: 15-15-15 & DAP (15-15-15: 75kg & DAP: 25kg)	- applied: urea or DAP or both
- 1st top dressing (kg/ha) 3/	- applied: urea (50 kg)	- applied: urea or DAP or both
- 2nd top dressing (kg/ha) 3/	- not applied	- seldom applied
- Total doses (kg/ha)	- Basic:168 for early variety	- urea 70 kg/ha & DAP 58 kg/ha
5. Weeding	- 2 times/season	- 2 times/season
6. Irrigation	- continuous shallow flooding	- continuous flooding
7. Harvesting/post harvesting		
- Harvesting	- demonstrators current practices	- manual
- Threshing	- demonstrators current practices	- manual threshing/engine thresher (pedal thresher/threshing board/table)
- Winnowing	- demonstrators current practices	- engine winnower/manual
- Drying	- demonstrators current practices	- drying in field

1/: Socio-economic survey in F/S area conducted by JICA study team, 2006

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

3/: one top dressing during the rainy season & wo2 top dressing during the early rainy season: Urea 1st & 2nd 25 kg/ha

4/: field observation

Among the practices, key farming practices of nursery preparation, transplanting and fertilization adopted in the verification tests and on-farm water management done by farmers' options and the introductions of rotary weeder are explained below:

(a) Nursery

Main improved practices for nursery adopted in the test plots were as shown in comparison with current prevailing practices in the following table:

Improved Farming Practices Adopted in Verification Test Plots

Practices	Practices Adopted	Current Prevailing Practices
Early Variety		
Variety & seed source	Improved commercial seed	Self-multiplied improved seed
Seed bed	Raised semi-wet/dry seed bed	Flat semi-wet to wet seed bed
Seeding rate/density	25 kg/ha & 40 g/m ²	60 kg/ha & > 60 g/m ²



The problem encountered in nursery preparation was washing away of seeds due to heavy rain just after sowing. To prevent such damages in a nursery, covering of seedbed with rice straw was attempted and effects of straw cover to prevent such damages was confirmed.



(b) Transplanting

Main improved farming practices of transplanting methods adopted under the verification tests are as shown in the following table:

Transplanting Method Adopted in Verification Test Plots

Practices Adopted	Current Prevailing Practices
Planting density: 20 x 20cm & 20 x 25cm	Random planting
Regular line planting or line planting using line marker	
2-3 plants/hill & 14 ~ 20 days seedling	2-5 plants/hill & 20 ~ 25 days seedling

Both the regular planting by using planting strings (2 plots) and by using line markers (2 plots) were adopted in the verification plots. For the use of the line marker, there exists difficulty in controlling water depth after final leveling in the pilot project area because of the lack of on-farm level drains to control water depth.

		
Planting line marker	Planting using line marker	Planting using planting line

(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 last year, some modifications in fertilizer volumes were made. The basic doses proposed were similar to the same proposed for the 2006 verification tests and were N:P:K = 39:27:15 kg/ha and in total of 81 kg/ha in element. According to the interview with the demonstrators, three demonstrators reported increased doses of fertilizer from the previous year.

The fertilizer doses applied in the plots are indicated in the following table:

Fertilization Doses in Pilot Projects and Comparison with Farmers Practices

Plot	Fertilizer Doses (kg/ha)				Elements (kg/ha)			Changes 2/
	15-15-15	DAP	Urea	Total	N	P2O5	K2O 1/	
1	50	25	50	125	35	19	10	No change
2	100	26	42	168	39	27	18	Increased
3	75	25	55	155	41	23	16	Increased
4	75	25	50	150	39	23	15	increased

1/: Including, KCL applied as top dressing

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

The basal dressing of manure (cow dung) and fertilizer and the top dressing of urea at about two weeks after transplanting and at the panicle formation stage were carried out. All the demonstrators applied some manures, which differed in volume depending on the availability of manure.

(d) Irrigation

The adoption of intermittent irrigation was attempted by the implementation team in cooperation with demonstrators as trial bases. However, the adoption of intermittent irrigation was not properly practiced because on-farm level drains were not constructed to control water depth in the test plots.



Irrigation & Drainage Frequencies in Verification Test Plots

Indicator	Plot 1	Plot 2	Plot 3	Plot 4
No. of irrigation/season	5	5	5	4
No. of drainage/season	3	2	3	3

(e) Rotary Weeder

The critical farming practice for the adoption of water saving rice cultivation is weeding and success or failure in weeding is a key for the dissemination of the water saving culture. For the improvement of weeding efficiency, weeding by rotary weeder was introduced in the test plots. The introduction of the weeder would promote the adoption of regular planting by farmers.



CI-4.4.3.2 Yield and Production of Verification Plots

The results of the crop cut survey and yield survey of whole plots are presented in Table CI-4.1 and discussed by plot as shown below:.

(a) Plot 1

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment 1/	
	Range	Average	Field Yield	Production	Yield	Assessment
IR 66	5.0 - 5.4	5.2	4.8 t/ha	1,018 kg	3.7 t/ha	increased

1/: Assessment by a demonstrator; yield of last year & rough estimate of it

The growth of rice plants in the plot was uniform throughout a growing period and matured well at the ripening stage, although the slight infestation of Tungro disease occurred at about 1 month after transplanting. The yield level was highest in the verification plots in the early rainy season.



(b) Plot 2

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
IR 66	4.9 - 5.4	5.2	3.8 t/ha	1,207 kg	-	increased

The plot was the largest in area in the verification plots in the season and the proper land leveling was difficult to carry out. The growth of rice plants in the plot was not uniform as indicated in the differences in yields of the crop cut survey and the whole plot. The yield level was lowest in the verification plots. Another cause of low yield might be attributed to the adverse effects of Tungro disease which occurred at around 50 days after transplanting and missing hills due to damages caused by crabs after transplanting.



(c) Plot 3

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
IR 66	4.4 - 4.5	4.5	4.7 t/ha	786 kg	-	increased

Uniform and excellent ripening was attained in the plot, although the plot suffered from Tungro disease at around one month after transplanting. The plot recovered from the disease in the middle of the reproductive phase (before flowering stage) and matured well and uniformly. The yield level was lower than expected from the field appearance, which might be attributed to the infestation of Tungro disease.



(d) Plot 4

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
IR 66	4.4 - 5.8	5.0	4.2 t/ha	495 kg	2.9 t/ha	increased

Fairly uniform growth and ripening was attained in the plot, although the plot suffered from Tungro disease at around one month after transplanting. The recovery from the disease was slow and was after heading in the plot. In the ripening phase, the growth of rice plants became uniform and the plot matured evenly at harvest time.



CI-4.4.3.3 Results

Yields of verification plots are presented in comparison with the target yields 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
Early Variety	IR 66	Plot 1	3.3	4.8	+1.5
	IR 66	Plot 2	3.3	3.8	+0.5
	IR 66	Plot 3	3.3	4.7	+1.4
	IR 66	Plot 4	3.3	4.2	+0.9
Average			3.3	4.4	+1.1

Target yield: Master Plan target yield

As shown in the table, all the verification plots attained yield levels which were substantially higher than the target of the master plan and the yield levels attained were 0.5 to 1.5 ton/ha higher than the target and the overall average yield of the plots was 1.1 ton/ha higher than the same.

CI-4.4.4 Verification Test on Mungbeans

CI-4.4.4.1 Growth History and Key Farming Practices

(1) Overall Features

The progress reporting on the verification plot is presented in the following table:

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

Practice	Time	Remarks
Land Preparation	May 4	By draft animal
Basal dressing	May 4	15-15-15 50 kg/ha
Planting	May 4	20 x 50 cm; 2-3 grains/hole & broadcasting
Flowering	Early June	1 plot
Harvesting	Early July	1 plot

The operation of two verification plots was planned in the implementation schedule. However, the cultivation of mungbeans was cancelled in one plot because of the wet soil condition of the target field.

(2) Growth History and Key Farming Practices

The test was conducted in a rainfed paddy field located at an elevated area from surrounding paddy fields. The growth of mungbeans suffered from excessive rainfall, inundation for short periods, and occasional water shortage during a growing period. The rainfall distribution in the growing period of May to June in Chbar Mon District where the pilot project area was located was higher at 409 in 2007 compared with the average of 202 mm from 2000 to 2006 as shown in the following table.



Rainfall Distribution in Chabar Mon District

Year	May	June	Total
2007	237 mm	172 mm	409 mm
Average of 2000 to 2006	99 mm	103 mm	202 mm

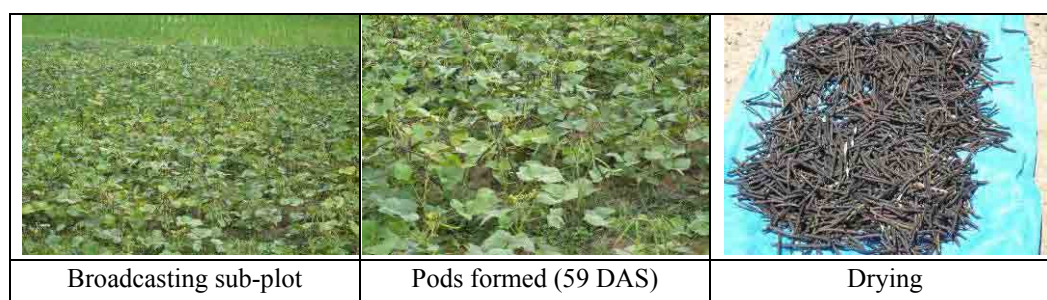
Source: *Kampung Speu PDOWRAM*

Flowering started in early June and harvesting was carried out on July 2nd and 8th.

Farming practices in the test were at low input level as no upland crops were cultivated in paddy fields in the project area. Key farming practices adopted were 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



CI-4.4.4.2 Results

The result of a crop cut survey indicates the lower yield level of 0.53 ton/ha compared with the master plan target of 0.7 ton/ha, which might be attributed mainly to wet injury due to heavy rain, inundation for a short period in the initial growth stage, and occasional water shortage during a growing period.

As the use of paddy fields under rainfed condition in the early rainy season is 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 of: i) cultivation in elevated fields without inflow of drainage water from surrounding fields, ii) planting as early as possible after the commencement 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 by PDA and CARDI in collaboration.

CI-4.5 Verification Test in Rainy Season

CI-4.5.1 Objective

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

Rainy season rice	Medium variety: 3.0 t/ha	Early variety: 3.3 t/ha
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CI-4.5.2 Verification Plots

The verification tests carried out in the season include: i) test on early variety of rice in 2 plots (double cropping of early variety) and ii) test on medium variety of rice in 3 plots (1 plot for double cropping of early and medium variety and 2 plots for single cropping of medium variety) as shown in the following table (see location map for Zone 1).

Verification Test Plots for Rainy Season Rice in 2007

Activity	Plot No.	Plot Size	Variety	Demonstrator
Verification test on medium variety	Plot 1	21.0 a	Riang Chey	Mokk Dara (M)
	Plot 4	34.0 a	Riang Chey	Bu Phat (F)
	Plot 5	37.0 a	Riang Chey	Tong Kin (M)
Verification test on early variety	Plot 2	31.0 a	Sen Pidao	Som Bot (M)
	Plot 3	16.8 a	Sen Pidao	Som Hearng (M)

CI-4.5.3 Growth History and Key Farming Practices

(1) Overall Features

The progress reporting on the verification test plots is presented in the following table.

Rice Farming Records in Verification Test Plots

Practice	Time or No. of Practices	Practice	Time
Nursery		Fertilization	
- Seedbed preparation	July 19 - Sep. 1	- Basal dressing	Aug. 10 - Sep. 17
- Sowing	July 19 - Sep. 1	- 1st top dressing	Sep. 5 - Oct. 18
Final land preparation	Aug. 3 - Sep. 17	- 2nd top dressing	Oct. 17
Transplanting	Aug. 4 - Sep. 18	Panicle initiation	± Sep. 20 - Oct. 14
Irrigation in field	2 ~ 7 times	Flowering	± Oct. 25 - Nov. 19
Weeding	1 ~ 2 times	Harvesting	Nov. 26 - Dec. 17

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

The differences in the time of practices are mainly due to the cultivation of both early and medium variety in the verification plots.

(2) Growth History

All the verification plots performed good to fairly good growth and no noticeable problems were experienced during growing periods except for crab cut damage that occurred after transplanting in Plot 2 and 4 and the infestation of brown spots in all the plots. Harvesting was carried out in the end of November up to the end of December.

(a) Plot 1

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 30	Aug. 18	± Oct. 14	± Nov. 19	Dec. 20~22 (144~146 days)

The plot showed uniform growth until maturity without experiencing any noticeable problems and matured well at around 145 days after sowing or 125 days after transplanting.



(b) Plot 2

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Sen Pidao	Sep. 1	Sep. 18	± Oct. 10	± Nov. 15	Dec. 12~15 (144~146 days)

The plot suffered from crab cut damages after transplanting and showed somewhat uneven growth due to poor land leveling. No other noticeable problems were observed until harvesting and it matured at around 104 days after sowing or 87 days after transplanting.



(c) Plot 3

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Sen Pidao	Aug. 17	Sep. 3	± Sep. 20	± Oct. 25	Nov. 26~28 (144~146 days)

The plot showed an excellent uniform growth and maturity without any noticeable disorders. Harvesting was at around 103 days after sowing or 86 days after transplanting.



(d) Plot 4

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 28	Aug. 14	± Oct. 14	± Nov. 19	Dec. 21~23 (144~146 days)

The plot suffered from crab cut damages after transplanting and showed uneven growth up to the middle growth stage in the poorly leveled field. However, the growth recovered and fairly uniform growth was attained at around the flowering stage. Harvesting was at around 145 days after sowing or 130 days after transplanting.



(e) Plot 5

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 19	Aug. 4~5	± Oct. 14	± Nov. 19	Dec. 19~21 (154~156 days)

The plot showed an excellent uniform growth up to maturity without experiencing any noticeable problems. Harvesting was at around 155 days after sowing or 140 days after transplanting.



(3) Key Farming Practices

The improved farming practices adopted for early and medium variety in the verification tests are presented in the following table.

Basic Farming Practices for the Verification Plots: Zone 1 Medium Variety

Practices	Farming Practices Adopted	Current Prevailing Practices in the Zone 1/
1. Nursery		
- Seed/variety	- improved medium variety	- medium variety (local) - medium variety (improved)
- Seed source	- commercial seed	- self multiplied seed
- Seed selection	- selection with salt water	- not practiced
- Incubation	- 1 day	- 1 - 2 days
- Seedbed preparation	- raised semi-wet bed	- flat semi-wet to wet bed
- Seeding rate	- 30 kg/ha	- 72 kg/ha 2/
- Seeding density	- 40 g/m ²	- denser than 60 g/m ² 3/
2. Land Preparation	- 2 times 2 plows + 2 harrowing/leveling 2 plows + 1 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 3/
- No. of plants/hill	- 2 ~ 3 plants/hill	- 4 ~ 5 plants/hill
- Age of seedling	- ±20 days	- 30 ~ 45 days
- Planting method	- simple line planting	- random planting
4. Fertilization		
- Basal: compost/manure	- depending on farmers practice (1 plot 1 t/ha & 2 plots not applied)	- applied
- Chemical fertilizer	- applied: 15-15-15 & DAP (15-15-15: 150kg & DAP: 24kg)	- applied: urea or DAP or both
- 1st top dressing	- applied: urea (61 kg/ha)	- applied: urea or DAP or both
- 2nd top dressing	- applied: urea (31 kg/ha)	- seldom applied
- Total doses (kg/ha)	- Basic: 266 kg/ha for medium variety	- urea 70 kg/ha & DAP 58 kg/ha
5. Weeding	- 2 times/season	- 2 times/season
6. Irrigation	- continuous shallow flooding	- continuous flooding
7. Harvesting/post harvesting		
- Harvesting	- demonstrators current practices	- manual
- Threshing	- demonstrators current practices	- manual threshing/engine thresher (pedal thresher/threshing board/table)
- Winnowing	- demonstrators current practices	- engine winnower/manual
- Drying	- demonstrators current practices	- drying in field

1/: Socio-economic Survey in FS area conducted by JICA Study Team, 2006

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

3/: field observations

(a) Nursery

The main improvements in the practices for nursery adopted in the test plots were similar to those adopted in the early rainy season as shown in comparison with current prevailing practices as follows:

Improved Farming Practices Adopted in Verification Test Plots

Practices	Practices Adopted	Current Prevailing Practices
Variety & seed source	Improved commercial seed	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/m ²	60 kg/ha & > 60 g/m ²



In this season, to prevent washing away of seeds due to heavy rain just after sowing, the covering of the seedbed with covering sheet made of palm leaves was used in some plots as shown in the photograph.



(b) Transplanting

To improve the efficiency of transplanting, simple line planting was adopted in all the verification plots in the rainy season as follows;

Transplanting Method Adopted in Verification Test Plots

Practices Adopted	Current Prevailing Practices
Planting density: early 20 x 25cm & medium 25 x 25cm	Random planting
Simple line planting	
2-3 plants/hill & 17 ~ 20 days seedling	2-5 plants/hill & 20 ~ 25 days seedling

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 using line markers. Farmers soon became accustomed to the simple line planting.

		
Planting in guide line	Simple line planting	Simple line planting

(c) Fertilization

Fertilizer doses were basically determined in accordance with the proposed farming practices and the application of basal dressing and one top dressing for early variety and two top dressings for medium variety were practiced. However, based on reported volumes of manure applied by demonstrators and farmers' fertilization doses in the last year, some modifications in fertilizer volumes were made. According to the results of the interview with the demonstrators, four of them reported increased doses of fertilization from the last year.

The fertilizer doses applied in the plots are indicated in the following table.

Fertilization 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	P2O5	K2O 1/	
1	155	24	92	266	69	34	23	Increased
2	120	26	50	196	46	30	18	No change
3	120	25	50	196	46	30	18	Increased
4	150	24	100	274	73	34	23	Increased
5	150	24	100	274	73	34	23	Increased

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

In the case of the medium variety, 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. For early variety, the basal dressing and one top dressing at the panicle formation stage were carried out. Three demonstrators reported the application of manure, but limited in volume compared with its application in the early rainy season.

Compared with the fertilizer amount in the rainy season in 2006, for medium variety, the total volume of fertilizers was increased for about 20% in elements because no manure or

only a limited amount of manure was applied in the verification plots in 2007 as shown in the following table.

Comparison of Fertilizer Amount in the Rainy Season in 2006/07

Variety	Fertilizer	2006 1/	2007 1/
Riang Chey (medium)	NPK (in elements)	105 kg/ha	128 kg/ha
	Manure	applied	not applied
Sen Pidao (early)	NPK (in elements)	96 kg/ha	94 kg/ha
	Manure	applied/not applied 2/	Applied

1/: 2006 & 2007: Medium: average of 3 plots; early: average of 2 plots

2/: Applied in 1 plot & not applied in 1 plot

(d) Irrigation

The adoption of intermittent irrigation was attempted by the Implementation Team in cooperation with demonstrators on a trial basis. However, the adoption of intermittent irrigation was not properly practiced because on-farm level drains were not constructed to control water depth in the test plots. The irrigation frequencies in the field after transplanting in the test plots were as follows



Irrigation Frequencies in the Verification Test Plots

Indicator	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5 1/
No. of irrigation/season	2	4	6	7	continuous flooding
Variety	medium	early	early	medium	Medium

1/: Continuous flooding plot; irrigation frequency not recorded

CI-4.5.4 Yield and Production of Verification Plots

The results of the crop cut survey and yield survey of whole plots of the verification plots in the rainy season are presented in Table CI-4.1 and discussed by plot as follows:

(a) Plot 1

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment 1/	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	4.5 - 5.3	4.8	3.7 t/ha	733 kg	2.6 t/ha	increased

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

The growth of rice plants in the plot was uniform throughout a growing period and matured well at the ripening stage without any serious problems during the growing period. However, the yield level was lower than expected from the growth of rice plants. The lower tillering capacity of the variety (Riang Chey, improved local variety) might be attributed to the yield level attained.



(b) Plot 2

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Sen Pidao	4.7 - 4.8	4.7	3.4 t/ha	1,067 kg	2.5 t/ha	increased

The growth of rice plants in the plot was not uniform because of the poor leveling of the plot and the yield level was lower than Plot 3 where excellent uniform growth of the same variety was attained. Another possible cause of low yield might be attributed to the missing hills due to damages caused by the crabs after transplanting.



(c) Plot 3

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Sen Pidao	4.2 - 4.5	4.7	4.0 t/ha	-	-	no change

The growth of rice plants in the plot was uniform and excellent throughout the growing period and had no problems during the growth period. The yield level of the whole plot was estimated to be over 4.0 ton/ha from the growth of rice plants.



(d) Plot 4

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	4.2 - 4.5	4.4	3.1 t/ha	1,037 kg	3.2 t/ha	Decreased

The growth of rice plants in the plot was not so uniform because of poor leveling of the plot and the yield level was lowest in the verification plots in the rainy season. Possible another cause of low yield might be attributed to missing hills due to serious damages caused by crabs after transplanting and poor weeding.



(e) Plot 5

Variety	Crop Cut Survey (t/ha)		Whole Plot		Demonstrators Assessment	
	Range	Average	Field Yield	Production	Yield	Assessment
Riang Chey	4.5 - 5.3	4.8	3.6 t/ha	1,345 kg	3.0 t/ha	increased

The growth of rice plants in the plot was fairly uniform throughout a growing period and matured well at the ripening stage without any serious problems during the growing period. However, the yield level was lower than expected from the growth of rice plants. The lower tillering capacity of the variety might be attributed to the yield level attained.



CI-4.5.5 Results

(1) Target Yields

Yields of five verification plots 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)

Category of Variety	Variety	Plot No.	Target Yield	Verification Yield	Difference
Medium variety	Riang Chey	Plot 1	3.0	3.7	+0.7
	Riang Chey	Plot 4	3.0	3.1	+0.1
	Riang Chey	Plot 5	3.0	3.6	+0.6
	Average		3.0	3.5	+0.5
Early variety	Sen Pidao	Plot 2	3.3	3.4	+0.1
	Sen Pidao	Plot 3	3.3	4.0	+0.7
	Average		3.3	3.7	+0.4
Overall Average			3.2	3.6	+0.4
Farmers field 1/	Riang Chey	2 plots	-	2.8	-

Target yield: Master plan target yield for rainy season

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 of equal or higher than the target of the master plan. However, the average yield of the medium variety decreased by 0.5 ton/ha from that of 4.0 ton/ha and the yield of the early variety decreased by 0.3 ton/ha from that of 4.0 ton/ha in the verification plots in 2006. The results of crop cut survey in the farmers' fields around the verification plots indicate that the yield level of fields of average growth was around 2.8 ton/ha as shown in Table CI-4.1.

CI-4.6 Small Scale Adaptability Test

CI-4.6.1 Objective

The general objective was to establish a trial field for the Implementation Team members where they could carry out trials on alternative farming practices such as improved rice farming practices, adaptability test on alternative farming practices, and trial on element farming technologies such as variety trial. Another important side objective was to demonstrate alternative farming practices and responses of rice growth to the alternatives to farmers so that they could learn something from the differences in practices and growth. Individual objectives of the tests are explained as follows;

Objectives of Adaptability Test in Zone-1 in 2007/08

Trial	Objective
Simple Trial on Medium Variety (RT 2)	
- Planting method	- To test effects of number of plants/hill on growth & yield
- On-farm water management	- To test effects of water saving rice culture on growth & yield - To test adaptability of water saving rice cultivation
- Fertilization trial	- To test effects of fertilizer doses (manure & fertilizer)
Simple Trial on Early Variety (Prey Pdao Station)	
- Planting method	- To test effects of planting methods on growth & yield - To test adaptability of seedling broadcasting method

CI-4.6.2 Trial Design

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

Design of Adaptability Tests in Zone-1 in 2007/08

Trial	Treatment	Remarks
Simple Trial on Medium Variety (RT 2)		
- Planting method	5 treatments/variety = 10 treatments - 1 plant/hill ~ 5 plants/hill	Variety: Riang Chey/Sen Pdao
- On-farm water management	3 treatments x triplicate = 9 sub-plots - Continuous flooding - Intermittent irrigation in vegetative phase - Continuous intermittent irrigation	Variety: Riang Chey In triplicate sub-plots
- Fertilization trial	4 treatments x triplicate = 12 sub-plots - Manure + chemical fertilizer	Variety: Riang Chey In triplicate sub-plots
Simple Trial on Early Variety (Prey Pdao Station)		
- Planting method	4 treatments x triplicate = 12 sub-plots - Regular planting, random planting, seedling broadcasting, direct sowing	Variety: IR 66

CI-4.6.3 Key Farming Practices and Growth History

The key farming practices adopted in the individual trials were basically similar to those adopted in the verification plots as explained in the trial designs.

Harvesting was carried out on December 22nd to 23rd in the medium variety test field and December 1st in the case of the early variety test field. The growth histories of the individual plots are summarized in the following table.

Variety	Sowing	Transplanting	Panicle Initiation	Flowering	Harvesting (DAS)
Riang Chey	July 27	Aug. 15/16	± Oct. 15	± Nov. 20	Dec. 22~23 (149~150 days)
IR 66	July 27	Aug. 13	± Sep. 15	± Oct. 20	Dec. 1 (127 days)

Note: Riang Chey: planting method, on-farm water management & fertilization trial

IR 66: planting method trial in Prey Pdao Station

CI-4.6.4 Results

The results of the tests are presented in Table CI-4.1 and are summarized below:

(1) Adaptability Tests on Medium Variety

Rice plants in all the test plots had uniform and satisfactory growth throughout the growing periods without experiencing any noticeable problems. The results of the tests are as follows:



Results of Tests for Medium Variety in Zone-1

Trial/Variety	Treatment	Crop Cut Yield	Whole Plot Yield
Planting method (Riang Chey)	1 plant/hill	4.4 t/ha	3.7 t/ha
	2 plants/hill	5.4 t/ha	3.8 t/ha
	3 plants/hill	3.9 t/ha	4.0 t/ha
	4 plants/hill	4.3 t/ha	3.8 t/ha
	5 plants/hill	4.8 t/ha	3.9 t/ha
Planting method (Sen Pidao)	1 plant/hill	3.1 t/ha	-
	2 plants/hill	2.7 t/ha	-
	3 plants/hill	2.5 t/ha	-
	4 plants/hill	2.4 t/ha	-
	5 plants/hill	2.4 t/ha	-
On-farm water management 1/ (Riang Chey)	Continuous intermittent	5.1 t/ha	4.3 t/ha
	Intermittent in vegetative phase	4.3 t/ha	4.0 t/ha
	Continuous flooding	4.9 t/ha	3.9 t/ha
Fertilization trial 1/ (Riang Chey)	Manure 10 ton/ha only	4.6 t/ha	4.2 t/ha
	Manure 5 ton/ha only	4.2 t/ha	3.8 t/ha
	Manure 2.5 ton/ha + fertilizer	4.5 t/ha	4.3 t/ha
	Fertilizer only	4.6 t/ha	4.3 t/ha

Crop cut survey: 1 sample/ treatment; random sampling of 1m² (16 hills) at normal growth spot

1/: Average of triplicate treatments

(a) Planting Method Trial

The trial was conducted to examine the effects of a number of plants/hill on growth & yield of medium and early the early variety suffered from rat attacks due to the isolated maturing of the variety.



No clear differences among treatments were observed (whole plot yields of 3.7 ~ 4.0 ton/ha). However, the number of panicles per m² was largest in the treatment of 5 plants/hill. Further tests on the planting method of photosensitive varieties should be carried out to examine the effects of the planting method (no of plants/hill) and the dates of sowing to growth and yield of rice plant.

(b) On-farm Water Management Trial

The trial was conducted to examine the effects of water saving culture on rice growth and yield and to make preliminary tests on the adoptability of water saving rice cultivation as stated earlier. The trial was conducted in triplicate treatments. The water saving or on-farm water management methods applied are as follows;

Continuous intermittent irrigation up to late maturing stage	4 days flooding + 3 days dry-up
Continuous intermittent irrigation during vegetative phase	4 days flooding + 3 days dry-up
Continuous flooding up to late maturing stage	Continuous flooding

The growth of rice plants in the trial was uniform and excellent throughout the growth period. Field observations during the growth period indicated better growth in the intermittent plots compared with a continuous flooding plot. The irrigation methods and growth differences were explained to the farmer group members at the field guidance held on September 9 to demonstrate better initial growth in the intermittent plots.



The yield level of whole plots indicated no clear difference among treatments (whole plot yields of 3.9 ~ 4.3 ton/ha), however, the results indicated that at least similar yield levels could be attained under the water saving culture by adopting the intermittent irrigation

The adoption of water saving culture or on-farm water management by draining water is impossible because of the lack of on-farm level drains in Zone 1. Therefore, on-farm water management by regulating water depth in the field at the time of irrigation will be a method to be applied.

(c) Fertilization Trial

The trial was conducted to examine the effects of fertilizer doses (manure & fertilizer) on rice growth & yield as stated earlier. The trial was conducted in triplicate treatments.



The results of the trial indicated that there was no clear difference among treatments (whole plot yields of 3.8 ~ 4.2 ton/ha), however, the sub-plot of chemical fertilizer only and manure 2.5 to/ha + chemical fertilizer (half the amount of chemical fertilizer sub-plot) attained similar yield levels with the sub-plot of manure 10 ton/ha. As the volume of manure available per farm household in the zone was estimated at around 3 ton/ha and average holding size of paddy field was around 1.0 ha per farm, the application of manure and chemical fertilizer, which was a prevailing practice in the zone, will be a recommended farming practice. The yield level of sub-plot of manure 5.0 ton/ha was somewhat lower than other plots.

(2) Adaptability Tests on Early Variety

The test was conducted at the Prey Pdao Experimental Station of DAALI aiming at examining the effects of planting methods on rice growth & yield and at preliminarily testing adaptability of seedling broadcasting method for rice cultivation. The test was conducted in triplicate treatments.



Rice plants in all the test sub-plots had uniform and satisfactory growth throughout the growing periods without experiencing any noticeable problems. The results of the test are as follows;

Results of Test for Early Variety in Prey Pdao Station 1/

Trial/Variety	Treatment	Whole Plot Yield	
		Range	Average
Planting Method (IR 66)	Regular planting	4.7 ~ 4.8 t/ha	4.7 t/ha
	Random planting	4.1 ~ 4.8 t/ha	4.5 t/ha
	Seedling broadcasting	4.1 ~ 4.4 t/ha	4.3 t/ha
	Direct sowing (under puddled condition)	4.1 ~ 4.9 t/ha	4.5 t/ha

1/ Average of triplicate treatments

The results indicated that there was no clear difference among treatments, however, the possibility of the adoption of seedling broadcasting and direct sowing under puddle condition was identified, although, further intensive tests at a large scale should be carried out to test adaptability of the practices at farmers fields.

CI-4.7 Farmers' Acceptability Survey

CI-4.7.1 Objective

The farmers' acceptability survey was carried out with an objective of the 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.

CI-4.7.2 Methodology

The acceptability survey was carried out on the improved rice farming practices and on the mungbeans cultivation by way of the simple interview survey with the demonstrators. Furthermore, the interview survey with the non-demonstrator farmer group members on changes in rice farming practices after the pilot project was carried out. Major inquiries made to the interviewee 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
	- Intension to grow upland crops in paddy field	
Farmers' farming practices	Changes in farming practices (before/after pilot project) - Planting method & density, method of transplanting, age of seedlings, seedbed preparation, seeding rate & etc.	Farmer group 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 in early rainy season		
- Verification test on early variety of rice	October, 2007	3 demonstrators
- Verification test on upland crops (mungbeans)	September, 2007	1 demonstrator
Verification test in rainy season		
- Verification test on early variety	January, 2008	2 demonstrators
- Verification test on medium variety	January, 2008	3 demonstrators
Farmers' farming practices 1/	January, 2008	15 group members

1/: Interview with non-demonstrators (group members not involved in verification tests)

CI-4.7.3 Results

(1) Rice Demonstrators Interview

All the demonstrators (a total of eight demonstrators) assessed as "good" or "proper rate" the improved farming practices adopted, except for variety, seeding rate, planting density and fertilization. The demonstrators' major comments on such practices assessed unfavorably were: i) preferring IR 66 having higher yielding capacity to Sen Pidao (1 farmer), ii) excessive seeding rate of 30 kg/ha (3 farmers), iii) proper planting density of

early variety 20 x 20cm in stead of 20 x 25cm (5 farmers) and iv) excessive basal dressing (2 farmers). All the demonstrators in the rainy season assessed positively the simple line planting newly introduced in the season.

Six demonstrators reported a yield increase of paddy from the previous year. Their reasoning for yield increase include: *sufficient fertilizer; adoption of water management (irrigation & drainage), improved nursery & transplanting practices*. One demonstrator reported yield decrease because of poor weeding, poor leveling and missing hills due to crab cuts.

Asked whether they followed the proposed practices in the next season, almost all the demonstrators reported that they followed seed selection, seeding density in nursery, number of seedlings/hill and fertilization. However, rather negative responses to raised seedbed preparation and regular planting were reported because of labor requirements for practices.

(2) Farmers' Group Members Interview

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

- All the target members (15 members) reported that they reduced the 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	6.2 ~ 7.5	2.3 ~ 3.8
Age of seedlings for transplanting (days)	42.5	25.6
Seeding rate/ha (kg/ha)	57.0	27.3

- In addition, the changes in planting method from random planting to random line planting (line planting without using planting string or line marker) and 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) were reported by seven (47%) members.
- As extension programs of PDA anticipated by them, IPM, extension of farming technologies, fish culture and pig farming were raised.

The findings 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 that such practices will be disseminated quickly with demonstration and timely provision of guidance. The findings also revealed that the farmers' anticipation and motivation toward the improvement of farming practices appeared to be high. To meet such farmers' attitude, the deployment of extension staff having enough practical skills should be envisaged and the operation of field programs as the pilot project should be continued.

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

CI-4.8.1 Evaluation of Verification Tests

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

(1) Target Yields

The yields of 14 verification plots operated in 2006 and 2007 in Zone 1 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	3.0	6	3.1 ~ 4.8	3.8	+ 0.8
Early	IR 66	3.3	4	3.8 ~ 4.8	4.4	+ 1.1
	Sen Pidao	3.3	4	3.4 ~ 4.0	3.9	+ 0.6
	Average	3.3	8	3.4 ~ 4.8	4.1	+ 0.8

Target yield: Master Plan target yield for rainy season

As shown in the table, all the verification plots attained yield levels which were higher than the targets of the master plan. Both the average yields of the medium and early varieties were 0.8 ton/ha higher than the targets set in the master plan. The results verified that the target yields of the plan were attainable through the adoption of improved farming practices employed in the verification tests.

(2) Cropping Pattern

The adoptability of the proposed cropping patterns for Zone 1 in the master plan consisting of a double cropping of early rice and a single cropping of medium rice was verified through the implementation of the verification tests in 2007 as illustrated in Figure PI-1. In addition to the patterns, the adoptability of a double cropping of early rice in the early rainy season + medium rice in the rainy season was also verified. Furthermore, 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	Net Income per Ha (1,000 riel)	
	Early Rice	Medium Rice
Master plan estimate		
1. Without project condition	955	1,042
2. With project condition	1,321	1,498
Verification tests results		
3. Improved farming practices	2,146	2,360
Balance (3 – 1)	825	862

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

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

Items	Unit	Unit Price (Riel 1000)	Master Plan Estimates 2/						Results of Verification Tests				
			Without Project			With Project			Early 3/		Medium 4/		
			Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	
			Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	Q'ty	Value (Riel 1000)	
1. Gross Return													
Paddy													
Unit Yield	(ton/ha)		2.40		2.10		3.30		3.00		4.10		3.80
Unit Price	(Riel.000/t)												
Gross Return of Paddy	(Riel.000)				800		675		800		675		800
By Product (straw) 5/	(Riel.000)				1,620		1,680		2,228		2,400		3,040
Gross Return	(Riel.000)				81		84		111		120		138
					1,701		1,764		2,339		2,520		3,192
2. Production cost					746		722		1,017		1,022		760
2-1. Farm Inputs					299		285		462		467		409
Seed 6/	(kg)	1.60	60		42		80		64		40		27.5
Fertilizers					251		217		388		393		365
- Urea	(kg)	1.60	70		112		60		96		110		50
- DAP	(kg)	1.80	70		126		60		108		65		55
- KCl	(kg)	1.55			0		0		40		62		60
- 15-15-15	(kg)	1.60			0		0		0		0		0
- Compost 7/	(ton)	25.0	0.5		13		0.5		13		1.0		25
Agro-chemicals					6		4		10		10		10
- Agro-chemicals	(lit)	10.0	0.6		6		0.4		4		1.0		10
- Agro-chemicals	(kg)				0		0		0		0		0
2-2. Labor Costs					160		160		168		176		192
Labor Requirements 8/													
- Hired Labor	(man-day)	8.0	20		160		20		160		21		168
- Family Labor	(man-day)		78		77		84		88		88		96
Total	(man-day)		98		97		105		110		120		130
2-3. Land Preparation													
- Draft Animal	(per ha)		1		180		1		180		1		240
2-4. Transportation	(Riel.000/t)	30	2.40		72		2.10		63		3.30		99
- By Ox Cart													
2-5. Miscellaneous Expenses	(L.S.)				36		34		48		49		36
3. Net Return	Riel 1,000				955		1,042		1,321		1,498		2,146
	%				56		59		56		59		74

1/: Results of verification tests in 2006 & 2007

4/: Average yields of 6 verification test plots

7/: Average doses applied in case of verification tests

2/: Crop budgets estimated under the Master Plan

5/: By products/straw: assumed to be 5% of gross return of paddy

8/: Hired Labor Requirements --- assumed to be 20% of total labor requirements

3/: Average yields of 8 verification test plots

6/: Commercial seeds for with project & verification tests

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

CI-4.8.2 Improved Farming Practices and Technical Development Required

(1) Improved Farming Practices

On the results and findings of the pilot project and the preliminary assessment of adaptability discussed earlier in the preceding section, the approaches for improving rice farming are proposed in 2 steps as follows;

Proposed Approaches for Improving Rice Farming

1st Step	To attain uniform growth of rice plants in an entire field: <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - Younger seedling, fewer number of seedling/hill & other practices
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Practice	Improved Practices
Land leveling	Gradual land leveling works year by year during off-season
Nursery	Pure seed
- Seed	Full and heavy grains (seed selection with salt water)
- Seeding rate	Reduced seeding rate
- Seeding density	40 g/m ² (in seedbed)
Transplanting	Early: 20 x 20 cm Medium: 25 x 25 cm
- Planting density	Reduced number of plants/hill: 2 ~ 3 plants/hill
- No. plants/hill	To avoid damages to roots of seedlings (use shovel for uprooting)
- Uprooting	Simple line planting
- Transplanting	(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	Before plowing & mixed well with soils
Basal Dressing	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
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Practice	Improved Practices
Fertilization	Increase as basal dressing, if available
- Manure application	Increase as basal dressing and/or top dressing
- Fertilizer application	Intensify weeding
Weeding	Shallow irrigation
Water Management	Flooded & drained field surface intermittently
	Improvement of harvest & post-harvest practices
Harvesting	- timely harvesting
	- threshing in paddy fields to reduce grain losses during transportation
	- proper sun drying & winnowing

(2) Technology Development Required

The introduction of upland crops (mungbeans) in paddy fields in the early rainy season was carried out in 2007. Unfortunately the attempts were mostly failures mainly due to unusual heavy rainfall, wet injury and water shortage which occurred during growing periods. However, the possibility of the introduction was confirmed in several plots. For the improvement of land use intensity and crop diversification in paddy fields, one of the development strategies of the master plan, the introduction of upland crops (mungbeans) in the early rainy season, should be envisaged.

For the successful introduction of upland crops in the season, improved farming practices of: 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 by the PDA and CARDI in collaboration.

The technology development required for rice production includes:

- Development/selection of non-photosensitive variety of growth duration of \pm 120 days, and
- Purification of promising local varieties popular among farmers and multiplication of improved or pure seeds.