Chapter 2 PILOT PROJECTS' ACTIVITIES, ACHIVEMENT AND OUTCOMES

2.1 Land and Water Resources Development Programme

2.1.1 Activities

In line with the selection of 4 P/P areas, the following activities have been undertaken to establish the irrigation and drainage system; demonstrating irrigated paddy cultivation practised in a participatory way by farmers and training district officers and farmers involved in the P/P.

(1) Topographical survey
(2) Training of PIEs and Farmers at Doho Rice Scheme
(3) Water balance study for P/P areas and A/P areas
(4) Design of irrigation and drainage system
(5) Construction of irrigation and drainage facilities
(6) Field training of PIEs and farmers during construction
(7) Completion of Construction Works and Hand-over Ceremony
(8) Monitoring of O&M of the Irrigation Facilities

The above-mentioned activities are explained in detail as follows;

(1) Topographical Survey

The topographical survey works have been divided into two stages. The first survey was undertaken for the 3 P/P areas of Budaka (Pallisa), Bugiri, and Kumi in June 2004. The second survey which involved Sironko P/P, a new development area, was undertaken in January 2005 in which Sipi River survey has been included.

1) Items for Topographic Survey

The following survey works necessary for conducting the detailed design of the 4 P/P areas in Budaka (Pallisa), Bugiri, Kumi and Sironko districts were conducted in the field.

a. Installation of a Survey Control Point (permanent bench-mark) including levelling survey: Three new control points made of concrete were installed in the P/P area near the proposed intake, at the middle point of the P/P area and downstream of it. Levelling survey was carried out from the nearest existing control point.
b. Topographic survey by Total Station method for the proposed P/P area and intake site area: The total topographic survey area covered over 25 ha including surrounding slope area with the scale of 1:1,000 and 1:500, respectively, and contour lines of 0.5 m interval with supplementary 0.25 m interval lines were provided.
c. Longitudinal section survey of the proposed irrigation and drainage canals and the P/P area: Two lines of longitudinal section were surveyed at the most upstream point of the P/P area to the most downstream point to find the slope of the area. Longitudinal sections of proposed irrigation and

drainage canals were surveyed.

d. For the survey works of Sironko P/P area, additional Sipi River survey has been included. Sipi River survey: Longitudinal section survey including the deepest points of the river and the height of the left and right embankments was undertaken for a distance of 600 m along the Sipi River. Cross sectional survey involving every 100 m interval for both the left and right sides was made; covering 100 m width from the centre of the river.
e. Cadastral and Tenants Survey: The name of the land owner and boundary of the ownership were surveyed, and based on that the cadastral map was prepared.
f. Output of the mapping survey: All the results of the above survey were processed using CAD (Computer-aided Design). Survey outputs are listed.
    i) P/P area topographic map of a scale of 1:1000, contour line at 1.0 m intervals with supplemental 0.5 and 0.25 m contour lines.
    ii) Intake area topographic map of a scale of 1:500, contour line at 1.0 m intervals with supplemental 0.25 to 0.5 m contour lines (only Sironko).
    iii) Longitudinal section of the P/P area for a vertical scale of 1:200 and horizontal scale of 1:500.
    iv) Longitudinal section of the proposed irrigation and drainage canal routes for a vertical scale of 1:200 and horizontal scale of 1:500.
    v) Longitudinal and cross section survey of the Sipi River for a vertical scale of 1:100 and horizontal scale of 1:200 (only Sironko).
    vi) Cadastral map showing boundary of land owners and tenants name on the scale of 1:1000 with the list of name and address of owners and tenants and the plot numbers and acreage.
    vii) Elevation lists of the installed control points and bench marks used during the survey works were shown in the survey report.

(2) Training Programme for PIEs and Farmers at Doho Rice Scheme

The P/P will be implemented on the basis of farmers' participatory involvement supervised by the district PIEs, and the construction technology is to be transferred to the farmers to enable them to undertake the next construction works by themselves.

In the 3rd Field Work, a training programme for 14 PIEs was completed. In order to strengthen and develop their capacity as irrigation engineers, an additional training programme was implemented as an OJT during the construction works of the P/Ps. The trainees were dispatched in the 4 P/P areas and learned how to supervise the construction works.

1) Technical training of PIEs

a. Purpose of Training

Currently, there is a limited number of irrigation engineers in Uganda, both in MAAIF and at the district level. Consequently, there is a need to not only promote the increase of irrigation engineers, but also to plan and construct proper irrigation and drainage schemes that can guarantee stable rice production.

In order to cope with these requirements, a training programme has been provided in the Doho Irrigation Scheme.

The following basic concepts were considered in the programme:

i) Introduction of high learning institutions involved in the training of irrigation and drainage engineers,
ii) Knowledge of capacity building in irrigation and drainage technology for farmers and engineers in the local governments,
iii) Transfer of operation and maintenance technologies and facilities of irrigation and drainage to farmers,
iv) High learning/sensitisation and training in roles of water users associations,
v) Research and extension of on-farm water management technologies, and
vii) Promotion and guidance on actual project planning and implementation to support farmers' organisations.

After completing this programme, PIEs will play very important roles in the establishment and construction of irrigation schemes in their districts and in the capacity building of farmers' organisations involved in WUAs. The PIEs will ensure the role of leadership and promoters of the selection and planning of irrigation schemes; assisting the establishment of farmers' organisations as WUAs. They will promote the implementation of planned irrigation schemes by farmers themselves as a participatory involvement with DAO and NGOs, etc.

This training programme consisted of the following three major lectures:

i) Irrigation planning and design,
ii) Drainage planning and engineering, and
iii) Water management, O&M engineering.

b. Trainees

The trainees were nominated by MAAIF and the district offices to attend the training programme. The nominated PIEs who were not initially trained in irrigation engineering, were presently engaged as Agricultural Officers or Assistant Agricultural Officers.

At first, the number of trainees was expected to be 14, one from each of the 13 districts and one from MAAIF. However, in addition to these 14, two came from Doho Irrigation scheme, one as a production manager and one as a farmer. As a result, the number jumped to 16 who attended the programme.

The trainees were mainly agronomists and soil scientists with no experience in the engineering fields. Six had short training in irrigation and drainage in Kenya (AICAD) and Tanzania (KATC).

All trainees were willing to be PIEs and willing to contribute greatly with the knowledge obtained through the programme. Questionnaires distributed at the

beginning to get their opinions on the programme show that all had high expectations; hoping that the programme would solve their individual technical problems. They basically exhibited a strong desire to learn irrigation and drainage engineering.

List of Trainees in the Technical Training for PIEs

No.	District	Nominee	Present Position	Remarks
1	Kamuli	Mr. A. Napeera	AO	
2	Iganga	Mr. R. Kayingo	AAO	
3	Mayuge	Mr. P. Waluube	AO	
4	Bugiri	Ms. P. Egibwa	AAO	
5	Busia	Mr. D. Opio	AO	
6	Tororo	Mr. A. Otim	AO	
7	Mbale	Mr. S. Nambafu	AAO	
8	Budaka (Pallisa)	Mr. R Mandu	AO	
9	Sironko	Mr. G. Nangai	AO	
10	Kumi	Mr. J. Etyang	AO	
11	Soroti	Mr. F. Anyumel	AO	
12	Katakwi	Mr. Emasu Egwela	AO	
13	Kaberamaido	Mr. D. Ebinu	AAO	
14	MAAIF	Mr. Byaruhanga	Farm Development	
15	Doho	Mr. Sagula Wilberforce	Production Manager	Added
16	Doho	Mr. Sagula Robert	Farmer	Added

Note. AO; Agriculture Officer
AAO; Assistant Agriculture Officer

c. Lecturers

In order to train the selected trainees, two lecturers were selected from reliable institutions. They were Mr. Michael Iwadra (lecturer at Makerere University) for irrigation and drainage planning, design and engineering, and Mr. Tom Malinga (former Doho Rice Scheme manager) for water management and O&M engineering. The lecturers have sufficient knowledge and experience in the subjects of the lectures. Especially the water management engineering part has been entrusted to the former manager of Doho Scheme who has experience in the field of participatory works and water management technology as related to farmers' capacity building in the field of irrigation and drainage. Furthermore, the main counterpart of the Study Team, Mr. John Mackay Ogwang helped and supported the lecturers in the preparation of the textbooks.

Necessary textbooks and materials were prepared beforehand; referring to the relevant lecture curriculum and materials provided by the Study Team.

d. Training Programme

At first, the background and purposes of the Study were explained along with the necessity of the irrigation engineers and the basic concepts of the plan and design for the 4P/P areas. Data and information indicating the status of wetland development in the 13 districts, which were relevant to future planning of irrigation scheme development in the said districts, were distributed to the trainees.

Basically the training consisted of lectures, practical exercises in problems

solving and of one day field training in a relevant area of Doho Rice Scheme (headworks and main irrigation canal) where the location of the irrigation facilities could be shown and the present problems in the scheme discussed.

In the field training, a hydraulic conductivity test by auger was conducted as part of the drainage programme by the trainees themselves. They realized that the exercise required team work in time keeping, measurement of water level and data recording. After the field works, results were confirmed; adopting equations learned in the lecture.

The table of contents of the textbooks used in the lectures is shown in Appendix 2-1; other related matters are detailed below.

i) Time schedule

The training programme was implemented from 29th March - 15th April, 2005 period. The daily schedule is shown in Table 2.1.1.

ii) Materials

The following materials were distributed to the trainees in the course of the programme.

a) Questionnaires: Assessment form of the training programme,
b) Irrigation engineers training programme:
   - Time schedule of the programme
   - List of participants
   - Daily schedule of the programme
   - Time table of irrigation planning and design
   - Time table of drainage planning and engineering, and
   - Time table of water management and O&M
c) Textbook for irrigation and drainage engineering:
   - Purpose of the training programme
   - Outline and information on the sustainable irrigation project in eastern Uganda, and
   - Drawings of the 4 P/P areas
d) WUAs in Japan initiated and facilitated by farmers,
e) Pamphlet on Japan Agriculture and Rural Development Today,
f) Annex on irrigation, evapo-transpiration and rain,
g) Textbook for irrigation planning and design,
h) Annex on crop coefficient curve drawn for maize grown close to Kutsaga Research Station,
i) Annex on vegetable crop coefficients,
j) Textbook for drainage planning and engineering, and
k) Textbook for water management and O&M.

iii) Examination

At the last day of the training programme an examination was given; asking trainees to layout irrigation and drainage canals in a given topographic map of 1:1,000 scale. The trainees were grouped into 4

groups consisting of 4 to 5 persons per group.

2) Evaluation of the training

a. Interview, examination and questionnaires

Prior to the commencement of the programme, a meeting was held with all participants on 28th March to ask their background and expectation from the programme. A questionnaire was distributed to get their initial opinion, background, experiences and knowledge in irrigation and drainage engineering.

On the last day of the programme, an examination, questionnaires and interview were given to evaluate their understanding of the lectures.

b. Certification

After check and evaluation of the observation and examination results, a certificate of attendance was presented to all the trainees to encourage their endeavour.

(3) Water Balance Study for P/P Areas and A/P Areas

At first, water balance study has been made to confirm the water availability in the 4 P/P areas. Also for further development study for A/P, water balance of the whole catchment area where the P/P areas is located has been studied.

The river discharge records on daily and monthly data have been collected from the Department of Water Resources, MWE. River discharge data for Manafwa River, Namatara River, Sipi and Simu Rivers, Mopologoma River, Malaba River and Kapri River have been collected from 1997 to 2003 for six years records considering the availability of the recent data on daily basis.

Comparing the monthly specific minimum discharge data among the rivers, the Mopologgoma data is too small and as the results the data have been neglected from hydrological analysis.

In order to sustain and conserve the water resources, the river flow within the base flow can be utilized for crop production. The capacity of the base flow will be proportional to the size of the catchment area. Therefore the water resources potential can be estimated from the observed river flow discharge during the dry season or a drought year. The base flow varies however depending on the characteristics of the geological strata or size of the catchment area. It is necessary to collect such observed discharge data as much as possible. The base flow of the unit catchment area can be estimated to find the capacity of the catchment area.

On the basis of the monthly minimum discharge data among the six rivers regression between catchment area and minimum monthly discharge have been analysed on the logarithmic explanation, the monthly minimum discharge has been estimated at 0.15 cu.m/sec/100 km^2 which amount of water should be released to downstream area.

On the other hand, irrigation water requirements have been estimated on the basis of meteorological monthly data of temperature, wind velocity, relative humidity, sunshine radiation obtained from 1997 to 2003 at Jinja station. Monthly evapo-transpiration from 1997 to 2003 has been estimated by modified Penman method. Percolation rate is 2 mm/day and irrigation efficiency has been adopted at 60% at intake site since the proposed irrigation canal length is not so long.

On the basis of the estimated available discharge in the catchment area of the P/P area, and water requirement estimated by consumptive use of paddy crop, six years simulation of water balance study has been performed for P/P area and A/P area. The summary of the analysis is shown in the Table 2.1.2. It has been confirmed that the water availability for the paddy field area for P/P area is sufficient. In order to secure the wetland conservation, water balance has also been checked not only P/P area but with the present cultivated paddy field area in the A/P area. When the existing paddy field area is exceeded to the estimated potential irrigable area in the catchment area, we have proposed for A/P to reduce the irrigable area during dry season within the capacity of the available water to maintain for sustainable use of irrigation water for wetland.

(4) Design of Irrigation and Drainage System

1) Budaka (Pallisa) P/P Area

a. Location

The wetland area is located in two sub-counties: Kakoli sub-county at Kakoli village and Kamonkoli sub-county at Jami village located about 13 km from Mbale via Triny main road. The wetland width is about 500 m, which is rather wide, and existing paddy fields are spread on both sides of the Triny main road from North to South with the water flowing into the Namatala River. The Jami side area is provided with 4 canals running at the centre of the area which are connected to two culverts (φ1200 and φ800) at the Triny main road. But almost no canal is provided in the Kakoli side though two culverts (φ1200 and φ1200) cross the Triny main road.

The downstream side of the swamp is directly affected by the backwater from the Namatala River where the Nyanza area is located. On the other hand, the upstream stretch in Jami/Kakoli side has about 1/400 to 1/500 slopes, which can be drained downstream since the capacities of the existing 4 culvers are sufficient for a medium flood flow. Based on the workshops held at Kamonkoli sub-county, farmers have acknowledged that the flooding period in the Nyanza area lasted three days while that in the Jami area two days.

b. Present conditions and constraints

The catchment area of the wetland is estimated at 37.37 km^2 and the total wetland area at 713 ha in which paddy fields cover about 315 ha. The ratio between catchment area and wetland area is 5.2, which is not sufficient for a

double cropping. During the dry season, most of the water resources are consumed in the upstream paddy fields areas; making possible only one rainy season crop in the proposed P/P area. At the moment there is no farmers' organisation in the project area.

c. Rehabilitation and improvement plan

i) Jami area

The Jami area has sufficiently provided necessary irrigation and drainage canals. However the function of the canals has not been clearly defined, and there is no intake facility in the field. Accordingly, the main purpose for the Jami area would be rehabilitation.

The rehabilitation will involve the following facilities.

a) Provision of necessary intake facilities along the main river course.
b) Provision of link canals from the intakes to the existing canals.
c) Reshaping of the existing canals, especially the drainage canals.
d) Linking the drainage canal, along the bottom of the existing Triny main road, to connect the four existing culverts.
e) Distinguishing the existing canals for irrigation and drainage purposes.

ii) Kakoli area

In the Kakoli area, there are no irrigation and drainage canals. In order to supply water quickly and timely for the proper growing of paddy, small ditches are to be provided. The route of a ditch and the plot elevation have been considered enabling irrigation water to flow smoothly in the canals. When a ditch follows only one route, the paddy plots which can directly get water from the ditch will cover only 20 % of the Kakoli area. But when two ditch routes are provided, the area covered by these plots will be increased to more than 70%. Consequently, two ditch routes are proposed for the Kakoli area. However the irrigation canal should be located higher than the paddy field to supply irrigation water. Hence, the embankment of the canal will be necessary, and the necessary soil for embankment should be brought from the nearby slope area. Intake facilities are also provided in the upstream stretch of the Kakoli River.

iii) Borrow pit

In order to bring the embankment material, it is necessary to set up a borrow pit. Digging soil in the slope area would make it possible to construct at the same time the collector drain and the maintenance road in the Kakoli slope area.

iv) Rotational irrigation

During the dry season, water will not be sufficient to irrigate the whole P/P area. A rotational irrigation system will be introduced.

v) Drainage improvement

Four culverts are provided in the Triny main road crossing. However,

two of these in the Kakoli side will not be directly connected with the canals. In order to drain flood water more smoothly downstream, a connecting drainage canal will be provided along the Triny main road to link the four culverts.

d. Planning and design

The drawings for construction works of Budaka (Pallisa) P/P area are shown in the attached sheet in Appendix 2-2.

2) Bugiri P/P Area

a. Improvement Plan

Paddy fields are spreading on both sides of the road. But the paddy fields area in the upstream side is only a few hectares, and a river course is not prominent there. In the downstream area, a river course/canal is running at the centre of the area. It would be difficult to provide an intake structure in the upstream area because there is no river course formation; excluding this area from the P/P area.

In accordance with the topographic survey, the average slope of the area from the upstream to the downstream stretch is approximately 1:400 to 500, which is suitable for the provision of irrigation canals. Two alternatives are possible to locate the irrigation canals. One is to use the existing river course as an irrigation canal running to the lowest point of the area. In this alternative, check structures would be required in the river course but would need frequent operations to avoid the flood effects. With this alternative, it would be rather difficult to provide farm roads because they would occupy the paddy field area; reducing its size.

The other alternative would be to provide irrigation canals along both sides of the edges of the sloping area together with farm roads. An intake structure can be installed at the centre of the river course with link canals provided along the existing road. The existing river course can be used as drainage canal as well as for the collection of return flow from the upper irrigated area. Supplemental intakes can be provided to utilize the limited water effectively.

b. Planning and design

The drawings for construction works of Bugiri P/P area are shown in the attached sheet in Appendix 2-3.

3) Kumi P/P Area

a. Basic concepts of the development

- Setting up a buffer zone of 30 m on both sides of the river course.
- Two intake facilities are set up in the centre of the river course.
- Farm ditch (irrigation canal) should be located in the slope side in order to prevent water loss from the canal.
- Maintenance road will be located in the down side of the slope to

protect against seepage loss from the irrigation canals.

b. On-farm development

At present, most of the P/P area is not under cultivation, and about 80% is used for livestock grazing. The proposed paddy field area is rather steep with an average slope of about 1:40 to 1:80.

In order to avoid expensive on-farm development, the steep slope area has not been included in the P/P area.

The top soil can be used for the paddy fields, but plant roots and grasses should be removed. There are many bushes and natural grasses in the area. At the moment, farmers are engaged in upland crop cultivation in order to maintain their livelihood. They would not be able to spend much time in opening new lands for paddy field construction works. In addition, it would take quite a long time to change the present land resources into paddy fields by farmers alone. As a result, a tractor would be necessary for opening and ploughing the land by disc harrow. Farmers would make the levelling and the construction of bunds for their paddy field on their own.

c. Planning and design

The drawings for construction works of Kumi P/P area are shown in the attached sheet in Appendix 2-4.

4) Sironko P/P Area

a. Location of intake site

The location of the proposed intake site was decided on the basis of the boundary of land ownership and the most higher point on the Sipi River to intake irrigation water easily and irrigate the P/P area effectively.

b. Basic concept of the layout

i) The Sipi River is a regulated river according to NEMA's laws. Hence, the buffer zone should cover 100 m from both sides of the riverbanks.

ii) The main irrigation canal layout should consider the boundary of the land ownership to avoid conflicts in the future.

iii) A flood protection dike, cum maintenance road, cum farm road would be necessary along the Sipi River and upstream of the irrigation main canal.

iv) In the middle of the P/P area along its lowest part, drainage canals should be located to drain excess water from the fields. Surrounding the area, drainage canals should be provided to protect flood water intrusion into the farm plots and drain excess water from the fields. Excavated soil from the drainage canals is to be embanked along them to form maintenance roads cum farm roads.

v) The P/P area is covered by very thick vegetations such as elephant grass, reeds, galingale, etc. The height of the grass is 1.0 to 2.0 m and the

roots are more than 30 cm deep, which makes it very hard to remove. It would be very difficult to open and clear the land by manpower alone within a short time. Land reclamation or clearing would be then undertaken; using a tractor disc harrow. But before bringing the tractor, the grasses should be mowed and thrashed by manpower.

vi) On-farm development consisting of land levelling and construction of bunds should be carried out by farmers themselves after the first ploughing by a tractor. According to the farmers, the adequate size of a plot should be approximately 1,000 m^2, which have been adopted for the on-farm development.

vi) As intake structure, the check gate on the Sipi River will not be constructed as a brick structure but as a temporary structure. The catchment area of the Sipi River is quite large (112 km^2) and constitutes a very steep slope in the mountain area from Mt. Elgon (El. 4,200 m). There are no flood protection dikes along the river. During the flood season, flash floods are expected, and if permanent structures such as head works or check gates are constructed, it is foreseeable that the river course would be easily changed avoiding such obstacles in the river. Permanent structures will be flashed out and flash flood will wash out the riverbanks.

For the Muyembe P/P area, a temporary type intake structure has been proposed, which costs very little compared to the other 3 P/P areas in which irrigation development is implemented, because the Sipi River catchment area at the proposed intake site is 105.7 km^2, the biggest among the P/P areas. The potential irrigable area is estimated at about 200 ha with the possibility of paddy double cropping from the viewpoint of water availability. However, the area specific P/P constraints have aimed at small-scale irrigation developments; setting the P/P area at 18 ha only.

In order to irrigate paddy fields, the size of the diversion dam (headworks) will depend upon the size of the catchment area but not upon the size of the irrigation area. The proper size of the headworks for the Sipi River would be too big and too costly for a small-scale irrigation area of 18 ha but could irrigate a potential irrigable area of 200 ha. Accordingly, the headworks for the Muyembe P/P area has been proposed as a temporary type of weir constructed using timber and bamboo, which is easy to break during big floods. Farmers could easily repair or reconstruct the temporary headworks when necessary.

c. Irrigation and drainage canals design

Considering the above mentioned basic concepts, a main irrigation canal (the layout plan of the P/P area is shown in Appendix 2-5) with a maintenance road whose function would also be a flood protection dike and a farm road would be provided. The embankment of the maintenance road would require a height of 60 cm from the ground considering the flood water depth and a width of 2 m.

The soil along the road can be excavated for embankment material to form a drainage canal to flow over spilled water from the Sipi River. Basically the construction of canals and the excavated volume of soil for embankment should be balanced from an economical view point.

Two tertiary irrigation canals are diverted from the main irrigation canal to supply irrigation water smoothly to the paddy plots, which are named T-1 and T-2. A lateral irrigation canal (I-2) is located along the buffer zone; keeping the 100 m from the Sipi riverbank intact. The shape of the drainage canal, maintenance road (cum flood protection dike and farm road) and irrigation canal adopts the same size as the main irrigation canal. The bottom of the drainage canal is 70 cm deep and 60 cm wide, and the excavated soil can be used to embank the maintenance road, which can be used as a farm road. At a crossing point of an irrigation or drainage canal with the maintenance road, a wooden bridge is planned. There will be 13 bridges in the project area.

The drawings for construction works of Sironko P/P area are shown in the attached sheet in Appendix 2-5.

(5) Construction of Irrigation and Drainage Facilities

1) Preparatory Works

After concluding the contractual agreement with the contractor, focus on the way forward was hinged on the following:

a. Assignment of contractor's personnel for the construction works, namely:
   - One Main Instructor (MI) for the training programmes and the preparation of text books and general instructions for the implementation of the construction works.
   - Four Assistant Instructors (AIs) with the role of facilitators in the training programmes as well as in the lectures.
   - One Construction Manager (CM) responsible for the overall management of the construction works in the 4 P/P areas and for the timely execution of the planned activities. The CM is the focal person to be in touch with the Study Team, the farmers in the respective sites and the MI.
   - Four Assistant Supervisors (ASs) are assigned by the contractor to supervise the construction works. Each one of the 4 P/P areas was to be assigned to an AS.

b. Preparation of detailed construction and training schedule.

The construction works started on October 13, 2005 and were to be completed on February 20, 2006 as stated in the contract. The construction schedule is presented in Figure 2.1.1 along with the training schedule.

c. Preparation of training programmes at the 4 P/P areas for the initial training stage.

d. Setting up of the contractor's office in Mbale town.

e. Procurement of tools for the construction works including clear hose pipe for in-field levelling.

f. Preparation of sign boards for each of the 4 P/P areas.

At the beginning of the construction works on October 2005, field conditions were not favourable (wet) due to the late rains. This provided ample time for selecting and drawing the agreement with the contractor in addition to undertaking workshops. The workshops were to promote farmers participation in the construction works; setting land acquisition as a prerequisite. In the course of monitoring the field conditions, hands-on-training for PIEs and farmers was conducted accordingly; the construction works began with Kajamaka P/P site in Kumi district. Kasolwe, Jami/Kakoli and Muyembe in Bugiri, Budaka (Pallisa) and Sironko districts followed suit later, respectively.

2) Modifications of the facility design

Modifications of the design and construction materials for the intake facilities and gate structures were deemed necessary based on the results of the detailed field inspection at each site. Farmers were expected to be able to easily get the necessary materials for repairing and renewal of the intake structure in the future. It was found, however that the strength and quality of the bricks were not reliable for the intake structures. Accordingly, the materials of the intake facilities were modified to reinforced concrete structures.

The major modifications of the design and materials are summarised in Table 2.1.3.

The major data for the 4 P/P areas are shown in the table below. The drawings of modified main and supplement intake structures and reinforcement are shown in Appendix 2-6.

Dimensions of the 4 P/P sites

Name of District	Budaka (Pallisa)	Bugiri	Kumi	Sironko	Total
Name of P/P	Jami/Kakoli	Kasolwe	Kajamaka	Muyembe	
Dimension of the Project					
Gross Acreage (ha)	17.86	10.87	6.85	15.03	50.61
Net Acreage (ha)	16.78	10.08	6.32	13.14	46.32
Facility Area (ha)	1.08	0.79	0.52	1.89	4.28
Buffer Zone (ha)	0	0	3.77	7.42	11.19
Intake Facilities (Place)	4	2	1	1	8
Turnout Facilities (Place)	1	2	0	1	4
On-farm Development (ha)	0	0	6.32	13.14	19.46
Irrigation Canal (m)	2,500	1,790	1,220	1,575	7,085
Farm or Maintenance Road (m)	380	1,610	1,220	1,870	5,080
Drainage canal (m)	1,490	760	0	1,470	3,720
Collector Drainage (m)	510	2,700	0	0	3,210
Fencing (m)	0	0	1,370	0	1,370
Sprig Protection (Place)	0	0	2	0	2

In Kumi, Budaka (Pallisa) and Bugiri sites, for example, farmers rely on seasonal rivers for paddy production. Yet these rivers originate from catchment

areas distant from the P/P sites. It is therefore prudent to make sure that any additional flow to supplement rainfall should be utilized as efficiently as possible; necessitating an appropriate design of intake(s) and specific canal systems.

Additionally, the Study Team followed NEMA regulations; leaving a buffer zone of 100m for Muyembe site (irrigation water from Sipi River) and 30m for Kajamaka site (irrigation water from Agurut stream). Accordingly, the total area for the 4 P/Ps; including the buffer zone amounted to 61.8ha.

3) Characteristics and Implementation plan

It is noteworthy that the selection of the 4 P/P areas is based on the grouping of the districts according to specific plans of action (i.e., rehabilitation, improvement, diversification and new development), and the implementation of the in-field development in each case is a reflection of these plans.

a. Budaka (Pallisa) P/P Area

In order to rehabilitate the paddy fields, it was deemed necessary to rehabilitate the existing canals; targeting specific functions (i.e., irrigation and drainage canals). The approach requires provision of other structures, like: main and supplementary intake(s) turn out, checks etc.

i) Intake facilities
The main intake facility was constructed upstream of the river at the administrative boundary of Jami and Kakoli. The supplementary three intake facilities and turnout were also constructed accordingly; after determination of their levels to facilitate flow of irrigation water.

ii) Irrigation canals
Irrigation canals on the Kakoli side were newly constructed with the centre line located within/along the centre of the bunds of the farm plot area. The embankment material for the canals were transported from the borrow pit area located on the Kakoli side slope. Inadequate moisture conditions, however, did not permit proper compaction, as required, to prevent irrigation water leakage. However, water from the nearby spring was utilized in watering and compaction of the embankment. In the course of irrigation water supply, there is a need for the water level to be kept high enough above the paddy field level, to facilitate its application/supply from the canal to the paddy plots. In case of deep canals, check structures have been established at strategic points to raise the water level to desirable height(s) with the assistance of check boards.

iii) Borrow pits
After soil excavation, the borrow pit has been reshaped to give it a function of a collector drain equipped with a maintenance road. The purpose of the collector drain is to supply the adjoining paddy plots

with run off water (rainfall).

iv) Layout route for irrigation and drainage canals

In all P/P areas, the land used for the construction of irrigation and drainage canals was donated by the beneficiaries without any compensation cost. The land offer is based on an agreement signed by the beneficiaries and was confirmed; marking the route of the canals with red painted wooden piles before excavation.

v) Drainage canal

The main link drainage canal was provided along the Triny main road; connecting the existing 4 culverts. Wooden bridges, at strategic points, were provided in order to facilitate linkages between the main road, maintenance roads and paddy plots.

b. Bugiri P/P Area

i) Intake facility

The main intake facility was constructed upstream of the P/P area and downstream of the Bugiri-Iganga main road. It is expected to accommodate the return flow from the upstream area, which should be connected to the irrigation canal to supply water to the downstream area. However, due to the low lying level of the road surface, Bugiri District Administration was requested to raise the road level using culverts of minimum diameters of 0.9 m.

ii) Irrigation canals

These were constructed along the boundary between the slope area and the existing paddy fields. Under normal circumstances the water level is expected to be higher than the existing paddy plots. However, in areas where the canals are deeper than the paddy plots, checks at strategic points were provided for raising the water level by check boards.

The head created would facilitate irrigation water application to the existing paddy plots. Maintenance roads were constructed along the irrigation canals, but high enough to tap water from the collector drains through the PVC connector pipes laid at strategic distances. The run off in the collector drains on either side of the scheme (Bupala/Kiteigalwa) is expected to add to the volume of the stream flow meant for irrigation.

iii) Drainage canal

400 m downstream, the drainage canal was connected to 2 link canals (left and right) to facilitate re-distribution of water for irrigation in case of water scarcity or evacuation of water from the paddy plots.

c. Kumi P/P Area

i) Buffer zone

In consonance with the wetlands conservation regulations, a 30m wide buffer zone was reserved on either side of the stream (Mukongoro/Kanyum) for biodiversity conservation purposes. This was clearly marked with red painted piles and the explanation duly given to

the beneficiaries.

ii) Irrigation canals

Irrigation canals in Mukongoro and Kanyum sides were completed along with the maintenance roads. Flow and velocity tests were conducted for the Mukongoro wing, and an efficiency of 88% was recorded. Unfortunately, the stream flow dried up before a similar test was undertaken for the Kanyum wing.

iii) Bridge

To facilitate the crossing of the beneficiaries from the Kanyum side to the Mukongoro side of the scheme, a bridge was constructed using compacted clay material reinforced with additional layers of gunny bags packed with sand. Across the entrance of water to the intake basin, is the link board over stone pitched masonry work. The two earth canals in Mukongoro and Kanyum sides were linked to the intake with stone pitched sections of the canals; covering either side of the buffer zone area.

iv) Land reclamation and cultivation

The area between the buffer zone and the irrigation canal in Mukongoro and Kanyum sides was ploughed by tractor. There is need for disc harrowing; to break big soil clods before farmers embark on land development (levelling). Due to the sloping nature of some areas, it is recommended that farmers first begin by cultivating upland rice to provide adequate time for land levelling. The farmers, after the hands-on-training, are expected to construct farm bunds along their land boundaries by themselves. This is to be a farmer's undertaking guided by the PIEs and MAAIF.

vi) Land levelling

Due to the sandy nature of the soils, it is expected that the basement of the farm plot under the top soil be compacted adequately to provide impermeable conditions to store irrigation water. To improve on soil structure, farmers have been advised to produce composted manure; utilizing kraal manure which is readily available in the district.

vii) Embankment of irrigation canals and maintenance roads

The embankment of the irrigation canals and maintenance roads was properly and sufficiently compacted. On both sides (Kanyum and Mukongoro), the maintenance road was constructed on the outer side of the irrigation canal. At the beginning of this canal in the buffer zone area, 30 m length of canal was protected by stone pitching on either Mukongoro and Kanyum side. Also the maintenance road within the buffer zone was protected for 30 m on Mukongoro and Kanyum sides; using sand bags.

viii)Fencing off the P/P area

To avoid damages that the cattle in the surrounding area may cause to

the canals and other hydraulic structures while in search of pasture and water, it was deemed necessary to fence off the scheme. However, in-lets and out-lets for the beneficiaries, who may need to perform pertinent activities in the P/P area, were provided for.

ix) Cattle troughs and spring protection

To facilitate watering of animals outside the fenced area, two cattle troughs were constructed in either side of the P/P area (Kanyum and Mukongoro). The water feeding the troughs is accessed through irrigation canals (PVC pipe) and back to the irrigation canal through the additional out-let PVC pipe. Furthermore, to enable the surrounding population to access clean potable water, the existing spring wells on either side of the project area were protected.

d. Sironko P/P Area

i) Setting up of the buffer zone

To adhere to the wetlands conservation regulations, a 100m wide buffer zone was left for the maintenance of natural conditions since the Sipi River is declared one of the regulated major rivers. The limit of the buffer zone was clearly marked with red painted wooden piles fixed along the river course, and as in Kumi the beneficiaries were sensitized to keep the area under natural conditions (no cultivation).

ii) Temporary check gate structure on Sipi River

To avoid flush out and changing of river course in time of severe floods, a temporary check gate structure was constructed; using wooden piles, bamboo and banana stems.

iii) Land reclamation and cultivation

The P/P area was originally grassland which had to be converted into agricultural land. The area was slashed and the existing bush trees and elephant grass uprooted in the first stage of construction. A tractor was then put in for 1st ploughing to facilitate removal of the roots of the trees and grasses. It would be necessary to perform a 2nd ploughing before farmers set in for land development. The farmers will construct farm bunds along their land boundaries by themselves.

iv) Land levelling by farmers for future development of paddy cultivation

As it is for Kajamaka, land levelling is to be undertaken by farmers themselves; it should be gradually undertaken to enable the conversion of the farm plots into paddy fields. Similarly, the basement of the farm plot under the top soil should be compacted adequately in order to create impermeable conditions to store irrigation water in the paddy plots. Clear hose pipe has been provided for levelling. Consequently, with the assistance of the PIEs and MAAIF, the beneficiaries should be able to achieve recommended standards on land levelling.

v) Protection against floods

To protect the P/P area against floods, drainage canals were constructed

in the outer limit of the scheme along with maintenance roads cum flood protection dykes adjacent to them. Irrigation canals, on the other hand, were constructed on the inner part of the dykes. The embankment of the irrigation canals and maintenance roads cum flood protection dykes have to be properly compacted to avoid scouring. Due to expected high flood levels, the eastern embankment was raised to a height of 1.4 m from the bed level of the drainage canal.

(6) Field Training of PIEs and Farmers during Construction

1) Grouping of Trainees

In parallel with the construction works, a field training (On-the-job-training) programme for PIEs and farmers was performed accordingly; kicking started 10th October 2005 at Kumi P/P site. This is a hands-on-training where PIEs and farmers, based on the grouping of districts, were expected to get exposed to field activities pertinent to paddy production. Grouping of the trainees was as follows:

- Budaka (Pallisa), Tororo, Iganga and Doho; training in Jami/Kakoli P/P in Budaka (Pallisa) district.
- Bugiri, Mayuge, Busia and MAAIF; training in Kasolwe P/P in Bugiri district.
- Kumi, Kamuli, Mbale and MAAIF; training in Kajamaka P/P in Kumi district.
- Sironko, Soroti, Katakwi and Kaberamaido; training in Muyembe P/P in Sironko district.

The field training programmes were executed three times, separately in each of the 4 P/P sites in accordance with the above mentioned grouping. The major contents of the three training programmes are shown in the following paragraphs. The total number of attendants and period of the training for each programme are listed in the table below. A 122-page manual was prepared for the field training; and the table of contents is shown in Appendix 2-7.

Number of Attendants and Period of Irrigation Engineering Training

Items	Budaka (Pallisa)	Bugiri	Kumi	Sironko
1st Training				
Start	2005/11/7	2005/10/31	2005/10/10	2005/10/24
End	2005/11/11	2005/11/4	2005/10/14	2005/10/28
Irrigation Engineers	4	4	4	4
Farmers	27	24	25	13
2nd Training				
Start	2005/12/13	2005/11/28	2005/12/5	2006/1/2
End	2005/12/17	2005/12/2	2005/12/9	2006/1/6
Irrigation Engineers	4	4	4	4
Farmers	24	19	12	16
3rd Training				
Start	2006/1/23	2006/1/16	2006/1/9	2006/2/6
End	2006/1/27	2006/1/20	2006/1/13	2006/2/10
Irrigation Engineers	4	4	4	4
Farmers	19	31	16	16
PIEs from;	Troro, Doho Iganga, Budaka (Pallisa)	MAAIF, Mayuge Bugiri, Busia	Mbale, Kamuli Kumi, MAAIF	Soroti, Katakuwi Kaberamaido Sironko

2) Training Programmes

During the construction works period, 16 PIEs and key farmers of the P/Ps were trained. The 16 PIEs included one representative from each of the 13 districts, one from MAAIF and two from Doho Rice Scheme. The contractor had training programmes designed for these PIEs who were divided into four groups and dispatched to the 4 P/P areas along with local key farmers of the P/P areas. The training programmes covered the construction methods of irrigation and drainage canals and facilities and the O&M method of these facilities.

A main instructor and 4 assistant instructors had the responsibility to perform the training programmes. The training was provided in three sessions arranged during the construction period with each session scheduled for 5 days. It was given (i) at the initial stage of the preparation works for construction to decide the location and position of the layout facilities in the field, (ii) at the middle of the construction period, and (iii) at the end of the construction works prior to the inspection signifying the completion of the works. Especially, the operation of intake and turnout gates, the maintenance of irrigation and drainage canals and that of farm roads were properly transferred to the trainees during the third training and adequate materials were prepared as text books.

a. Initial stage training

i) Survey works

In accordance with the layout plan, the actual locations of irrigation and drainage facilities were to be located in the field. The training consisted in finding the location of the intake site, the elevation of the bottom based on bench marks installed during the survey works considering the field conditions of the surrounding area. The route of irrigation canals along with the slope of the canal were to be identified in the field by

piling pegs along the canal route.

ii) Confirmation of the boundaries of land owners

The confirmation of the boundaries of land owners is very important in deciding for the layout of irrigation canals and the size of the farm plots. In order to avoid land conflicts among owners, on farm plot size should be decided according to these boundaries and farmer's ability to work smoothly in the fields.

iii) Process of the construction works

In order to construct the necessary facilities, the process and methods were given to the irrigation engineers and local key farmers.

b. Second training

In the course of the second training, the participants were expected to learn the procedure and methods of canal excavation and embankment. They were also expected to comprehend methods of land levelling; using particularly the clear hose pipe method introduced by the Study Team.

i) Construction methods

Methods of excavation and embankment with manual compaction were taught to the participants.

ii) Method of land levelling

The pipe levelling method proposed by the Study Team, the methods of finding the necessary slope in the proposed canals and the methods of land levelling were taught to the trainees.

c. Final training

In the course of the third training, the participants were expected to be abreast with the inspection of the completed construction works and the operation of various facilities; particularly, intake, maintenance and management of the system in collaboration with farmers through WUAs and monitoring of the P/P areas. The emphasis on monitoring is related to the sustainable and wise use of wetlands.

i) Inspection of the completed construction works

In accordance with the contract agreement, the actual constructed facilities were to be inspected with the trainees. When there were something wrong, amendment would be requested to the contractor and farmers to repair the part.

ii) Methods of operation

The most important method of operation is the control of the check and intake gates for irrigation water utilisation during the paddy growing period.

iii) Methods of maintenance

In the off-season, the maintenance of intake facilities and irrigation and drainage canals should be very important works for the farmers. The methods of maintenance were taught to the trainees.

iv) Methods of management
Management methods for the water users association and necessary administrative works were shown in the final training programme.

v) Method of monitoring
After completion of the construction works, continuous monitoring of the irrigation and drainage functions is necessary for the sustainable use of irrigation water and the wise use of wetland.

3) Observations

The training evaluation revealed that the PIEs were in a position to promote irrigation development in the wetlands. Farmers, on the other hand, had learned how to operate the main intake and supplementary gates, turnout and check boards for water levels, in addition to the maintenance of the structures. Farmers' ability to operate the P/Ps will be further enhanced in the actual field when water flows in the canals through the intakes and turn-outs.

In order to evaluate the effect of the extension of the irrigation technology throughout the P/P areas, the followings were observed.

a. Performance of PIEs

As a result of the field training in irrigation technology, some of the PIEs have promoted new wetland development projects in their districts. In Kumi district, Atutur sub-county, tail water of a spring tapped for domestic use was utilized for paddy cultivation; constructing irrigation canals and introducing regular transplanting method. The farmer concerned purchased a push weeder to facilitate paddy field weeding activity. In Kaberamaido, Kalaki sub-county, 15 farmers helped by the PIE started paddy field development; utilising tail water from springs. These activities by the PIEs are clear indications of the success of the capacity development and technology transfer to district officials.

b. Performance of trained farmers

One of the trained farmers in Kajamaka P/P, Kumi District, has alone developed an irrigation canal and a maintenance road of about 300 m long 150 m downstream of the P/P area; using knowledge acquired in the irrigation technology programme. In Budaka (Pallisa), the chairperson of the farmers' organisation has mobilized farmers to participate in maintenance works after completion of the construction; consisting in slashing the grasses and cleaning the irrigation canals.

In Sironko, one farmer in WUA of the P/P together with 16 other farmers constructed an irrigation canal about 300 m long upstream of the intake site of the P/P area and irrigated about 4 ha of paddy area newly developed by the group.

c. Visitors outside of P/P areas

Several outsiders visited the Sironko P/P area. On 6th February 2006, 15

farmers from Bunambutye and Bukhalu sub-counties visited the site accompanied by the Chairman LC5 and members of Sironko district local government. Similarly WID officials with more than 30 environmental specialists visited the Sironko P/P area. This is an indication that the impact of the P/P with respect to NEMA's regulations has been shown in Uganda for the first time.

(7) Completion of Construction Works and Hand-over Ceremony

In agreement with the contract document and construction schedule, the contractor completed the construction works on 17th February 2006 and submitted the letter of inspection. Soon after receiving the letter, the Study Team inspected the 4 P/P areas together with the MAAIF counterpart from 18th February to 20th February. Consequently the whole construction works were confirmed complete for the 4 P/P areas.

Accordingly the transfer ceremonies for the 4 P/P areas were performed as follows:

- 8th February 2006: Hand-over Ceremony for Kumi P/P area,
- 9th February 2006; Hand-over Ceremony for Bugiri P/P area,
- 10th February 2006; Hand-over Ceremony for Budaka (Pallisa) P/P area, and
- 16th February 2006; Hand over Ceremony for Sironko P/P area.

The hand-over ceremonies were performed in-situ to confirm the actual completion of the constructed facilities.

The following items were transferred in accordance with the Ugandan official rules; from the Study Team, to the Commissioner of Farm Development, MAAIF, to the CAO of the district office and finally to the Chairman of the farmers' organisation.

The handing-over of an O&M core fund was decided to support the farmers' organisation activities in O&M in the upcoming wet season, March to August 2006; that is before the harvesting of the first crop. This is because the farmers do not have enough funds for the O&M of the first year. This core fund is equivalent to one year's total water charge for the scheme and was deposited in the bank accounts or respective farmers' organisations as indicated in the table below. In addition to covering O&M costs, the funds will also assist farmers on capacity development in financial and asset management.

Items Transferred to the Farmers' Organisation

Items	Budaka (Pallisa) District	Bugiri District	Kumi District	Sironko District
1. Facilities	As Constructed Facilities	As Constructed Facilities	As Constructed Facilities	As Constructed Facilities
2. Tools for Construction works	As listed in the Contract Document	As listed in the Contract Document	As listed in the Contract Document	As listed in the Contract Document
3. Additional Tools				
a) Push weeder	2	2	2	2
b) Taplin (Plastic Sheets)	2	2	2	2
c) Gum Boots	20	20	0	0
d) Screw Drivers & Spanner	1	1	1	0
4. Core fund for O&M (Ush)	597,024	883,950	554,400	876,420
Unit Water Charge (Ush/acre/year)	14,400	35,500	22,00	27,000
Total Beneficial Area (Acre)	41.46	24.9	25.2	32.46

(8) Monitoring of O&M of Irrigation Facilities

a. Recording of hydrological conditions

The installation of rain gauges in the P/P sites and staff gauges at the intake sites was carried out to observe the natural conditions and meteorological features. The recorded data of daily rainfall and water levels were given to the farmers' organisations.

b. Manual for recording activities

An activity recording notebook was distributed to the farmers' organisations and PIEs to keep record of their performance and activities during the operation, maintenance and management of the irrigation and drainage facilities. The recording manual was prepared based on the followings.

i) Farmers should record their activities during operation, maintenance and management of the irrigation and drainage facilities. Activities can be categorized into the following two performances. One is an ordinary performance; referring to periodical activities performed during the operation and maintenance period such as start of irrigation, slashing of grasses, digging of soil deposit in the canals and at the intake point, etc., which are necessary activities keeping the facilities clean. The other performance is undertaken in emergency situations such as the incidence of heavy rain and flood which could wash parts of the canals or farm roads. Farmers should repair the broken parts immediately. Such repair or rehabilitation works should be recorded.

ii) Problems should be identified and recorded for solution through observations

iii) A plan of action should be decided to solve the observed problems

iv) The period taken by the activity should also be recorded. Sometimes repair works may take several days.

v) The type of activity should also be recorded.

vi) Detailed activities/actions taken should be recorded. For example: what kind of works was performed or what kind of materials was utilized. The volume or length of canal or road involved should be clearly mentioned together with the location of the works; especially, when the supporting personnel from the district office such as DAO or irrigation engineer come to assist given farmers' activities, their names should appear in the records.

vii) Names of the persons who attended the work and activity conducted should be recorded. In case the Irrigation Engineer or DAO attend the activity, their names should be mentioned.

viii) Countermeasures should be mentioned for emergency works such as diverting flood water through a by-pass or utilising hard cores to protect a broken part etc.

ix) Remarks should be mentioned as a result of the activities carried out and countermeasures applied; for example, repair works completed or additional works will be necessary etc.

x) Remaining problems should be written down when the repair or rehabilitation works are not complete; requiring further additional works.

xi) Plan for the next activity should be mentioned or when the problems cannot be solved properly. If the problem is too difficult to be solved by the farmers themselves, assistance or advice should be sought from the district office or MAAIF headquarters.

2.1.2 Achievement

(1) Outline

1) Weather Conditions in P/P Areas

During the construction period, notebooks of "Record of Activity" were distributed to the WUAs and PIEs of the 4 P/Ps to record their activities in the operation and maintenance of irrigation facilities. At the same time, small size rain gauges were installed at each P/P area, and they were requested to keep records on the amount of daily rainfall.

According to the above, rainfall started from February as shown in Figure 2.1.2. In Kumi and Sironko, rainfall started early March, and 40 to 80 mm of rainfall were recorded in some cases; flooding the irrigation areas between April 3rd to 10th hence damaging the irrigation facilities and maintenance roads. Farmers however repaired damaged parts, by themselves, using sandbags and piles.

On the other hand in Budaka (Pallisa) and Bugiri areas, there was not enough rainfall to enhance runoff in the rivers, and less than 20 mm rainfall precipitated in March and April. From the end of April to early May, about 40 to 70 mm rainfall was recorded, resulting into sufficient flow by late May, to allow irrigation of the P/P area. The flow in rivers in Budaka (Pallisa) and Bugiri sites

delayed for a period of about one month compared to that in Kumi and Sironko.

2) Irrigation water supply

In general, irrigation water was well distributed; reaching the end of the irrigation canals and saturating the paddy fields. Farmers started preparing nursery beds and areas/plots for transplanting seedlings in all P/P areas. This was more so in the newly developed Sironko P/P area where about 80 % of the area was cultivated, and farmers finished transplanting paddy fields in May. This is great and quite amazing in the sense that it shows farmers' good initiative and efforts. As a result, it is expected that the whole area would be cultivated by the end of June or July. In Kumi P/P area, more than 60 % of the project area had been transplanted with upland paddy (NERICA), and the cultivated/ploughed area is expected to be expanded further. On the other hand, farmers in Budaka (Pallisa) P/P started nursery and land preparation (the whole area), in May due to the delay in rainfall. The amount of rainfall in Budaka (Pallisa) site appeared to be insufficient and not well distributed enough to permit proper growth of paddy in August. Hence, the likelihood of stressed paddy development at the booting stage thus affecting production. But some harvesting can be expected.

In Bugiri P/P area, farmers started land and nursery bed preparation in May, but unfortunately there was no adequate rainfall in the next months. As a result, the persistent dry spell did not allow any crop to be grown. Farmers were however advised to plant NERICA as soon as the rains set in, although some of them had already planted beans, soybeans, maize and vegetables, particularly tomatoes.

With the exception of Bugiri area, irrigation water supply and drainage function have been satisfactorily achieved in the others 3 P/P areas where the WUAs played their very important roles in water management and maintenance of irrigation and drainage facilities. However the maintenance of canals and farm roads was not satisfactory due to in-adequate weed control. Farmers were still busy with farming activities in the paddy fields and did not find enough time to maintain the irrigation and drainage facilities.

Land levelling was not satisfactory in almost all the P/P areas, an indication of the lack of the technology in farmers. Similarly, bunds surrounding paddy fields were not properly maintained. As a result, it has been recommended that a model plot, for the purpose of demonstrating proper land levelling and bunds construction in each P/P area, be established.

(2) Achievement

In order to justify and evaluate the achievement of the output, the following four items have been considered: (i) function of the constructed facilities such as irrigation and drainage canals, maintenance roads, intake facilities, etc., (ii) activities of the established WUAs; in their performance of water management and O&M of

the established facilities, (iii) on-farm development under farmers own initiative such as land levelling and construction of bunds, and (iv) achievement of environmental conservation; wise and sustainable use of wetland by the farmers, such as; keeping the buffer zone which was established during the construction in Kumi and Sironko P/P areas. In order to use wetland in a sustainable and wise way, intake water should be distributed equally to the paddy field area to minimise water consumption. Minimum outflow should be released to the downstream area for wetland conservation.

1) Budaka (Pallisa) P/P Area

a. Function of the facilities

At the intake structure, a check gate has been installed to control the water level in the irrigation canal. The gate has been smoothly and easily operated, regulating the water level, and there has been no problem, so far, experienced with the functioning of the facilities.

Check boards temporally installed in parts of the irrigation canals to check the water level have shown a smooth flow of water which has reached distal ends of the irrigation canals; meaning that water has been sufficiently distributed to the paddy field. However, as the Jami side is topographically lower than the Kakoli side, the latter area is more inclined to get less sufficient irrigation water. In order to correct the situation, several stop logs have been installed at supplementary intake points located upstream and in the drainage canal for the purpose of raising the water level higher, and the embankment of the link canal and irrigation canals have been heightened to accommodate the situation. As a result, the excess irrigation water in the Jami side can be re-channelled to Kakoli side to facilitate achievement of adequate water balance in the whole area. Originally there were no irrigation canals in the Kakoli side, but with the construction of new irrigation canals, irrigation water can be distributed smoothly and effectively to the paddy fields in the Kaloli side.

In the P/P area, existing and newly constructed irrigation and drainage canals have been properly designated to ensure their specific functions. A link drainage canal has been dug at the most downstream area of the scheme to connect to the existing culverts under the main road, improving the drainage function and allowing almost no excess water in the paddy field area.

b. Activities of WUA

Since notebooks of Record of Activities were distributed to the WUA and PIE, their activities and performance in O&M of irrigation facilities have been properly recorded. Also the WUA have measured and recorded rainfall figures obtained through installed small size rain gauges; readings taken daily at 9:00 AM. The PIE inspected his respective P/P areas almost 3 times a week in a bid to instruct farmers on their activities.

In WUA, few persons in charge of water management were assigned to check on uniform field water distribution condition, and check boards which are installed in strategic places in the irrigation canals, where necessary, to raise the water level in the canals. WUA has decided to work periodically, every Saturday, in their effort to maintain the facilities.

c. On-farm development under farmers own initiative

Technique on land levelling and bunds' construction has not been satisfactorily grasped by the farmers. They use two or four oxen for ploughing the field, but none is used for paddling, which is usually done with hoes; hence, improper levelling. Farmers do not possess adequate technology on utilisation of oxen for ploughing and paddling by dragging a log behind them. However, the technology of paddling by oxen had been introduced to some farmers when they went for irrigation training course in Tanzania (KATC) in 2005. The Study Team has recommended to the chairperson of each WUA to set up a model or a demonstration plot for land levelling and bunds construction around the paddy plot for farmers. Because the bunds are not properly maintained, weeds and grasses have quickly invaded them, in addition to the canals and maintenance roads. Slashed weeds are left on the bunds and roads, which make it difficult to walk on them. It is expected that farmers would be shown typical and beautiful land levelling and bunds in the model plot.

d. Achievement on the environmental conservation

Farmers are trying to utilize and distribute water as equally as possible into paddy plots, which can minimize water consumption in the wetland. At the intake point, a small flow is passing over the check gate, and sufficient amount of water is returned from paddy plots into drainage canals. Sufficient amount of water is also released to downstream area when irrigation water is enough in the P/P area.

2) Bugiri P/P Area

a. Function of the facilities

In May 2006, it was confirmed that the check gate located upstream has adequately controlled the water level; ensuring smooth flow into irrigation canals located both left and right of it, and to the end of these canals. Also one farmer's paddy plot located upstream of the intake structure outside the P/P area could get enough water because of the check gate operation. At the middle of the central drainage canal, an additional intake facility has been constructed to utilize the return flow from the upstream area. When the water level, however, is not sufficient enough to supply additional water to the irrigation canals, the embankments on both sides of the link canal to the main irrigation canals were raised to keep the water level high enough for supplemental flow to the canals. This work has been executed by the farmers themselves.

At the intake point, the water level is raised through the use of the check gate,

and the paddy plots located upstream the P/P area easily obtain irrigation water and benefit from the project (apparent backflow). Excess water is drained from the field through a drainage canal thus improving paddy field conditions.

b. Activities of WUA

The WUA and the PIE properly recorded their activities on performance, O&M in the Record of Activity notebooks. Also the WUA measured and recorded rainfall through the installed small size rain gauges on daily basis. Similarly, water level at the intake site was being recorded through the reading on the installed staff gauge. These rainfall and water level records will be useful in the future for estimating correlations between rainfall amount and water level increase in the river. The PIE routinely visited the P/P area and advised farmers accordingly on required activities. For the purpose of water management, the P/P area has been divided into 4 blocks, and 4 block masters have been assigned for the operation and maintenance of the facilities. Furthermore, the WUA has decided to work every Saturday to maintain the irrigation and drainage facilities.

c. On-farm development under farmers own initiative

On-farm development in this P/P area is the best among the 4 P/P areas. Ploughing coupled with land levelling was very good. But unfortunately, due to lack of rainfall, paddy could not be cultivated in the P/P area this year.

d. Achievement of environmental conservation

At the intake point, the small flow over the check gate contributed to releasing water to the downstream area. Water is also flowing over the supplementary intake located in the middle of the drainage canal, and the return flow from upstream can be expected to supplement water to the downstream area.

3) Kumi P/P Area

a. Function of the facilities

The river flow at the intake point is sufficient enough for irrigation, and the check gate has also been operated properly to raise the water level; supplying enough irrigation water to the canals. Irrigation water was smoothly flowing in the canal and reaching the other end. However, just after the intake, the height of the embankment is too low; causing an over flow to the river side. Repair works will be done by farmers soon. In the Mukongoro side, most of the plots were planted with NERICA in May.

In the Kanyum side, transplanting was delayed due to late purchase of seeds from Doho Rice Scheme. In the upstream part of the irrigation canal in the Kanyum side, flood water from the sloping area ran over the canal and damaged parts of the maintenance road. It is recommended that a wide enough drainage canal be constructed outside the sloping area and down to the river course. In the Kumi area, the soil type is sandy, and the side slope of the

irrigation canals has been eroded, causing sand to be deposited in the bottom of the canal. It is recommended that sand deposits in the bottom of the canals be removed more frequently.

b. Activities of WUA

The chairperson of the farmers' organisation recorded their activities and work plan and performance almost every day. The daily rainfall data have also been properly recorded. However, the PIE has been sent to Egypt for training from April to September 2006, and a new person, from the sub-county, has been assigned to act in his place. Unfortunately, the activities of the PIE could not be deemed sufficient.

The water management activities in the Mukongoro side have been conducted very well by the assigned water master. He has worked very hard in managing and equally distributing water along with setting a check board. In the Kanyum side, the water master did not do as well as in the Mukongoro side. Furthermore, because PIE was absent, proper guidance and instruction to WUA have not been done. However, as PIE is known to be an enthusiastic good engineer, one can expect that he will carry out adequate instruction and guidance to the farmers on the basis of his training knowledge after completing his course in September.

c. On-farm development under farmers own initiative

As for the on-farm development, the P/P area is sloping midway from the river course, and land levelling has not been properly done, especially near the irrigation canal area located in the higher portion of the field, which has kept its original slope. However, NERICA seeds have been distributed to the farmers, which do not require land levelling as much as paddy production. Furthermore, in the lower flat area near the buffer zone, land levelling has been satisfactorily performed by the farmers.

In order to determine crop water requirement of paddy, a drum was installed in the area to measure field infiltration rate in 24 hours. As a result, the value obtained is 18 mm/day. The soil in Kumi is sandy, and the infiltration rate is expected to be rather high; making the result of the measurement acceptable. But further investigations have been recommended to test several points in the area.

Farmers in the upstream area have started digging irrigation canal in the left hand side, which is about 150 m long and destined for rice irrigation. They have kept a buffer zone of 30 m from the river course accordingly to NEMA's regulation. Farmers of the P/P site have been recommended to negotiate with them for water intake distribution. The upstream farmers have already joined the WUA of the P/P area; hence serious problems are not expected.

d. Achievement of environmental conservation

A buffer zone was set up during the construction period and has still been maintained by the farmers. Also as mentioned above, the farmers in the upstream area have kept a buffer zone similar to that in the P/P area.

4) Sironko P/P Area

a. Function of the facilities

Water level in the Sipi River is high enough to permit intake of irrigation water to the P/P area without any check structure. The outer surrounding drainage canal and flood protection dikes have satisfactorily performed their function; keeping the P/P area flood free. Farmers could enjoy farming activities with anxiety. Before the heavy rains, the drainage functions tremendously improved the surrounding area outside the P/P. However, heavy rains coupled with 16 farmers intervention upstream have resulted into additional needs for flood control; to be elaborated later.

At the beginning of the rainy season of April 2006, drainage in the downstream area was a problem, and farmers dug three drainage canals of about 200 m each in that area. As a result of that, drainage has been very much improved, and the area became flood free. The Sipi River water flows at almost the same level as the riverbank height due to heavy rains in the catchment area. A small intake gate opened downstream has made irrigation water to flow smoothly, reaching the end of the canals and irrigating the whole P/P area. However, due to too much rain, the Sipi River flooded partially, raising the water level in the downstream drainage canal and submerging parts of the flood protection dike. One reason why the flood occurred is the digging of one irrigation canal 300 m upstream of the main intake by 16 farmers, who are irrigating about 4 hectares of paddy outside the P/P area. They have no control of water inflow to the irrigation canal due to lack of gate structure. Consequently, excess water invaded the outer surrounding drainage canal in the P/P area. This is coupled with direct flooding; upstream of the 4-ha piece of land.

Although the outer surrounding drainage canal has the good function of draining excess water from outside and from the Sipi River, too many weeds growing in some parts of the canal are limiting its function. Since the area has been newly developed and weeds grow so quickly, farmers should be slashing these weeds more frequently or before any on-farm development. Farmers are spending too much time on the on- farm development, and not devoting enough time for maintenance. It is expected that they would spend more time for the maintenance of the irrigation and drainage facilities in the future when the field conditions are improved.

b. Activities of WUA

Since May there was too much rain and the water master closed the intake gate and drained excess water as much as possible from the field. But some farmers

were getting irrigation water from the drainage canal, which basically could not be managed. It would be necessary for farmers to communicate among themselves and decide on their water scheduling, and the P/P area should be divided into 8 blocks with 8 block masters assigned to a better and systematic water management.

c. On- farm development under farmers own initiative

At the end of May, almost 80 % of the area has been cultivated and transplanted with paddy. It can be expected that 90 to 95% of the P/P area would be developed this year. It would be an amazing achievement for the farmers to open new land in the first year of operation.

In order to estimate field infiltration rate, a drum was installed and observations made for a few days. As a result, the infiltration rate was 46 mm/day, which is a very high value. The area has been newly opened and an impermeable layer has not developed yet. This value can be gradually reduced when paddy cultivation is continued. In order to know the infiltration rate in the whole area, the measurement by drum should be continued in each of the 8 blocks.

d. Achievement on the environmental conservation

Since a 100 m wide buffer zone was established during construction, the area has been still kept and maintained. River flow to the downstream area releases enough water.

2.1.3 Outcomes

As shown in the PDM, for the rehabilitation and improvement in Budaka (Pallisa) and Bugiri, the project purpose is to increase paddy production. For the diversification and new development in Kumi and Sironko, the project purpose is to develop paddy field and start paddy cultivation.

(1) Budaka (Pallisa) P/P Area

In the middle of May, nursery bed has been prepared and transplanted in the field. It has been confirmed that the paddy has been growing rather well, but the observed gradual reduction in rainfall may eventually affect production. As rainfall started one month late, harvest is expected in September when yield level could be confirmed. NERICA has been planted in the sloping area surrounding the wetland, and the yield level expected can be very good.

The PIE has performed well in guiding and instructing farmers quite effectively as shown in his Record of Activity. He will lead farmers in the next A/P and D/P. However, the district office cannot provide sufficient funds to the PIE to cater for transport.

(2) Bugiri P/P Area

The start of the rainy season was delayed till May, but the nursery beds were prepared. After that there was not enough rainfall, and farmers could not grow any

paddy. There will not be unfortunately any production in Bugiri P/P area this year. However, records available confirm that in May, irrigation water can reach the end of the irrigation canals, and the supplementary intake installed in the middle of the drainage canal could play an important role; supplementing irrigation water to the main canal. So far as sufficient rainfall or irrigation water is available, there would be no problems in the function of the facilities and the activities of the WUA as far as water management and operation and maintenance are satisfactory.

Regarding paddy production, a farmer operating upstream of the scheme, has learned from the experiences of the farmers in the P/P area. The Study Team has suggested to the said farmer to divide his large size paddy plot into 3 plots by constructing supplementary bunds and making small size plots for easy land levelling hence flooding. The farmer could reduce irrigation water consumption by reducing water depth in the plots.

The PIE has frequently visited the P/P area and has kept a good communication with the farmers. She has rented a plot in the P/P area in order to grow paddy by herself. She also contributed in negotiating with the CAO for the rehabilitation and improvement of the culverts located in the district road which needed repair. The PIE will have sufficient capacity and responsibility to perform in the A/P and D/P.

(3) Kumi P/P Area

In Kumi, diversification is the purpose of the P/P, and paddy field has been developed. The field has been ploughed by tractors but on-farm development was supposed to be done by farmers themselves. Bunds have been constructed, but land levelling has not been properly done. This time NERICA has been planted as an upland crop since it does not require ideal land levelling. However, in order to increase rice production, paddy would be more suitable for the farmers and land levelling would have to be done more accurately. The Study Team has recommended to the farmers to develop plots following the contour lines in order to reduce soil movement in the plots.

(4) Sironko P/P Area

In spite of being a new development site, almost 90% of the P/P area has been cultivated and planted with paddy. It can be said that this achievement is excellent and is more than expected.

Originally, the area was covered by thick elephant grasses and bushes, and a tractor has been introduced to plough the field, but the on-farm development was to be done by farmers themselves. The farmers constructed bunds along the boundary of the field and started land levelling by hoes. When rains started, weeds grew so quickly, causing farmers to spend too much time slashing weeds. As a result, they did not have enough time to carry out proper land levelling in the first year of new development. Farmers are expected to make beautiful paddy fields in the future.

In some parts of the area, harvesting has commenced, but the downstream area was

submerged due to heavy rains.

(5) Implication to Future Further Development

The implication to future further development will have the following two directions: (1) In the P/P area, further improvement of irrigation and drainage system can be introduced by farmers, and; (2) The irrigation and drainage technology can be diffused and expanded to the surrounding area and outside the P/P.

1) Introducing further improved technology in the P/P areas

Further improved technology can be introduced to upgrade the level of the irrigation and drainage system in the P/P area. It is confirmed that farmers have tried to improve and construct additional facilities to better the field conditions. There will be the following improvement and additional works for the area.

a. Improvement of land levelling; Oxen ploughing for paddling by pulling the log behind them could be introduced since some of the farmers had learned the technique in the KATC training.
b. In order to confirm the necessity of land levelling, yield difference between excess water plots and shallow water plots in the paddy field can be compared.
c. Maintenance of bunds and farm road; In order to utilize bunds and farm roads efficiently for their farming activities, bund and farm roads should be kept clean and flat.
d. Common facilities such as irrigation and drainage canals and maintenance roads should be maintained by farmers themselves.
e. Roles of embankment of canal should be understood.
f. Maintenance of irrigation canal section to facilitate flow of irrigation water.
g. Maintenance of drainage canal to facilitate flow of drained water.
h. In order to achieve further water management technology, tertiary canals should be supplemented in the field.
i. More farm roads should be constructed in the P/P area for farmers' daily activities.

2) Diffusion and expansion to other areas.

Expanding technology to other areas from the P/P area will be very important for implementing the A/P and D/P. The following items have to be introduced.

a. The most efficient way to expand the P/P technology is for the PIE to identify potential areas in his/her district and promote further development of the wetland by new farmers. This work has already been undertaken in Kumi and Sironko.
b. The farmers in the P/P areas can directly expand to the nearest wetland and increase their incomes.
c. Farmers from nearby villages and other areas can visit the P/P areas for study and training. Farmers can exchange opinions and transfer the

technology to the visiting farmers. In Sironko P/P area there are many farmers visiting from nearby villages.

d. Other donors can cooperate for further development. In Bugiri, AfDB plans to establish a small impounding storage structure upstream the P/P area.

3) Budaka (Pallisa) P/P Area

The farmers have constructed additional tertiary canals in the Kakoli side to supplement irrigation water more smoothly. A proposed small impounding site has been found at the upstream stretch of Katira for AfDB to follow up and study the possibility of constructing an impounding structure.

4) Bugiri P/P Area

Without a reservoir, Bugiri cannot cultivate paddy because of the uncertainty of rainfall. In order to overcome such a situation, a small reservoir should be constructed upstream of the P/P area. AfDB will support and study the construction of small impounding.

5) Kumi P/P Area

A farmer has constructed an irrigation canal downstream the P/P area, using tail water of a spring. Also in the upstream area, 3 farmers have dug an irrigation canal for paddy growing and have set up a buffer zone. In the Kumi P/P area, a proposed small impounding site has been found, and AfDB can follow up and study the possibility of constructing an impounding structure. In Kumi district, the PIE has already found a few spring water sites and extended to the farmers the irrigation technology.

6) Sironko P/P Area

300 m upstream of the P/P area, 16 farmers constructed an irrigation canal by themselves, irrigating about 4 ha of paddy. However, there was no water control structure at the intake point, causing flood water to be introduced through the irrigation canal and draining into the P/P area. It has been strongly suggested that the farmers install an intake gate at the river entrance to control flood inflow by shutting the gate.

(6) Necessity of water resources development

Water distribution to paddy field and drainage of excess water can be achieved by constructing adequate irrigation and drainage facilities. As observed this year, irrigation is totally dependent on rainfall. Hence, in order to stabilise and secure production for future development, water resources development should be considered in the A/P and D/P.

The small impounding reservoir will play very important roles due to the following multi functions;

1) Flood mitigation by storing peak floodwater into the storage reservoir.

2) Constant water supply to the wetland for environmental conservation.
3) Constant water supply to the paddy field in the wetland especially during the dry season for annual double cropping. Normally, irrigation water for paddy field will be returned about 30% to 40% of the irrigated water to downstream area through drainage canal which will contribute to wetland environmental conservation.
4) Constant water supply for rural water supply to near by residence area.
5) Mini-hydraulic power generation utilizing the constant water supply for the above purposes.
6) Protection against farmers' intrusion of the upstream stretches of the wetland area due to deep-water depth and seasonal water level fluctuation.
7) Inland fishery development in the storage area that will supply protein to farmers.

2.2 Production Technology Development Programme

2.2.1 Activities

(1) General

In order to improve the present paddy farming, and then, settle "environment-friendly-cum-sustainable irrigated paddy production schemes" in the wetland in the Eastern Region, it is essential and crucially needed to set-up technical-cum-institutional supporting service system through provision of the technical training programme for both of the farmers and local government staff being responsible for the extension service in each respective district area.

The production technology development programme was thus formulated as one of the P/P components to implement the following sub-programmes:

1) Experimental works on paddy cultivation technology,
2) Seed multiplication,
3) Technical training of extension staff and seed farmers, and
4) Technical training of farmers at demonstration farm plots

The objectives of each sub-programme are as follows:

1) Experimental works on paddy production technology at Rice Research-cum-Technical Demonstration Farm Plot (RRTDFP), Doho Rice Scheme

i) Varieties adaptability test: Selection of adaptable-cum-promising paddy varieties so as to replace the present old varieties;
ii) Seasonal cropping test: Identification of productive crop season for intensification and regularisation of seasonal paddy cultivation;
iii) Fertilizers dosage test: Determination of economical and ecology-friendly dosage of chemical fertilisers and compost for paddy production;
iv) Plant spacing test: Determination of optimum planting spaces.

2) Seed multiplication

i) Establishment and operation of seed farm plots: Preservation of the foundation seeds for maintaining sustainable multiplication of the extension seeds;

ii) Multiplication of extension seeds and commercial seeds.

3) Technical training of extension staff and seed farmers

i) Capacity building of extension service staff in the irrigated paddy production technology;

ii) Capacity building of seed growers for performing seed multiplication and distribution of quality seeds.

4) Technical training of farmers at Technical Demonstration Farm Plot (TDFP)

i) Capacity building of key farmers from the respective P/P sites in 13 districts in the irrigated paddy cultivation practices (key farmers from 13 sites were trained separately in TDFP established in Budaka (Pallisa) and Bugiri districts);

ii) Demonstration of plant-physiological features of paddy and advanced farming practices including irrigation water management for better understanding on the paddy production technology as well as conservation of the wetland environment;

iii) Establishment and operation of TDFP in 11 districts, i.e., Namutumba (Iganga), Mayuge, Busia, Butaleja (Tororo), Manafwa (Mbale), Kaliro (Kamuli), Sironko, Kumi, Soroti, Amuria (Katakwi), and Kaberamaido.

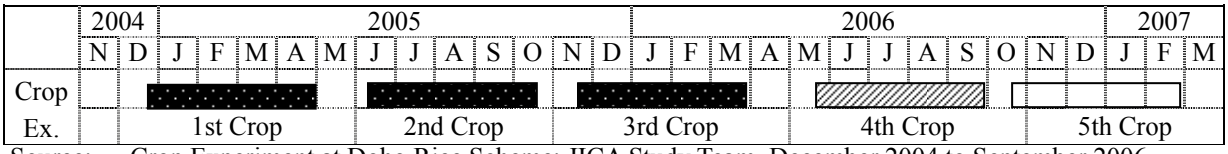
(2) Implementation Activities

1) Experimental works on paddy production

The experimental works was carried out with direct participation of 13 extension service officers who are dispatched from the respective 13 districts within the Study area. The experimental works hereby conducted emphasised on the following tests, i.e., varieties adaptability test, fertilizer dosage test, seasonal cropping test, and plant spacing test.

In close collaboration with the Study Team and Doho Rice Scheme, it has been successfully conducted two crop experiment programmes during the year period of 2005. In succession to the said 2005 programme, the third crop experiment has been conducted in early 2006, and successfully completed up to the end of March 2006. Paddy cropping for the fourth experimental works was then started by the end of May 2006. Commencement of this programme was delayed for almost one month from the original schedule. This was due to a shortage of irrigation water in April 2006 and a serious seasonal flood in the first half of May. The following figure demonstrates performance progress of the crop experimental programme on paddy.

Performance Progress of Crop Experimental Works on Paddy



Source: Crop Experiment at Doho Rice Scheme; JICA Study Team, December 2004 to September 2006
Remarks: The first to third crop experiments that have been progressed successfully. The fourth crop experiment is under performance, while the fifth is still as the planed schedule.

i) Varieties adaptability test

The present paddy varieties prevailed in the eastern Uganda are all weak or susceptible to disease and very loose in threshing capability or weak to grain-shattering problem. Moreover, many varieties are being impoverished and degraded their original plant physiological characters due to improper management of seeds and rough cultivation practices. The essential objectives of the varieties adaptability test are thus to find out the most recommendable new varieties which should be highly adaptable to the local conditions in eastern Uganda and be resistible to the pest and diseases. Accordingly, refreshment of the existing varieties is crucial so as to mitigate both technical and financial risks in rice production activities. Identification-cum-selection of the recommendable varieties was then made in terms of the following five essential features, i.e., (i) productivities (high-yielding with quality conditions), (ii) middle growing days (110 to 120 days) for maturation, (iii) resistible to diseases especially rice blast, (iv) resistible to grain-shattering problem and (v) taste to be acceptable for Ugandan people.

The varieties adaptability test was made taking single plot method because of limited quantity of seeds. Each test plot has 4.5 m^2 (1.5 m x 3.0 m) in net. The planting density is at 105 hills per plot (15 cm x 25 cm in spacing) with application of the regular transplanting method. Transplanting has been made using a single seedling for each hill. The testing varieties so far collected and applied to this testing operation are of 59 varieties in total as listed in Table 2.2.1 and those cropping performance is summarised as follows:

Performance Progress of Paddy Varieties Plantation

Variety Testing Lines		Nos. of Varieties	Date of Sowing	Date of Transplanting
Popular varieties in Doho RIS	K-series	2 varieties	24th Dec. '04	12-14th Jan. '05
WARDA origins	NM-series	5 varieties	4th Jan. '05	24th Jan. '05
	WAS-, FKR- and NERICA-series	31 varieties	16th Jan. '05	7 to 8th Feb. '05
Southeast Asian origins	NS-series1 to NS-13	13 varieties	4th Jan. '05	24th Jan. '05
Egyptian origins	EG- series	8 varieties	20th Jan. '05	9th Feb. '05
	Total	59 varieties		

Out of 59 varieties in the above, the following 17 varieties were selected as new candidate of promising varieties for future propagation and commercial rice production. These varieties are scheduling to apply to the henceforth test programme, and then, confirm resistibility to the blast diseases as well as

yellow-mottled diseases.

Essential Plant Physiological Features of Promising Varieties Selected in Primary Adaptability Test

Varieties	Days for Maturation	Plant Height (cm)	Leaf Colour	Resistibility to Leaf Blast	Threshing Capability	1000 Grains Weight (gr.)	Potential Yield (ton/ha)
NS-1	125	125 – 130	Green	Resistible	Moderate	26	7.3
NS-2	125	75-90	Green	Resistible	Moderate	27-28	7.3
NS-4	120	100-110	Green	Resistible	Moderate	25-28	9.3
NS-9	125	145-150	Green	Resistible	Firm	29	10.0
NS-10	120	100-110	Green	Resistible	Moderate	21-23	8.0
NS-11	115	90-115	Green	Resistible	Moderate	25-26	8.5
NS-12	125	100-110	Green	Resistible	Moderate	24-26	7.5
WAS-7	125	75-90	Brownish Violet	Resistible	Loose	26-28	5.1
WAS-31	115	100-110	Green	Resistible	Loose	22	5.3
WAS-50	115	75-90	Green	Moderate	Moderate	29	4.2
WAS-66	125	75-90	Green	Resistible	Moderate	30	4.0
FKR-73	135	90-100	Green	Resistible	Moderate	26	6.2
EG-1	110	65-85	Green	Resistible	Firm	25	4.9
EG-3	115	50-65	Green	Fairly Susceptible	Loose	30	7.5
EG-4	130	50-65	Green	Fairly Susceptible	Firm	30	5.6
EG-8	125	60-75	Green	Resistible	Firm	27-30	8.5
NERICA-4	105	65-85	Greene	Highly Resistible	Firm	30	4.5

Source: Test results of varieties adaptability test made by the Study Team during the year period from December 2004 to October 2006, in Doho Rice Scheme.

Note: Application of fertiliser at the rate of 50 kg of NPK compound per acre; No agro-chemicals were applied.

Amongst the above17 new candidate varieties, 12 varieties presented in the following table were preliminarily taken up and being applied to the 2nd and 3rd varieties adaptability test. Other than the above, preservation-cum-demonstration of the paddy varieties is also continued using 59 varieties that were adapted to the 1st crop experiment conducted directly by the Study Team.

Paddy Varieties applied to the 2nd & 3rd Varieties Adaptability Test

Origins	Varieties
WARDA origins	WAS-7, WAS-31, WAS-52, WAS-66, FKR-73, NERICA-4
Southeast Asian origins	NS-1, NS-4,
Egyptian origins	EG-1, EG-3, EG-4, EG-8,

Source: Performance record on varieties adaptability test, Doho Rice Scheme administration, May 2006

ii) Fertilizer dosage test

In Uganda, the research work on paddy production technology has been recently conducted by NAARI. The crop experiment on paddy is also being conducted at Doho Rice Scheme. However, the said research information is so far limited to a negligible small for rice growers, and accordingly, the rice production technology is still at the primary level. Farmers grow paddy without precise preparation of soil and land as well as non-utilisation of farming inputs. Even under implementation of the subjected D/P and A/P, it is foreseeable that most of farmers would not invest farm inputs at the initiation stage of the implementation, since they are economically poor and technically unskilled. In very near future, however, it would become necessary to deepen technical knowledge as well as practical technology on soil/crop fertilisation while

Uganda would require certain increment of paddy production so as to meet national demand of the same.

The fertiliser dosage test had dual purposes, saying (i) technical demonstration how to practise soil/crop fertilisation and (ii) identification of standard dosage of chemical fertilizers for maintaining productivity cum quality of rice production. The chemical fertilisers were used for supplementing N.P.K. elements that would be required during the crop-growing period. The chemical fertilizers were applied by means of split application method essentially at the soil preparation stage to transplantation stage, after rooting/active tillering stage, neck-node differential to young panicle formation stage, and full heading stage. In a course of the test, it was also scheduled to demonstrate cultivation of "Azolla" and monitor crop fertilisation effect of Azolla. To perform the fertiliser dosage test, the prospective target yields were set up according to the request of the attendants, and then set up the following conditions for design of the testing lines:

a. Prospective target yield set at 7 tons/ha with split application of fertilisers,
b. Prospective target yield set at 7 tons/ha with ordinary application of basic and once additional fertilisers,
c. Prospective target yield set at 4 tons/ha with split application of fertilisers,
d. Prospective target yield set at 4 tons/ha with ordinary application of basic and once additional fertilisers,
e. Application of fresh rice bran as organic manure, and
f. Neutral plots without application of fertiliser elements.

The specific dosage of fertilisers for each subjected testing plots was designed based on the basic requirement of three elemental nutrition (N:P:K) for producing 100 kg unhusked paddy, i.e., N = 2.0 kg, P =0.8 kg, and K = 1.8 kg respectively and natural supply of the same elemental nutrition, which was foreseeable from the present average production of 1,800 kg/ha, saying N = 20 kg/ha, P = 8 kg/ha and 18.4 kg/ha, respectively. Then, the testing lines with scheduled fertilizer dosage herein primarily designed are as summarized below:

Schedule of Fertiliser Dosage Test

Testing Lines	Chemical Fertilisers (kg/ha)				Rice Bran (kg/ha)
	Nitrogen (N)		Super Phosphate (P)	Potassium Chloride (K)	
	NPK	Urea			
NPK-7 t	250	135	110	95	-
NPK-H	250	135	110	95	-
NPK-4 t	140	80	60	55	-
NPK-L	140	80	60	55	-
Rice Bran			-	-	1,100
Control	-	-	-	-	-

Remarks:
(1) In case of NPK-7t and NPK-4t, fertilisers are applied by means of split application method, namely "basal (N&K 50% and P 100%)" and remaining 50% of N&K split 4 times evenly.
(2) In case of NPK-H and NPK-L, fertilisers are applied twice time namely basal (N&K 50% and P 100%) and remaining 50% of N&K at the most active tillering stage.

The fertilizer dosage test was made taking three-random-replication method. The basin type plots were applied to this test. Each test plot has 4.5 m^2 (1.5 m x 3.0 m) in net. The planting density is at 105 hills per plot (15 cm x 25 cm in spacing) with application of the regular transplanting method. Transplanting was made using a single seedling for each hill. Paddy variety applied to this test is K-5 and K-85 that are the most popular varieties in Doho Rice Scheme, at present. The basic design of test plots is shown in Figure 2.2.1.

iii) Seasonal cropping test

The seasonal cropping test on paddy is one of the essential crop experimental programmes. This test is crucially needed to conduct for certain long year repeatedly so as to know how the paddy varieties would, in each their growing stage, response to seasonal changes of natural conditions. In Uganda, no seasonal cropping test on paddy has been conducted so far. In a course of the P/P, it is therefore scheduled to carry out the test on paddy as one of the important works of the participatory research programme. Through the subjected test operation, it would be identified the best productive season for paddy growing as well as seasonal appearance of the insects, pest and diseases. The field observations are highly be helpful for setting up technically effective-cum-economically viable cropping pattern for commercial paddy production. The seasonal cropping test has been scheduled on as follows:

Schedule of the Seasonal Cropping Test

	1	2	3	4	5	6	7	8	9	10	11	12
Sowing	12/24	1/16	2/15	3/15	4/15	5/15	6/15	7/15	8/15	9/15	10/15	11/15
T-planting	1/14	2/5	3/8	4/4	5/5	6/5	7/5	8/5	9/5	10/5	11/5	12/5

Remarks: Figures in the table are the scheduled date that is shown by calendar days, e.g., month/day.

Paddy varieties used for the seasonal cropping test are selected K-5 and K-85 that are the most popular varieties in Doho Rice Scheme.

The seasonal cropping test was performed till the second sowing as schedule. However, the later works were all obliged to cancel due to long drought spell and irregular precipitation on this study period.

iv) Plant Spacing Test

Adjustment and/or keeping a proper planting space is one of the essential and crucial practices in paddy cultivation. Generally, growing conditions of paddy are largely influenced by soil fertilities and moisture conditions of soils other than the local climate. Thus, for maintaining the most favourable growth of paddy, planting space should be optimised taking into account the soil and moisture conditions of the paddy field. To determine the optimum planting spaces, it has therefore been scheduled on to undertake plant spacing test hereunder the experimental works. The subjected test is being designed as follows:

a. Subjected plant spaces: 15 cm x 15 cm, 15 cm x 20 cm, 15 cm x 25 cm and 15 cm x 30 cm

b. Transplantation method: Regular transplanting with single seedling per hill
c. Variety of Paddy: K-5 for the 1st test, and both K-5 and K-85 for the 2nd and 3rd tests.
d. Crop fertilisation: Basal fertiliser applied just after transplantation [NPK compound at the rate of 50 kg/acre (or 124kg/ha)]
   Additional fertiliser applied at the most active tillering stage [NPK compound at the rate of 50 kg/acre (or 124kg/ha)]
e. Testing method: Two-replication method

The 2nd and 3rd tests operation have been conducted successfully, and finished by the end of March 2006. Performance of paddy cropping under the said testing operation was favourable and brought useful results with good yield. The fourth crop performance is still under execution as of the end of September 2006. The harvesting work will be finished by the middle of October and data analysis and compilation would be completed preferably by the end of November 2006.

2) Seed multiplication

In Uganda, paddy seed production as well as paddy seed supply function is not yet available at present. Thus, all of farmers use their own seeds for commercial production of paddy. Recently, some NGOs has challenged to train/grow up paddy seed growers, however, it is still poor in progress. A lack of technical knowledge as well as experience on seed multiplication work is one of the breaking factors. Absent of skilled technicians as well as sufficiently consolidated paddy field with irrigation function is also risky constraints in the above concern. Establishment of the specific-cum-step-wise functions for preservation of foundation seeds, multiplication of extension seeds and then multiplication of the commercial seeds is essential and crucially needed so as to materialize smooth supply of commercial seeds, timely and as demands. The seed multiplication and seed distribution services could operate and manage on the farmers' participatory basis. Accordingly, seeds production and its distribution could be organised as one of the promising business of the farmers' co-operatives. This business is also highly contributable not only to the household economy of seed growers but also realisation of a financial self-reliance of farmers' organisation.

i) Preservation of foundation seeds

Preservation of the foundation seeds is now under practices using a part of the function of RRTDFP. The subjected varieties are of NM-1, NM-2, NM-3, NM-5 and NERICA-4. These are originated from WARDA, and have successfully passed the varieties adaptability test and screening of NARRI, NARO procedure. The essential plant physiological characters so far identified through the varieties adaptability test are as follows:

Essential Plant-physiological Characters of Varieties Recommended by NAARI

Varieties	Growing Term	Plant Height (cm)	Leaf Colour	Resistibility to Leaf Blast	Threshing Capability	1000 Grains Weight (gr.)	Potential Yield (ton/ha)
NM-1	120	100 -110	Green	High	Moderate	24 - 26	12.7
NM-2	125	100 -110	Green	Moderate	Firm	30	9.1
NM-3	125	100 -110	Green	High	Moderate	28	9.3
NM-5	125	100 -110	Green	Moderate	Loose	28 - 29	8.9
NERICA-4	105	65-85	Green	Highly Resistible	Firm	30	4.5

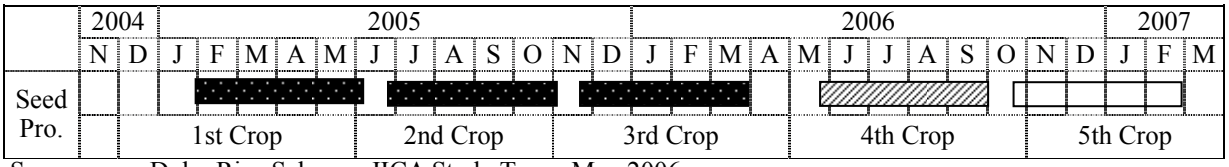
Remarks: The "threshing capability" is the same meaning to the "resistibility to grain-shattering problem". Essential features stated above are all observed through the varieties adaptability test conducted at the experimental farm plots, Doho Rice Scheme during the period from December, 2004 to October 2006.

ii) Multiplication of extension seeds and commercial seeds

To up-keep a sustainability of seeds business, efficiently and satisfactorily, the seeds multiplication should be made taking two steps, i.e., (i) multiplication of "extension seeds" from the foundation seeds, and then, (ii) multiplication of "commercial seeds" from the extension seeds. This two-step seed multiplication system is helpful for management of the subjected seed production, qualitatively and quantitatively as the distribution schedule. Namely, in the said step-wise seed multiplication system, the production of the extension seeds is practically the buffer-stock to meet a variation of the seasonal demand of commercial seeds production. The extension seeds should be multiplied under direct management of a certain scheme, for instance RRTDFP in Doho Rice Scheme, while the seed grower shall produce the commercial seeds on the contract basis.

To perform seed multiplication, the P/P has commenced to grow-up the seed growers in a part of the technical training of the extension service officers. Currently, 5 candidate farmers, who were selected and recommended by Doho Rice Scheme, participated to the subjected training programme. After the training, they took practical field exercise in seed multiplication repeatedly crop season and season under the guidance of the Study Team through practical on-field works. Each farmer has prepared 0.1 ha (or 1/4 acre) of the seed multiplication farm plots using a part of their own paddy field. The seeds subjected to multiplication were of NM-1, NM-2, NM-3 and NM-5 that have been selected by NAARI, NARO as one of the most promising varieties and those extension seeds have already been multiplied by Doho Rice Scheme. The produced seeds of these varieties are being distributed to each P/P area and utilized for TDFP operation. The practical performance progress is as demonstrating in Figure below. The progress of seeds production is presented hereafter the Section.

Performance Progress of Paddy Seed Multiplication Exercises



Source: Doho Rice Scheme; JICA Study Team, May 2006
Remarks: The 1st to 3rd cropping for seed multiplication have been progressed successfully. The 4th cropping is under performance, while the 5th is to be scheduled.

The 4th seed multiplication exercise has been commenced by the end of May 2006. Performance schedule of this programme is almost one and half months delayed from the original schedule because of a shortage of irrigation water in April, while occurrence of serious seasonal floods in earlier half of May.

3) Technical training of extension staff and seed farmers

In Uganda, no specialised extension service officers are so far available in paddy production sub-sector. Besides, seeds supply system is also yet established in both of the public sector and private sector. To develop paddy production sub-sector and improve the current situation of land use of the wetland, it is crucially and urgently needed to train-up the paddy specialist and/or the skilled technicians in paddy cultivation technology. To deal with the said demand, the present workshop programme on training of extension service officers as well as training of seed growers has been organised as a part of the production technology development programme on the P/P.

As it is presented the detailed schedule and curriculum in the respective Table 2.2.2 and 2.2.3[1], the subjected training workshop was started since 10th January 2005 using the function of Doho Rice Scheme for classroom activities and the function of Rice Research-cum-Technical Demonstration Farm Plots (RRTDFPs) for the technical demonstration as well as on-field exercise of the advanced paddy cultivation technology. This training workshop was scheduled by the six sessions, and then, finished by 22nd April 2005. The performance progress of the training programme is as follows:

i) Participants to training workshop

To the above training workshop, DAO in each district selected the attendants amongst the extension service officers. In case of the seed growers, the Doho Rice Scheme selected//recommended 5 farmers as the most reliable candidates amongst the scheme's farmers. Their educational back-ground and experience in paddy cultivation is as summarised below:

[1] Detailed curriculum is shown in Appendix 3-1.

Attendants to Technical Training of Extension Staff and Seed Farmers

Attendants	Educational Back-ground			Experiences on Paddy Cultivation		
	University or Collage	High School or Technical Courses	Middle School or Lower	5 years or more	2 to 4 years	1 year or less
Extension Officers	13	-	-	-	-	3
Seed Growers	-	-	5	5	-	-
Others	2	-	-	-	1	1
Total	15	-	5	5	1	1

Remarks: Figures in Table show a number of persons to be fulfilling the subjected conditions.

The above table suggested that all of the extension officers are university or collage graduates, however, no one have an experience in paddy cultivation except the production manager of Doho Rice Scheme. In case of the candidate seed growers, they have a long enough experiences in commercial paddy cultivation with more than 0.4 ha (one acre) operation. In fact, they are sufficiently familiar with the respective field work/practices in paddy cultivation though their technology is still at traditional.

ii) Training function and materials

The classroom function provided by the Doho Rice Scheme is enough for receiving 20 attendants and supporting their classroom activities. Establishment and then operation of RRDFP is the best practical experience for all the attendants. The training materials, including (i) the text on nursery work, (ii) text on main field work for paddy cultivation and (iii) standard cropping calendar for paddy cultivation, were prepared as the beginner's guideline, and therefore, it is helpful for easy understanding the respective technology for paddy production from A to Z. On-the-job practices performed through practical operation of the soil/crop fertilisation test, varieties adaptability test, plant spacing test, etc. as well as technical exercise that was carried out in nursery work, up-rooting of seedlings, regular transplanting using papyrus line-marker, hand weeding, weeding by use of rotary weeder, etc. were all being highly appreciated as so effective curriculum for studying and deepening of technical awareness on paddy varieties as well as modern farming technology for taking care of the paddy at each respective growing stage. Provision of the saw-edged sharp sickles, rotary weeders and pedal thresher also made a considerable impact to the attendants. Successful assembling of the rotary weeder and pedal thresher in the local workshop also verified a high possibility for doing farm mechanisation even it is still at the small-scale basis.

iii) Technical demonstration function of RRTDFP

In RRTDFP, paddy plantations were conducted with particular emphases on the following technology demonstration effects:

a. Basically, transplanting work was made using a single seedling for each hill,
b. Quantity of seeds was controlled as the minimum requirement (3.4 kg for acre operation that is almost one tenth of that used by the farmers, at present),

c. The sowing density (nursery population) was controlled to 3,500 to 4,000 seedlings per m^2 so as to grow healthy-cum-vigorous seedlings,
d. Regular transplanting was applied with planting spaces at 15 cm x 25 cm,
e. Young nursery being 18 to 20 day-ages (or 4.5 to 5 leaf-ages) was used for transplantation. This aged seedling is the most active for rooting and also initiating tiller number increase,
f. Use of chemical fertilisers were limited only to one bag of NPK compound (25:5:5) for basal application just after transplantation, and another one bag of NPK compound as the additional application at the most active tillering stage.

iv) Technical guidance and on-the-job training

As presented in the training curriculum, the training programme was constituted with (i) lecture on the basic technology, (ii) field guidance on the practical farming technology, and (iii) on-the-job exercise on the farming practices and then (iv) group discussion for deepening of technical awareness and/or capacity building to deal with future development. Through these training activities, the programme provided an opportunity to acquire the most adequate technology as well as knowledge on paddy cultivation practices. Particularly, the programme emphasised on how to improve the present paddy cultivation technology, and what are the "impacts" from the subjected improvement. The essential components discussed are as summarised in Table 2.2.4.

As described in Table 2.2.4, there are two essential ways for proceeding technical improvement or development as regards rice production practices/technology, namely:

- Technical improvement without (or to be not required) capital investment but crucially need "changing mind", and
- Technical improvement/development with (or to be required) capital investment.

Amongst the farming practices and those related technology, the workshop took up the "nursery work" and "planting work" as the most essential key points to be subject to improvement of the present situations of paddy cultivation. Even without capital investment, these improvements could be made so effectively for maintaining paddy yield, and moreover, contributable to a financial amendment of the farm budget and bringing a good balance.

Essential Key Points on Improvement of Farming Practices for Paddy Production Increase

Subjects	Key Point for Improvement	Impacts from Improvement
Nursery Work	1. Use of quality seeds	Guarantee of a good-cum-uniform growth of paddy plant, and hence, bring a reasonably high yield and quality of products
	2. Optimisation of seed quantity	Directly contributable to farming budget through reduction of waste money
	3. Control adequate sowing density (3,500 to 4,500 seedlings per m^2)	Establishing healthy-cum-vigorous seed- lings that could directly be contributable to determination of the best yielding conditions.
	4. Use of the most active seedlings (4.5 to 5-leaf stage) for trans- plantation	Realising smooth rooting and then increasing number of tillers, which is one of the essential conditions for determination of the reasonably high production
Planting Work	5. Introduction of regular transplanting method	The subjected method id effective for creating the best growing environment for paddy plant as well as the best workable conditions for farmers, and thus, would bring a reasonably high yield as well as a good financial balance in the farm budget
	6. Transplantation as shallow soil depth as possible	Realisation of smooth rooting and then earlier initiation of increasing number of tillers is the most ideal and effective factor for determination of a reasonably high production

4) Technical training of farmers at demonstration farm plot

i) Technical demonstration farm plot

Establishment of the farmers' participatory Technical Demonstration Farm Plot (TDFP) has on 27th December 2004 been made at each core P/P site in Bugiri district and Budaka (Pallisa) district. On 28th and 29th December 2004, the Study Team supply the quality seeds (3.7 kg for acre operation) and provided the farm guidance how to prepare the paddy nursery, and also demonstrate how to treat seeds for pre-germination respectively. The farmers groups in both core P/P areas were then sown the pre-germinated seeds to the nursery beds on 31st December 2004. In case of P/P in Bugiri district, the farmers group was obliged to replace the demonstration farm due to the fact that the main spring (irrigation water resource) was dried up under the current dry-spell. Fortunately, the alternative site was available nearby the members' village and within the same sub-county area. The farmers' group was then re-seeded to the new nursery beds on 16th January 2005. The performance activities of both P/P areas are as summarised below:

Performance Progress in TDFP

Particulars	P/P in Bugiri District	P/P in Budaka (Pallisa) District
Establishment of TDFP	27th December '04	27th December '04
Farm guidance on nursery preparation	29th December '04	28th December '04
Seeding of pre-germinated seeds on nursery beds	31st December '04	31st December '04
Replacement of nursery and re-seeding on beds	19th January '05	-
Transplantation of seedlings to main paddy field	6th February '05	18th January '05
Application of basic fertiliser	5th February '05 TSP 50 kg/ac.	20th January '05 NPK Compound 50 kg/ac.
Application of additional fertiliser	5th March '05 Urea 50 kg/ac. And NPK Compound 50 kg/ac.	15th February '05 NPK compound 50 kg/ac.
Plant protection using Dithan M-45 Fungicide	13th March '05	12th March '05
2nd protection against rice leaf blast	19th March '05	18th March '05
Initiation of panicle heading/flowering	10th April '05	1st April '05

The technical demonstration is being operated with emphases on the following technology and/or practices of paddy cultivation:

a. Optimum use of seeds for nursery preparation,
b. Shortening of nursery period to 18 - 20 days only and use the most active young seedling for transplantation,
c. Regular transplanting method with single seedlings per hill,
d. Optimisation of planting space, i.e. 15 x 15 cm, 15 x 20 cm, 15 x 25 cm, 15 x 30 cm, etc.,
f. Crop/soil fertilisation practices,
g. Plant protection using agro-chemical against infection of pests and diseases,
h. Weeding by use of rotary weeder,
i. Harvesting using saw-edged sickles, and
j. Threshing using the pedal thresher.

The technical demonstration is being operated very smoothly and effectively as schedule. Most of the visitors as well as the key farmers from the other districts got strong impact and appreciated a high possibility in improvement of the present paddy cultivation technology.

Following to the above two TDFPs in the core P/Ps, the key farmers in collaboration with the extension services officer promoted and then established the similar type of TDFP at the respective P/P in each home district. The performance progress on the said establishment in each district is as summarised below:

Profile of Farmers' Participatory Demonstration Farm Plot Established in Each District

Districts	Pilot Project	No. of Participants	TDFP (acre)	Land Category of TDFP	Irrigability
Namutumba (Iganga)	Namwiwa P/P	24	1.0	Private (Paddy Field)	Rain-fed
Kaliro (Kamuli)	Igonbe P/P	20	1.0	Private (Paddy Field)	Rain-fed
Mayuge	Nawankoko P/P	21	1.0	Private (Paddy Field)	Irrigable
Bugiri	Kasolwe P/P	20	0.5	Private (Paddy Field)	Irrigable
Busia	Sibimba P/P	22	1.0	Private (Paddy Field)	Irrigable
Butaleja (Tororo)	Muwenge P/P	16	1.0	Community Land (Bush)	Rain-fed
Manafwa (Mbale)	Tembelela P/P	21	1.0	Private (Paddy Field)	Irrigable
Sironko	Muyenbe P/P	25	1.0	Private (Bush Land)	Rain-fed
Budaka (Pallisa)	Jami-Kakoli P/P	20	1.0	Private (Paddy Field)	Irrigable
Kumi	Kajamaka P/P	42	0.8	Private (Upland Field)	Irrigable
Soroti	Gweri P/P	22	1.0	Community Land (wetland)	Rain-fed
Kaberamido	Wera P/P	13	1.0	Community Land (wetland)	Irrigable
Amuria (Katakwe)	Kalaki P/P	29	1.0	Community Land (wetland)	Rain-fed

Paddy field in most of the P/P areas is still unconsolidated. Even irrigation facilities are available in a part, those are not sufficiently functioning due to instable water supply because of limited availability of water resources (small springs). Accordingly, under the current irregular climatic conditions, performance of the TDFP was not progressed smoothly and efficiently as shown in Figure-2.2.2 and summarised in the following Table:

Performance Progress on Paddy Cropping in TDFP in Each P/P Areas

Name of District	2005		2006	
	1st Crop	2nd Crop	3rd Crop	4th Crop
TDFP in 2 Core Pilot Projects				
1. Budaka (Pallisa)	○	□	Under harvesting	x
2. Bugiri	○	x	Cropping of beans	x
TDFP in 11 District Pilot Projects				
3. Kumi	○	x	Yellow ripening stage	Scheduled
4. Sironko	○	x	Under harvesting	Scheduled
5. Namtumba (Iganga)	○	□	○	x
6. Butaleja (Tororo)	○	□	○	x
7. Mayuge	○	x	xx	xx
8. Busia	○	□	xxx	xxx
9. Manafwa (Mbale)	○	○	○	Dough-ripening stage
10. Kaliro (Kamuli)	○	x	□	Seeds preparation
11. Soroti	○	x	Yellow ripening	x
12. Amuria (Katakwi)	x	x	Ripening stage	x
13. Kaberamaido	○	○	○	Heading stage

Source: JICA Study Team, as of end of September 2006

Note: 1st crop; January – April 2005 in TDFP in two core P/P, and April/May - August/September 2005 in TDFP in P/P of 11 districts
2nd crop; September - December 2005
3rd crop; March/May - July/September 2006; and
4th crop; June/September - November 2006/ January 2007
○; Cropping performance being successfully completed
□; Cropping performance being imperfect due to drought problem
x; Cropping being fully suspended due to no irrigation function against drought problem.
xx; Cropping being fully suspended due to institutional trouble in farmers' group.
xxx; Cropping being fully suspended due to trouble in land tenure problem; a land owner didn't allow to operate TDFP.

ii) Technical training of farmers

The training workshop has been organised at two locations, i.e., P/P in Bugiri and Budaka (Pallisa) districts. To this training workshop, two key farmers (or representative farmers) from each P/P of the respective 13 districts were invited as trainees. They were divided into two groups and assigned to the respective training functions that have been established in the TDFP in two core P/P sites, respectively. The assignment conditions in each training function are as summarised in the Table below:

Assignment of the Attendants in Training Workshop

Training Functions	Home District of the Attendants	Number of Attendants		
		Key Farmers Invited	Home Village Participants	Total
P/P in Bugiri district	Kaliro (Kamuli), Mayuge, Bugiri, Busia	8	25	33
P/P in Budaka (Pallisa) district	Namutunba (Iganga), Butaleja (Tororo), Manafwa (Mbale), Sironko, Budaka (Pallisa), Kumi, Soroti, Kaberamido, Amuria (Katakwi)	18	19	37
Total		26	44	70

a) Participants to training workshop

As seen in the Table below, all of the participants, except two key farmers who came from Kaberamido and Amuria (Katakwi), had an experience, more or less, in paddy cultivation. However, no attendants had an experience in regular transplanting method, use of such farm inputs as fertilisers and agro chemicals. No attendants had so far got an opportunity to participate to any other training courses or workshop in respect to paddy cultivation technology. Accordingly, this training workshop was the first experience of all the attendants.

Attendants' Experiences in Paddy Cultivation

Participants	Experience in Years				
	Above10	5 to10	3 to 5	1 to 3	Nile
Key Farmers	7	6	7	4	2
Home Villagers	20	24	0	0	0
Total	27	30	7	4	2

b) Schedule and procedure of training workshop

This training workshop started since middle of January 2005 and scheduled to finish by the end of April 2005. The workshop was constituted with seven sessions. Each session is being held periodically according to the essential growing stage of paddy, i.e., nursery stage, transplanting stage, active tillering stage, young panicle initiation stage, heading and flowering stage and tallow ripening (maturation) stage.

In the workshop, training of the key farmers was basically conducted fully taking the "learning and doing method" through practical field guidance and then exercise of paddy cultivation practices to be specifically required at each growing stage of paddy. The progress of major topics in each session is as summarised in Table 2.2.5.

c) Training function and materials

The training function provided/arranged by the home village farmers is as follows:

Training Workshop Functions provided in Each Core P/P site

Training Sites	Demonstration Plot (acre)	Classroom	Accommodation	Transportation
P/P in Bugiri	0.5	Teaching room of middle school	Public gust house	Micro-bus
P/P in Budaka (Pallisa)	1.0	Private guest house	Drive-inn	Micro-bus

The training materials provided by the Study Team are of (i) the text on the nursery work, (ii) text on the main field works, (iii) standard cropping calendar, (iv) references (hand-out) and (vi) ordinary set of the stationeries. Other than the above, a set of the farming tools, including tooth hoes, panga, weed slasher, transplanting ruler, saw-edged sickles, and rotary-weeder were provided for exercising the ordinary farming practices. Besides, the knapsack sprayer and pedal thresher are offered as the special equipment for exercising the small-scale mechanisation practices in paddy cultivation.

(3) Monitoring Activities

Major parts of the above sub-programmes have first been implemented during the month period from December 2004 to April 2005. The monitoring of the P/P activities has been then planned as follows:

1) To confirm the performance progress, including “inputs” and “activities” scheduled in the implementation plan,
2) To monitor the achievement of the “outputs” through collection and analysis of the related indicators,
3) To monitor the achievement of the “project purpose” through collection and analysis of the related indicators, and
4) To provide proper guidance to the beneficiary farmers and local officials concerned for the solution to the problems in the course of monitoring.

In the First Monitoring (September to October 2005) which was conducted in the 4th Field Work, general performance and achievement of the subjected sub-programmes were centrally monitored and assessed at each P/P site including Doho Rice Scheme. In addition, in the course of the First Monitoring, follow-up support have been made by the Study Team for the representative farmers and local agriculture officers by providing technical guidance for smooth operation of P/Ps.

The monitoring period was about three weeks; two weeks for the field works and one week for the office work. For the execution of field works, two monitoring teams were organised under the Study Team. Each team consisted of a main facilitator and a co-facilitator. Information on production technology development was collected from each P/P site and Doho Rice Scheme through a

group interview with the representative farmers using questionnaires. However, several issues which were not available in the questionnaires were also assessed, time to time and place by place, applying an open-end question method. The monitoring teams tried to contact with the interviewees who were trained in the 3rd Field Work (from December 2004 to April 2005) in order to know the impact of previous training. The interview was also made with the local agriculture officers who were also trained in the 3rd Field Work and responsible for the production technology development in the respective sub-counties.

The Second Monitoring was made on January 2006 within the 4th Field Work period (specifically from August 2005 to March 2006). Through this monitoring, it has been assessed the performance progress of each TDFP especially an efficiency of field work on paddy cultivation practices and crop yield in paddy production. In succession to the second monitoring, the third one has also scheduled on during August 2006 in the 5th Field Work period (May to August 2006). Practically, the third monitoring is the final session for assessment of the performance of TDFP, therefore, the field monitoring work was conducted with particular emphases on "assessment of an achievement of each sub-programme" and "any outstanding problems whether remain or not". All the important information from the representative farmers and agriculture officers were recorded in the field, and compiled in a head office of the monitoring team in Kampala. The number of representative farmers and agriculture officers (or assistant agriculture officers) interviewed in the monitoring on the performance progress of TDFP in the first, second and third monitoring is respectively presented in Table 2.2.6 as par attached hereto.

2.2.2 Achievement

(1) Experimental works on paddy production

1) Varieties adaptability test

The following Table shows the essential plant physiological features of the paddy varieties so far identified through the varieties adaptability test that was performed up to March 2006. Amongst 14 varieties, four varieties, i.e., WAS-52, NS-4, EG-8 and NERICA-4 are appreciated as highly resistible varieties to the blast diseases and moderate to firm threshing capability, and moreover, have a high yielding capability. These four are considered to be one of the promising varieties for paddy production in the Study area. It is also notable that NERICA-4 is highly tolerant to the yellow-mottled disease that is the most serious diseases in the Project area. Now the project own eight varieties, i.e., NM-1, NM-2, NM-3, NM-5, WAS-52, NS-4, EG-8 and NERICA-4 that would be recommendable for sustaining a viable paddy production.

Adaptability Test on Selected Paddy Varieties

Varieties	General Features of Varieties					Average Yield (ton/ha)		
	Growing Term (days)	Plant Height (cm)	Resistibility to Blast	Threshing Capability	1000 Grains Weight (gr.)	1st Test	2nd Test	3rd Test
NM-1	120	110-115	Highly Resistible	Moderate	24-26	12.70	Not applied	
NM-2	120	110-115	Resistible	Firm	30	9.10	Not applied	
NM-3	120	100-110	Highly Resistible	Moderate	28	9.30	Not applied	
NM-5	125	110-115	Resistible	Loose	28-29	8.90	Not applied	
WAS-7	125	55-65	Susceptible	Loose	25	5.10	4.40	4.85
WAS-31	115	100-110	Susceptible	Loose	22	1.60	4.85	Not applied
WAS-52	125	100-110	Resistible	Moderate	22-25	2.20	7.80	4.19
WAS-66	125	75-90	Resistible	Loose	30	4.00	5.50	4.67
NERICA-4	105	65-85	Highly Resistible	Firm	30	2.00	**1)4.50	**1)5.50
NS-1	120	120	Susceptible	Moderate	27-28	7.30	2.40	Not applied
NS-4	105	95-100	Highly Resistible	Moderate	27-28	9.30	5.15	5.52
EG-1	110	65-85	Resistible	Firm	25	1.80	4.95	Not applied
EG-3	115	50-65	Fairly Susceptible	Loose	30	3.60	7.50	5.33
EG-4	130	50-65	Fairly Susceptible	Firm	30	1.50	5.60	Not applied
EG-8	125	60-75	Resistible	Firm	27-30	2.90	5.50	8.47
FKR-73	135	90-100	Susceptible	Moderate	26	6.20	6.95	3.90

Source: Varieties Adaptability Test, Doho Rice Scheme and JICA Study Team, 2005/2006
Remarks: The crop yield of NERICA at 2nd and 3rd test columns are obtained from the practical performance in commercial production made at P/P site of Butaleja (Tororo) and Kaliro (Kamuli), respectively.

2) Plant spacing test

The following table demonstrates the "yielding conditions of paddy by different planting spaces". Although the subjected test should be repeated more times for confirmation of the growing-cum-productive conditions of paddy, the planting space at 20 cm x 15 cm and/or 25 cm x 15 cm would be recommendable as the most capable and/or economical plant-spacing for sustaining higher productive conditions. These planting spaces are also good for using the rotary weeder, smoothly-cum-effectively.

As for the number of seedlings to be planted for each hill, a single and/or few seedlings/hill is enough for maintaining favourable growth of paddy and its reasonably high production. Number of seedlings per hill should be controlled depending on a technical skilfulness in nursery preparation, up-rooting and transplantation practices.

Paddy Yield by Different Plant Spacing

Spacing Order (cm)	No. of Seedlings/Hill	Yield (ton/ha)		
		1st Crop	2nd Crop	3rd Crop
15 x 15	1	4.10	4.05	3.80
	3	-	3.85	3.85
20 x 15	1	4.50	4.20	4.15
	3	-	4.05	4.30
25 x 15	1	4.60	4.35	4.30
	3	-	4.30	4.30
30 x 15	1	4.38	4.30	4.35
	3	-	4.30	4.30

Source: Plant Spacing Test, Doho Rice Scheme & JICA Study Team, 2005/2006
Notes: Crop fertilisation was made using NPK compound at the dosage of 50 kg/acre.

3) Fertiliser dosage test

The fertiliser dosage test brought useful data for practical operation and management of the commercial paddy production at farmers' field. Growing performance of paddy in each testing plot in terms of plant height, number of tillers and number of leaves at the respective growing stage is presented in Table 2.2.7. The yield of each testing line is shown in Table 2.2.8 and summarized in the following table.

Paddy Yield in Fertiliser Dosage Test (ton/ha)

	NPK-7t	NPK-H	NPK-4t	NPK-L	RB	Control
Replication-1	8.00	7.33	6.44	4.44	4.89	1.56
Replication-2	6.67	7.11	6.44	5.11	2.22	2.89
Replication-3	7.11	6.67	5.78	5.56	4.00	3.33
Average	**7.55**	**7.22**	**6.44**	**5.33**	**4.44**	**2.22**

Source: Test results of the first fertiliser dosage test that has been made by the Study Team during December 2004 - April 2005 period in Doho Rice Scheme.
Notes: In case of NPK-7t and NPK-4t, fertilisers were applied by means of split application method, namely "basal (N&K 50% and P 100%)" and remaining 50% of N&K split 4 times evenly.
In case of NPK-H and NPK-L, fertilisers were applied two times namely "basal (N&K 50% and P 100%) and remaining 50% of N&K at the most active tillering stage.
Agro-chemical (Dithan-45) was applied at the rate of 250 gr per acre for protection of blast-diseases

According to the testing results of the second and third fertiliser dosage test, it is rather difficult to identify significant difference of fertilisation effectiveness amongst the testing plots. Although it should test more times continuously, it is foreseeable that an application of one bag of NPK compound (15:15:15)/acre or equivalent to 2 and 1/4 bags/ha (112.5 kg/ha) would be enough for achieving the target yield at 1,600 kg to 2,000 kg/acre (or 4 to 5 tons/ha). This fertiliser cost would be sharing as low at only 5-6% to the gross income. Decomposed rice bran is also useful and effective as organic manure. According to the results of rice bran application, it can be evaluated that the rate of 1.0 ton/ha (or 400 kg/ac) of the decomposed paddy straw (compost) or rice bran will be effective for achieving the yield level at 4 to 5 tons/ha even without application of additional chemical fertilisers. Under application of the organic manures, azolla would grow well in the farm plots. If put azolla into soil using the rotary weeder, time to time, it would become effective nitrogen resource for assisting

vegetative growth of paddy.

4) Seasonal cropping test

The results of seasonal cropping test are limited to only two cropping records because of cancellation of the programme by the middle of January 2005 due to the consecutive long drought spell in January and February, and irregular precipitation thereafter the month. This test should be re-organised when development work of the P/P will be completed. The yielding conditions of seasonal paddy so far obtained are as follows:

Paddy Yield by Different Planting Seasons (Applied Variety: K-5)

Date of Sowing	Test Plots (ha)	Dry Grain Weight (kg)	Yield (eq. ton/ha)
24th Dec. '04	0.05	224	4.48
16th Jan. '05	0.05	188	3.76

Source: Test results of seasonal cropping test made by the Study Team during December 2004 - May 2005 period in Doho Rice Scheme.

Note: Application of fertiliser at the rate of 50 kg of NPK compound per acre; agro-chemical (Dithan-45) was applied at the rate of 250 gr per acre for protection against blast-diseases.

(2) Seeds Multiplication

Training of 5 potential paddy seed growers is being continued at Doho Rice Scheme. The subjected training is conducted taking practical exercise of seed-multiplication practices on field. Up to the end of March 2006, it has been progressed three round exercises on seed multiplication practices as shown in the following table. Performance of seed multiplication works is being improved time by time. In fact, production of quality seeds has been harvested 1,095 kg by the first exercise, 1,470 kg by the second exercise and 1,790 kg by the third exercise. A part of these paddy seeds were distributed to the respective district P/P areas and used effectively for demonstration of an advanced paddy production as well as for commercial production in a part. Accordingly, it can be certified that the seed growers attended to this training programme have achieved over a technical skill for producing a quality seeds.

Performance of Seed Multiplication Exercise at Doho Rice Scheme

Seed Growers	Paddy Varieties	Plot Size (ha)	Round of Exercise	Grains Harvested (kg)	Certifiable Seeds Screened (kg)	Seeds Recovery Efficiency (%)	Remarks
SG-1	NM-1	0.1	1	425	270	63.50	Moderately high % chalky grain
			2	550	500	91.00	Grains to be over maturation
			3	430	370	86.00	Seed grains to be ideally ripened
SG-2	NM-2	0.1	1	400	255	63.70	Moderately high % chalky grain
			2	410	320	78.00	Seed grains to be ideally ripened
			3	425	340	80.00	Seed grains to be ideally ripened
SG-3	NM-3	0.1	1	350	275	78.60	Seed grains to be ideally ripened
			2	400	350	88.00	Seed grains to be ideally ripened
			3	425	353	83.00	Seed grains to be ideally ripened
SG-4	NM-4	0.1	1	185	-	-	Damaged by leaf-blast
			2	-	-	-	Damaged by rat attacking
	K-85		3	430	355	83.00	Seed grains to be ideally ripened
SG-5	NM-5	0.1	1	455	295	64.80	Moderately high % chalky grain
			2	350	300	86.00	Seed grains to be ideally ripened
			3	435	370	85.00	Seed grains to be ideally ripened

Source: Doho Rice Scheme and JICA Study Team, 2005/2006
Remarks: The first round multiplication was performed between May/June and August/September 2005.
The second round exercise was made between September/October 2005 and December/ January 2006.
The third round exercise was conducted between January and April 2006.
SG means the seeds growers who are trained through the training workshop, Doho RIS.

(3) Technical Training and Capacity Building of Extension Staff

1) Effectiveness of extension services

During the year period of 2005, all 13 agricultural officers who were trained at RRTDFP in Doho Rice Scheme had an experience in extending the technical guidance in advanced paddy cultivation practices through practical engagement in TDFP operation throughout the crop season. The following table shows a frequency of field guidance that was made by the agricultural officers by P/P areas up to date. The said frequency is the averaged conditions being obtainable from the passed two to three progress of cropping activities in each P/P site.

Averaged Frequency of Field Guidance of Agricultural Officers to P/Ps

Name of District	Averaged Frequency of Field Guidance at Each Essential Paddy Growing Stage						
	Nursery Stage	Trans-plantation Stage	Active Tillering Stage	Maximum Tillering/ Panicle Initiation Stage	Reduction Division Stage	Heading/ Flowering Stage	Yellow Ripening/ Harvesting Stage
Budaka (Pallisa)	2	1	-	1	-	1	1
Bugiri	2	1	2	1	-	1	1
Kumi	1	1	2	-	1	1	1
Sironko	1	-	2	-	-	1	1
Namutumba (Iganga)	2	1	-	1	-	-	1
Butaleja (Tororo)	2	1	2	1	-	1	1
Mayuge[1)]	1	-	1	-	-	-	1
Busia[1)]	1	-	-	1	-	-	-
Manafwa (Mbale)	1	1	1	1	-	1	1
Kaliro (Kamuli)	2	1	-	1	-	1	-
Soroti	1	1	1	1	-	1	1
Amuria (Katakwi)	1	1	1	1	-	1	1
Kaberamaido	2	1	1	-	1	1	1
Doho Rice Scheme[2)]	2	1	2	1	1	1	1

Source: Performance record on TDFP, Study Team, May 2006

Notes: 1) In case of Mayuge and Busia districts, the agricultural officers took field guidance only for the 1st crop, and no site visit was made thereafter the 2nd crop.

2) In case of the Doho Rice Scheme, the production manager took charges in technical guidance to seeds growers as well as rice growers within the scheme area.

As seen in the above, most of the agricultural officers extended the technical guidance to farmers appropriately at each essential growing stage of paddy. In fact, farmers attended to TDFP greatly appreciated the technical extension services of agricultural officer in all of the cases. It is also remarkable that the paddy production in both TDFP as well as the private paddy field in each P/P area is being increased significantly at the rate of 1.5 to 3 times of the previous production.

To the above end, the Study Team extended the follow-up guidance with emphases on the technology regarding “regular transplantation by means of transplanting-ruler”, “soil puddling and land levelling in each farm plot”, “irrigation water management by means of temporally ridge arrangement” and “management of irrigation water depth for each growing stage of paddy”. The Study Team also provided quality seeds that have been obtained through seeds multiplication exercise in Doho Rice Scheme, farm implements, such as rotary weeder, triangle transplantation ruler, saw-edged sickles for supporting performance of the field guidance and then rising of technical skilfulness in the subjected paddy cultivation technology.

2) Technical demonstration effects

According to the field observation made on the practical activities in establishment and management of TDFP, the concerned agricultural officers and the key farmers definitely acquired the basic technology on paddy production, and moreover, deepened their own technology in farming practices, awareness and knowledge through the training workshop as well as practical

engagement in the extension services for operation of TDFP in each P/P area. It is also appreciated that their technical skilfulness in paddy cultivation would be sufficient for demonstrating an advanced paddy cultivation technology to paddy growers. In fact, almost all of the member farmers in P/P area have adopted an advanced paddy cultivation technology even to commercial rice production in the individual farms as summarizing the performance progress of paddy farming improvement and its extension achievement in the following Table.

Progress of Rice Farming Improvement and Its Extension Achievement in Each P/P Area

Name of District	No. of Attendants in P/P Area	2005		2006	Extension Achievement (%)
		1st Crop	2nd Crop	3rd Crop	
	(1)	(2)	(3)	(4)	(5)
Budaka (Pallisa)	72	-	20 (2.0 ha)	72 (12.4 ha)	100.0
Bugiri	20	-	10 (1.0 ha)	20 (9.8 ha)	100.0
Kumi	18	-	18 (1.5 ha)	18 (6.2 ha)	97.6
Sironko	25	-	-	60 (14.3 ha)	100.0
Namutumba (Iganga)	24	-	8 (0.8 ha)	24 (10.0 ha)	100.0
Butaleja (Tororo)	16	-	3 (0.6 ha)	16 (6.0 ha)	100.0
Mayuge	21	-	7 (0.5 ha)	-	-
Busia	22	-	10 (1.0 ha)	20 (8.0 ha)	90.9
Manafwa (Mbale)	21	7 (2.5 ha)	18 (7.2 ha)	21 (8.5 ha)	100.0
Kaliro (Kamuli)	20	-	20 (1.5 ha)	20 (10.0 ha)	100.0
Soroti	22	-	5 (0.5 ha)	22 (4.5 ha)	100.0
Amuria (Katakwi)	29	-	-	29 (1.5 ha)	100.0
Kaberamaido	21	13 (1.0 ha)	13 (1.2 ha)	21 (5.5 ha)	100.0
Total or Average	331	20 (3.5 ha)	132 (17.3 ha)	331 (97.5 ha)	98.9

Source: Questionnaire to the member farmers in each P/P area, Study Team, May 2006
Note: Figures in columns (1), (2), (3) and (4) present numbers of farmers who took "practical action for improvement of rice farming".
Hectare(s) in parentheses in columns (2), (3) and (4) shows an extent of paddy plantation that is being performed with introduction of advanced farming technology.

Other than the technical extension effect in P/P area stated above, it is also observed that the technical demonstration impact on an advanced paddy cultivation technology has been extended even to outside of P/P area. In fact, 32 farmers has, in the second crop season in 2005, challenged to improve their paddy cultivation practices, while the challenger farmers are drastically increasing to 122 numbers at 36 locations in the main crop season in 2006 in the entire Study area as broken-down in the table below. To the above end, the local governments in the respective districts and/or the sub-counties have recently been taking supporting action even in the limited part. In case of Butaleja (Tororo) district, the local government pays an administrative effort for improvement of paddy cultivation technology. Practical support of the local government is of (i) sharing the community land to establish TDFP, (ii) assisting to organise "farmers' participatory training workshop" and (iii) budgeting to assist field activities of the agricultural officers for extending the advanced paddy cultivation technology.

Progress of Rice Farming Improvement and Its Extension Achievement Outside of P/P Area

Districts	2005		2006	Extension Achievement (locations)
	1st Crop	2nd Crop	3rd Crop	
	(1)	(2)	(3)	(4)
Budaka (Pallisa)	-	-	7 (2.5 ha)	2
Bugiri	-	3 (0.4 ha)	15 (3.0 ha)	3
Kumi	-	4 (0.4 ha)	13 (5.8 ha)	5
Sironko	-	25 (0.8 ha)	17 (4.8 ha)	2
Namutumba (Iganga)	-	-	11 (5.0 ha)	4
Butaleja (Tororo)	-	-	18 (7.5 ha)	3
Mayuge	-	-	2(0.8 ha)	-
Busia	-	-	1 (0.5 ha)	3
Manafwa (Mbale)	-	-	17 (5.8 ha)	2
Kaliro (Kamuli)	-	-	7 (6.0 ha)	5
Soroti	-	-	5 (0.6 ha)	2
Amuria (Katakwi)	-	-	1 (0.5 ha)	1
Kaberamaido	-	-	10 (1.4 ha)	4
Total or Average	- (-)	32 (1.6 ha)	122 (44.2 ha)	36

Source: Questionnaire to farmers in and around P/P areas, Study Team, May 2006
Note: Figures in columns (1), (2) and (3) present numbers of farmers who took "practical action for improvement of rice farming".
Hectare(s) in parentheses in columns (2) and (3) shows an extent of paddy plantation that is being performed with introduction of advanced farming technology.

(4) Improvement of Technical Skilfulness of Paddy Growers

1) Achievement of target yield

It has been observed that all of the farmers were strictly referring to the technology and farming practices that were being transferred through the training workshop provided by the JICA Study Team. It is also observed that most of farmers are aggressive and have ability to properly response to an advanced farming technology. In fact, the cropping performance in both of TDFP and individual farms were considerably good as presented in the Tables attached hereafter. Amongst 13 P/P sites, all 13 sites have achieved the target yield of 4.0 tons/ha both in TDFP and individual farms. Even in case of outside of P/P areas, the local paddy growers in all the sites except Amuria (Katakwi) district achieved the target by adoption of the advanced paddy cultivation technology.

The most serious disturbance and/or problems on paddy production are simply of a lack of irrigation facilities against unfavourable rain distribution and/or appearance of a long drought spell. Crop damages caused by the seasonal flood have been successfully minimised by adjustment of the cropping pattern. In case of P/P in Manafwa (Mbale) district, it has shifted the nursery period from April to mid-May and after. As the result, farmers could grow paddy without flood risks and being achieved over the target yield, successfully. The monitoring results on an effect of paddy production increment in case of TDFP are presented in Table 2.2.9 and summarized here below:

Paddy Production Incremental Effect in TDFP in Each P/P

Districts	Yield in Previous Years (kg/ha)	Yield Performance (kg/ha)			Achievement to Target Yield (%)		
		2005		2006	2005		2006
		1st Crop	2nd Crop	3rd Crop	1st Crop	2nd Crop	3rd Crop
Budaka (Pallisa)	1,500	3,370	*1	5,670	84.3	-	141.8
Bugiri	1,750	2,500	*1	*4	62.5	-	-
	2,000	4,670	-	4,080	116.8	-	102.0
Kumi	1,500	2,520	*1	4,000	63.0	-	100.0
	1,750	5,000	-	5,760	125.0	-	144.0
Sironko	2,500	3,750	*1	4,350	93.8	-	108.8
Namutumba (Iganga)	3,250	4,330	2,450*2	4,200	108.3	61.3	105.0
Butaleja (Tororo)	2,000	4,500	3,200*2	4,600	112.5	80.0	115.0
Mayuge	2,000	2,530	*1	*6	63.3	-	-
Busia	1,500	2,500	3,000*2	*7	62.5	75.0	-
Manafwa (Mbale)	2,000	4,500	4,250*3	4,500	112.5	106.3	112.5
Kaliro (Kamuli)	1,500	2,200	*1	6,710	55.0	-	167.8
Soroti	1,500	3,250	*1	4,350	81.3	-	108.8
Amuria (Katakwi)	2,500	-	*1	5,020	-	-	125.5
Kaberamaido	1,500	3,400	3,400*3	4,800	85.0	85.0	120.0
Average	1,917	3,501	3,260	**5,380**	87.5	81.5	**128.5**

Source: Performance record on FPDFP, Study Team, May and Mid-August 2006

Notes: *1; Cropping was suspended due to a long drought spell in later half of year 2005.
*2; Lower yield than that of the 1st crop due to drought damages.
*3; Crop performances in the respective P/Ps in Manafwa (Mbale) and Kaberamaido were being favourable under fully irrigated conditions.
*4; Cropping was suspended due to a drought spell from June to August 2006, although nursery was prepared in May.
*5; This yield was performed by NERICA.
*6; The 3rd crop is being suspended due to an institutional trouble within the farmers group.
*7; The 3rd crop is being suspended due to trouble in land tenure; land owner didn't allow to operate FPDFP.

The following two Tables show an effect of technical improvement that has been realising as an increment of paddy production in the individual farms in P/P area. The performance progress of paddy cultivation in the individual farms in P/P area is presented in Figure 2.2.3 and the detailed breakdown of paddy yielding conditions in each P/P area is as compiled in Table 2.2.10 attached hereto. Although it was under influence of drought problems and/or the seasonal flood damages, farmers attended to P/P activities could materialise reasonably high yield by adoption of the advanced technologies. Besides, majority of farmers have achieved over the target yield of the project (4 to 5 tons/ha in terms of dry un-husked rice).

Yield in Commercial Paddy Production and Its Achievement to Target in case of member farmers of P/P area

Districts	Yield in Previous Years (kg/ha)	Yield Performance (kg/ha)			Achievement to Target Yield (%)		
		2005		2006	2005		2006
		1st Crop	2nd Crop	3rd Crop	1st Crop	2nd Crop	3rd Crop
Budaka (Pallisa)	1,500	-	5,500	5,530	-	137.5	138.3
Bugiri	1,750	-	*1	*3	-	-	-
		-	3,950*2	4,100	-	98.8	102.5
Kumi	1,500	-	3,500	6,850	-	87.5	171.3
Sironko	2,500	-	*1	7,130	-	-	178.3
Namutumba (Iganga)	3,250	-	4,750	5,100	-	118.8	127.5
Butaleja (Tororo)	2,000	-	4,500	5,330	-	112.5	133.3
Mayuge	2,000	-	*1	5,000	-		125.0
Busia	1,500	-	4,000	6,000	-	100.0	150.0
Manafwa (Mbale)	2,000	4,500	4,500	7,230	112.5	112.5	180.8
Kaliro (Kamuli)	1,500	-	2,500*2	4,000*2	-	62.5	100.0
Soroti	1,500	-	3,500*2	5,000	-	87.5	125.0
Amuria (Katakwi)	2,500	-	*1	4,330	-	-	108.3
Kaberamaido	1,500	-	2,700*2	4,800	-	67.5	120.0
Average	1,916	4,500	3,968	5,370	112.5	99.2	134.3

Source: Performance record on commercial paddy cultivation using a new technology, Study Team, Mid-August 2006

Notes: *1; Cropping was suspended due to a long drought spell in later half of year 2005.
*2; Damaged by drought.
*3; Cropping was suspended due to a drought spell from June to August 2006, although nursery was prepared in May.

The paddy production technology demonstrated in TDFP is now gradually extending to the surrounding areas, and giving a valuable impact to the local paddy growers. In fact, as it has been presented in the previous Section (3) hereof, technical improvement in paddy cultivation is, as of May 2006, being progressed at 36 locations with a total extent area of some 44.2 ha by 122 local paddy growers in the entire Study area. Although an effect of technical improvement is relatively lower than that in P/P area, paddy production is surely increased as summarised in the following Table, and the detailed breakdown of paddy yielding conditions outside of P/P area is as compiled in Table 2.2.10 attached hereto;

Yield in Commercial Paddy Production and Its Achievement to Target in case of local paddy growers outside of P/P area

Districts	Yield in Previous Years (kg/ha)	Yield Performance (kg/ha)			Achievement to Target Yield (%)		
		2005		2006	2005		2006
		1st Crop	2nd Crop	3rd Crop	1st Crop	2nd Crop	3rd Crop
Budaka (Pallisa)	1,500	-	-	4,710	-	-	117.8
		-	3,950*2	4,100	-	98.8	102.5
Kumi	1,500	-	*1	5710	-	-	142.8
Sironko	2,500	-	*1	5,150	-	-	128.8
Namutumba (Iganga)	3,250	-	-	4,200	-	-	105.0
Butaleja (Tororo)	2,000	-	-	5,000	-	-	125.0
Mayuge	2,000	-	*1	-	-		-
Busia	1,500	-	-	5,150	-	-	128.8
Manafwa (Mbale)	2,000	-	-	5,960	-	-	149.0
Kaliro (Kamuli)	1,500	-	-	5,230	-	-	130.8
Soroti	1,500	-	-	4,850	-	-	121.3
Amuria (Katakwi)	2,500	-	-	3,900	-	-	97.5
Kaberamaido	1,500	-	-	4,500	-	-	112.5
Average	*1,916*	-	-	***4,872***	-	-	***121.8***

Source: Performance record on commercial paddy cultivation using a new technology, Study Team, May and Mid-August 2006

Notes: *1; Cropping was suspended due to a long drought spell in later half of year 2005.
*2; Damaged by drought.
*3; Cropping was suspended due to a drought spell from June to August 2006 though nursery was prepared in May.

2) Achievement of technical skilfulness

The following Table demonstrates an improvement effect in paddy cultivation practices that is represented in terms of "reduction rate of labour intensity" in the private farms where farmers have been adopted an advanced technology for paddy cultivation. The detailed breakdown for P/P area is compiled in Table-2.2.11 as par attached hereto. As far as the nursery preparation and transplantation work, farmers have achieved their technical skilfulness to an advanced level, and remarkably reduced the labour intensity to 30-33 person-days from 40-55 person-days. The labour intensity in soil/land preparation is also improved to a significant extent (achievement 70 to 80% in skilfulness to the advanced conditions). Adoption of oxen power to ploughing and harrowing works is much contributable to a successful improvement.

Improvement Effect in Paddy Cultivation Practices (Reduction of Labour Intensity)

Major Farming Practices	Labour Requirement under Present Conditions (man-day/ha)	Labour Requirement under Advanced Conditions*1 (man-day/ha)	Averaged Labour Requirement with Farm Guidance (man-day/ha)		Achievement of Skilfulness to Advanced Conditions (%)	
	(a)	(b)	1st Crop*2	3rd Crop*3	1st Crop*2	3rd Crop*3
Nursery preparation work	3.1	2.5	2.6	2.5	68.3	100.0
Soil preparation in the main field	82.0	53.0	80.3	57.5	8.1	87.5
Transplantation of seedlings	41.0	30.0	32.6	30.0	76.4	100.0
Crop fertilisation and weeding	90.0	40.1	50.2	45.5	81.7	91.4
Harvesting Work	55.0	26.0	32.8	37.6	76.6	60.0
Total labour requirement	**271.1**	151.6	198.5	**173.1**	65.7	88.8

Source: Field data collected by the Study Team, May 2006

Notes: *1; Labour requirement under advanced conditions is the average figure that is widely accepted in paddy cultivation in the Southeast Asia countries.

*2; Labour Requirement with Farm Guidance (1st Crop) is the averaged condition that has been obtained from the 1st crop performance at 4 core P/P areas.

*3; Labour Requirement with Farm Guidance (3rd Crop) is one of the sample case that has been observed in P/P in Manafwa (Mbale) district.

A low improvement effect still remains in the crop fertilisation and weeding work. As far as the weeding work is concerned, an achievement ratio is being drastically increased to more than 80 % to the advanced conditions in a case where farmers use the rotary weeders. For improvement of working efficiency of crop/soil fertilisation, provision of farm road, transportation means, etc. is essential and crucially needed. In case of the harvesting work, the sharp-saw-edged sickles might be highly helpful for maintaining efficiency of the labour work or directly reduction of the labour intensity. Any ways, for the total works in paddy cultivation, reduction of the total labour intensity is achieved at 83 to 87 % in case of the most advanced conditions, while it is still lower at 50 to 60 % to an advanced condition. At present, most farmers have only limited farming tools, i.e., handy hoe and panga (knife). To promote improved paddy production practices and then optimise working efficiency as well as quality of the rice product, it is crucially needed to propagate adequate farming tools, implements and equipment, such as triangle transplantation ruler, rotary weeder, oxen soil-puddler, saw-edged sickles, pedal thresher, etc. Besides, such cart, oxen-trailer as transportation means are also indispensable equipment for smooth-cum-efficiently transporting paddy production, by-product, compost etc. from the field to house-yard and its reverse way.

2.2.3 Outcomes

The essential objectives of the production technology development programme are to realise productive-cum-profitable paddy farming system. Although performance progress of the crop experimental works as well as the demonstration farm plot activities is so far limited only on three crop seasons, it could be appreciated that the programme has achieved the most part of the objectives, and then, verified that the subjected paddy production is technically feasible and socio-economically viable as follows:

1) The nature of the project area is mild and highly suitable for paddy cultivation,

though artificial irrigation is essentially needed for maintaining favourable watering conditions against a long drought spell in the crop season.

2) Soils in the Study area still reserve the basal fertility (or relatively rich natural supply is available) and well response to crop/soil fertilisation practices. A potential yielding condition is as high at 8 to 10 tons/ha while normal yield will be 4 to 6 tons/ha on an average under economical-cum-environment-friendly farming conditions.
3) All the agricultural officers as well as key farmers have definitely acquired the basic technology on paddy cultivation, and also deepen their own techniques, awareness and knowledge in the farming practices through the training workshop and practical engagement in operation and management of TDFP.
4) Almost all of paddy growers are aggressive and have high ability to properly response to new farming technology. It is also essential fact that many farmers have been achieved higher yield than 4 tons/ha even though the seasonal drought and flood trouble influenced during the paddy-growing period.

So far, however, majority of farmers did not achieve "technical skilfulness for sustaining advanced paddy cultivation practices", and hence, "reduction of labour intensity in paddy cultivation to the advanced conditions". The outstanding problems and/or disturbance lying in the above are (i) unfavourable field conditions, i.e., unconsolidated farm plots, a lack of irrigation and drainage facilities, less availability of farm roads, etc., and (ii) a lack of adequate farming tools/equipment for soil preparation, transplantation of seedlings, weeding, harvesting and threshing works. To realise a sustainable paddy production, in further planning of the Project, it should be scheduling to satisfy all the above deficits with particular emphasis on the beneficiaries' participatory programme and provision of such practical institutional support as "workshop for promotion of technical works", "micro-credit for improvement of paddy farming", etc.

As for an achievement of TDFP, it is foreseeable that an incremental effect in the paddy production under the Project would be almost 128% in terms of the crop production increment. To the above end, accordingly, the farm-household economy could be improved to a significant extent. Namely, the gross income becomes about Ush. 2,080,000 (2.3 times of the present conditions) at the unit price Ush. 800/kg milled rice bases, while the farming expenditures are decreasing 33% to the present conditions even though the cost for procurement of fertilisers and farming tools/equipment is added newly. The cost for seeds and labour wages could much be reducible when advanced technologies are adopted. Finally, the net income increases greatly with an incremental effect at about 320 % (or about 4 times) of the present conditions. The above means that TDFP would be technically feasible and financially viable especially in terms of the farming budget of unit farm as roughly estimated and demonstrated here below:

Increment of Cost and Benefit under With and Without Project Conditions (per ha unit)

Particulars		Without Project	With Project	Incremental Effect (%)
Paddy Production (kg)		1,750	4,000	128.6
Milled rice (kg)		1,140	2,600	128.1
Gross Income (Ush)		912,000	2,080,000	128.1
Farming Expenditures (Ush)		499,200	333,080	-33.3
	Seeds	87,500	9,380	-89.3
	Fertilisers	0	60,000	-
	Agro-chemicals	0	0	-
	Tools/equipment	5000	21,000	320.0
	Labourers	406700	242,700	-40.3
Net income (Ush)		412,800	1,746,920	323.2
Net income per capita (Ush)		82,560	349,380	323.2

2.3 Organisational and Institutional Development Programme

2.3.1 Activities

(1) Background

Farmer's group formation has been promoted under the PMA and also has been an integral part of various agriculture development interventions in Uganda. Such a strategy assumes better access to agriculture supporting services and market. This means more to paddy growers in Uganda who mostly cultivate in wetlands. Under the current laws and regulations concerning wetlands, farmers who cultivate wetlands are obliged to apply for the permits to use wetlands and thus to be organized as a Wetland Association (WA). Furthermore, by introduction of irrigation facilities as in 4 P/P sites in the P/P, a Water User's Association (WUA) is indispensable for coordinating activities of O&M.

The types of groups introduced during the training included CBO, WA, WUA and Cooperative which registration procedures are indicated in the table below.

Types of Groups and Registration

Type of Organisation	Offices concerned	Function of Group
CBO	District Community Based Services Office through Sub-county CDO/ Assistant	Foundation for organisational development
Wetland Association	NEMA	Permit to use wetland through adopting wise-use principles
	WID, MW&E; DEO/ DWO	Communal Wetland Users * The group must have CWMP.
Water User's Association	Formed independently or under the mother organisation	Participatory Irrigation Development, O&M and water management
Cooperative	Ministry of Trade and Industry; District Cooperative Officer	Better access to agriculture supporting services and market

Considering the need and high relevance of the group formation and capacity development of the participating farmers, the JICA Study Team implemented the training programme between January and March, 2005 spending 22 days. The first session was to provide guidance for the district technical staff. Two officers from

each district were invited. Between session II and session VIII spending 20 days, 2 key farmers and 1 sub-county official or a local leader from each P/P site were trained in guidelines on uses of wetlands, organisational management and participatory irrigation development.

Objectives of the workshops:

1) To sensitise farmers in various regulations in growing paddy in wetlands;
2) To train local government officials in facilitation of the workshops;
3) To enable farmers to protect their rights by establishing a community based organisation;
4) To enable both farmers and local government officers to carry out participatory irrigation development; and
5) To assess the relevance and effectiveness of the training methodologies for the capacity development for paddy growers' organisation.

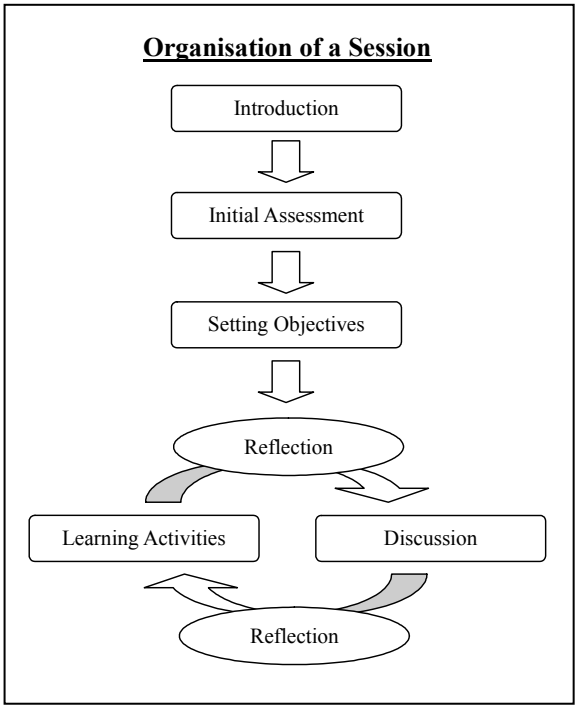
The outline of the sessions is indicated bellow.

Session Schedule and Outline

Title of Sessions	Dates	Outline of Each Session
Session I: Nurturing Farmers' Organisation for Paddy Cultivation in Wetlands (District Officers Only)	13-14 Jan 2005 (2 days)	This session is organised for the district level officers and NAADS service providers concerning wetland management, paddy growing and farmers' group formation. The session aimed at informing the stakeholders who support paddy growers in wetland areas to know the government guidelines on paddy growing and wetland management as well as the process of irrigation development. In addition, facilitation skills of the participatory workshop were expected to be acquired by the participants.
Session II: Wetland Management and Livelihood	20-21 Jan 2005 (2 days)	This session introduces the concept of wise-use and management of wetlands to the participating farmers. The participants shall discuss the mutual dependency between the ecology of wetlands and farmers' livelihoods. Activities such as mapping, time-line and group discussion will help them to develop their understanding towards the wetland management. The participants will then carry out the diagramming to identify the different groups of individuals who have access to the wetland resources. It is to help participants to identify conflicts and their causes and thus to help them to mitigate such situation.
Session III: Organisation for Paddy Growers in Wetlands	27-29 Jan 2005 (3 days)	This session intends to give the overview of different types/ functions of organisations for paddy growers in wetlands. The paddy growers in wetlands are required to be organized in a group according to the government guideline. Furthermore, being organised as a group will ensure their use rights to wetlands and improve access to other supporting services. The type of organisations to be outlined introduced during the session includes Wetland Users' Association, Cooperative and Water User's Association. Each type of group has different functions and requires a separate registration procedure to different offices. These shall be clarified during the session. In addition to this, "Water Permit" will be explained.
Session IV: Registration of a Community Based Organisation (CBO)	3-4 Feb 2005 (2 days)	This session is a practical workshop for the paddy growers to organize a group and the organisational management. The participants will be explained of the registration procedures of CBO and activities concerning organisational management. Drafting of the constitution is included as a group activity.
Session V: Organisational Capacity Building	9-11 Feb 2005 (3 days)	The topics covered in this session include good governance, accountability, and activity planning and monitoring. Brain Storming and Problem Tree will be carried out as to provide participants to experience the actual planning process. The participants will fill in the activity planning matrix which format will be provided by the JICA Study Team and also try the budget allocation.
Session VI: Financial Management for Farmers' Organisations	17-19 Feb 2005 (3 days)	This session intends to increase the financial management capacity of the farmers' organisation. The type of funding dealt in this session includes loans, the membership fees and revolving funds. The cash flow of each type of funding will be explained to the participants. The role play shall also be carried out as part of the workshop activity. In addition to the above, the different types of financial records and how to keep them shall be explained to the participants.
Session VII: Accessing Agriculture Supporting Services	24-26 Feb 2005 (3 days)	The session provides necessary information for the paddy growers how to access various agriculture supporting services. During the workshop, the analytical skills on information network on farming and access to markets are introduced. We also conduct participatory farm budget to train them in record keeping.
Session VIII: Participatory Irrigation Development/ Wrap Up	2-5 Mar 2005 (4 days)	As the Participatory Irrigation Development, which is promoted by the Study and by the Government of Uganda, requires commitment of farmers, it is important to equip them with the appropriate knowledge on the procedures, and their rights and obligations in its process. The Agriculture Officer, who is specialised in irrigation development, will explain the process of physical work and the consultations to be carried out in the procedure with assistance of facilitators. The role of farmers' organisation in O&M in the post-construction period will be explained and the participating farmers will learn how to develop O&M plan and monitoring. Being the last session in the Programme, the overall evaluation will be carried out. Group discussion will be held to assess the relevance and effectiveness of the materials and training methods used in the Programme.

(2) Methodology

The training workshop was designed by adopting experiential learning cycle: a sequence of brain storming-lecture - group work/ role play – reflection. A range of PRA/ PLA tools were incorporated during the sessions to facilitate the learning of participants.



In addition to the facilitators who were skilled in PRA/ PLA and adult learning, 2 District Officers were invited to facilitate a session to supplement with the technical information. This also gave them an opportunity to reflect on what they have been doing and to be exposed to farmers' perspectives.

We have used the flipcharts and drawings where possible to increase the learning efficiency of the participants.

(3) Process of the Workshop

Characteristics of Participants

As mentioned earlier, the participants of the first session were district officers. Two officers represented each district. The remaining 7 sessions were attended by the key farmers and sub-county officer/ local leaders. In this section, the background of the participants in 7 sessions was explored.

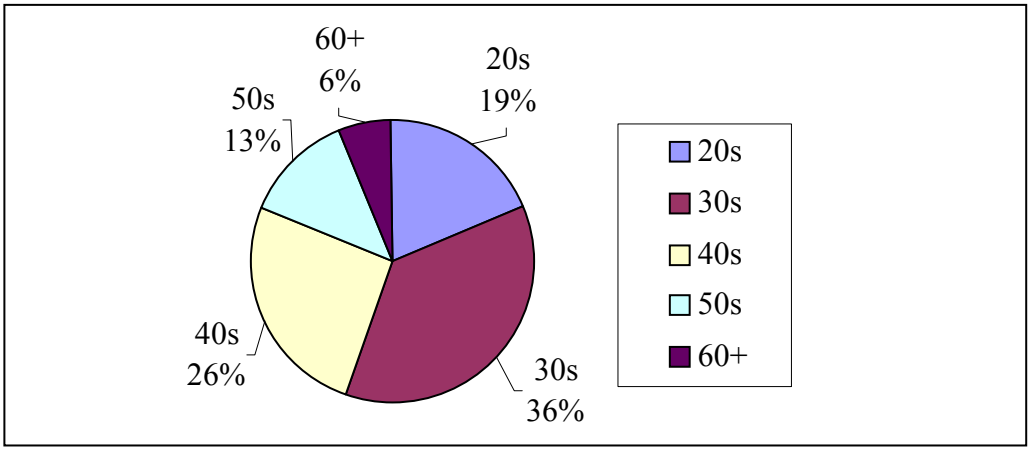
As the Study area covers thirteen districts, the participants came from different language areas namely Lusoga, Lunyole, Lumasaba, and Ateso. Thus, the participants were required to be able to communicate in English as well as the key farmer in the selected P/P sites.

Languages spoken by the Participants

Languages	District where Participants came from
Lusoga	Iganga, Mayuge, Kamuli, Bugiri
Lunyole	Tororo, Pallisa
Lugisu	Mbale, Sironko
Lumasaba	Busia
Ateso	Kumi, Soroti, Katakuwi, Kaberamaido
Kumam	Kaberamaido

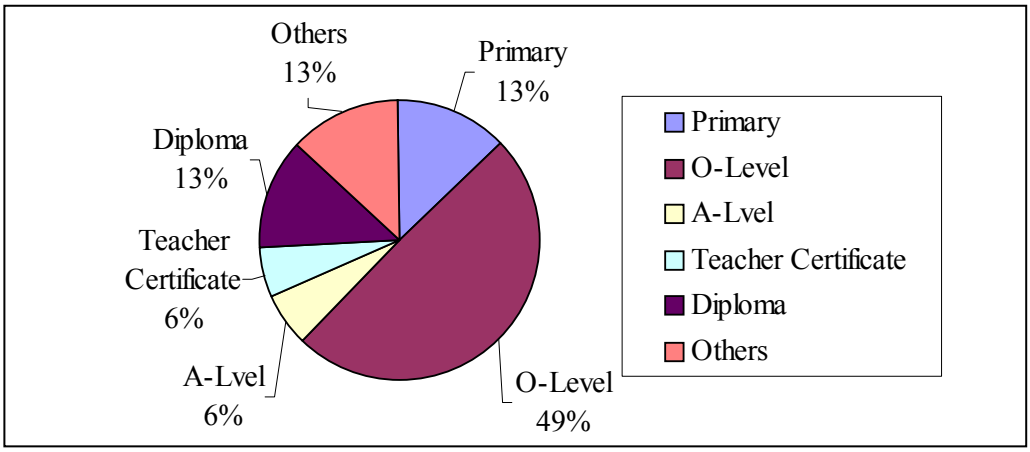
The gender balance was also considered during the mobilisation. As a result, on average, 78% of participants were male and 22% for female. Female participants in their 30s mentioned that whether they can participate or not in the workshops depended on the availability of the child care. During the early sessions of the workshops, some children came with their parents.

Age Distribution among Participants



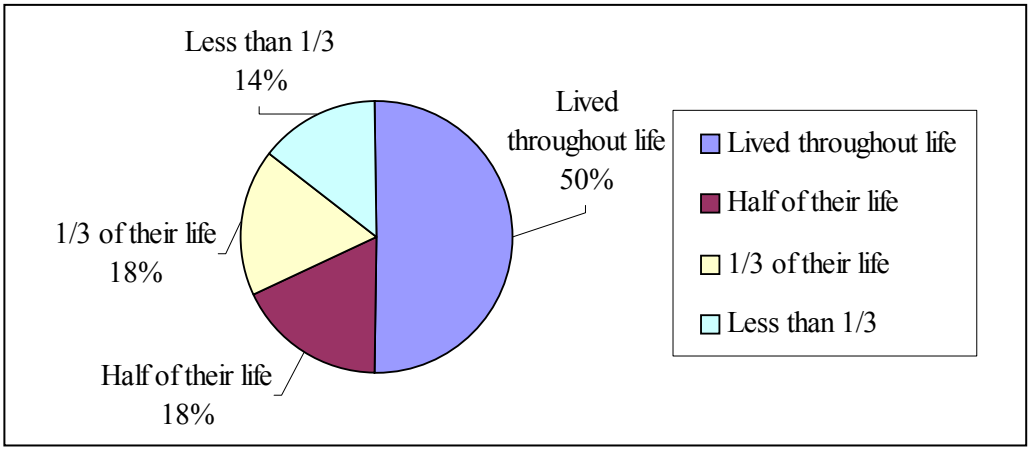
Most dominant age group among the participants were in their 30s (36%) followed by 40s (26%) and 20s (19%). 49% of the participants had the O-Level educational background. Participants who held Diploma were sub-county officers.

Education Level of Participants



45% of the participants were born of the locality. 16% of them have lived about half of their lives. Sub-county officers tend to live less years in the area. This implies that the farmer community mobilisers are likely to be found among those who lived in the area for long time. On the other hand, the many officers lived in the area between less than 1 to 7 years. This implies that they may not have sufficient time to develop rapport with the local residents.

Year Lived in the Locality



Participants Dynamics during the Workshop

In general participants were enthusiastic and actively participated in the activities conducted between session II and session VII. Participatory and interactive methods allowed us to accommodate the learning needs of the participants and sharing of knowledge and experiences among themselves as much as possible. This has also maximised their learning opportunities and proved to be effective.

1) Group Dynamics

In the beginning participants were hesitant to speak up during the sessions. A few participants were observed to be vocal. Thus facilitators used cards during the brain storming so that each participant will have the chance to express themselves. Interaction between the participants was also encouraged from time to time and emphasised on the benefit of sharing experiences from each other. As the workshop progressed, the level of interaction between the participants were increased and those who were quiet in the beginning started to ask questions and participate actively in the group activities. This experience of sharing has resulted in a proposal to establish the Eastern Uganda Paddy Growers Association among the participants on the closing day. This implied that the participants began to vision their future, which was the beginning towards a change.

2) Coping with Diversity

The diversity of educational background and language spoken by participants posed a challenge to the workshop implementation. This had affected the learning efficiency by the participants and also the level of participation. Some had more experience than others in the similar activities and thus learned quickly. Some had difficulties in understanding English. Thus, after Session III, we have introduced the group discussion according to the language group. Initially it was introduced during the "Recap of the previous day" and later adopted for all the group work according to the request from the participants. Participants mentioned that it was good and helped them to learn more.

During the session, technical terms used by the District Officers who were invited to facilitate the workshops were found out to be difficult to be understood by the participants. It became apparent that the gap in perception between the farmers and District Officers. However, in many occasions participants were not able to speak up as they did not understand certain terms. Therefore, a sheet of flipchart was placed on the wall so that the participants can jot down the terms they did not understand during the day. We reviewed the term from time to time. Facilitators also took notes of the seemingly difficult terms on the flipchart as the presentation was carried out. This also helped the participants to understand more. Addressing small concerns such as these also nurtured the favourable learning environment. Along the similar line, the participants preferred to use the cards during the brainstorming. For them, they felt that each person's opinion was respected and felt participated more.

3) Learning to Analyse

During the Sessions, we emphasised on strengthening analytical skills and also to identify the "coping strategy". The tool we used for this purpose was problem tree analysis. In the beginning, participants were hesitant to carry out such analysis and did not see the benefit of analysing a problem such as poverty. Yet once they started the analysis, they discovered that the tool was useful in identifying feasible solutions. The message they learned though this exercise was that "having many feasible coping strategies is better than having one perfect but unfeasible solution."

4) Keeping Records

Keeping records will help one to analyse the situation and plan for the future and also ensure accountability of an organisation. Through the workshops, it was observed that the participants were not used to keep records such as financial records, cropping calendar, and farm budget. Thus various formats were provided and tried to use them during the sessions. Especially, making of a farm budget was the first experience for most of the participants, which they said "eye-opening".

Contract document can be regarded as a record of an agreement. When the concept of contract was introduced during the discussion of agreement exchange prior to the construction of irrigation facilities, participants mentioned the difficulties in understanding the necessity of exchanging such documents. The reason was that it was a new concept for them as they are used to exchanging verbal agreement.

2.3.2 Achievement

(1) Achievement of Learning Objectives

This workshop aimed at launching the cycle of "knowing" – "understanding" - "internalisation" - "adoption of the knowledge or practice" by providing them with

the first-hand information and skills. The workshop with limited scope only intended to achieve the participants' "knowing" and partly "understanding" process as outputs. The participants were given a questionnaire to tell us whether they have acquired the intended knowledge or not. In general, participants achieved the learning objectives and their achievements of each session are outlined bellow.

Session I: Nurturing Farmers' Organisations for Paddy Cultivation in Wetlands (District Officers only)

Participants to this session were composed of mixture of DAO, DEO, DWO, DCDO and District Commerce/ Cooperative Officer. DEOs and DWOs were very much aware of the issues concerning paddy growing in wetlands while others had less knowledge. Participants also suggested that the workshop of similar nature to continued to be carried out to share information between officers of different specialisation as well as farmers.

Session II: Wetland Management and Livelihoods

From this session to onwards, the participants were key farmers from each pilot sites and sub-county officers/ local leaders in the pilot area. The concept of wetland management or sustainable use of wetlands was new to most of the participants. Yet after the workshop, 97% of the participants have responded that they learned the linkage. After the workshop, participants became more conscious of dos and don'ts within the wetlands and how to manage the resources. However, the issue of wetland ownership and guidelines was as still very controversial among the participants.

Session III: Organisation for Paddy Growers in Wetlands

This session introduced different types of organisations for the paddy growers in wetlands and various permits to be obtained prior to the cultivation in wetlands. Prior to the workshop, most of the participants were not aware of the permits to be obtained and the type of organisations required for paddy growing in wetlands. After the workshop, all the participants learned that such was necessary. Participants also mentioned that the information on guidelines opened their eyes and minds more about implication of wetlands and benefits of farmers' organisation. However, at the same time, they were concerned of the cost and time involved in obtaining permits, conflicts over sharing of water resources and procurement of funds.

Participants were not very positive of establishing a cooperative in the advanced stage of their organisation. This was because many of the farmers were cheated in the past and lost faith in its system.

Session IV: Registration of a Community Based Organisation (CBO)

This session intended to introduce the procedures of registering a CBO. At the beginning of the workshop, only a small number of participants were aware of the registration procedures while almost all the participants became aware of them after the workshop. The role play of the process of registration brought the knowledge

closer to the real life experience. Participants suggested more time to be allocated for group discussions.

Session V: Organisational Capacity Building

Emphasis on responsibilities and accountability was relevant as many of the participants didn't seem to be clear on whether members were accountable or not and to whom. The concept of problem analysis and its linkage to planning did not seem to be understood by the participants in the beginning and needed to be explained further.

Session VI: Financial Management for Farmers' Organisations

Participants learned financial planning and record keeping skills in addition to different ways of managing funds. Keeping financial record has been required of a necessity to ensure accountability. However, many of the participants were still hesitant of handling cash collectively due to the previous experiences of funds being mismanaged by the group executives. The role play of Creating Revolving Funds helped the participants to learn how it should be administered. The financial record introduced by the District Commerce Officer was too advanced for participants of this workshop.

Session VII: Accessing Agriculture Supporting Services

This session covered different agriculture supporting services and how to make farm budget. Firstly, participants had difficulties in understanding how NAADS Programme operates especially selection of enterprises and co-funding. Especially the participants did not understand as to why poor farmers had to co-fund to access the services. Furthermore, it was also a surprise for the participants to know that NAADS only provides technical knowledge. On the other hand, participatory farm budget gave them a very good opportunity to reflect on their spending and earnings for the first time.

Session VIII: Participatory Irrigation Development

Although the end of session evaluation indicated that most of the participants learned the process of participatory irrigation development and O & M, this session seemed to be the most difficult one for the participants. This was partly because participants did not have the experience of irrigation development and many new concepts were introduced. For instance, agreement exchange was a difficult one for them to understand since most of the agreement in the areas was verbal and informal. Furthermore, the training methods depended on lecture and thus participants could not understand well. This session should have been carried out along the irrigation development and include on-farm training on O&M in order to help participants learn.

(2) Achievement assessed by Appropriateness of Workshop Organisation

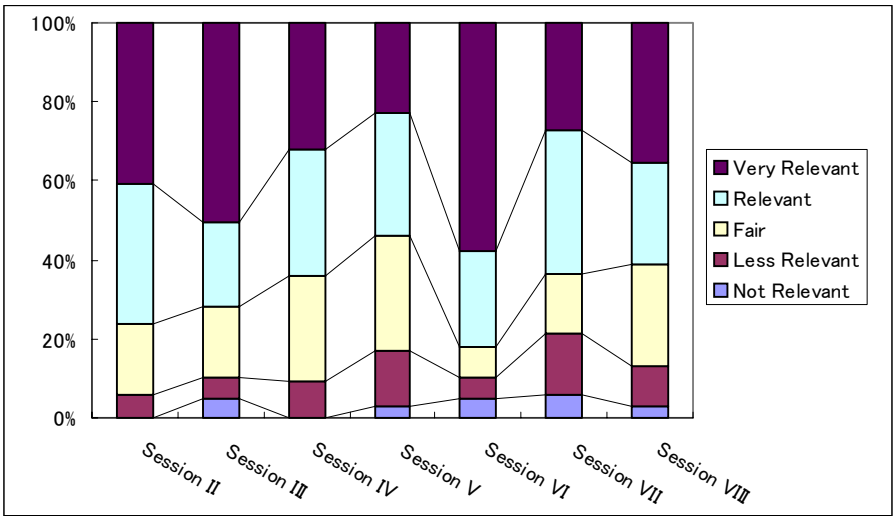
Achievement of learning outcome can often be affected by how the workshops were

organised. For instance, relevance of the training contents, handouts, and effectiveness of facilitation methods and appropriateness of time allocation. Therefore, at the end of the 7 sessions, participants were requested to complete a questionnaire to assess the appropriateness of workshop organisation.

1) Relevance of the Training Contents and Materials

The contents of the training were considered to be relevant in all sessions. Especially the participants found the session VI on financial management was very relevant.

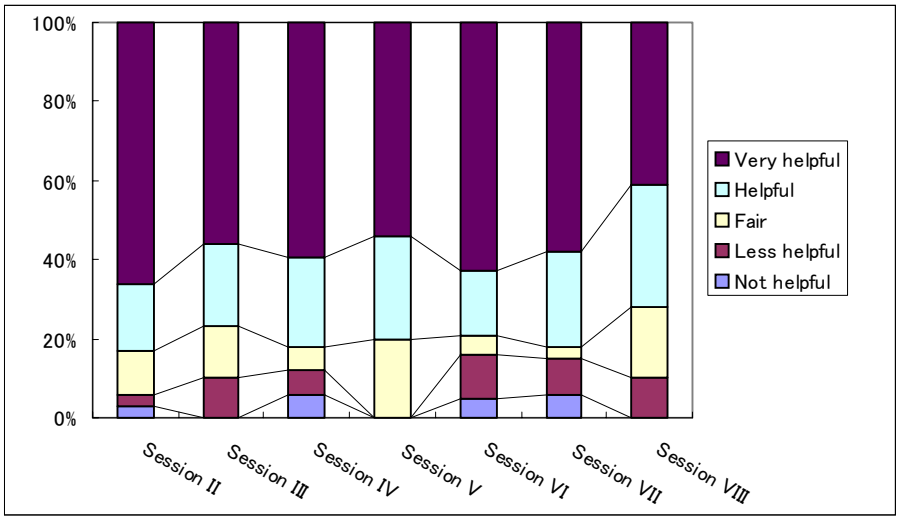
How relavent was the content?



Source: JICA Study Team (2005) End of Workshop Evaluation.

The training materials were compiled from various sources. The main material was drafted by the Study Team, which provided the facilitators guideline. Those who were invited to facilitate the workshops from District Offices have also compiled the materials of their specialised area. The guidelines for sustainable use of wetlands and paddy cultivations, and posters were used during the presentations as well as the posters. Between Session II and Session VII, more than half the participants found handouts were very helpful.

How helpful were the handouts?



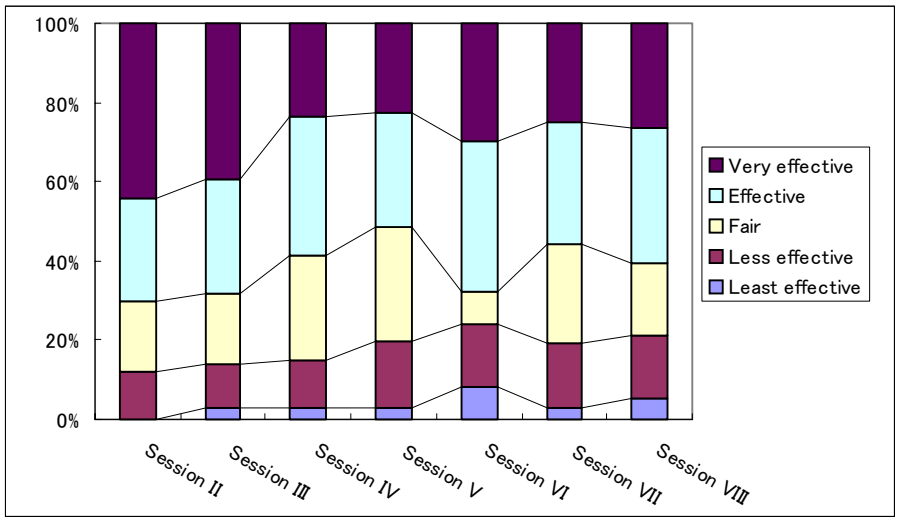
Source: JICA Study Team (2005) End of Workshop Evaluation

The participants found the posters on wetland use were very effective for them to understand as well as to sensitise other farmers. During our workshop, we have delivered two posters per pilot site as for the key farmers to be used when sensitising others. However, the participants require more visual aids and illustrations in the handouts.

2) Effectiveness of the Training Methodology

During the training programme, various participatory tools were used. This was partly to develop the analytical skills of the participants, which was then to enhance capacity of planning. The tools used were mapping, problem tree analysis, chapatti diagramme for stakeholder analysis, information network analysis, and market channel analysis. For planning purposes, we introduced planning matrix for organisational activity planning, farm budget and O&M planning.

How effective was the training methodology?



Source: JICA Study Team (2005) End of Workshop Evaluation

It was often claimed that the role play is an effective method to the adult learning. During the Session IV and Session VI, we have incorporated short role play. Registration procedure of CBO and how to create revolving funds have been effective.

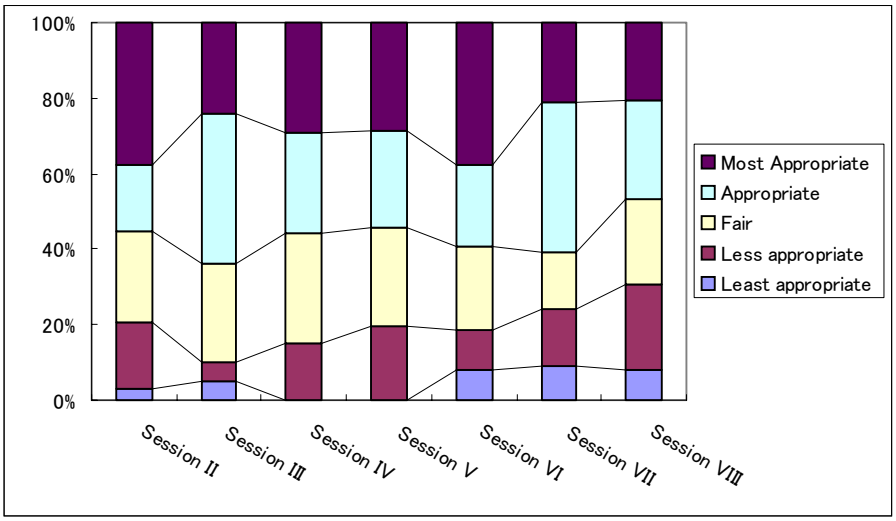
Session VIII Participatory Irrigation Development seemed to have been a difficult one. This is partly due to the lack of experience among the participants in irrigation development and also due to the training skills of the facilitators. Without having looked at the actual irrigation structure that they would have, the participants could not picture how their involvement in the development would be.

3) Time Allocation

The time allocation has been a challenge when these workshops were planned. It is often known that the participatory activities require a good amount of time in order for the participants to think critically. Our time frame was very tight yet we had to keep the time. Thus, the participants' fatigue was evident. Participants suggested that there needs to be some time for relaxing between and after the workshop. Especially, the content of Session III: Organisation for Paddy Growers in Wetlands, Session VII: Accessing Agriculture Supporting Services and Session VIII: Participatory Irrigation Development required more time allocation.

During the session, it was often the case some of the activities were carried over to the following day or beyond the planned closing time. The participants also suggested that the activities of each day should be completed by 4:30 in the afternoon.

How appropriate was the time allocation?



Source: JICA Study Team (2005) End of Workshop Evaluation

(3) Achievement by Learning from the Workshops

During the workshops, we have carried out a number of group discussions and

participatory activities, through which we have gained further understanding in the current situation in the P/P sites from the farmers' perspectives. These learnings could be counted as part of the unintended achievement of the workshops and thus were presented bellow. This section is based on the qualitative data through such activities.

Land Tenure of Wetlands

The Guidelines for Smallholder Paddy Cultivation in Seasonal Wetlands stipulates that no individual can claim the ownership of the wetland and that a community based organisation can be granted of user rights through application of such permit.

Despite the government guideline claiming the ownership of the land being public asset, the participants of the workshop regarded wetland as a transferable asset of an individual, which ownership can be claimed. Participants summarised how they acquired the access to wetlands. Most commonly, wetlands have been inherited by male heir of the family from the father. Some have purchased them. Some also hired the wetlands for cultivation which also involved the payment of tenant fees although such an agreement was always verbal and informal.

When a District Wetland Officer explained during the workshops that wetland was owned by the government of Uganda, participants expressed that "it was a shock" to discover such a fact. However, they have also learned that they could be granted of wetland user permit which would protect their rights to use the wetland resources. In general, participants understood why such procedure is needed and its application procedure as well as the role of farmers' organisation in such a procedure.

Farmers' Perception of Irrigation Development

The participants defined irrigation as "an artificial way of getting water during dry season". In other words, participants mostly understood irrigation by constructing reservoir to cope with the water scarcity during the dry season. They also raised the concern of the compensation for the land owners whose land would be taken by the canal or other facilities and how to raise the funds for the further development and requested more guidance on developing project brief.

Sense of Community and Organisation for Irrigation Development

The participants have understood that they needed to be organised to continue paddy growing in the wetlands. The complication arouse when it came to the Water Users' Association, which membership was limited to those of the direct beneficiaries of the irrigation. In some cases, where a farmers' organisation was already established, the intended irrigation users could foresee the conflicts within the community by establishing a separate organisation only by the direct beneficiaries of irrigation. Keeping good relationship with the non-benefiting community members also was critical for the success of organisation. This indicates that it may not be appropriate to establish a WUA as an independent organisation in all cases. There may be a situation that establishing a committee for irrigation would be appropriate. As long as

the irrigation users are organised for O&M, whether to have an independent WUA or not should be decided with flexibility considering the social context.

Conflict Resolution Mechanism

In many areas, disputes occur during the dry season around springs when people depend on both domestic and agriculture water supply. In general, both parties in conflict were to discuss the matter. In Teso area, if it could not be solved between them, the case would be brought to Clan Court and then to the LC Court. In other areas, the cases would be brought to LC Court if the concerned parties failed to resolve among themselves. Participants then claimed that the officers at the sub-county court were not very well equipped with the legal knowledge and thus they were not reliable.

Concerning disputes, preventing it might be more effective than settling the matter. Through the workshop, participants learned a way of avoiding such situation. They have identified that the cause of conflict was the lack of proper planning of the wetland use, which was acceptable to all the wetland users in the area.

There has been a case of minor conflict observed at the Demonstration Plot in Pallisa district where the plot required water to be fed by the nearby spring while other community members depended on for their domestic water. It has been suggested to the farmers working in the Demonstration Plot to discuss with the other community members for sharing of water. The cause of such disputes most likely derives from the lack of understanding between two parties. Further, it was also suggested to be effective to develop the Community Wetland Management Plan or the plan of similar nature by involving all the stakeholders to better share the limited water resources. The workshop participants were well aware of the point and some have already started working on it.

2.3.3 Outcomes

The outcome of an intervention is often not immediate. Especially that of training programme takes some time after it is completed. Therefore, the outcomes for the organisational and Institutional Development Programme were assessed by the results of monitoring activities conducted thrice during the study period: 1st monitoring in September 2005; 2nd monitoring in January 2006; and 3rd monitoring in August 2006. The assessment was carried out by interviewing the trained officers and key farmers using questionnaire by the national consultants and supplementary field visit by the Study Team.

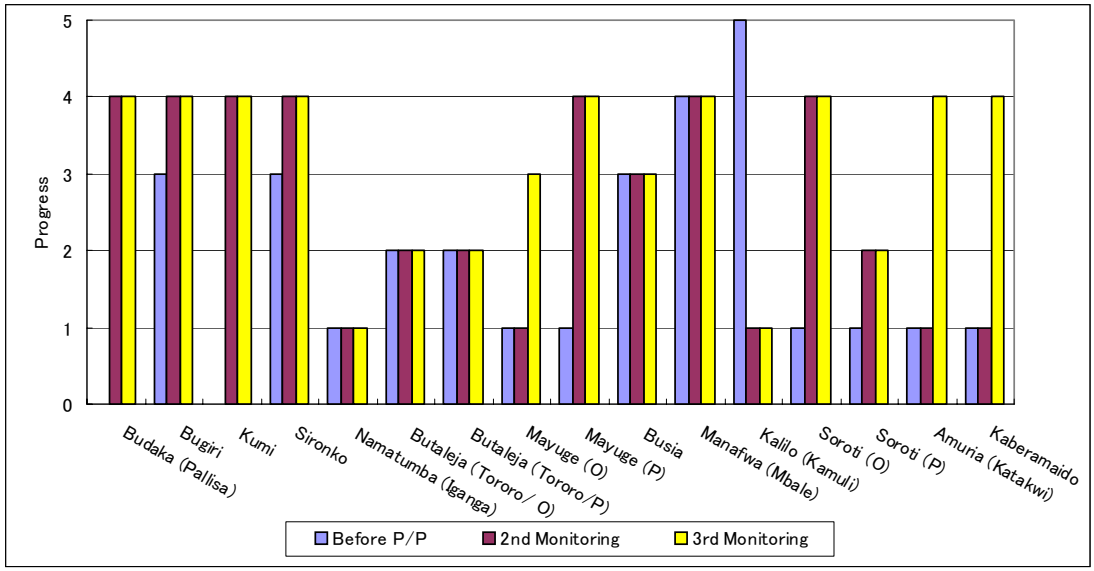
During the first and second monitoring, the Study Team was refrained from visiting Soroti, Amuria (Katakwi) and Kaberamaido for security reasons while it was possible in the 3rd monitoring. On the other hand, the Study Team refrained from visiting Busia P/P site as the visit of the Study Team might interfere with the community's social order as there have been conflicts between the paddy growers and rest of the community. However, the condition of the P/P site was assessed by the interview

with the agriculture officer at the district office and assessment conducted by the national consultants. The indicators used for assessment were generated from the PDM of the P/Ps. The findings were also supplemented with relevant qualitative data.

(1) Establishment of CBO, WA and WUA

In each pilot site, the group formation began in various contexts. Iganga, Mayuge, Busia, there were no group as such specifically targeting sustainable irrigation and paddy cultivation although there were locally organised groups by NGOs and others. Mbale was already registered as CBO when the project began. The organisation in Kalilo (Kamuli) pilot site was already registered as a cooperative. In Butaleja (Tororo), two NAADS groups co-existed in the same wetland area.

Progress of Organisational Establishment



Number from 1 to 5 indicates the following types of registration:
0: No group
1: Group without registration,
2: NAADS Group,
3: Registered at Sub-County,
4: Registered at District, and
5: Registered as Cooperative
Source: JICA Study Team. Monitoring 2005/ 2006

After the training workshops conducted by Study Team, the changes began to emerge. Before the training programme, there was only one CBO existed. After the training programme, the number of CBO increased to 9 as of September 2006. The difficulties in organising and registering a group include 1) lack of awareness by the potential members towards benefit of being shortage of funds and 2) shortage of funds.

Two groups in Mayuge and Kaliro were registered at the sub-county. In the case of Kalilo, the group of paddy growers decided to organise their own group from the cooperative. Therefore, they are still at the earlier stage of organisational development. They were still in the process of seeking understanding from the members towards benefits of collective action so that they could mobilize funds and

register at the district level. There were also 3 groups registered as NAADS group which were in Butaleja (Tororo) and Soroti districts.

The rate of progress in the northern pilot sites was very high. The factor behind their achievement could be the active involvement of the sub-county officials in the group activities as well as the members' understanding of the needs to secure the wetland user rights by following the necessary procedures and the benefits of working collectively. Secondly, where the trained farmers under organisational development were active in sensitisation of other community members, the groups achieved the registration within the project duration. As shown in the table, groups where the trained farmers were active, especially Budaka (Pallisa) and Kaberamaido, achieved registration as CBO as planned. This also suggests the role of mobilising farmers were critical in promoting the farmers' organisational development. Thirdly, sociological factor might have added a positive influence in the northern pilot sites where the social cohesion seemed to be stronger and community members have higher tendency to work collectively than other parts of the Study area.

Performance of Trained Farmers for Organisational Development in Each P/P

P/P District	No. of Training Provided	Organisational Development Technologies Trained
Budaka (Pallisa)	2 times in April 2 times in May 2 times in June	Proper record keeping and sustainable use of wetlands
Bugiri	1 time in April 1 time in May	Livelihoods and wetland, formation of WUA,
Kumi	1 time in June	Wise use of wetland, formation and registration of groups, record keeping
Sironko	No training was provided	-
Namutumba (Iganga)	No training was provided	-
Butaleja (Tororo)	No training was provided	-
Mayuge	1 time in June	Importance of working in a group
Busia	No training was provided	-
Manafwa (Mbale)	1 time in August	Sustainable use of wetlands and procedures of CBO formation
Katakwi	Informal discussion in April	General issues on farmers organisation development
Soroti	No training was provided	-
Amuria (Katakwi)	2 times in April	Wise use of wetlands, benefits of belonging to CBO, procedures of CBO formation
Kabe'do	4 times in March 4 times in April 4 times in May 4 times in June 4 times in July	Formation, registration of farmer groups, wise use of wetlands, accessing credit, sharing wetland, etc.

Source: 1st monitoring in September 2005, JICA Study Team

Other factors affecting the formation and development of the group in the Study area included the availability of the natural resources and appropriate technical guidance on paddy production. Where the water was sufficient and paddy yield was high, farmers had higher motivation to work in a group as the benefits were tangible. These groups were found in Butaleja (Tororo), Manafwa (Mbale), and in P/P sites in the north. On the other hand, the scarcity of water could be a demotivating factor as in

Bugiri P/P site. Second factor is the availability of appropriate technical guidance to the farmers. In the case of Kaberamaido, sub-county officers are among the members of the farmers' organisation and therefore the technical assistance was easily available.

Adequate resources and appropriate technical guidance allow the farmers to carry out what they planned for. If the action is successful, the farmers will gain confidence in their own capacity. This is a critical factor and also process for the farmers' organisation to have a successful launch. These examples from the field again remind the JICA Study Team the close follow-up by the sub-county technical officers or specialists is critical especially at the earlier stage of organisational development.

It is also worth mentioning of the case of Busia where the political interference and persistenent sense of land insecurity among community members negatively affected the formation or farmers' organisation. In the case of Busia, the community members other than group members and local political leaders have hindered the paddy production activities as a group and thus the registration process. There has been a persistence belief by the community members and local political leaders other than group members that their land would be taken away by the Study Team and government of Uganda thus the group activities shall not continue.

Wetland Association (WA)

The WA formation was initiated in Kumi and Sironko P/P sites during the CWMP workshops which were carried out between November and December 2006. During the workshops, a representative from each wetland users' group was identified and to form an executive committee of WA. Currently, in two sites, mobilization of various wetland users by the executive members is in progress. However, since the geographical area covered under the wetland management plan is relatively large and users are dispersed, the mobilisers found it difficult to communicate with others. Thus the process of mobilization is sluggish in both P/P sites. Furthermore, the support provided by the local officials such as a community development assistant/ officer or a District Environment/ Wetland Officer, who could facilitate the process of mobilization, has been limited. This has also slowed down the process of mobilization.

In other P/P sites, WA formation has not been initiated other than through the training programme carried out as a part of the organisational development between January and March 2005. In these sites, the farmers were reluctant to organize WA since many of the community members still believed in their individual ownership of the wetlands and thus could not accept that the wetlands as public property. Therefore, it was difficult for the community leaders to mobilize wetland users to organize WA which members' wetlands as common property.

Water Users' Association (WUA)

WUA were organized in all 4 P/P sites in Budaka (Pallisa), Bugiri, Kumi and Sironko districts as part of the existing farmers' group as mentioned earlier. As the initially organised farmers' group included non-irrigation users, WUA functions were installed as water users' committee of the mother organisation. WUA began functioning during the cropping season of 2006 and began conducting O&M activities.

The challenge faced by the WUAs was the communication with the members and coordinate activities. The group in Budaka (Pallisa) indicated that they find it difficult to communicate as the group members' houses are scattered and they are many in number. In Sironko P/P site, immediately after the construction, the land was divided among the community members and large number of tenants was brought in to work in the scheme. Currently 30 owners hold plots in the scheme with 32 tenants. When a large number of tenants are introduced, it is difficult to maintain the order in the scheme as they change from time to time. Further their sense of ownership to the scheme is often less than that of the owner farmers. Initially, the Study Team had advised owner farmers the problems concerning tenants and the owners' responsibilities to make sure that their tenants follow rules. This situation in Sironko may affect the sustainability of the scheme.

No of Irrigation Users and Planned Irrigated Area

	Budaka (Pallisa)	Bugiri	Kumi	Sironko
Total No of irrigation users*	75	40	19	19
	Owner: 13 Tenant: 62	Owner: 22 Tenant: 18	Owner: 19	Owner: 19
Irrigated area (Flat area)	16.48 ha (41.4 ac)	10.76ha (24.89ac)	6.3ha (15.62 ac)	13.13ha (32.5ac)

* Total No of irrigation users are based on the agreement exchange note signed by the irrigation users in October, 2005.

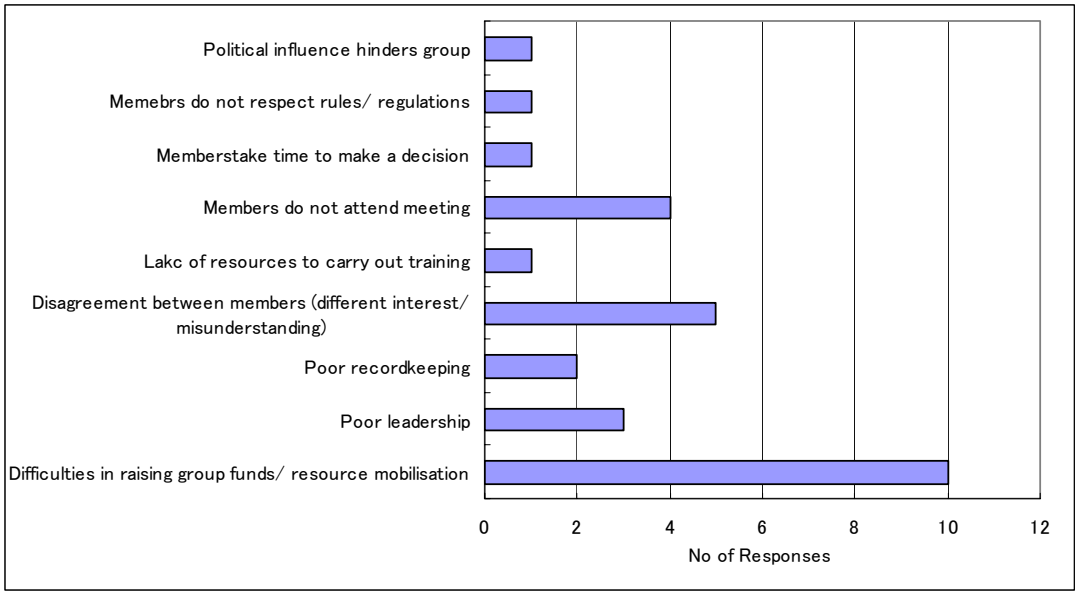
There seems to be a manageable size of the WUA. When the scheme is large, the number of tenants increases as the family labour of the owner farmers' is not sufficient. In the case of Bugiri, WUA members are cohesive and problems are less. Further, the cohesiveness of the group itself also affects the progress of technology dissemination on appropriate paddy cultivation and irrigation management. The WUA members in Kumi, in this sense, have achieved well. Therefore, smaller the group size the better the outcomes of the interventions.

At the beginning of establishing an organisation, there are many things which may go wrong. Even simple communication can be more difficult than expected. Keeping financial record and collecting fees may pose problem when the members are many. To minimise risks of failing, it is advisable to keep the size of the scheme small at the beginning so that the number of WUA members is also manageable. Indeed, they can expand the scheme when they have sufficient experiences in managing the small scheme.

(2) Capacity for Organisational Management

The training workshops for organisational development intended to build organisational capacities of paddy growers and irrigation users. The initial and foremost challenges that they faced was 1) to mobilize sufficient resources/ group funds, 2) disagreement between members and 3) members do no attend meetings.

Problems in organisational management



Note: Multiple Response
Source: 2nd monitoring in January 2006, JICA Study Team

1) Financial Management

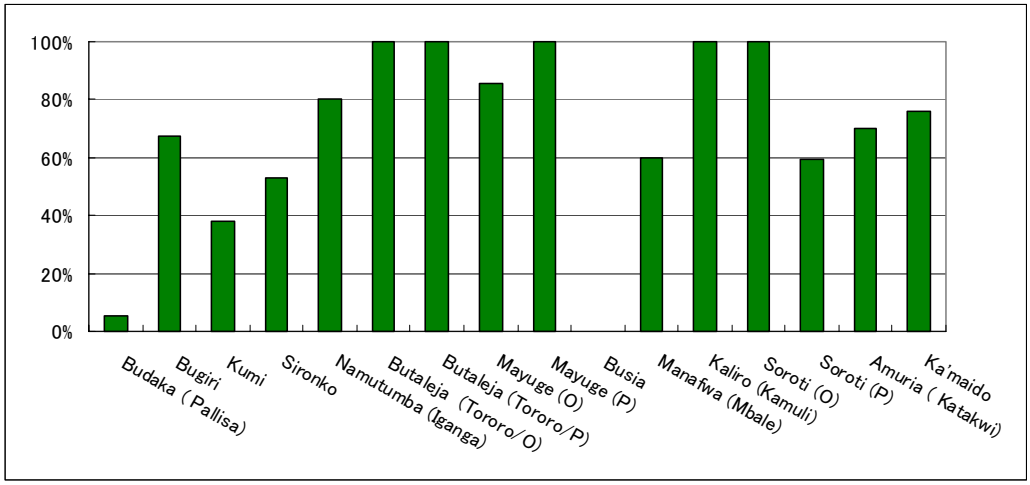
General

Depending on the group, different types of fees were collected. Some collected entry fee at the time of registration in addition to the fees paid annually which is called subscription or membership fees. Where irrigation has been developed, the irrigation water users have to pay the irrigation fees or water users' fees for O&M of the irrigation facilities.

The figure shows the last season's payment of the group membership fees in the farmers' groups in 13 P/P sites. Five (5) groups had achieved the collection rate of 100 %. On the other hand, the collection rate remained low in 6 groups ranging between 5% and 67% which included all the 4 P/P sites with irrigation development[2]. Especially in the 4 P/P sites where the irrigation facilities were constructed, the farmers could not cultivate paddy in the previous season, many members were unable to pay membership fees. However, the group executives expect them to pay after the first harvest.

[2] The data from Busia was not been confirmed during 3rd monitoring. It has been reported that the group members were afraid of collecting fees due to the unfavourable atmosphere to the paddy growing from the rest of the community.

Collection of Membership Fee by Farmers' Groups in P/Ps



Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

The most common problem in fee collection was that the members were often short of cash. However, in many cases, many of them paid when they could and the collection rate would eventually reach nearly 100% as they are aware of the importance of creating the group funds. This result from the 3rd monitoring indicates that the challenges in mobilising group funds were partly solved.

Financial Management of WUA

Particularly for irrigation users, it is critical to manage the funds for O&M separately from the general budget of the farmers' group. In general, the spending from the core funds of WUA was accountable. Among the 4 P/P sites, Kumi P/P sites was the only group which had a good amount of financial contribution from its members for registration of the group and other minor maintenance activities. Sironko P/P had already spent the substantial amount of the seed funds for maintenance. This suggests the farmers' group in Sironko P/P site to accumulate high amount of O&M funds compare to the other sites.

Balance of Accounts in 4 P/P Sites between March and August 2006

	Budaka (Pallisa)	Bugiri	Kumi	Sironko
Initial Deposit by the Group	40,000	100,000	257,500	100,000
Initial Deposit under JICA Study	590,000	880,000	599,139	876,000
Cash in Hand	16,850	65,400	-6,500	15,500
Spending on Registration	0	100,000	189,000	0
Spending on O&M of the Irrigation Facilities	125,000	45,000	0	913,500
Balance as of Aug 2006	521,850	900,400	661,139	62,500

Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

The JICA Study Team earlier advised the appropriate irrigation fees to the irrigation water users at each site. They were well aware of the needs of the importance of having a sufficient maintenance funds and agreed to collect them.

Sources of funds and financial services for members

Creating a sound financial background is a key to the success of farmers' organisations. Many of the groups were only depending upon their members for their source of funds. However, there is a limit to how much they can contribute. If the contribution is increased, the group may suffer the low rate of collection. Therefore, the group executives are advised to diversify the sources of funding for the benefit of the group and its members.

There were a few groups among the P/P sites where they introduced some of the financial mechanisms to benefit both the group and individual members. For instance, the group in Kaberamaido P/P shared its earnings from the demonstration plot with its members and partly saved in the account for future investment. They also constructed fish ponds using NUSAF funds, which earnings were also shared among the members. The group in Busia P/P had introduced savings and credit scheme for the members.

2) Activity level

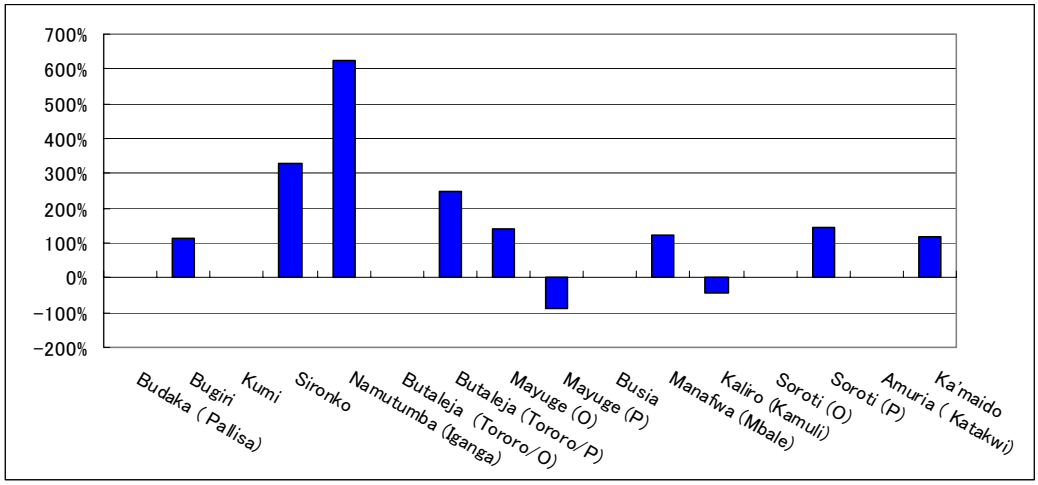
Activity level of groups was assessed by the number of meetings. Meetings were held ranging from monthly to seasonally. Ten groups (or 67%) out of 15 groups had regular meetings. Five groups (33%) held meetings where there was a need for discussion. In the 4 P/P sites of Budaka (Pallisa), Bugiri, Kumi and Sironko, the group activities were mostly conducted regarding the maintenance of the irrigation system. In the remaining sites, the activities were conducted concerning management of demonstration plot, selling and sharing of the earnings.

Nature of group activities and future plan

In most of the groups, their future plan was not yet documented. However, at this stage, it is better to have something rather than nothing. The JICA Study Team advised the farmers to document such plans in the due course. Furthermore, the increment of the number of members was also assessed as a sign of growth and activity level.

In all the P/P sites, the groups were considering expanding the paddy area. In all the sites having irrigation facilities were initially advised to limit the tenants. Thus, the groups in Budaka (Pallisa) and Kumi P/Ps remained stable. However, in Sironko, the number of land owners was increased to 30 and tenants to 32 where initially the JICA Study Team had identified 19 land owners. The full group membership is granted to the land owners while the tenants will also attend the farmers' group meetings as sub-members. In other words, the land owners assume the responsibility of payment of irrigation fees and supervision of tenants in the scheme. Groups in the P/P sites without irrigation development, the number of members increased except for two P/P sites in Mayuge and Kaliro (Kamuli).

Growth Rate of Member by Farmers' Groups in P/Ps



Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

Two groups in Butaleja (Tororo) P/P were very active. These farmers' groups had good collaboration with NAADS under the local political support. Using the budgetary support from the sub-county and NAADS, the key farmers had organised workshops for the farmers in the surrounding potential paddy areas and have further plan to train the newly joined farmers in Nakwiga wetlands. Two farmers' groups established in the areas are currently discussing the formation of joint management committee to better coordinate the activities concerning paddy cultivation and share the resources. This idea has emerged from the farmers themselves yet is a welcomed one as the wetland overlays three sub-counties and some paddy growers from different sub-counties are beginning to cause some threats to environment by uses of chemicals and fertilizers. Once the joint committee is established, it is expected to regulate and advance sustainable wetland use through paddy cultivation in Nakwiga wetland.

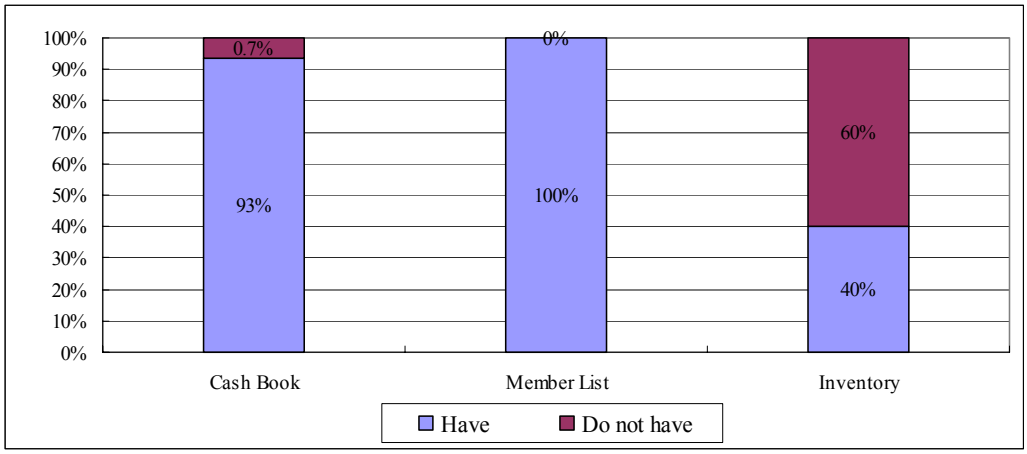
In Busia P/P, the group activities could not be assessed in a quantitative terms. There had been a conflict between the interests of farmers groups. Currently, this issue seemed to have been resolved and farmers resumed paddy growing. The group has also been reported to have introduced credit and savings scheme.

3) Accountability

General Record Keeping

During the second monitoring, many of the groups indicated record keeping was still a problem. The results from the 3rd monitoring indicated that the cash book was kept by 93% of the organisations and member list by all the organisations. Inventory list was not kept in 60% of the groups visited by the JICA Study Team. This was because they did not own any group equipments or if owned, not functioning. However, they were advised to keep records as such assets were equivalent of funds.

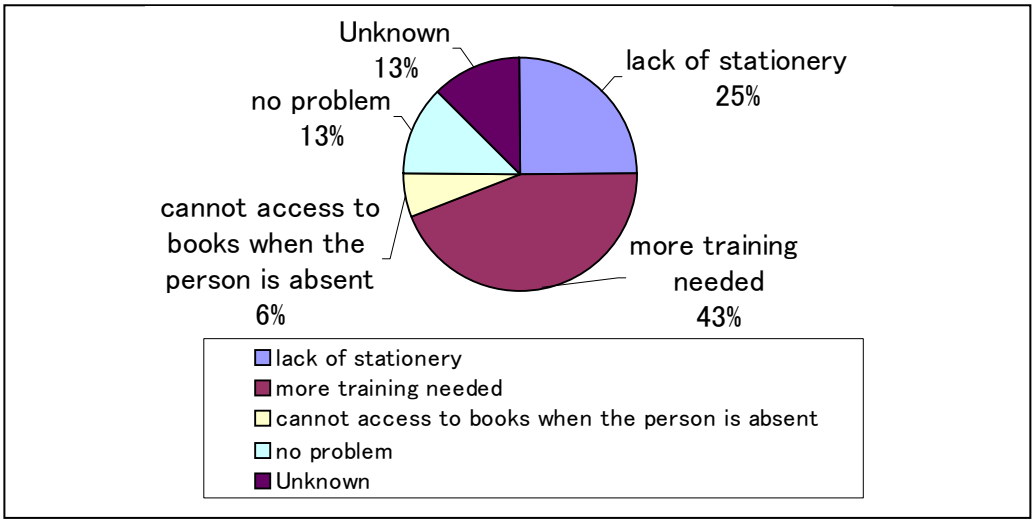
Status of Record Keeping by Farmers' Groups in P/Ps by Type of Records



Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

Although most groups keep records for groups' accountability, many of the groups found it still challenging and lack confidence. 56% of the groups indicated that they require further training for bookkeeping. As many of the farmer treasurers started keeping financial record for the first time, the close follow-up by the officer was essential in addition to the training provided by the JICA Study Team.

Problems in Bookkeeping by Farmers' Groups in P/Ps



Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

In case of 4 P/Ps, bookkeeping is difficult because of lack of stationary in Budaka (Pallisa) and Bugiri P/P sites, and inadequate skills in Kumi and Sironko P/P sites.

O&M records in 4 P/P sites

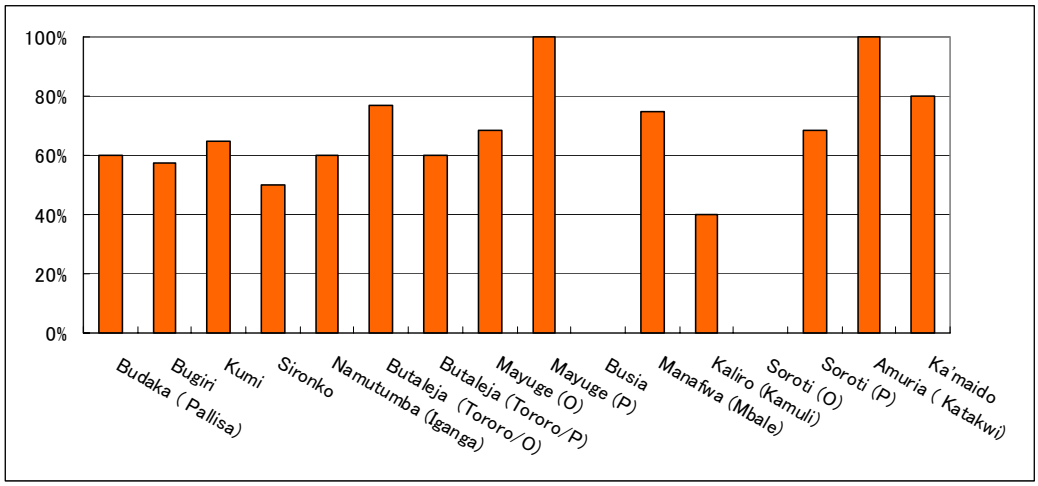
In P/P sites where the irrigation facilities were constructed, the groups were advised to keep the O&M records following format provided by the JICA Study Team. The precise record was kept by the secretary in charge of water users' group except in Sironko P/P site. In case of Sironko, the chairperson of the water users' group had passed away and this post had been vacant till now.

Therefore, the activities of the irrigation users' were coordinated by the farmers' group leader who also had other responsibilities and could not guide the secretary to keep the O&M records. They were advised to elect the new chairperson before the coming season.

4) Level of Participation by the Members

For the sustainability of the group, it is critical to nurture social capital between the members. One way to promote is to convene regularly for discussions, problem solving and communication. This has been indicated as a challenge during the 2nd monitoring.

Attendance to Meeting by Farmers' Groups in P/Ps



Source: 3rd Monitoring, Aug-Sep 2006, JICA Study Team.

The average participation of the members was 64%. Kaberamaido P/P site had 100% of attendance by the members.

Many of the organisations in P/P sites indicated that getting sufficient attendance still remained as a challenge. The reasons for members not attending included: (i) members are busy and have other commitment on the date of the meeting, (ii) members are too many, (iii) members expect things to be given such as tea, seeds and others, (iv) members are far away from each other and difficult to communicate. The group leaders were advised to fix the date at the beginning of the year so that everyone will plan in advance and to discuss with the members for the issues related to expectations.

5) Awareness towards wise use of wetlands

For the paddy growers in the Study area, following the guidelines of the wise use of wetlands and protecting their user right through forming the wetland user's association were essential. Therefore, the JICA Study Team had conducted sensitisation to all the groups in the P/P sites and supported the formulation of community wetland management plan in Kumi and Sironko P/P sites. From the bellow, it became clear that the effectiveness of the sensitisation towards wise-use of wetlands depends on the timing: the earlier the

sensitisation, the higher the people's motivation and awareness to maintain the wetlands resources. For this, it is critical for the local government to place sufficient number of technical staff at the sub-county level. The level of awareness and condition of wetland use in some of the pilot sites were summarised bellow.

In Kumi and Sironko, farmers' awareness towards wetland management has decreased rapidly while the absence of the JICA Study Team. The associations in the both P/P sites were not active. Especially in Sironko, considering the rapid growth in the paddy area and increase of outgrowers, the decline of the awareness towards the issue was alarming. During the visit of the Study Team, the executives of the farmers' group and wetland users' associations were reminded of the guidelines and relevant laws concerning the uses of wetlands.

In Mayuge, the farmers' group had been experiencing water scarcity as they were located at the lowest stream of the wetlands. During the follow-up interview, the chairperson of the group became aware of the cause of the water scarcity being the water blocked by the upper stream farmers in the wetland area. They have been advised to coordinate the water allocation by organising a wetland users' association.

Amuria (Katakwi) and Kaberamaido, in particular, showed a clear awareness and understanding towards the ownership of wetlands and needs to establish wetland users' association. This might be partly due to their land being opened after sensitisation of the relevant issues during the training programme conducted by the JICA Study Team.

2.4 Environment Conservation Programme

2.4.1 Activities

The activities carried out in the framework of the environment conservation programme are of two kinds. The first kind deals mainly with the supporting works for MAAIF/NEMA coordination for the implementation of the P/P, which has been already presented in Chapter 1 of this report. It includes; conducting a preliminary EIA workshop in Mbale and preparing and submitting project briefs to NEMA for the screening of the project.

The second kind of activities, which will be presented here, deals mainly with promoting the wise use of wetlands for a sustainable development of paddy growing in these regulated ecosystems. This kind of activities includes; formulating CWMPs for the two new development P/P sites of Kumi and Sironko districts, conducting a workshop on new development and wetland environmental conservation and implementing water and soil quality monitoring activities along which training village workshops were carried out to introduce the concept of wetland wise use to farmers and district officials. This second kind of activities is presented in this

chapter as follows.

(1) Workshops for formulating CWMP

Policies and laws have been put in place to regulate use and management of natural resources including lakeshores, rivers and wetlands. As a way to ensure an environmentally sustainable development of wetlands, the government of Uganda advises the community to develop its own wetland management plan in a participatory manner in order to enhance conservation, use and to minimize potential conflicts among the different interest groups. Such a process also helps the community understand the linkage between their livelihoods and wetland resource management and how they can benefit from it. It further helps them to develop a sense of ownership towards the wetland resources and the responsibility of managing them.

The process of developing the CWMP will be highly participatory. PRA/PLA based activities are to be carried out in the process of analysis and making of the plan, which will involve local communities' participation in decision making and management of wetland resources. These PRA/PLA tools have been introduced in some wetlands of Uganda and have significantly reduced conflicts between resource users and managers and have also greatly improved the management of these resources. Such an approach is likely to be more acceptable to the local communities, will greatly minimize law enforcement and enhance sustainable management of the project area. At the same time, through the process, participants of different background are expected to learn each others' perspectives in terms of the use of wetland resources. In other words, the different activities involved in the making of the plan serve for the purpose of sensitizing the local community in wise use of wetlands.

In the Study, workshops to formulate CWMP were conducted in two new development P/P sites of Kumi and Sironko districts over the period of November and December 2006. Three Uganda facilitators were employed for each site. One of them was able to communicate in the local language. The participants were mobilised from various wetland users, district and sub-county officials and political leaders. In each P/P site, participatory activities were carried out in 13 days covering the following activities as indicated in the table below.

Programme of Workshop for CWMP

Programme	No. of Days
Regulations and policies on wetlands	1
Stakeholder analysis Resource analysis	1
Economic valuation of wetland resources	1
Problem and conflict analysis Zoning	2
Formulation of vision and management objectives Planning of activities & budgeting	5
Formulation of bye-laws Formulation of executive committee of wetland users' association Implementation schedule	3
Total Number of Days	13

(2) Workshop on New Development and Wetland Environmental Conservation

A workshop on new development and wetland environmental conservation was convened in Mbale from January 30th to February 1st, 2006 by MAAIF with the support of Study Team. Participants included officials from the central government (MAAIF, WID, NEMA and NAADS), district officers (DAOs, DAAOs, DEOs, DWOs, DFOs), keys farmers from concerned P/P sites in the seven districts of Budaka (Pallisa), Kumi, Sironko, Bugiri, Soroti, Amuria (Katakwi), and Kaberamaido, and representatives from Doho Rice Scheme.

1) Main Objectives of the Workshop

The main objectives of the workshop were to:

a. sensitize rice farmers on the importance of current legislation (laws, regulations and national policy) affecting ownership, use and access to wetlands and specifically affecting rice cultivation in seasonal wetlands;
b. sensitize rice farmers on sustainable/wise use of wetlands while conserving them perpetually (many generations);
c. facilitate interaction between government officials and farmers in identifying constraints to the project in eastern Uganda and
d. find a way forward to develop both old (those which existed before 1995) and new rice fields for purposes of eradicating poverty and strengthening food security but at the same time using wetlands wisely.

2) Arrangement of the Workshop

During the three (3) days of the workshop the following were accomplished:

a. Presentations from different participants, Study Team, WID, NEMA and local consultant/environmentalist on the first day;
b. Field visit to one of the four P/P sites located in Muyembe sub-county of Sironko district and films showing on the second day;
c. Group discussions (on first and last days of the workshop) involving all participants with the aim of identifying the workshop practical recommendations; and

d. Evaluating how participants have benefited from the workshop through the use of questionnaires.

(3) Monitoring Water and Soil Quality

The monitoring of water quality and soil fertility programme started being implemented by MAAIF/Study Team together with the DAOs and farmers in the 4 P/Ps of Budaka (Pallisa), Bugiri, Kumi and Sironko early January 2005. It was repeated in September the same year for water quality and is about to end this year, 2006. This was during the P/P stage. Monitoring, however, is to be continued by the DAOs and farmers with support of DEOs and DWOs after that. It is the wise use concept of the project which requires that water quality and soil fertility monitoring programmes be undertaken. The former (water quality monitoring) programme is to ensure that water used in production by farmers involved in paddy growing is safe enough for use downstream by fishermen (and fish), livestock and domestic use (drinking and cooking). The water therefore must not be polluted by agricultural practices namely: agro-chemicals and fertilizers. The soil fertility monitoring programme, on the other hand, will ensure that fertility is maintained by advising farmers on what is missing in their plots and how they should improve it without further encroaching on new areas on the wetlands.

1) Objectives of the monitoring

Specific objectives of water quality and soil fertility monitoring include:

- To acquire baseline data necessary to address environmental issues of water quality and soil fertility.
- To train relevant district staff and farmers in monitoring water quality and soil fertility
- To ensure wise use of wetlands through regular monitoring of water quality and soil fertility.

2) Target area or location of sites for data collection

For water quality analysis, the survey consists of sampling and laboratory analysis of water from the main stream flow supplying the irrigation water of each pilot project in order to assess its quality for use as irrigation water for rice and as drainage water back into the flow taking into account the safety biodiversity factors of the wetland. This means that water samples will be taken at both inlet and outlet so as to evaluate their conditions/state before passing through the paddy and, after the rice field at the outlets.

For soil fertility analysis, the survey consists of sampling and soil chemical analysis to identify the fertility and suitability of the land in the 4 pilot projects for irrigated rice farming. It is estimated that soil samples will be taken from representative soil profiles in each pilot project as follows: representative soil samples of the upstream stretch of the pilot project area; representative soil samples of the midstream stretch; and representative soil samples of the

downstream stretch.

3) Method of analysis (water and soil)

a. Water quality analysis

Samples of water collected at each pilot project site were delivered to the Water Quality & Pollution Control Laboratory - Entebbe for analysis of physicochemical parameters. Analysis of pesticide residues was carried out at the Government Chemist and Analytical Laboratories.

The water analysis was focused on:

- pH
- Electrical Conductivity (EC)
- Nitrates
- Phosphorus
- Agrochemicals or biocides

The samples were collected in polyethylene bottles, which had been previously acid-cleaned and rinsed with deionised water. PH and EC were measured in situ while for the rest of the parameters, samples were preserved at $4^{o}C$ and later analysed according to standard analytical methodologies.

Given the table in Appendix 2-9 is a summary of the analytical methodologies used for the various parameters.

b. Soil fertility analysis

A quick survey of the overall area was made, and then sampling units were identified according to the flow of the streams i.e. upstream, midstream and lower stream. The units were also based on appearance of the crops or vegetation. The idea was that different soils were not to be mixed to make one sample. For each unit, 5-10 soil augerings were collected at 0-20cm depths and mixed in the basin before 1 kg samples were collected. These soil samples were air-dried at room temperature at Makerere University Soils Analytical Laboratory before various analyses were carried out after crushing and sieving the soil. Chemical analysis for each soil sample in each pilot project site included specific items which pertain to agricultural production. These were:

(1)	pH (H_2O)	(7)	Available Phosphorus (P)
(2)	Electrical Conductivity (EC)	(8)	Available Nitrogen (N)
(3)	Exchangeable Calcium (Ca)	(9)	Zinc Nitrogen
(4)	Exchangeable Magnesium (Mg)	(10)	Manganese (Mn)
(5)	Exchangeable Sodium (Na)	(11)	Copper (Cu)
(6)	Exchangeable Potassium (K)	(12)	Iron (Fe)

Additional analyses presumed to be important for farmers and for wetland management were Cation Exchange Capacity (CEC), Organic matter and Total nitrogen and texture.

Chemical analyses to determine levels of nutrients and in the various soil

samples were carried out following standard methods. Given the table in Appendix 2-10 is a summary of the analytical methodologies used for the various parameters.

(4) Training Village Workshops

In line with the water and soil monitoring programmes, training village workshops were also conducted at each P/P site prior to water and soil sampling. These workshops aimed at training relevant district staff and farmers. Target district staff included DAOs, agriculture extension staff, DEOs and DWOs. Targeted Farmers were those that are directly involved in the pilot projects.

The workshops focussed on enlightening participants on water quality and soil fertility monitoring objectives and wetland wise use concept. Further, impacts on wetland ecosystem associated with rice cultivation were discussed. In particular biophysical impacts discussed included deterioration of water quality, changes in species diversity and abundance in wetlands, land degradation stemming from soil erosion, loss of fertility and soil salinisation.

Adverse socio-economic impacts emphasised included rise in incidence of malaria and bilharzia and health problems resulting from misuse of agrochemicals and improper handling of chemical containers. Positive beneficial socio-economic impacts included increased incomes through increased crop production to community thus reduced poverty, increased food security, as well as increased incomes through irrigation canal construction works.

Mitigation measures that will ensure wetland wise use were proposed and also discussed. It was pointed out that proper use of pesticides (including seeking guidance from MAAIF and extension staff on when and how pesticides and fertilisers should be used), proper use of fertilisers, prevention of soil erosion, maintenance of ecological balance (by keeping a buffer zone), monitoring of water and soil fertility are crucial to wetland wise use.

The schedule and location for monitoring of water quality and soil fertility were explained to the workshop participants. The water and soil sampling schedule was also discussed. Reference can be made to the workshop content in Appendix 2-11

At the end of each workshop at the pilot project sites, an evaluation of the workshop was conducted. Evaluation was by use of questionnaires earlier developed. The workshop participants were guided through the questionnaire and responses made by individuals on questionnaires were recorded.

2.4.2 Achievement

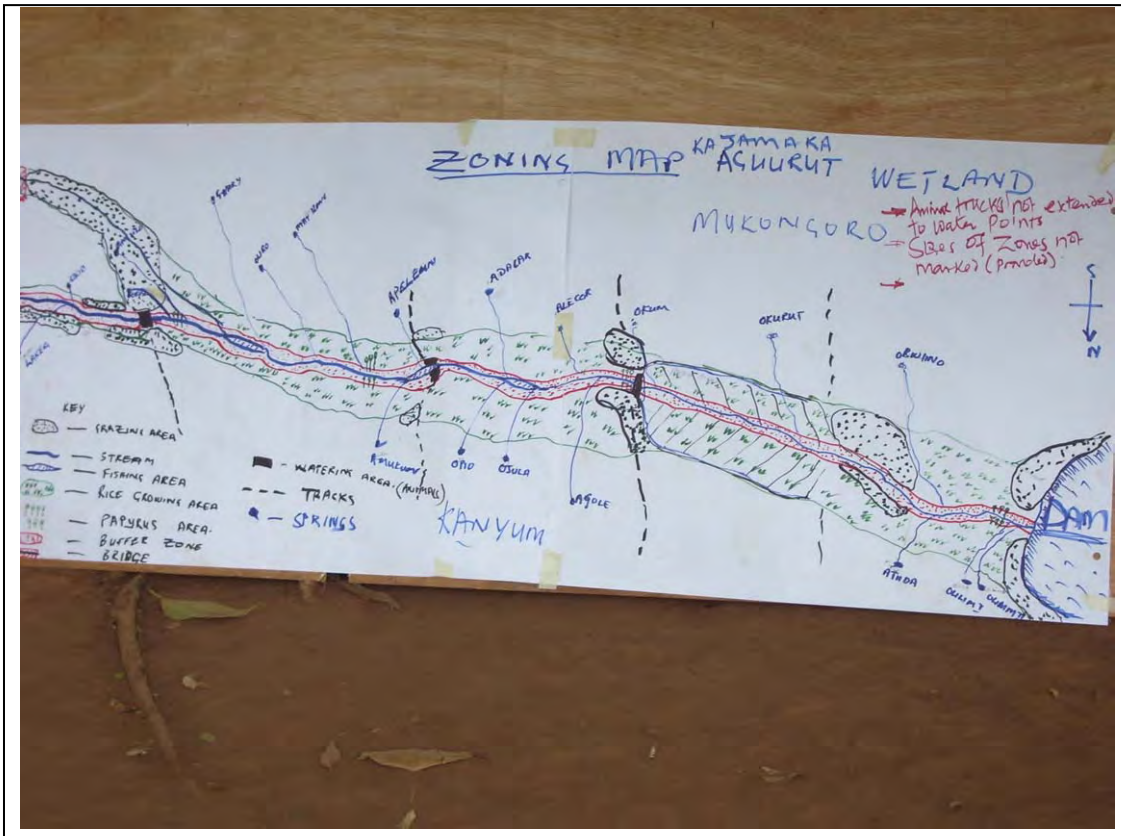
(1) Workshops for formulating CWMP

The above programme was designed not only to develop a plan but also to ensure its implementation. Therefore, the executive committee of the wetland association (WA) was organised and implementation schedule agreed. The WA has been organised in the form of umbrella organisation which takes the membership of different user

groups but not individuals. The CWMP for each site was finalised and submitted to MW&E, NEMA, CAO, LC-5 Chairperson and local government leaders. A copy of CWMP was also delivered to the leader of the WA of each site. This has been decided in envisaging the transformation of a group into cooperative or other business entity which requires record of performance as a CBO. The summary of workshop process and achievements are summarised below.

P/P Site in Kumi district

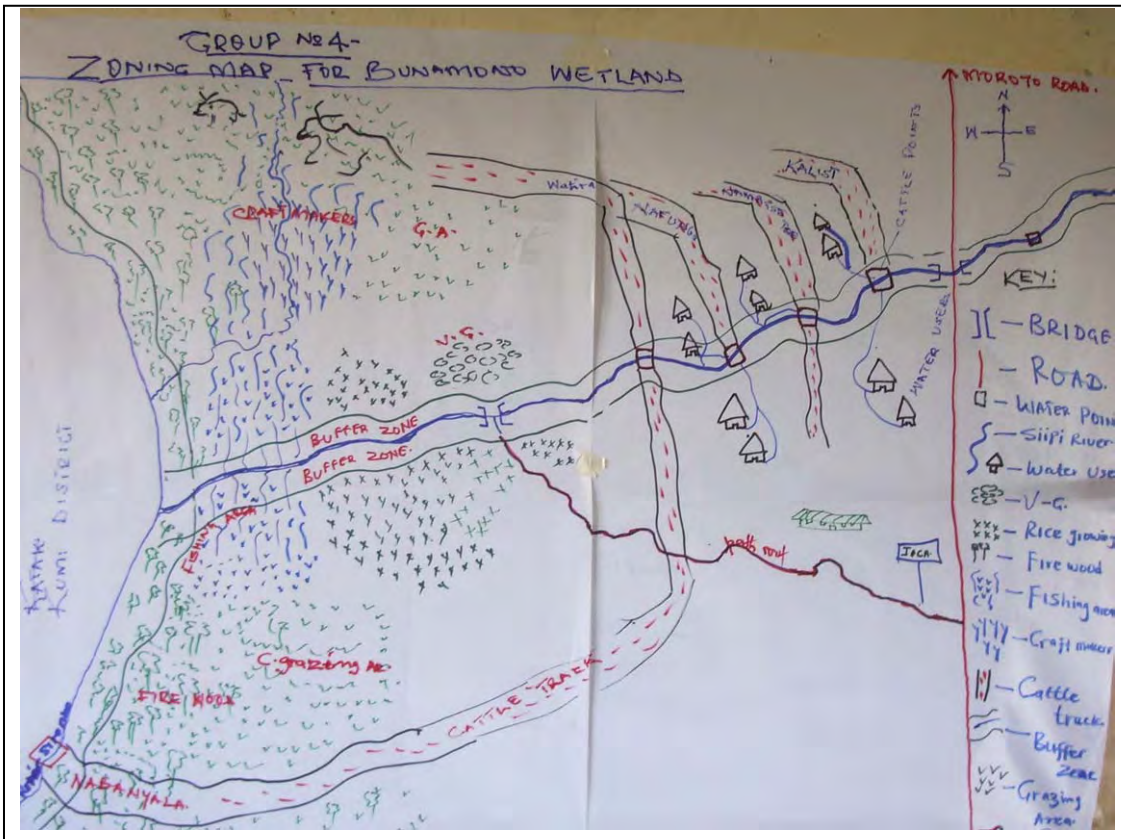
Kajamaka Wetlands are used by paddy growers, cattle grazers, domestic water users, and craft makers. The wetlands are exposed to various threats by these users by drainage of wetlands; denied access of livestock water; burning of wetlands; encroachment of buffer zone; drying up of the springs and drying of the wetlands by poor cultivation methods. In particular, up-stream farmers have encroached on the buffer zone and diverted water from the original river course, which was a critical concern amongst the paddy growers in the P/P site. During the workshops, participants realised that the most of these issues could be dealt with through sensitisation of wetland users and demarcation of wetlands for different uses which are reflected in the Kajamaka Wetland Management Plan and zoning map. Further, the Wetland Uses' Association were formed which would also be highly beneficial in coordinating various users.



Zoning Map for Kajamaka Wetlands
Source: Kajamaka Wetlands CWMP/ JICA Study Team, Dec 2005.

P/P Site in Sironko district

Sipi Wetland has been large in area. Thus, a number of users including rice growers, domestic water users, vegetable growers, cattle grazers, sugarcane growers, firewood collectors, have shared the resources. The local government has started an attempt to regulate cattle grazing activities in order to protect the food crops from the cattle encroachment by adopting the Muyembe Sub-County Food Security bye-laws though not specifically regulating the activities within wetlands. Through the resource analysis, participants have understood the wetland resources were in high demand while the availability continued to decrease. The nature of conflicts in the area has also been clarified during the workshops. The conflict in this area often occurred between rice growers and other users or within rice growers. The former conflict emerged over sharing of resources and destruction of cultivated areas. While the latter disputes have been concerning sharing of water, land boundary and sometimes caused by jealousy.



Zoning Map for Sipi Wetlands
Source: Sipi Wetlands CWMP/ JICA Study Team, Dec 2005.

Through the analysis of benefits and conflicts, the participants have drawn the zoning map for the respective wetland areas. Sensitisation on sustainable use and the demonstration of appropriate farming methods and confirmation of the zoning map through survey have been the key activities in their management plan. By the suggestion of the DEO, the budget cycle of the local government was considered in developing the time frame so that the relevant offices could allocate necessary budget

to help wetland users' association to implement the plan.

The progress on the formation of WUA in Kumi and Sironko has been very slow. This is due to the farmers' commitment to other activities such as irrigation construction and political campaigning. Thus the nominated executives have been unable to mobilise users' groups to organise a meeting to launch the formation of the association. Furthermore, the follow up by the relevant officers such as CDO/Assistant at the sub-county or the DEO/ DWO have been limited due to the lack of transport funds.

(2) Workshop on New Development and Wetland Environmental Conservation

1) Presentations

The Study Team leader gave a presentation on the progress of the Study and P/Ps and the future plans (remaining work to be done). He also presented several important findings in the Study area including the present land use in wetlands, development potential for paddy production, constraints on wise use of wetlands, etc.

The representative from NEMA gave a presentation on environmental legislation as regards wetland conservation and wise use. One of the most important contributions to this workshop made by the presenter was to inform participants that for small fields (typical of subsistence farmers) the buffer zone has been reduced to 3-5 metres from the recommended 30 metres.

The representative of WID gave a presentation on wetland conservation and wise use. One of the most important contributions made by this presenter to this workshop was to inform participants that WID can help in preparing CWMP for organized wetland users.

Presentations on Uganda legislation on wetlands with emphasis on rice cultivation in seasonal wetlands and on wise use were given by the local consultant, main facilitator of the workshop.

2) Field Visit and Films Showing

Field Visit to Bunamono P/P in Sironko district

Participants were told by the Study Team leader that each of the four P/Ps was developed according to specified purposes. For P/P in Sironko district, this was new development built according to NEMA regulations for wetland conservation.

At the project site, participants were shown the scheme by the irrigation engineer of the Study Team. This P/P will be handed over to Bunamono Farmers Association created with the help of Study Team. The scheme is located on 15 hectares along Sipi River which flows from Mt. Elgon. Banana, cassava and rice were grown in a very small-scale in the wetland. Due to continuous flooding of the river, however, farming was abandoned leaving the

wetland to grazing.

Exchange of Views with Member Farmers of Bunamono Farmers Association

The site visit was followed by a meeting between participants and with member farmers of Bunamono Farmers Association (BFA). The representative of MAAIF addressed the congregation and outlined highlight of the project objectives: to eradicate poverty through irrigation schemes, like one just visited. Farmers were cautioned on the challenges still ahead in paddy growing.

The Chairman of BFA, expressed thanks to MAAIF and Study Team for implementing the P/P, reviving the wetland, offering training and bringing farmers closer to their extension workers. He said he was happy to meet the visiting farmers from other districts of eastern Uganda with whom they had shared their experiences on rice cultivation.

During the discussion between participants and farmers it was agreed that the buffer zone be maintained whenever farmers want to expand rice gardens after the one developed by Study Team. The scheme will act as a base for development as it was specifically designed as a demonstration scheme. Farmers were advised to form a banking institution (e.g. cooperative) which is to be run and managed by the association. This will be important to provide savings and become financially self-reliant.

Pest control should be practiced while protecting the environment. The following measures practiced by other rice farmers were suggested and include:

- Variety selection: growing post tolerant rice varieties of uniform height;
- Bird scaring (using scare crows which are wind operated);
- Slashing around the plot edges to reduce on rodents damage;
- Using livestock carcass (lungs) which is hanged onto the central portion of the plot. Rotting lung repels birds!
- Constructing bunds every cropping season.
- Biological control by predatory birds which prey on rats and are found in Uganda.

Regarding management of the scheme, farmers were encouraged to develop a spirit of contributing generously towards development activities.

Films on P/Ps' Progress and Paddy Cultivation in Japan

a) Film on P/P in Kumi district

The P/P in Kumi district developed to demonstrate conversion from earlier wetland uses: upland crops and grazing to lowland paddy growing. Participants were shown a film on the ongoing P/P activities where farmers were actively involved in the whole process of constructing the irrigation facilities at the site.

Agricultural officers and farmers were trained on theoretical and practical irrigation engineering. The P/P site was identified by the local communities themselves with technical assistance of the Study Team.

Land clearing was done by farmers. Farmers were taking measurements as directed by the engineers. Construction of the bridge, dykes, intake and outlet irrigation canals and drainage canals was done with the help of JICA irrigation engineers of Study Team and Contractor. Farmers were involved in all the construction process.

Reference was also made to a farmer who adopted the technology and dug his own irrigation canal in his rice garden after receiving training from JICA. Two more sites were identified as potential areas for paddy in Atutur and Kolir sub-counties where farmers have constructed irrigation canals with the technical guidance of Kanyum Agricultural officer trained by the Study Team.

b) Film on P/P in Kaberamaido district - A Case Study

A film taken by the Study Team at P/P in Kaberamaido district was projected in the Workshop with the object of introducing good practices of P/P made for the development of new irrigated paddy field.

The farmers of Kalaki P/P in Kaberamaido district started growing rice in 2005 after provision of a series of training by Study Team. The wetland situated in Kalaki spring was previously used for sugarcane cultivation. The project which started with 15 farmers took an initiative to set up rice demonstration plots through contributions from their members (Ush. 5,000 per farmer) as operation fee. The project also has set up plots for seed multiplication.

The Kaberamaido local government through the department of agriculture appreciated farmers' effort and allocated money (Ush. 3 million) to the group to allow farmers share experiences with other rice growing districts through exchange visits, where they visited Kumi farmers last year and plan to continue with visits to other rice growing districts.

Before the Study Team, the following organisations provided agricultural support to farmers:

- SOCADIDO (Soroti Catholic Diocese Development Organisation) provided skills, seeds, restocking and forestation training;
- Teso Development organisation which provided seeds (upland crops), skills and hoes;
- Katanga Women's Association provided labour especially during weeding to needy groups or individuals and
- FAO and Makerere University Supported farmer field schools targeted cotton, groundnuts and cowpeas growers.

However, there was no organisation to train farmers on paddy production.

JICA support involved, covering both the farmers and local officials,

- Training in paddy cultivation technology from seed selection to harvesting;
- Training in organisation and institutional development for strengthening

of farmers' organisation in production, wetland conservation, water use, and organisational management (financial management, record keeping, leadership and cohesion); and
- Training in irrigation engineering including irrigation scheme planning and promotion, irrigation facility constriction, water management, and operation and maintenance.

In conclusion, farmers of Kalaki attributed their success to:

- Good and active leadership;
- Strong linkages between farmers and local officer for the development of paddy sub-sector and community;
- Gender sensitive groups which are in leadership;
- Cooperation and commitment among the group members and the leadership;
- Supportive local environmental policies and presence of technical staff at field level.

The total paddy field operated by the farmers' group members was 1.4 ha (3.5 ac) in 2005, and it will be 2.0 ha (5 ac) in 2006. The group has a plan for its expansion up to 4.0 ha (10 ac) paying attention to wise use of wetland.

c) Two films on paddy cultivation in Japan

Two films which introduce Japanese way of paddy cultivation technologies were projected also in the workshop: one was a 53-minute film produced in 1954 (or 52 years ago) showing less mechanized paddy cultivation that were introduced to the farmers and extension officers in the training of P/Ps, and the other one was an 18-minute film produced recently showing the present mechanised paddy cultivation. By showing these two films, the Study Team intended to give understanding to the participants of the following points:

- Multilateral function of paddy field, particularly in its role in water resource conservation and wetland sustainable use (Refer to Appendix 2-12 for more details);
- Importance of group work in irrigated paddy production, e.g., operation and maintenance of irrigation facilities; and
- Importance of research work in developing paddy technologies.

3) Group discussions

Some sections of the legislation, according to the observations made by farmers and Study Team, are ambiguous and unattainable. Most notable ones to focus on and discuss in this workshop included:

a) Wetland users' rights, buffer zone, CWMP and WA for wise use of all the wetlands;
b) Water users' rights;
c) Fear of wetland users to form groups; and
d) WA expected to carry out EIA when in reality, it is not possible.

The above mentioned ambiguities are part of group discussion presented below.

Group Discussions on Legislation Affecting Wetland Ownership, Use and Access

Participants were divided into four groups:

Group I - Officers from central government. These officers are from:

- MAAIF,
- NEMA,
- WID (a division in the Ministry of Lands, Water and Environment);

Group II - District Agriculture Officers

Group III - District Environment and Wetland Officer

Group IV - Key Farmers

Before all the four groups the following five issues/questions were explained, and each group was requested to discuss them:

- Can subsistence farmers process wetland permit and pay Ush. 50,000 for application and Ush. 100,000 for user permit?
- For areas, e.g., Bugiri and Budaka (Pallisa) where rice fields existed before 1995, even 3-5 metres is too wide for buffer zone - what to do?
- For small farmers (20 x 20 metres) water permit is not required. What about when form WA – Can the permit be waived? (For area like Doho rice Scheme processing permit is Ush. 450,000 and permit is Ush. 3,000,000 per year).
- What can be done to develop trust in government workers by farmers?
- Is it possible to waive off EIA or Project Brief and can some funds be provided to undertake for the cost of preparing CWMP?

Groups discussed the above questions and responded to them in the plenary. Responses to questions and recommendations for the way ahead are presented in Table 2.4.1.

Group Discussions on Issues/Problems Affecting Wetland Wise Use

Participants were divided into three groups:

Group A: MAAIF and DAOs
Group B: WID and NEMA officers and District Environment & Wetland officers; and
Group C: Key farmers.

Each of the above groups was given the same questions below to discuss and give recommendations. The questions were:

- Where will money come from for water quality and soil fertility monitoring? And by who?
- Is there enough capacity and resources for effective environmental monitoring at district level?

- Is there enough capacity and resources to monitor proper use of agrochemicals and fertilizers?
- What about users right for wetlands and water with such exorbitant rates?
- Can EIA be substituted for CWMP?
- Can WA carry out EIA for wetlands?
- Can WA prepare CWMP?

Response to the questions and recommendations are summarized in Table 2.4.2.

The recommendations given by the different parties in the group discussions, though not solving all the tricky questions associated with wetland ownership, use, access and wise use, have somewhat shed some lights on some of them. Therefore, farmers with the help of central and districts officers can hopefully start the necessary procedures for users' rights and wetland sustainable use, knowing that many challenges are ahead of them, which are, however, surmountable.

Questions to Presenters

Participants were requested to ask questions and the following were directed to different resource persons:

a) Is it possible for farmers to share costs for user rights/ permits of wetland and water?

Answer:

Yes, it is possible when farmers are in organized groups (associations) and it becomes even cheaper for each member farmer.

b) Can one say that the government policy on farmers is poor?

Answer:

The central government needs to help poor farmers, initially, until they are able to pay for themselves.

c) What is in your opinion, as a consultant, the cause of fear expressed by farmers on seeing government officers and donors?

Answer:

In my opinion, as a consultant or environmental practitioner, there are several reasons but as a son of a peasant (born a village), I know that people in villages just think that government officers are big people who can arrest anybody and people just fear them. Another reason is poor conduct of government officers. They are at times not polite.

d) Can you give more explanation on drainage of a wetland and in which case is permit needed? (addressed to the representative of NEMA)

Answer:

There is a difference between draining (removing water from a wetland) and diverting some water from a river or a stream (for irrigation purpose) to a crop field. The one draining a wetland is illegal while one who is irrigating is not illegal only that water abstraction and wetland use permits may or may not be required depending on the size of the field and water requirement.

e) What are legal implications regarding land tittles acquired before and after 1995 as regards use of wetlands? (addressed to the representative of NEMA)?

Answer:

Titles in wetland acquired before 1995 are legal but when their lease periods expire they cannot be renewed. To use any of those pieces of land (wetlands), however, a permit is required all the same. Titles acquired after 1995 are illegal but can be used after getting relevant permits.

f) Doesn't the recent directive by H.E. The President of Uganda on eviction of wetland encroachers' conflict with law enforcement? (addressed to the representative of NEMA)

Answer:

The directive is for political purposes. Enforcement of law/regulations continues.

g) People still prefer to use wetlands individually than operating through the WAs. What do you say about that? (addressed to the representative of NEMA)

Answer:

The national policy emphasizes communal use of the wetland.

h) How does one determine the highest river mark (when measuring required buffer zone), especially if the river floods an area stretching over a kilometre from the (obvious) river bank? (addressed to the representative of NEMA)

Answer:

The highest river marker is the last mark reached when the river last flooded and for the lake – is the lowest mark reached when the lake last shrunk.

i) Wetland management was decentralized to districts but issuing wetland user permits has not started. Why? And where does money colleted supposed to be paid? (addressed to the representative of NEMA)

Answer:

It is true that district committees are supposed to issue wetland use permit but the process for some reasons has not been started. Money from the permit is supposed to be deposited on the account of National Environment Fund.

j) What are implications of leasing land which has some wetlands within its boundaries? (addressed to the representative of NEMA)

Answer:

Land can be leased but using those wetlands will require clearance from NEMA.

Though attempts to answer the above questions were made, still the following issues seem to remain unresolved and require further consultation among stakeholders:

a) Possibility of paying and sharing user right fees (wetland and water);
b) Causes of fear among farmers when encounter government officials and donors;
c) Ownership of wetlands before and after 1995;
d) Preference of individual use of wetland versus communal use;
e) Determining the highest river mark for purposes of determining buffer zone and lowest mark for lakes.

Workshop Evaluation and Analysis

a) Workshop Evaluation

Using a questionnaire provided (see Appendix 2-13), participants were requested to evaluate the workshop by just ticking on one of the answers provided. Forty three (43) responded and results of the evaluation are in Tables 2.4.3 and 2.4.4.

b) Workshop Evaluation Analysis

General

As expected, according to Table 2.4.3, government officials (central and district) answered more positively (YES) than farmers.

In Table 2.4.4, Question 15" Do you know when and where to monitor soil fertility in the rice field?" was least understood – 26% of farmers did not know when and where to monitor soil fertility in rice fields. This was followed by Questions 11 "Have you understood what the term "soil fertility" and what is checked?" and 12 "Do you know what agrochemicals to use and from where to get correct information? – 16% and 11% of farmers did not understand the questions respectively. Similarly 11% of farmers did not know what agrochemicals to use and where to get correct information. One District official did not know Question 12.

Generally, one can say that 90% of the participants benefited from the workshop according to the way the questionnaire was answered. There were 14 answers with a "NO" out of the total 817 and 25 not answered questions. Questions with "NO" answers accounted for 1.7% of the total.

Workshop Evaluation on Understanding Wetland Wise Use

What is the percentage (%) of farmers who understood the objectives of monitoring for wetlands use?

- According to Table 2.4.4, Question 8 “Have you understood the term "wise use" of wetlands?” was answered 100% by all farmers. The same applies to government workers.
- Question 9 “Have you understood what the term "monitoring" means?” was answered 100% by all participants.

Group discussions indicated that there is lack of resources to implement monitoring at district level (after P/P carried out by the Study Team).

From the film of Kumi P/P, it was clear that there is a high degree of group participation in P/P.

Workshop Evaluation on Understanding a Buffer Zone

What is the percentage (%) of participants who have understood the objectives of buffer zone for wetland wise use?

- More than 90% understood because 95 % of farmers answered YES to Question 2 “Did you understand sections of laws/Regulations which are directly related to wetland use? 100 % to Question 3 “Have you understood other environmental management regulations which also concern wetlands users? And 100 % to Question 5.” Did you learn new things on rice cultivation from Sironko P/P (demonstration site)”?
- 100% of government officials understood the importance of buffer zone according to the way they answered Questions 2, 3 and 5.
- 100% of local government officers can lecture about the importance of a buffer zone.

Workshop Evaluation on Understanding CWMP

Over 80% of farmers understood CWMP because they said it is expensive to do during their group discussion.

Workshop Evaluation on Understanding Legislation on Wetland Use

From Table 2.4.1, the following were observed:

- After workshop at least 80% understood because 100% of all participants answered “YES” on Question 1” How have you understood current laws and Regulations on wetlands?” of the Questionnaire.
- Local government officials’ group discussion indicated that they want the law/regulations enforced for EIA and wetland and Water user permits) but proposed to farmers to ask for grace period before they can start paying and also ask for reduced rates.
- Local government officials promised to change their attitude towards farmers (to increase trust) after the workshop.

(3) Water Quality and Soil Fertility Monitoring and Village Training Workshops on Wise Use of Wetlands

1) Water Quality Monitoring

a) Background

The first time water was analyzed in January 2005 in 4 P/P sites by the Study Team, it was a dry season. The second water monitoring in September 2005 was carried out in the same areas in the rainy season. This last time, in August 2006, it is also a rainy season. The difference in results of the two sets (September, 2005 and August, 2006) of analyses should, therefore, not be attributed to rainy season. The same laboratories were used for water analysis.

b) Location of water sampling points

In each P/P site there is specific surface water (river/stream) flowing through or along the site which will be used to irrigate low land paddy fields. Water quality sampling carried out at two specific points (upstream and down stream) along each of the surface water (stream/river/seasonal wetland). Exact locations of water sampling points for each of the P/P site are summarized in the tables below. GPS co-ordinates (locations) of sampling points are the same as those used in September 2005 but differed slightly from those of January 2005 (see below).

Location of Water Sampling Points (September 2005 and August 2006)

Site Name (District)	Used Surface water	GPS Co-ordinates			
		Upstream		Down stream	
		UTME	UTM N/S	UTME	UTM N/S
Jami &kakoli (Pallisa)	Seasonal stream	618 804	17 154	617 971	16 561
Kasolwe (Bugiri)	Seasonal stream	572 411	60 503	572 071	61 321
Kajamaka (Kumi)	Seasonal stream	597 736	48 111	596 900	48 111
Muyembe (Sironko)	Sipi River	643 336	52 942	642 759	53 191

Location of Water Sampling Points (January 2005)

Site Name (District)	Used Surface water	GPS Co-ordinates			
		Upstream		Down stream	
		UTME	UTM N/S	UTME	UTM N/S
Jami &kakoli (Pallisa)	Seasonal stream	618 147	17 121	617 971	16 530
Kasolwe (Bugiri)	Seasonal stream	572 411	60 503	572 278	61 151
Kajamaka (Kumi)	Seasonal stream	597 736	48 111	596 900	48 778
Muyembe (Sironko)	Sipi River	643 336	52 942	642 759	53 191

c) Order of water sampling and analysis

It is very important that right from the beginning, it was clear where and when to start and to end the water and sampling/analysis if results are to be representative of the actual state of water in the streams/rivers. The 4 P/P sites were visited within a period of six days: from 8th to 12th August 2006. To

avoid deterioration of water quality, water samples were immediately put inside icebox (of about 4^{o}C) and on 10th September, the samples were delivered to the two laboratories.

d) Water sampling/analysis (field)

At each of the P/P site, using the German 12Global Positioning System (GPS) exact points where previous (January and September 2005) water sampling were carried out were identified. District officers and local farmers confirmed the sampling points. Water was sampled using new glass bottles (clean and dry). The bottles were immediately stored at temperatures of about 4^{o}C to slow down water quality deterioration. Two parameters (pH and electrical conductivity) were analysed on spot (in the field) using portable field kits of standard specifications.

e) Laboratory analysis

Water samples (eight in total) were taken to two laboratories:

- Water quality and pollution control laboratory, Entebbe (we call it Lab No. 1); and
- Government chemist and Analytical Laboratory (we call it Lab. No.2).

In Lab. No.1, Nitrates and Phosphates (reactive phosphorous were analyzed) while in Lab.No.2, pesticides were analyzed. The two Laboratories are believed to be accurate. No evidence of equipment calibration was, however, provided. Laboratory No.1 used standard procedures to analyze Nitrates and Phosphorous while Lab.No.2 used spectroscopic method of analysis to identify and quantify the commonly used pesticides in the P/P areas.

From previous response to the questionnaires (in 2005), it was established that the most commonly used agrochemicals (in the P/P sites) area are:

- Dithane (macozeb);
- Diquat;
- Round up (glyphosate amine salt);
- Paraquat dichloride (gramoxone extra); and
- Ambush (permethrin).

These five pesticides were then analysed in the Lab No.2. Other water quality parameters (physiochemical) are described in the section below.

f) Water quality

The water quality for all the water samples obtained is explained in terms of physical, chemical (nutrients) and agrochemical (pesticides) quality.

Physio-chemical parameters analyzed were:

- pH;
- Electrical conductivity (EC);
- Nitrates;
- Phosphorous

Apart from pH and EC, which were to be analysed, upstream only (on each P/P site) the rest of the above parameters were supposed to be analysed both upstream and down stream. Electrical conductivity (EC) and pH was analysed directly on-site (in the field). The electrical conductivity indicates the capacity of water to conduct current. High EC values of 500 μS/cm for surface water indicates inflow of pollutants. The pH expresses the acidity and alkalinity of the water. pH less than (<) 7.0 indicates acidic conditions, pH which equals (=) 7.0 indicate neutrals condition while pH greater than (>) 7.0 indicates alkaline conditions.

2) Soil Fertility Monitoring

a) Soil sampling and analysis methodology

This was the second soil fertility monitoring activity and the previous methodology used in January 2005 was adopted. Soil sampling and numbering followed the same pattern. Some farmers who participated in previous soil sampling guided (the soil scientist) in the areas to sample according to sketch maps drawn in January 2005 study (P/R (2) of Study Team).

Soil sampling started from 8th to 12th August 2006. Samples were stored in double layer polyethylene bags and delivered to the laboratory at the Faculty of Agriculture, Makerere University, for analysis on 14th August 2006.

The obtained composite soil samples were air-dried, pounded and sieved through 2 mm sieve net and analyzed for chemical (No. 1-14) and physical (No. 15) properties using procedures described in P/R (2) of Study Team and Section 2.4.1 (3) above and having been adopted from Okalebo *et al*. (2002).

b) General observation on each P/P

Budaka (Pallisa)/ Jami/Kakoli P/P

Much of the area was under paddy ranging from fairly dark green in upper stream to light yellowish in the downstream. Similarly, the plots had been flooded to about 15-20 cm water depth. Some farmers have started using inorganic fertilizer in their crop especially in the down stream section of the P/P area.

Bugiri/ Kasolwe P/P

The P/P area was about under weed cover though 3 plots in the downstream had been ploughed and planted with millet/rice, maize and beans, respectively. The soil was wet and sticky but no flooding with water, for which reason paddy had not been planted. The weed appeared deep green but stunted. No record of soil fertility input reported.

Kumi/ Kajamaka P/P

The plots were irregularly prepared, such some had just been ploughed, and some rice about to harvest and others under weed cover (kind of fallow). This

could be attributed to irregular water distribution across the plot in the P/P area. The upper stream had wet and sticky soil, mid stream had some plots flooded (5-15 cm water depth) and under paddy crop while downstream also had wet but loose soil and some plot just ploughed. No record of soil fertility input reported.

Sironko/ Muyembe P/P

Most of the P/P area was under rice and deeply flooded (30-60 cm water depth). The rice crop appeared normal, green and stout. It was mentioned that the area had just been opened for cultivation and growing was the first crop. The soils were very wet and sticky. No record of any soil fertility input reported.

3) Village Training Workshops on Wise Use of Wetlands

a) Concept of Wetland Wise Use

One of the objectives of the Water Quality and Soil Fertility Monitoring activity was to train district officers and farmers how to sample water and soil by themselves (as the Study Team was facilitating the monitoring for the last time) in addition to deepening their knowledge on wetland wise use. The following people were present at a brief workshop at each of P/P before field demonstration of how to sample water and soil and how/where to take them (to corresponding laboratories):

- District Environmental Officer;
- District Wetland Officer;
- District Agriculture Officer (or his/ her assignment); and selected farmers.

The facilitator of the workshop used charts and maps as well as previous results of water monitoring to explain to participants the concept of wetland wise use which is based on five important points, i.e., (i) proper use of pesticides, (ii) proper use of fertilizers, (iii) prevention of soil erosion, (iv) maintenance of ecological balance, and (v) monitoring (water quality and soil fertility, among others).

To establish the levels of understanding of the concept of wetland wise use by the main stakeholders of P/Ps, one questionnaire for farmers and one for district officers (see Appendix 2-14) were used. Summary of response to the questionnaires is presented in Appendix 2-15.

4) Achievement of the Outputs

1. Water Quality

a) Physiochemical quality

Physiochemical water parameters of stream (surface water) used for rice growing at the 4 P/Ps are summarized in the table below.

Results of Analysis of Physical Water quality

Parameter	Unit	Budaka (Pallisa) Jami & Kakoli		Bugiri Kasolwe		Kumi Kajamaka		Sironko Muyembe		Effluent discharge Standards (NEMA)
		Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	
pH	…	5.66	5.91	5.72	5.40	6.38	6.03	6.72	6.51	5.5-9.9
Electrical Conductivity	µS/cm	236	175	130	154	96	74	116	117	NS

NS: Not specified

Electrical Conductivity (EC)

EC measurements indicated that EC values for the upstream and downstream recorded at each site showed no significant differences and no inflow of pollutants.

pH

Measurements of pH at the 4 P/P sites indicated that, all the water samples showed pH in the range of acidic conditions but pH values observed are within the recommended standard for surface water and therefore not harmful to aquatic lives.

Nutrients in water

The nutrient parameters measured were nitrate and Total phosphates. As shown in the table below, all the water samples examined indicated nitrate levels below the ambient level of 0.20 mg/l (that is, natural levels) and far below the National effluent standards of 10 mg/l. Total phosphate levels in all the water samples examined were higher than the ambient level of 0.2 mg/l but still far below the National effluent standards of 10 mg/l. The analyses also indicated insignificant difference in concentration levels between the upstream and downstream for both nitrate and phosphorus.

Nutrient levels in the water

Parameter	Unit	Budaka (Pallisa) Jami & Kakoli		Bugiri Kasolwe		Kumi Kajamaka		Sironko Muyembe		Effluent discharge Standards (NEMA)
		Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	
Nitrate	mg/l	0.10	0.15	0.05	0.10	0.05	0.07	0.09	0.11	10
T. Phosphate	mg/l	2.00	2.13	0.29	0.28	1.09	1.16	0.32	0.36	10

Presence of agrochemicals (pesticides)

From the result shown below, water samples of 4 P/P sites indicated agrochemical concentrations below the detection limits. However, treatment of paddy fungal disease was confirmed at Budaka (Pallisa) P/P site and localised application of Dithane was conducted under the supervision of the district. The agrochemicals are: Dithane, Ambush, Diquat, Paraquat and glyphosphate.

Agrochemical Levels in the water

Parameter	Unit	Budaka (Pallisa) Jami & Kakoli		Bugiri Kasolwe		Kumi Kajamaka		Sironko Muyembe		Effluent discharge Standards (NEMA)
		Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	
Dithane (Mancozeb)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02
Glyphosphate	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.70
Diquat	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.06
Paraquat dichloride salt (gramoxone extra)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Ambush (Permethrin)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02

b) Major observations and discussion on the water quality analyses

The table below shows physiochemical water quality results for the 4 P/P sites measured at different times (2005 and 2006) and seasons (dry season in January and rain season in August/September). The results in the first line (1) are for January 2005, in the second line (2) are for September 2005 and in the third line (3) are for August 2006. From these results, the pH, Electrical Conductivity and nitrate levels in all the water samples showed no significant variation except the Electrical Conductivity result for Sironko P/P site measured in September 2005 which was lower than the measurements obtained in January 2005 and August 2006 as a result of seasonal change.

The phosphorus measured in August 2006 was total phosphorus, while that measured in January 2005 and September 2005 was for reactive phosphorus. From the result obtained in August 2006, there was no significant difference in phosphorus levels between the upstream and down stream water samples. Although the measurements obtained in August 2006 was based on total phosphorus, there was no significant increase in phosphorus levels in water at all the sites (T. phosphorus x 0.03= reactive phosphorus) (see table below).

It can, therefore, be concluded that within a period of two years no significant change has taken place in physiochemical water quality irrespective of seasonal changes.

Physiochemical Water Quality Results for 2005 and 2006

Parameter	Unit	Time of Sampling/ analysis*	Budaka (Pallisa) Jami & Kakoli		Bugiri Kasolwe		Kumi Kajamaka		Sironko Muyembe	
			Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream
pH	…	(1) (2) (3)	7.10 6.26 5.66	7.70 - 5.91	6.60 6.35 5.72	5.50 - 5.40	6.80 5.93 6.38	6.70 - 6.03	7.80 7.04 6.72	7.80 - 6.51
Electrical Conducting	µs/cm	(1) (2) (3)	288 225 236	258 203 175	130 138 130	153 174.3 154	164 107.3 96	102 85.6 74	117 65.6 116	117 68 117
Nitrates	mg/l	(1) (2) (3)	0.05 <0.02 0.10	0.05 <0.02 0.15	0.242 <0.02 0.10	0.123 0.02 0.05	0.106 <0.02 0.05	0.092 <0.02 0.07	0.528 <0.02 0.09	0.616 0.14 0.11
Phosphorous	mg/l	(1) (2) (3)	0.05 0.09 0.06	0.05 0.10 0.06	<0.08 <0.08 0.01	<0.08 <0.08 0.01	0.24 0.17 0.03	0.24 0.15 0.03	0.23 <0.08 0.01	0.20 0.08 0.01

Note *; Time of sampling and analysis was in (1) January 2005, (2) September 2005, and (3) August 2006

Similarly, the agrochemical levels examined in all the water samples indicated no deviation from the previous measurements (after one year) as shown in the table below. This results shows that there is little increase in use of agrochemicals during the one year period not only on the P/P sites but also within the catchment areas. This is confirmed by answers to questionnaires on use of agrochemicals where the majority indicates that they do not use them.

Agrochemical Water Quality Results after One Year

Parameter	Unit	Time of Sampling/ analysis*	Budaka (Pallisa) Jami & Kakoli		Bugiri Kasolwe		Kumi Kajamaka		Sironko Muyembe	
			Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream	Up Stream	Down Stream
Dithane (Mancozeb)	mg/l	(1) (3)	<0.001 <0.001	<0.001 0.001	<0.001 <0.001	<0.001 <0.001	<0.001 0.001	<0.001 0.001	<0.001 0.001	<0.001 <0.001
Diquat	mg/l	(1) (3)	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001
Glyphosphate amine salt	mg/l	(1) (3)	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001
Paraquat dichloride salt (gramoxone extra)	mg/l	(1) (3)	<0.001 <0.001	<0.001- <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001
Ambush (Permethrin)	mg/l	(1) (3)	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001	<0.001 <0.001

Note *; Time of sampling and analysis was in (1) January 2005, and (3) August 2006

c) Recommendations and conclusion

Recommendations

Although all the water samples examined indicated good quality in terms of nutrient and agrochemical levels, the following recommendations should be put

in place to ensure that water quality in P/P sites does not deteriorate:

- Farmers should avoid use of fertilizers and erosion-inducing agricultural practices in the protective buffer strip surrounding the wetlands.
- Limit the use of nitrogen fertilizers to quantities that do not exceed 100 Kg/ (ha farmlands)/year.
- Fertilizers should be applied in ways that maximize their utilisation by plants and thus preventing introduction into water.
- Distribute fertilizers dosages during periods of most rapid growth.
- Use slow release fertilizer forms e.g. pellets.
- Leave natural organic matter in ploughed field to slow nitrate elution.
- Do not apply fertilizers to un-vegetated or unsown fields.
- Localise the application of agrochemicals.
- Good agricultural practices should be designed to slow erosion and silt input into the streams.
- Provide training to the farmers on the use of agrochemicals and the value of the watershed.
- Initiate awareness campaigns and community involvement to improve on their attitude regarding environmental issues.

Conclusion

Based on the laboratory and field analysis carried out on the water samples, all the samples analysed conformed to the recommended National Environmental standards for surface water. If the above recommendations are implemented, the rate of surface water pollution can remain slow for examined parameters.

2. Soil Fertility

a) Results of soil analysis

Soil samples were analysed in the soil laboratory at the Faculty of Agriculture, Makerere University. Results of soil analysis in 2005 and 2006 are summarized in Tables 2.4.5 and 2.4.6, respectively.

b) Major observations on soil analysis and recommendations

Pallisa/ Jami/Kakoli P/P

Samples indicate fertile soil for crop production. For instance, pH is within recommended range of 5.5 - 6-5, total N and available P are equally above critical values. Comparing these results with results from previous soil analysis (Table 2.4.5), it would occur as if there was an improvement in soil fertility. It should be noted that the wet condition could have helped conserve nutrients from organic matter mineralization unlike in the previous study when sampling was done on dry and hard soil. Secondly observations from the growing crop indicate that the soils were relatively fertile. It is recommended that caution must be taken to conserve and ensure nutrient recycling to maintain and improve soil fertility.

Bugiri/ Kasolwe P/P

Soil samples indicate increasing soil acidity, low and declining major plant nutrients (N and P) and organic matter. Lack of water could have accelerated oxidation of acid forming elements (e.g. Sulphur and Iron) leading to an increase in acidity compared to January 2005 soil analysis results. Similarly, there has been increased mineralization of organic matter and loss of N. The results indicate low soil fertility and productivity. A great negative deviation from previous soil analysis noted from soil analysis results. It is recommended that soil fertility improvement technologies proposed in previous report must be adopted to change the declining trend.

Kumi/ Kajamaka P/P

The soil samples indicate increasing alkalinity though still generally within recommended range (5.5 - 6.5). Secondly, there is limited organic matter, low soil fertility especially deficiencies of N and P, not much deviation from previous analysis. Due to the sandy nature of the soils, it is recommended that to successfully implement paddy scheme, efforts must be made to increase soil organic matter, which would reduce nutrient leaching, at the same time adding nutrient especially N and P. Under the current condition, even use of inorganic fertilizer would not be profitable and would increase water pollution.

Sironko/ Muyembe P/P

Soil analysis results indicate a fertile and productive land. There is adequate soil organic matter, nitrogen, phosphorous and all the other nutrients analyzed were above critical values. Similarly, pH was in the comfortable range for all crops. There is no much deviation from previous soil analysis (January 2005).

Further comments relating to soil test results of 2005 and 2006

(a) Disparity in CEC results between 2005 and 2006:

After carefully studying the results, one is forced to believe that the reported CEC (2005) is a mere summation of exchangeable bases (i.e. Ca^{2+}, Mg^{2+}, Na^{+} and K^{+}. Whereas these bases have a positive correlation with CEC, they are not always equal to CEC. Note that CEC is "the sum total of the exchangeable cations that a soil can absorb". Results of 2005 suggested 100% circulation which is hardly achievable in arable soil. Please also note that the CEC results of 0.89 and 0.86 (Sironko 16 and 17 respectively) presented in P/R5 was a human error when typing-in the results. You will notice that these results are the same as for K^{+} for each site respectively. In the data form, K and CEC followed each other and we regret such a gross error, fortunately it has been noticed before being published and corrected. The correct results are 16.8 and 17.2 respectively

(b) Disparity in EC results between 2005 and 2006

Possible explanation should be related to moisture content. When we were in

the field collecting the samples, It was learnt that at first sampling, the soils were very dry and almost impenetrable by the auger. On the second sampling, Sironko was over-submerged (ca 0.5 – 1 m water level) while Pallisa and Kumi were equally oversaturated. EC fluctuates with water content. It increases with soil moisture as more salts get in solution and conduct current flow but reduces at excesses levels of water due to over-dilution of salt concentration. McCutcheon *et al*. (2006) report water content is dominant factor affecting spatial and temporal apparent EC variability. (Ref: *McCutcheon M.C., H.J. Farahani, J.D. Stednick, G.W. Buchleiter, T.R. Green 2006. Effect of soil water on apparent soil electrical conductivity and texture relationship in dryland fields.* ***Biosystems Engineering*** *94 (1): 19 – 32*).

(c) Observations on salinisation and acidification of soils

On salinity, the pilot project is using fresh water of river originating from non-saline lakes. It is therefore less likely to lead to salinisation in a short time. Besides, farmers do not apply any chemical fertilizers that would accelerate accumulation of salts in the paddy fields. On the other hand, excessive drainage will lead to acidification as observed in Bugiri. Acidification due to excessive drainage was reported in Kigezi wetlands here in Uganda. In a nutshell, with limited sources of salts in the paddy fields, the focus should be on ensuring adequate water in the soil to minimize oxidation of sulphides, Iron and Lead oxides, which would increase acidification. Note that the soils have high clay content and high Iron concentration (consistent in results of both 2005 and 2006). It is important to also note Bugiri was over-drained, no sufficient water; had the highest Iron concentration that drastically dropped in 2006 analysis leading to a drop in pH values. Similarly, Sironko has a great risk of acidification indicated by relatively low pH (in 2005 and 2006) and high Iron concentration.

3. Training Village Workshops on Wise Use of Wetlands

a) Major observations on understanding wise use of wetlands

From the analysis of answers given to questions in the questionnaires (Tables 2.4.7 and 2.4.8), major observations were made regarding the levels of understanding the concept of wise/sustainable use of wetlands.

<u>District Officers</u>

To ensure continuity of this programme of paddy cultivation in wetlands, district officers have to play a leading role. Their understanding of sustainable use of wetlands must be high. From the questionnaires given to them after a short training workshop (there were two similar one conducted in the year 2005) at each P/P site, the following major observations were made by analysing Table 2.4.7.

(a) All (100%) DEO/DWO in the four districts have not been conducting water quality monitoring. Reasons include lack of facilitation and equipment;

(b) Only officers in Bugiri and half in Budaka (Pallisa) district out of the total 11 officers (36%) are capable of conducting water quality and soil fertility monitoring with farmers alone if funds are available;
(c) All officers (100%) in the four districts know agrochemicals and fertilisers recommended by MAAIF for paddy cultivation;
(d) Only 5 of the 11 district officers (45%) have lists of a recommended agrochemicals and fertilisers and these are in Budaka (Pallisa) and Kumi districts;
(e) Six out of 11 officers (55%) can differentiate between agrochemicals used for upland and lowland paddy;
(f) All 11 officers (100%) understand the meaning of wetland wise use;
(g) Only one officer out of 11 (9%) does not know the purpose of water monitoring;
(h) Eight out of 11 officers (73%) know the purpose of soil fertility;
(i) Eight out of 11 officers (73%) know when water monitoring should be carried out;
(j) Seven out of 11 officers (64%) know when to carry out soil fertility monitoring;
(k) District officers have received little from MAAIF;
(l) One (Sironko district) received twice progress reports (by Study Team); and
(m) One received lists of recommended agrochemicals for farmers.

The above mentioned analysis shows that district officials understand very well the concept of wise use of wetlands and the potential is there to conduct water and soil quality monitoring. Therefore, provided that initial support can be guaranteed by the central level in terms of fund, equipment and technical backup, it would be fair to say that the monitoring of water and soil quality can be successfully continued by officers and farmers who have been fully involved in the past activities.

Farmers

Farmers are the most important in sustainable use of the wetlands as they are directly involved in using it. From Table 2.4.8, the following major observations can be made:

(a) In all four districts only 63 out 69 (91%) say they would be able to monitor water quality and soil fertility with 100% of Kumi being capable.
(b) 27 farmers out of 69 (39%) have experience in the use of agrochemicals - the lowest being in Sironko (0%) and highest in Kumi (87%)
(c) Few farmers know correct names of agrochemicals but those of Kumi and Budaka (Pallisa) have some knowledge.
(d) Some farmers claim using cow dung and urine as well as rice straws (for a organic manure) but to what extent remains the question.
(e) 24 farmers out of 69 (35%) know recommended fertilizers and agrochemicals by MAAIF with Kumi performing best (80%) followed by

Budaka (Pallisa) (59%).

(f) 49 farmers out of 69 (71%) know the meaning of wetland wise use with Sironko being the best (100%).

(g) As to what they should do before using pesticides only 38 out of 69 (55%) know the answer.

(h) For fertilizers only 37 out of 69 (54 %) farmers know who to contact.

(i) 45 farmers out of 69 (65%) know when to conduct water quality monitoring.

(j) 41 farmers out of 69 (59%) know when to monitor fertility with Sironko being the best (100%).

(k) 36 out of 69 (52%) claim not to burn bush to clear their plots and burn straw

(l) 46 out of 69 (67%) say they will practice what they have been taught

(m) From district officers farmers receive:

- Advice on recommended agrochemicals: 23 of 69 (33%)
- Advice on how to get good water quality
- Advice on how to maintain good soil fertility: 8 out of 69 (12 %)

(n) over 46 out of 69 (over 67%) farmers say they have good relationships with their district officers - the highest being Sironko (100%) and lowest Kumi (53%)

Above figures suggest that the farmers' groups and member farmers in the 4 P/Ps learnt how to grow paddy with minimum impact to wetland. This claim is also supported by the results of the water and soil quality monitoring which did not show major changes in water and soil quality after irrigation development. Efforts should be continued by MAAIF and concerned parties of the central level in supporting the districts and farmers in capacity building and regular monitoring activities to ensure the wise use of wetlands. Local governments should gradually take the activity on board of their annual budgeting system to make it sustainable.

2.4.3 Outcomes

As regards the CWMPs, the documents were endorsed by NEMA and WID/ML&E in the early stage of the 5th Field Work, May-November 2006, following the endorsement by the local officials, completed in February 2006. Sufficient copies of the CWMP have been distributed to ML&E, MAAIF, local government officials and farmers' representatives. It is hoped that farmers of the concerned areas will make good use of the valuable information contained in the plans. It is also hoped that this experience in making CWMP can be transferred to other wetland users who can get support from WID in making CWMP.

From the evaluations and achievement of the workshops and monitoring activities conducted in the environment conservation programme, it is believed that the wise use concept stressed by NEMA and WID in dealing with national wetlands have been well understood by local farmers and officials concerned. Adequate knowledge on wetland wise use and the policies and laws regulating their use and management was

provided by presentations on the workshops from WID and Study Team and relevant booklets were given to participants. Further knowledge of wise use came from Study Team presentation which focused on water quality and soil fertility monitoring and correct use of pesticides and inorganic fertilizers. However, certain issues related to poor farmers and the laws and/or government, remain still unclear; needing to be adequately addressed and requiring appropriate recommendations to MAAIF, which should continue the consultation with concerned stakeholders for their solution. The main issues concerned are discussed in the lessons learnt dealt with in later chapters.

CHAPTER 3 EVALUATION OF PILOT PROJECTS

3.1 Introduction

The P/P were commenced in December 2004 and evaluated in February and October 2006 in the mid-term and final evaluations, respectively. Prior to these evaluations, monitoring surveys were carried out to collect data and information about the progress and performance of the implementation along Evaluation Grids presented in Table 3.1.1. Then, two workshops were held respectively at mid-term and final evaluations; inviting representative farmers and officers related to the 4 P/P areas.

(1) Monitoring Surveys

Monitoring surveys were conducted basically by local consultants on subletting basis, covering all the 13 P/P sites and Doho Rice Scheme in order to record the progress and problems encountered in the P/P operation, i.e., "Actual Input and Activities", "Achievement of Output" and "Important Assumptions" presented in PDMs. In these monitoring surveys, the Study Team members also visited some P/P sites and local offices concerned, and direct observation and interview surveys were conducted three times, i.e., in September 2005, January and August 2006. The results of these surveys were used in the evaluations.

(2) Mid-term evaluation

The purpose of the mid-term evaluation is to verify whether P/Ps have been implemented smoothly and are on their ways to produce effects. In addition, the results of this evaluation can be used to improve of the P/Ps contents. Data and information obtained from the monitoring surveys were analyzed and evaluated from the view point of five evaluation criteria as shown in the table below:

Five Evaluation Criteria

Evaluation Criteria	Main Consideration
Relevance	The extent to which the Project Purpose and Overall Goal are consistent with beneficiaries' requirements, country needs and partners.
Effectiveness	Identify the achievement of the Project Purpose, focussing to the extent to which the project Output and Activities contributed to its achievement.
Efficiency	A measure of how economically resources and Input (funds, person-power, time, etc.) are converted to Output and Project Purpose.
Impact	An examination of the project's effects including the ripple effects in the long-term through the prospect of the achievement of overall goal.
Sustainability	The continuation of benefits from the project after the project has been completed. The probability of continued long-term benefits. The resilience to risk of the net benefit follows over time.

An "evaluation grid" prepared correspondingly to each PDM has also been utilized in the evaluation process.

(3) Final Evaluation

The final evaluation is conducted at the end of the P/Ps, and it is to examine on a comprehensive wise whether the P/P objectives were achieved. The conclusion is

drawn from the analysis of five evaluation criteria. Based on the conclusion, recommendations are made and lessons learned are drawn. And those results must constitute a feedback used to review the provisional A/P and M/P.

3.2 Workshop for Mid-term Evaluation of Pilot Projects

The workshop for the mid-term evaluation was held on February 2006 in Mbale. The 4 P/P areas in Budaka (Pallisa), Bugiri, Kumi and Sironko districts were the subjects of the evaluation. The workshop was participatory; inviting representative farmers and selected local government officers related to the 4 P/P areas. Officers from the central government were also invited as resource persons. Agenda and participants of the workshop are presented in Appendix 3-1.

The workshop was to achieve the following objectives:

- To give mutual understanding among the participants on the present progress and problems encountered in the 4 P/P areas,
- To work out causes of problems in the operation of the 4 P/P areas,
- To find the solutions to the above problems, and
- To set the responsibility of organisations or personnel for the solutions of the problems.

The two-day workshop has been designed strategically in the following three major parts:

Part I; to give mutual understanding of present progress and problems encountered in P/P operations,

Part II; to give also mutual understanding of the reasons of good performance achieved in other P/Ps after the introduction of new technologies and practices by the Study Team, and

Part III; to establish a work plan for further operation of the P/Ps.

The outcome of each part of the workshop is presented hereinafter.

(1) Problem Analysis (Part I)

Before starting a group work for problem analysis, the progress of the present Study and P/Ps were outlined and the results of the 1st and 2nd monitoring were informed to the participants. The participants were then requested to identify problems encountered in the P/Ps operations. The method of group work in problem analysis was also explained to the participants by the facilitators (hired local consultants). The group work was conducted; dividing the participants into the following seven groups:

Group 1: farmers in P/P, Pallisa district

Group 2: farmers in P/P, Bugiri district

Group 3: farmers in P/P, Kumi district

Group 4: farmers in P/P, Sironko district

Group 5: Agronomists/irrigation engineers and agricultural officers

Group 6: Community development staff

Group 7: MAAIF and NARO representatives

Although detailed Outputs from the group work are presented in Table 3.2.1, the main or core problem identified by each group is as shown below:

Group 1: Lack of capital to buy input

Group 2: Shortage of production water

Group 3: Diversion of water by upstream farmers

Group 4: Mobilisation of resources (money, tools, equipment)

Group 5: Inadequate capacity to manage floods/droughts

Group 6: Inadequate funding/facilitation of CDOs by local government

Group 7: Inadequate and erratic provision of technical services and monitoring

It seems that the identified core problems are those now actually faced in the P/Ps operation by farmers' groups or by local and central government officers in their daily activities. Some "root causes" of core problems, which were drawn from the problem analysis, are listed below:

- Farmers themselves recognise their weakness, e.g., lack of cooperation among them, and lack of saving and financial management skills, and
- Local government officers are dissatisfied with small budget allocation to their activities.

(2) A Case Study - Kalaki P/P in Kaberamaido District (Part II)

As a case study, Kalaki P/P in Kaberamaido district was introduced to the participants because the performance of this P/P was considerably good. They established a new organisation and developed a new irrigation system of 1.4 ha (3.5 ac) and started paddy cultivation by applying new technologies learnt from the Study Team. They performed such development without any direct support from the Study Team (because of security reasons, the Study Team could not visit the site).

The factors that led to the good performance were analyzed by the local consultant and presented to the participants as follows:

1) Organisational and institutional aspect

- Good and active leadership of leader farmers,
- Strong linkages between the farmers and the local government officers for community development and agriculture extension,
- Gender sensitive groups which are in leadership,
- Cooperation and commitment among the group members,
- Extension staff is member of the farmers' organisation,

2) Environmental aspect

- Supportive local environmental policies: The local leadership together with technical staff support paddy development and allowed the community access to the wetland,
- Public wetland in place. They did not have any problem in developing and using the land (the land was formerly grazing land),
- Collaboration between the different water resources users (cattle keepers, fish farmers, vegetable growers, sugarcane farmers, domestic water users),

3) Production technology (including irrigation technology) aspect

- The farmers trained by the Study Team convinced other farmers (sugarcane) to adopt paddy due to high income return,
- Permanent springs are available and a fish pond acts as a reservoir,
- Technologies introduced were completely new and simple to the member farmers and accordingly it was not difficult to transfer to their TDFP and their farms,
- Farmers were impressed with the high yields and early maturing of the paddy compared to upland rice, and

4) Other

- Comprehensive approach of training both farmers and officers in organisation, production and engineering which facilitated easy adoption and diffusion of the technology.

(3) Work Plans for Further Operation of P/Ps (Part III)

After the above sessions in Part I and II, the participants were requested to develop work plans for the solution of core problems. Each plan developed by the above mentioned groups was composed of (i) objective, (ii) activity, (iii) indicators, (iv) stakeholders, (v) timeframe, (vi) resources, and (vii) potential resource providers.

As shown in Table 3.2.2, some plans developed by the participants were unrealistic. However, it can be evaluated that the representative farmers from the 4 P/P areas understood what they have to do for sustainable operation of the P/Ps. In the columns of “stakeholders” and “potential resource providers”, they wrote/indicated “farmers” for all the activities required for the solution of core problems.

It seems difficult for group 6 (community development staff) and group 7 (MAAIF and NARO representatives) to provide proper services for sustainable operation of P/Ps, because their core problem identified was “inadequate/erratic funding” that can not be easily solved either personally or by an agency. It is expected, however, that the officers in group 6, 7 and 5 will promote their work plans for funding.

3.3 Workshop for Final Evaluation of Pilot Projects

The two-day workshop for final evaluation was held in October 2006 in Mbale. The

participants were almost the same as the ones in the mid-term evaluation; consisting of representative farmers and local government staff from the 4 P/P areas, and central government staff. Agenda and participants of the workshop are presented in Appendix 3-1.

The Final evaluation workshop consisted of the following three major parts:

Part I; to evaluate the work plan of the P/Ps, which was made in the mid-term evaluation,

Part II; to carry out factor analysis of the work plan, and

Part III; to establish a new work plan for sustainable operation of the P/Ps.

The outcome of each part of the workshop is presented hereinafter.

(1) Evaluation of previous Work Plan (Part I)

At the beginning, the previous work plan which was made by each group at the mid-term evaluation was reviewed with the purpose of evaluating the extent to which planned Activities had been achieved. The achievement was measured by each participant individually with scoring. At the same time, each participant evaluated the usefulness of the four programmes of the P/Ps.

Although detailed Outputs from the group work are presented in Table 3.3.1, scoring by each group is as shown below:

Group 1: Farmers in P/P, Pallisa district

- Group members training on group activity and water management was well done, but the construction of water reservoir could not be arranged.
- All the four programmes were useful.

Group 2: Farmers in P/P, Bugiri district

- Group members training on water management and farming practice, O&M of irrigation facilities and organisation was conducted as planned, but a water reservoir could not be constructed.
- All the four programmes were useful.

Group 3: Farmers in P/P, Kumi district

- Activity to involve farmers in upper stream area, and group members training on organisation were succeeded, however, the demarcation of buffer zone was not easy.
- All the four programmes were useful.

Group 4: Farmers in P/P, Sironko district

- Understanding of the importance of contribution and its management method was deepened, but training on how to save and mobilize credit was not done at all.
- All the four programmes were useful, however, the ones who could not obtain a plot in the P/P site expressed unfairness.

Group 5: Agronomists/PIEs and agricultural officers

- Trainings for farmers were well conducted while trainings for extension officers were not adequate. Farmers' exchange visits were conducted only at limited area; no study tour to advanced sites.
- Learning on production and organisation/institution was satisfactory, but not on land /water and environment.

Group 6: Community development staff

- Identification of sources of fund and proposal writing to get fund were conducted well. Concerning the importance of revenue, community could understand well, but the sensitisation of political leaders was not satisfactory.
- All the four programmes were useful.

Group 7: MAAIF and NARO representatives

- Contact with donors and MFPED was implemented, but training of accountants, computerisation and audit were not well done.
- Learning on production and environment was satisfactory, but not on land/water and organisation/institution.

(2) Factor Analysis of Previous Work Plan (Part II)

When each group implemented the work plans, they faced facilitating factors and hindering factors. These factors were examined by group with a score given in the section of Part I.

(3) Development of New Sustainable Plan (Part III)

The hindering factors which were examined in the section of Part II were set as new main problems. The ways to solve the problems were developed as a new sustainable plan. Each new plan included activities, indicators, stakeholders, timeframe, resources and potential resource providers.

3.4 Final Evaluation of Pilot Projects

About two years have passed since the Study Team in cooperation with Ugandan stakeholders commenced the P/P in 13 districts. The P/Ps brought outcomes as shown in Chapter 2.

In the Final evaluation, the verification of performance, examination of implementation process, and value judgement by five evaluation criteria were assessed based on PDMs. Evaluation grids which contain questions for evaluation, required data, information sources etc. are used during the evaluation process.

(1) Budaka (Pallisa) P/P Area

1) Verification of Performance:

Inputs from both Japanese side and Ugandan side were contributed fully. Some

Outputs were produced as planned, but others were not. For instance, it was observed that some members left cut weeds on embankment, and farm levelling was not done well. Also the rate of contribution collected was extremely low. On the other hand, the members participated in the collective works and meetings aggressively. Capability of paddy cultivation of farmers and extension skill of local government staff were improved. Environmental awareness was still active in members.

The project objective was "paddy yield increases in RPGA members' fields". The yields at both the TDFP and farmers' fields were better than the previous ones. Even the fields outside of the P/P area were observed to have increased. But the second and third cropping at the P/P area were affected by drought.

The Overall Goal was "similar rehabilitation works of existing paddy field is carried out by farmers' organisation in other basins in district and reduces rampant development and encroachment of wetlands." These issues may be achieved in the near future. In fact, this wetland was opened by visitors who were given incentive in rice growing by the Doho Rice Scheme. The farmers are easily affected by good practices. And fortunately, this district is neighbouring Mbale town which is one of the biggest rice trading points in the country.

2) Examination of Implementation Process:

Activities were implemented as scheduled, and the farmers group and local government staff acquired the transferred technology smoothly. The P/P had a high recognition in the target groups, and the degree of participation of these target groups in the P/P was also high.

At the mid-term evaluation workshop, the representative farmers of the P/P group identified a problem to sustain the P/P, i.e., lack of capital to invest due to lack of sensitisation of members. After that, group meetings were held several times and most of the problems were solved. However, one problem was still remaining; the fund to get a water reservoir to solve the lack of irrigation water was not secured

3) Value Judgement by Five Evaluation Criteria:

Relevance:

The GoU's core development objective is the eradication of poverty, with the target of reducing the number of people below the poverty line to fewer than 10% by 2017. The promotion of paddy cultivation fully complies with PEAP, PMA and other National Policies, and Development Plans formulated by local governments. Several laws, regulations and National Policy, which were established in and after 1995, concerning environmental and wetland conservation are closely related to paddy growers and other wetland users. It is consistent with the national environmental policy to learn about wetland wise

use for farmers and local government officers in order to ensure sustained conservation of wetland.

According to the National Environmental Statute 1995 and the Water Statute 1995, the wetlands do not belong to individuals, and the government suggests that farmers who wish to cultivate in wetlands must form a CBO and acquire wetland use permit. On the other hand, the irrigation system must be operated and maintained by a farmers' group. Such grouping as cooperative or rice growers association can also benefit members, providing advantages throughout the process of production to marketing. The P/P members listed problems related to water shortage, drought and uncontrollable flood as major constraints to paddy production. The number of members of the targeted P/P group was 20 and the P/P area was 17.9ha, these sizes were adequate.

The P/P matches the needs of the target group and the country and Japan has an advanced technology on promoting the paddy cultivation. For the above reasons, this P/P is judged to be of high relevance.

Effectiveness:

Since the P/P started, three paddy growing seasons were observed at the TDFP; however, the second cropping was suspended due to drought. The yields of the first and third season were 3.4 tons/ha and 5.7 tons/ha, respectively. And the yields of the P/P members' farm also doubled; scoring 5.5 tons/ha in both seasons. Previous yield before the intervention of the Study Team was 1.5 tons/ha. The goal of 4 tons/ha yield was achieved. For the above reasons, the effectiveness is judged to be high. On the other hand, it showed that the lack of reservoir caused fluctuation of yields.

Most of the Outputs were achieved as already mentioned above in the "Verification of Performance", and it is very clear that those Outputs contributed to the achievement of the project objective.

Efficiency:

It was fixed that the P/P implementation period was two years. The Input from both the Japanese side and the Ugandan side were contributed as scheduled. The target farmers and officers appreciated the P/P programmes; according to the final evaluation workshop almost all of them expressed their satisfaction with all the four programmes except the failure to arrange the fund necessary for the reservoirs. It was difficult for all P/P farmers to attend the training programmes due to the limited time and fund, but immediately after the key farmers have learnt the new technologies, they took the next step; transferring the learnt technologies to member farmers at each P/P site. Seen from the achieved Output, the input was delivered efficiently. A comparison of the cost for the P/P was not possible because there is no similar project.

Impact:

The possibility that the Overall Goal will be achieved in the near future is high because a lot of active paddy farmers are in the surrounding area. But proper methods to inform the target farmers on what a wetland wise use will be essential to reduce rampant development and encroachment of wetlands. Solving the shortage of staff and budget for extension, engineering, community development, environment, etc. is also important. Furthermore, upland paddy (NERICA) cultivation has been spreading in the area, a synergistic effect will be expected on rice marketing.

Sustainability:

The P/P farmers have been deeply impressed with the effectiveness of transferred technology of paddy cultivation i.e., cropping, water management and farming tools. AfDB has some plans to construct water reservoirs in this area. If so, that will contribute greatly to improving paddy cultivation. The prospects of sustainability will be possible if water reservoir, financial management and O&M skill are arranged more properly.

(2) Bugiri P/P Area

1) Verification of Performance:

The Input from both the Japanese side and the Ugandan side was contributed fully. The Output was produced almost perfectly except only on the shortage of irrigation water.

The project objective was “paddy yield increases in PRGA members’ fields”, which was not achieved fully within the P/P period due to the lack of water. Although TDFP showed enough yield increase towards the target, the farmers’ fields did not satisfactorily follow suit.

The Overall Goal was “similar rehabilitation works of existing paddy field is carried out by farmers' organisation in other basins in district and reduces rampant development and encroachment of wetlands.” These issues can be achieved if reliable water resource exists. A choice of crops which have high potential of production is important because the land size is relatively smaller in this area due to the high population density.

2) Examination of Implementation Process:

The Activities were implemented well similarly to the case of Budaka (Pallisa) district. In the process of P/P implementation, false rumour of local politicians concerning wetland ownership caused a lack of organisation. However, the farmers group learned the truth through the P/P programmes and succeeded to establish a firm organisation.

3) Value Judgement by Five Evaluation Criteria:

Relevance:

There were necessity, priority and suitability for the Ugandan policy and the community at the P/P site as same as in Budaka (Pallisa) case. The number of members of the targeted P/P group was 20 and the P/P area was 10.9ha, these sizes were adequate. For the above reasons, this P/P is judged to be highly relevant.

Effectiveness:

Since the P/P started, three paddy growing seasons were observed at the TDFP; however, the second cropping was suspended due to drought. The yields of the first and third season were 4.7 tons/ha and 4.1 tons/ha, respectively. The yields of the P/P members' farm also doubled with 4.0 tons/ha and 4.1 tons/ha recorded respectively in the two seasons. The previous yield before the intervention of the Study Team was 2.0 tons/ha. The goal of 4 tons/ha yield was achieved. For the above reasons, the effectiveness is judged to be high. On the other hand, it showed that the lack of reservoir did not prevent double cropping. Most of the Outputs were achieved, and it is very clear that this contributed to the achievement of the project objective.

Efficiency:

The number and background of P/P farmers, training programmes and timing were judged to be appropriate. The number and allocation of local technical staff was also appropriate. The construction cost was not so high because many of the works were done by beneficiaries. So the input was efficient per achieved Output.

Impact:

It seems that similar paddy field rehabilitation works and organisation of multi-functional groups will spread to other basins in the district. But to demarcate between the buffer zone and farms is not easy in this district because farm plot size is relatively smaller than other areas due to high population density. Rice is not a new crop in this area, and the fields are just beside a main road, so that a lot of farmers have been attracted by the result of the TDFP here. But the development of water reservoirs is essential in this small river basin.

Sustainability:

Generally this area has less precipitation. Unfortunately throughout the P/P period this area had been suffering from long dry spells. The farmers have recognized deeply the importance of a stable water resource. AfDB has plans to fund the construction cost of water reservoirs in this area. The P/P group wanted to get the opportunity to get the fund; however, the compensation for the land cannot be funded by AfDB. The farmers' organisation has been under negotiation with the land owners at the reservoir site. The farmers' organisation

has been organized firmly, so that the O&M of facilities will be managed well. The farmers' organisation members failed to get any products from their owned P/P land during the P/P period, nevertheless the rate of member fee collection was more than 67%. When irrigation water is available, they will be able to operate the water management system and sustain the project.

(3) Kumi District P/P Area

1) Verification of Performance:

Concerning Input, the sub-county extension worker was absent and not available to provide the farmers technical guidance properly. The provision of upland paddy seeds also caused unfavourable Output. The other inputs from both the Japanese side and the Ugandan side were contributed as planned.

Most of the Outputs were produced as planned. However, some did not perform satisfactorily. On-farm levelling was not done well by farmers especially on the sloped area. The distribution of upland paddy seeds caused a lack of motivation for on-farm development because upland rice varieties do not require levelled surface water in the fields. And there was no technical advice to farmers due to the absence of the extension officer. The other O&M works for irrigation system and facilities were well done. Although the rate of contribution collected was still only 38%, it will be increased after selling the rice produced this season. P/P members fully understood the importance of buffer zone, and avoided cultivating rice there.

The project objective was “exiting upland crops fields are diversified to paddy fields with consensus of farmers' organisation members”. As already described, on-farm levelling was not completed, and it may take some time to finish levelling on all the P/P fields.

The Overall Goal was “diversification of upland crops fields to paddy fields in compliance with environmental guidelines expand to other area in district”. These issues may be achieved in the near future. In fact, there were some ripple effects around the P/P site. The farmers in both the upper and down stream areas started to follow the P/P’s example.

2) Examination of Implementation Process:

Activities were implemented as scheduled, and the farmers group and local government staff acquired the transferred technology smoothly. The P/P had a high recognition in the target groups, and the degree of participation of these groups in the P/P was also high.

At the mid-term evaluation workshop, the key farmers of the P/P group identified a problem to sustain the P/P; it was the diversion of water by upstream farmers. The said farmers were encroaching on the buffer zone, so the P/P farmers negotiated with them to join the WUA. Then they became involved, and the buffer zone was maintained untouched.

3) Value Judgement by Five Evaluation Criteria:

Relevance:

There were necessity, priority and suitability for the Ugandan policy and the community at the P/P site as same as in Budaka (Pallisa) case. The number of members of the targeted P/P group was 42 and the P/P area was 6.8ha, these sizes were adequate. The P/P matches the needs of the target group, and land conversion to paddy fields is needed by the community around this area. For the above reasons, this P/P is judged to be of high relevance.

Effectiveness:

The converted fields from upland crops farms to paddy farms were handed over in February 2006. Although on-farm levelling was not completed, O&M had been done by members properly. The rate of collection of membership fee last year was 40%, which was not satisfactory. The extension officer had gone abroad to study; the advisory service was entrusted to another officer who had not been trained by the Study Team. So it meant there was a lack of technical assistance here. Yields were more than the target in the TDFP, i.e., 5.0 tons/ha and 5.8 tons/ha. The yields of the P/P members' farm were also high at 3.5 tons/ha and 6.9 tons/ha, while the previous yield before the P/P was 1.5 tons/ha very in limited area. Through the development of the CWMP, group members and local government staff could clearly grasp the notion of wetland wise use in line with environmental guidelines. The results of water and soil quality monitoring showed no change for the worse. Upland NERICA seeds distributed brought unfavourable effects to the P/P because it disturbed the farmers' incentive to level the fields in sloped area. It meant a lag in the completion of the diversification to paddy. For the above reasons, the P/P was effective. However some hindering factors have been clarified.

Efficiency:

The quality, quantity and timing of input were almost appropriate. But the extension-cum-engineering officer suddenly left the P/P for a study abroad. This fact inhibited the efficiency.

Impact:

If proper technical assistance is available, farmers in this district will be able to comply with environmental guidelines. Already at both upper and down stream area some ripple effect appeared, i.e., some neighbouring farmers started to follow the P/P's example. AfDB is preparing to fund the water resource development, this assistance will be helpful for the achievement of the Overall Goal of this P/P. The impact mentioned above was recognised from the implementation of the P/P.

Sustainability:

The P/P group has a potential to continue P/P activities because the members

are capable to participate in the O&M of irrigation facilities. If the adequate services are continuously provide to the area, and financial status changes better, the prospects of the project's sustainability will be possible.

(4) Sironko District P/P Area

1) Verification of Performance:

The input was contributed as planned. Some of the Outputs were produced as planned but some was not. For instance, the group was smoothly registered as a CBO, but the members have not started to repay the cost. Weeding was not conducted properly on the facilities while the drainage canal was well maintained. The collection of allotment for the O&M of the facilities has not started. The extension worker visited the P/P site adequately. The farmers got great yields from their fields without any damage to the buffer zone. The project objective was "new paddy field development in wetland is implemented with consensus of PRGA members". It was done; paddy was planted in more than 90% of the P/P area by the P/P farmers. The Overall Goal was "new paddy field developments in compliance with environmental guidelines expand to other area in district". These issues may be achieved in the near future. In fact, there were many visitors to this development site even outside of the district.

2) Examination of Implementation Process:

On the process of the design and construction, unclear land registration system caused land owners' complaints.

3) Value Judgement by Five Evaluation Criteria:

Relevance:

There were necessity, priority and suitability for the Ugandan policy and the community at the P/P site as same as in Budaka (Pallisa) case. The number of members of the targeted P/P group was originally 19 land owners at the beginning, and the P/P area was 15.0ha, the land size per member was relatively large. Practically, the number of cultivators increased to 62 farmers at cultivation; 62 farmers consisted of 30 land owners and 32 tenant farmers. This unit area is the appropriate size for the cultivation depending on man-power. The P/P matches the needs of the target group, and new paddy field development was needed by the community around this area. For the above reasons, this P/P is judged to be of high relevance.

Effectiveness:

The newly developed paddy fields were handed over on February 2006. The farmers had just started O&M practice. The rate of collection of membership fee last year was 53%, the rate was not satisfactory. Yields were doubled in the TDFP. The results were 3.8 tons/ha and 4.4t/ha. The yields of the P/P members' farm could reach 7.1 tons/ha, while the previous yield before the P/P was 2.5

tons/ha in small paddy plots scattered in and around the P/P area. Through the development of the CWMP, group members and local government staff could clearly grasp the notion of wetland wise use in line with environmental guidelines. The results of water and soil quality monitoring showed no change for the worse. One of the hindering factors here can be caused by the farmers who are cultivating paddy at upper and down stream area. They do not know how to manage flood at all. If they intake water from the Sipi River without safety measures, large man-made disaster can occur. For the above reasons, the P/P was effective.

Efficiency:

The quality, quantity and timing of inputs were almost appropriate. The unit cost of construction was the highest among 4 P/P areas, however, the reliability of water resource and soil fertility provided by volcanic soils and flood water of the Sipi River yield good production. It is still profitable.

Impact:

If proper technical assistance is available, farmers in this district will be able to comply with environmental guidelines. Although at both upper and down stream area some ripple effect appeared, i.e., some neighbouring farmers started to follow the P/P's example, but they are following it uncontrolled manner. Sensitisation and dissemination of proper techniques are urgently needed. The impact mentioned above was recognized from the implementation of the P/P.

Sustainability:

The P/P group has the potential to continue the P/P activities because the members are capable to participate in the O&M of the irrigation facilities and they succeeded to produce more than 7 tons/ha of paddy. If proper guidance is provided, and the financial status changes, the prospects of the project's sustainability will be possible.

(5) Pilot Projects in Six Districts

The items of Activities undertaken for the P/P implementation in the following six districts were the same, i.e., Namutumba (Iganga), Butaleja (Tororo), Mayuge, Busia, Manafa (Mbale), and Kaliro (Kamuli). They are thus evaluated collectively as follows.

Relevance:

There were necessity, priority and suitability for the Ugandan policy and the community at each P/P site as same as in Budaka (Pallisa) case. The demand of advanced paddy cultivation methods is very high in all districts. For the above reasons, theses P/Ps are judged to be of high relevance.

Effectiveness:

Most of the Outputs were achieved. The P/Ps farmers' groups wanted to

cultivate paddy in wetland legally and wisely; hence they made efforts to acquire knowledge from the lectures and trainings. But the results on yield increase were not rewarding everywhere. TDFPs in 4 districts of Namutumba (Iganga), Butaleja (Tororo), Manafa (Mbale) and Kaliro (Kamuli) out of six passed the target yield of 4t/ha, however, 2 districts, Mayuge and Busia failed due to drought or other troubles. But P/P members fields in all of six districts recorded more than 4 tons/ha. There was an internal conflict in one P/P group. It showed some careful implication, when establishing and maintaining organisations in Uganda. The rates of member fee collection were very satisfactory; they were ranged from 80% to 100% except Busia district which was unknown due to a conflict. For the above reasons, the P/P was effective.

Efficiency:

The capacity development for P/P group members was conducted by the group representatives and officers concerned in each P/P. These representatives were trained in Doho Rice Scheme in the P/P, and the officers were also trained at the workshop in Mbale. The trainings were done collectively so that the costs were reasonable.

Impact:

If technical assistance is properly undertaken, farmers in P/P areas will be able to comply with environmental guidelines. Some ripple effects had been found already. Paddy yields in farmers' fields which were cultivated by non-member outside of the P/Ps showed great yield increase without any direct intervention of the P/Ps. These farmers also yielded over 4 tons/ha except in P/P area in Mayuge district. The impact mentioned above was recognised from the implementation of the P/Ps.

Sustainability:

The shortage of extension staff and budget may constitute constraints on the sustainable activities. During the implementation of the P/Ps, eight districts in the Study area were divided into two in order to restructure the local governments. Such innovation was followed by a change in jurisdiction and trained personnel in extension works, which might constrain the sustainability of the development.

(6) Pilot Projects in Three Districts

The items of Activities undertaken for the P/P implementation in the following three districts were the same, i.e., Soroti, Amuria (Katakwi), and Kaberamaido. They are thus evaluated collectively as follows.

Relevance:

There were necessity, priority and suitability for the Ugandan policy and the community at the P/P site as same as in Budaka (Pallisa) case. The demand of

advanced rice cultivation method is very high in all districts. For the above reasons, this P/P is judged to be of high relevance.

Effectiveness:

Most of the Outputs were achieved. P/P members' fields in all 3 districts recorded more than 4 tons/ha. The rates of member fee collection were satisfactory; they were ranged from 59% to 100%. For the above reasons, the P/P was effective.

Efficiency:

The Study Team was not allowed to enter this area at the initial stage for insecurity reasons. However, the P/P farmers and concerned officers set up demonstration fields by themselves. Those demonstration fields lead great effects on the paddy yield in each P/P site. In addition, Kaberamaido demonstration fields had fishery function to increase the profitability.

Impact:

The Overall Goal was "new paddy fields developments in compliance with environmental guidelines expand in each district". When key farmers of the Kaberamaido P/P group attended the environmental workshop held on February 2006, they showed that they started their own new development by themselves taking into consideration the laws regulations of wetland wise use. They were inspired by the field visit carried out earlier in Shironko P/P area. Even though, the Study Team could not visit them for security reason, then received support of the local government officers who were also trained by the Study Team.

Sustainability:

The shortage of extension staff and budget may constitute constraints on the sustainable activities. NAADS programme is going on in some of the areas; however, it is still unknown whether it would have an effect on paddy production development and poverty reduction in the future.

(7) Technical Training in Doho Rice Scheme

Relevance:

Extension of both advanced rice cultivation techniques and irrigation techniques are major items to eradicate poverty and modernize agriculture in eastern Uganda. The paddy seed quality i.e., adaptability, purity, maturity, freshness, storage etc. is very important to produce better yields. Low quality seed can never produce any good results. The number of participants for training, 5 Doho farmers for seed multiplication course, 13 district extension officers, 26 P/P potential farmers and 2 Doho officers for advanced paddy cultivation course, and 13 district irrigation officers, 2 MAAIF engineers and 1 Doho engineer for irrigation course, was adequate. For the above reasons, this P/P is judged to be of high relevance.

Effectiveness:

All of the Outputs were fully achieved. Capacity building for extension officers, irrigation engineers and seed growers were satisfactory. Capable rice varieties have been identified. Standard cropping calendar has been provided to farmers. Most of the extension officers visited each P/P site timely after the training courses. Although irrigation engineers need more experience to make irrigation development plans, they can guide farmers O&M of the irrigation facilities. Five rice growers have been trained in this P/P; however, the amount of quality seed is short for the area. The achievement of these Project Purposes was attributed to the Output of the P/P, because opportunities to join the training course of KATC or AICAD were limited. For the above reasons, the P/P was effective.

Efficiency:

Controllable irrigation facilities were available in Doho, and accommodation and catering for the participants were also available. Doho was the most economical and proper place to hold such trainings. One of the participants left his district for study abroad after this training, this incident was unfavourable to the local farmers.

Impact:

This P/P had three Overall Goals, "extension services on rice cultivation are provided in major paddy growing areas in the districts", "new development plan of farmland in collaboration with MAAIF is prepared" and "good seeds are supplied to other area". These Overall Goals must be achieved in a few years. The impact mentioned above was recognized from the implementation of the P/P.

Sustainability:

A demand for extension service of paddy cultivation and irrigation engineering will expand greatly. Their skills and roles are getting more important for the sustainable agricultural development.

3.5 Examination of Hypotheses Set Up in Pilot Projects' Planning

The ultimate aim of the study is to formulate D/P and A/P, as described in Chapter 1. Consequently hypotheses have been formulated as listed below in order to engender efficient learning of lessons from the P/Ps within the specified timeframe.

Three hypotheses were set at the project planning stage in order to get important information from the P/Ps to complete D/P and A/P. The results of verification of each hypothesis are mentioned below. And the lessons learnt which should be fed back to the D/P and A/P are described in Chapter 4.

Hypothesis 1: Increase of yield of lowland paddy

It was observed that every P/P site obtained paddy yield increase in comparison with previous one except P/P in Bugiri district as shown in a table below. This was attributed to advanced agronomic practices and improved hydrological condition of the fields.

Paddy Yield of P/P Sites

District	P/P Site (Area)	Paddy Yield (ton/ha)	
		Before P/P	Result, 2006
1. Budaka (Pallisa)	Jami/Kakoli P/P (17.9ha)	1.5	5.5
2. Bugiri	Kasolwe P/P (10.9ha)	1.8	-
3. Kumi	Kajamaka P/P (6.8ha)	1.5	6.9
4. Sironko	Muyembe P/P (15.0ha)	2.5	7.1
5. Namutumba (Iganga)	Nambigwa P/P (9ha)	3.3	5.1
6. Butaleja (Tororo)	Mwenge P/P (27ha)	2.0	5.3
7. Mayuge	Nawankoko P/P (10ha)	2.0	5.0
8. Busia	Sibimba P/P (10ha)	1.5	6.0
9. Manafa (Mbale)	Tembelela P/P (9ha)	2.0	7.2
10. Kaliro (Kamuli)	Igombe P/P (17ha)	1.5	4.0
11. Soroti	Gweri P/P (8.8ha)	1.5	5.0
12. Amuria (Katakwi)	Wera P/P (1.5ha)	2.5	4.3
13. Kaberamaido	Kalaki P/P (5.5ha)	1.5	4.8

Hypothesis 2: Development of management capacity of Primary Rice Growers Association (PRGA)

This hypothesis has not been verified yet, because any PRGA has not been established during P/P stage fully. PRGA means a multi-functional association, i.e., CBO, wetland association, irrigation water users' group, and paddy production and marketing oriented co-operative society. Although farmers group has been established in each P/P site as CBO and some of them are functioning as organisations said above, the functions as wetland users' association and co-operative societies are behind in the development of the associations. To prove this positive development of management capacity fully will require some more years after the intervention of the Study Team stops.

Hypothesis 3: Capacity building of government staff and farmers for wise use of wetland

In P/P areas in Kumi and Sironko, buffer zones are demarcated and avoided to be cultivated by the members of each P/P group. Once at upper stream area of Kumi P/P site buffer zone was encroached by local farmers who were not P/P members, however, the P/P group has solved the problem by involving those upper stream farmers. So the farmers not only learn the importance of wetland management but acquired how to persuade others to stop encroaching as well. Although these two groups have been formed as wetland association and prepared CWMP, they have not applied yet to register to MW&E. To constant follow up and to encourage those groups by the officers are essential for the successful management. A workshop, assembling major actors of the P/P activities related to environmental issues, were held in February 2006, revealed that understanding of wetland wise use was unclear and vague for not only

farmers but also local government staff. The workshop tried to solve the ambiguities of the laws and regulations. However, such ambiguities and vagueness could not be fully cleared; all participants could not share a common understanding and significance of these laws and regulations. To built capacities of all actors for wise use of wetland, central and local governments have to give more attention and provide some dissemination programme. On the other hand, one of the greatest constraints of organisation development for paddy producers is the high cost related to their registration and preparation. Especially, the huge costs concerning environmental issues, EIA and CWMP development, cannot be paid by these organisations, consisting of peasants. The Governmental administration is recommended to reconsider the situation.

3.6 Financial Evaluation of Pilot Projects

3.6.1 O&M Costs

After the completion of the constructions, the cost of O&M for the irrigation facilities will be covered by fees collected from each member of the farmers' organisations. The annual O&M cost for these facilities are estimated as 5% of the initial construction cost of the intake works. In order to grasp the financial feasibility of A/P, financial analysis is carried out by preparing cash flow statements on the basis of the annual O&M cost and the intake replacement cost. The estimation of these O&M costs was made under the following conditions:

a) After the implementation of the construction works, the WUA members participated in the maintenance works of the irrigation systems and farm roads without pay, and the WUA have to manage such communal works. The labour cost is therefore not included in the O&M cost;
b) The WUA do not employ a full-time staff and all of its activities are carried out under voluntary basis by members.

3.6.2 Replacement Costs

The project life is set as 30 years until the concrete intake gates replacement in the projects in Budaka (Pallisa), Bugiri and Kumi. Only Sironko is given 5 years of project life, because the intake gate is constructed with wooden materials.

3.6.3 Annual Member Fees of WUA

The annual member fees of WUA are analyzed under the following conditions:

a) All of the O&M and replacement costs are covered by the member fees, and no subsidy is provided from outside;
b) The deposit interest rate is set at 9.3 %, which is the average rate of commercial time deposit interest rate in Ush from February 2005 to July 2006 as announced by the Bank of Uganda.

The estimated annual fees in each P/P are presented in the following table.

Annual Amount of WUA Member Fees (per ha)

P/P	(ha)	Annual O&M cost		Annual replacement cost		Total Ave.per ha
		Total USh	Ave. per ha	Total USh	Ave. per ha	
Pallisa P/P	16.8	631,590	37,595	96,433	5,740	43,335
Bugiri P/P	10.1	590,058	58,422	90,092	8,920	67,342
Kumi P/P	6.3	393,310	62,430	60,052	9,532	71,962
Sironko P/P	13.1	40,978	3,128	178,419	13,620	16,748

The WUAs will collect these costs from members, and the annual amount per hectare is estimated at Ush. 43,000 to 72,000 in the P/Ps with intake gates made of concrete. On the other hand, the P/P with gates made of wooden material charge only Ush. 17,000 to the WUA member.

3.6.4 Capacity to Pay by WUA Members

In order to assess the capacity to pay by WUA members, the analysis of their farm budget is made for the conditions of the "with project" and 9.3 % of the deposit interest rate. The result of analysis is as follows:

Farm Budget Analysis for Typical Farmers in Pilot Project Areas

Pilot Project	Budaka(Pallisa)		Bugiri		Kumi		Sironko	
Paddy field size: ha/HH	0.22ha		0.21ha		0.33ha		0.22ha	
Without or With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
1)Gross income(USh)	420,898	962,043	521,363	763,105	618,233	1,969,787	907,830	1,813,315
-Paddy rice income	155,065	656,235	205,072	425,929	233,773	1,812,796	196,005	1,374,247
-Upland crop income	83,156	83,156	103,125	103,125	233,626	0	265,638	0
-Other income	182,677	222,652	213,167	234,051	150,833	156,992	446,188	439,069
2)Gross outgo(USh)	418,927	622,508	519,319	674,061	590,906	1,188,683	901,713	1,412,483
-Production cost	127,727	273,068	138,259	216,789	188,044	705,248	212,588	585,533
-Living expenses	291,200	349,440	381,060	457,272	402,863	483,435	689,125	826,950
3)Net income(USh)	1,972	339,536	2,044	89,044	27,327	781,105	6,117	400,833
4)Incremental net income(USh)	**337,564**		**87,000**		**753,778**		**394,716**	
Annual payment to WUA (USh)	**10,695**		**20,142**		**25,937**		**8,668**	
annual member fee	1,000		6,000		2,000		5,000	
annual O&M cost	8,411		12,269		20,766		685	
annual replacement cost	1,284		1,873		3,171		2,983	
% of capacity to pay	**3.2%**		**23.2%**		**3.4%**		**2.2%**	
annual member fee	0.3%		6.9%		0.3%		1.3%	
annual O&M cost	2.5%		14.1%		2.8%		0.2%	
annual replacement cost	0.4%		2.2%		0.4%		0.8%	

The analysis is made based on the following conditions: 1) there is no opportunity to get income from upland fields in Kumi and Sironko "with project" condition due to the high labour intensity involved in the double cropping of paddy; 2) the livestock income will increase 10% due to the utilisation of the by-products of paddy; 3) non-farm income will increase 20% in Budaka (Pallisa) and Bugiri due to the labour intensive paddy farming concentrated in one season and will decrease 50% in Kumi and Sironko due to the double cropping of paddy; 4) production costs exclude the family labour force; 5) the living expenses will increase 20% from the present condition; 6) yields "with project" are calculated, applying the data observed in each site during the P/P implementation; and 7) cropping intensity "with project" in each site was assumed 1.3, 1.2, 1.8 and 2.0 in Budaka (Pallisa), Bugiri, Kumi and Sironko, respectively.

The result of the analysis shows the capacity to pay of WUA members “with project” condition. As shown in the above table, the highest annual payment to WUA in Bugiri covers 23% of the capacity to pay. In case of this P/P, the annual payment can hinder further improvement and growth of the living standard, though the amount of annual payment is within the limit of the capacity to pay. From the result in other three sites, it may be concluded that the annual payment after implementation of the projects can be afforded by the WUAs.

CHAPTER 4 LESSONS LEARNT FROM PILOT PROJECTS

4.1 Introduction

Through the implementation of P/Ps, various lessons have been learnt that would be useful for the future planning and implementation of the Project in eastern Uganda. In this Chapter, the ones relating to the overall P/P area are presented first. Then, those relating to the respective major programmes are presented thereafter.

4.2 Overall Pilot Projects Area

4.2.1 Strong Will and High Capacity of Farmers to Learn New Technologies

It was clarified through the P/Ps that farmers generally have strong will to learn new technologies. As a conspicuous example, farmers in Kaberamaido P/P have established a new organisation, constructed an irrigation system of 1.4 ha (using spring water) and commenced paddy cultivation; immediately applying the new technologies learnt in the training courses provided by the Study Team in the period between January and April, 2004. As a result, they got yields of 3.4 tons/ha in the 1st and 2nd cropping seasons, and 4.8 tons/ha in the 3rd cropping season. Such good yields have been achieved mostly by the farmers themselves because the Study Team could not provide any follow-up training by visiting Kaberamaido P/P site due to security problems (However, considerable technical support has been provided by the local government officers also trained by the Study Team in the P/P).

In addition to the above, farmers' strong will to learn new technologies can be explained in the followings three examples.

1) Irrigation technology training: Farmers training regarding this technology was conducted together with that of the PIEs in the course of the irrigation construction works that took place in the 4 P/Ps during the period between October 2005 and February 2006. Soon after this, some trained farmers outside the P/P area developed their own irrigation facilities by applying the technology they learnt from the Study Team. Such new development was observed at two locations around the P/P in Kumi district and at one location around the P/P in Sironko district.

2) Paddy cultivation technology: Farmers training regarding this technology was provided on an OJT basis for one cropping season in the demonstration farm plot established in two P/P sites; lasting a total of 20 days (7 sessions) during the period between the end of December 2005 and the end of April 2006. After the training, trained farmers immediately established a demonstration farm plot in the respective P/P areas and commenced paddy cultivation; applying the new technology they learnt from the Study Team. These farmers also transferred the learnt new technology to the member farmers in each P/P area. As a result, as of September 2006, nearly 100% of the farmers in the P/P area have started

cultivating paddy; applying the new technology introduced by the Study Team. Moreover, the new cultivation technology is now expanding rapidly to other farmers outside the P/P areas and leading to higher yields.

3) Farmers' organisation strengthening technology: Farmers were trained in this aspect together with local government officers for a total of 22 days (8 sessions) during the period between mid-January and the beginning of March 2005. As a result, the number of farmers' organisations having registration status increased to 9 (69% of the total 13 organisations), although only one organisation had registration status at the commencement of the P/P.

It is worth to note that the above mentioned good achievements were accomplished by the farmers themselves within a period of about 18 months after participating at several training sessions held at the early stage of the P/Ps. Apart from the said trainings, none was additionally provided under the P/Ps except for two monitoring and follow-up activities held within a period of 18 months. Nevertheless the trained farmers attained good achievements; indicating not only their strong will to learn new technologies, but also their high capacity in learning.

4.2.2 High Capacity Local Government Offers to Give Technical Support to Farmers

The local government technical officers were also as motivated as the farmers to acquire new technologies. They disseminated the techniques and knowledge acquired through the training and supported farmers and their organisations. In some cases, their efforts even went beyond the supervision of the P/P activities. Bugiri, Kumi and Kaberamaido districts allocated budget to provide technical support to their farmers. For instance, agriculture officers and farmers' organisation representatives organised a study tour to Kumi P/P site. During the P/P period, many of the local governments showed their understanding of the contribution of irrigated paddy cultivation to poverty eradication. It is expected that the forthcoming Project of similar nature would be jointly implemented by MAAIF and the local governments. However, it would be necessary to revise the training and workshop programmes taking into account the newly established 8 districts (as of October 2006) before the actual implementation. Further division of districts should also be taken notice, which is now under consideration.

4.2.3 High Performance of Demonstration Farm Plot in Farmers' Mobilization

The strong will manifested by the farmers and local government officers can be shown through the high yields achieved in two demonstration farm plots of the P/P and at the RRTDFP in Doho Rice Scheme. Particularly in the two demonstration farm plots where farmers were trained in new cultivation technologies throughout the cropping season, they got high yields of 5.4 tons/ha and 6.3 tons/ha, respectively (about 2.5 - 3.5 times higher than their normal yields). These remarkably higher yields achieved at the initial stage of the P/P had a good impact on further participation of farmers to the P/P because they understood that the new technologies increase paddy yield and bring them higher income. As a result, farmers' willingness

to participate in the P/P was heightened, and this motivated them to work harder not only in paddy cultivation technology improvement, but also in irrigation facilities construction, organisational development and wise use of wetland. From the lesson learnt, it can be said that establishing a demonstration farm plot along with providing technical training would be essentially important in the future implementation of the Project.

4.2.4 Difficulty in Farmers' Mobilization Due to Fear of Government Intervention

At the initial stage of the Study, the Study Team faced many difficulties in the selection of P/P sites because farmers did not understand the aim and scope of work, and refused to participate in the P/P at many locations. The reasons behind such farmers' attitude toward the Study and the P/P were unclear at the time. However, the following reasons were clarified after holding several workshops and TWG meetings at the local and central government levels, respectively.

1) Farmers' anxiety based on past experience in large-scale irrigation developments

It is said that there were many farmers whose land was acquired by the government for the large-scale irrigation developments of Doho and Kibimba Rice Schemes in the 1970s'. Many farmers still remember this incident and thus are still afraid of government intervention because they believe they may lose their land through accepting government programmes.

2) Spread of wrong messages on use of wetland by local government officers and politicians

Some of the local government officers and political leaders misinterpreted the government intention to protect wetlands. The National Environmental Statute, which proclaimed the limitation in the uses of the wetlands in 1995, was understood as banning paddy cultivation in them. Many of these officers and leaders understood that paddy cultivation in wetlands was illegal, which was a misinterpretation of the government intention to promote sustainable wetland management. However, such views were transmitted to the local communities, and farmers' fear was amplified. Thus, they became hesitant to show their interest in paddy cultivation. Several cases where farmers did not wish to participate in the P/P because of such reasons were observed.

Even in the P/P sites, where the irrigation facilities were constructed and high yields were achieved, farmers were still sceptical about government intervention. To avoid causing unnecessary fear and discouraging farmers in paddy cultivation, when implementing the Project, sufficient time must be spent in establishing partnership with the farmers' organisations so that trust can be built between the project team and the organisations through sufficient interaction.

4.2.5 Need for Strategic Selection of Farmer Participants to Training Courses

The local government nominated some of the participants in the P/P during the

selection process. The time for mobilising participants was limited and thus, the Study Team and counterparts were unable to visit and select the participants themselves. Therefore, the selection procedure in some sites was partly affected by the local political and socio-cultural condition with little consideration for the nominated person's capacity to learn and train others. This had partly restricted the level of achievement of the P/P. Upon implementation of the Project, the participants shall be selected from the actual executive committee members of the organisation who hold relevant positions.

4.2.6 Reasonable Size of Unit of Area of Irrigation Scheme

The final figures of paddy growers and irrigation development area in the 4 P/Ps, where the irrigation facilities are constructed, are as shown in the table below.

Number of Paddy Growers and Irrigation Development Area in 4 P/Ps

Group of Districts	Group-1	Group-1	Group-1	Group-1	-	-
District and Name of P/P	Budaka (Pallisa): Jami/Kakoli	Bugiri: Kasoluwe	Kumi: Kajamaka	Sironko: Muyembe	Total or Average	Average of 4 P/Ps
Total Growers (No.)	75	40	19	62	196	49
- Owners (No.)	13	22	18	30	83	21
- Tenants (No.)	62	18	1	32	113	28
Total Net Area (ha)	16.78	10.08	6.32	13.14	46.32	11.58
Average Net Area per Growers (ha)	0.224	0.252	0.333	0.212	0.236	0.236

The average size of the 4 P/Ps is small with only 11.6 ha (in net area); accommodating about 50 beneficiary farmers. However, this has engendered a time consuming process in the mobilization of farmers, confirmation of land ownership and boundaries, agreement exchange for the construction works and construction in participatory manner, etc. A larger size of the unit development area would generally mean a larger number of beneficiary farmers; making it difficult for all the process required for the development. Although it cannot be said that the above figures are applicable to the whole Study area, a reasonable size and number of beneficiary farmers (farm households) would be about 10 ha and 50, respectively for one unit of irrigation scheme.

4.3 Land and Water Resources Development

4.3.1 Need for Selection of Development Areas Giving Priority to Water Availability

The paddy cultivation was unsuccessfully performed in 2 P/P areas among the 4 where the irrigation facilities were constructed. In these areas, irrigation water was not sufficiently available due to drought, and farmers could not satisfactorily produce paddy. This was partly due to the selection of the P/P areas made by the Study Team.

The Study Team could not always give priority to water availability in the selection. In some locations, farmers refused participation in P/P, and in others distance from the main roads was very far and higher demonstration effect of P/P was not expected

even when water availability in these locations was evaluated to be good. Moreover, the Study Team had to give priority to the capacity of the farmers' organisations; taking smooth implementation of the P/Ps into account.

For the future implementation of the Project, it would be therefore necessary to give higher priority to water availability. On the other hand, the potential for the capacity building of the farmers' organisation should also be an important criterion in the selection. Accordingly, several number of candidate sites have to be selected giving first priority to water availability, then the construction of irrigation facilities shall be commenced by selecting sites; giving second priority to the progress of farmers' organisations development. One suggested progress would be the CBO registration at district level.

4.3.2 Need for Water Resources Development by Constructing Small Impoundment

As mentioned above, the paddy cultivation was unsuccessfully performed in 2 P/P areas. The existing facilities were rehabilitated in the case of the P/P in Budaka (Pallisa) district, and improved in that of the P/P in Bugiri district without undertaking any water resource development in any of these P/P areas. In order to cultivate paddy safely, however, the lesson learnt would be to develop the existing water resources through the construction of small impoundment, which would be essentially important for the future implementation of the Project.

4.3.3 Need for Preparation of Construction Schedule Taking Uganda's Actual Situation into Consideration

Relating to the construction works of the irrigation facilities in the 4 P/P areas, the Study Team faced the following difficulties.

1) Low capacity of local contractors in the construction of irrigation facilities

In Uganda, there were no experienced contractors for the construction of irrigation facilities. Therefore, most parts of quality control during the construction works were carried out by the Study Team expert. As lesson learnt, enough time should be allocated to the construction schedule for the implementation of the Project. In addition, a qualified foreign irrigation engineer is essentially required for the implementation of the Project; taking into account the present shortage of irrigation engineers both in the government and private sectors in Uganda.

2) Shortage of irrigation engineers

Regarding the above, increasing the capacity of qualified irrigation engineers is urgently required in Uganda, if the considerably large potential for irrigation development in eastern Uganda is to be taken into account. There would be a limitation in the development by raising only PIEs whose bases are soil and/or crop sciences.

3) Annual fluctuation of rainfall pattern

The annual fluctuation of the rainfall pattern in Uganda makes the scheduling of

construction works difficult. In fact, the construction schedule had to be changed in the P/P due to unusual rainfall which continued in the Sipi river basin until the beginning of October 2005. In addition, the characteristics of the soils in the seasonal wetlands also make the scheduled construction works difficult to complete because the majority of these soils are Gleysols and Vertisols (black cotton soils) with a relatively friable consistence when wet and firm consistence when dry; affecting particularly the manual embankment works when the constructions are undertaken in improper seasons. From these standpoints, enough time should be allocated to the construction schedule.

4.3.4 Importance of Farmers Training in O&M Technology of Irrigation Facilities

In the P/P, farmers' training in the O&M of constructed irrigation facilities was insufficiently provided due to time constraint. As a result, some farmers improperly utilized the facilities (e.g., taking water from the drainage canal), and many farmers still could not understand that they have to follow a uniform cropping pattern. For the farmers who have no experience in group work in irrigation water use, it is still difficult to understand the total design of the irrigation system and the role of each irrigation facility. It is therefore necessary to provide continual technical support on O&M, even in the next phase of project implementation.

4.4 Production Technology Development

4.4.1 Highly Suitable Natural Conditions for Paddy Production in Eastern Uganda

It has been observed that the natural conditions of the Study area are highly suitable for paddy cultivation, although watering in paddy growing period shall be supplemented artificially by irrigation. Crop experiment reveals that the soils in the Study area still keep reserves of basal fertility and respond well to crop/soil fertilisation practices. The potential yielding condition is as high as 8 to 10 tons/ha and 5 to 6 tons/ha on average under normal farming conditions.

4.4.2 Effectiveness of Applied Method to Production Technology Development

Applied method to production technology development, so called "learning and doing", was effectively inculcated in the farmers. In the first step, key farmers were trained at TDFP. Immediately after learning new technologies at TDFP, these farmers took the next step of transferring the learnt technologies to the member farmers at FPDFP. Such two-step learning and doing practices applied to the farmers' training were effective in the smooth transfer of the technology from key farmers to local farmers. As a result, high yields of more than 4 tons/ha were achieved in all 13 P/Ps and yields greater than 5 tons/ha were reached in 9 P/Ps within 18 months. Moreover, the new technology is now expanding outside of the P/P areas as an effect of P/Ps.

4.4.3 High Possibility of Introduction of Farming Tools

The Study Team made trail of the effectiveness of manual weeders which were

manufactured in a workshop in Mbale in accordance with the design of the Study Team. Soon after the training on how to use these weeders, many farmers smoothly operated them in their paddy fields and recognized their efficiency in weeding. Such experience in using the weeders is considered to be one reason for the rapid dissemination of the line transplanting method over the 13 P/P areas within a short period. Furthermore, the farmers' organisations in Bugiri P/P area, jointly purchased 6 oxen for ploughing purpose. As shown by these examples, the farmers have a strong will to use farming tools. Therefore, in the project implementation, the introduction of farming tools such as thresher, oxen-drawn cart, etc. shall be promoted in the course of A/P and D/P implementation.

4.4.4 Importance of Farm Road and Working Place

Within the irrigation development areas, it is necessary to provide farm roads, ideally 4 m wide, for the future improvement of farming practices in which farming tools such as oxen-drawn carts would be introduced as local transportation means. Particularly in new development areas, farmers will easily understand and agree to construct farm roads because lands are abundant in such areas. After the introduction of the local transportation means, paddy cultivation without the use of chemical fertilizer is to be expected; using compost fertilizer instead. If compost fertilizer is applied to the upland, soils there will be improved. In addition, it is necessary to keep certain spaces within the irrigation development areas for threshing and drying. In the P/P area in Sironko district, many farmers practiced their threshing works on the flood protection dike-cum- farm roads that were provided.

4.5 Organisation and Institutional Development

4.5.1 Establishment and Institutionalisation of Supporting System for Building Capacities of Paddy Growers

Construction and management of irrigation facilities, paddy production, wetland management and collective marketing are the necessary functions required by the farmers' organisation as envisaged in D/P. To enable the organisation to acquire such functions, supports were needed from various sectors of government administration. First of all, to register as a CBO, the CDO/CDA shall help the farmers and link them with the District Community Based Services Office. The dissemination of the appropriate paddy production technologies is the responsibilities of AO working at the sub-county or NAADS. Establishing Wetland Association (WA) for community wetland management has to be facilitated by the DEO or DWO. Lastly, DCO is responsible for helping the organisation to register as a cooperative. Among the technical staff at the local government, sub-county level administration does not have technical staff concerning environment and wetlands, which constrains the implementation of the wetland management at the community level. This requires an urgent attention from the relevant authorities as the issue is critical in maintaining wetland based livelihoods. On the other hand, how to extend supports from the DCO

shall also require attention, though farmers' organisations which requires some time before they can consider registration as cooperatives. Last but not least; it is critical that an irrigation engineer be established at the district level. Under the current system, the water engineer at the district office is expected to provide technical support on water for production use such as irrigation. However, it is not technically feasible for one technician alone to deal with both domestic and productive water sectors as these require expertise of their own. During the P/P, the training for PIEs at the district level was conducted jointly with MAAIF though such qualification is not institutionalised.

From the above, the following four points are required to be considered for the further future stages of irrigation development in Uganda.

1) The training for PIE shall be continued. There is no qualification as PIE as such. However, the trained PIEs played an important role during the P/P implementation as irrigation agronomists. This proves the needs and effectiveness of such technical staff in irrigation development. Therefore, the training methods used during the P/P are relevant and necessary in the real situation. Furthermore, the PIE is also recommended to share the work of DEO/ DWO and support the establishment of WA since there is no technical officer on wetland management at the sub-county level.

2) A Task Force (TF) for wetland development and conservation shall be established at the district level to effectively support paddy growers. The TF members shall include DAO, NAADS coordinator, CDO, DEO, DWO, DCO and shall coordinate the interventions relevant for paddy growers. The proposed support for WA establishment by PIE shall also be guided by the TF. Such coordination shall also increase financial efficiency of the government intervention. Further, such coordination mechanism provides an arena to share understanding of government policy and guidelines on wetland development; minimising the complications caused by the misinterpretation of the law by individual technical staff.

3) Institutionalisation of TF shall be arranged at district level under MAAIF initiative. At the same time, institutionalisation of PIE is necessary also at the district level as the District Irrigation Officer (DIO) who is responsible for irrigation development in each district.

4) An Irrigation Department should be established in MAAIF. As the institutionalisation of PIE/DIO and TF, the training of fully qualified irrigation engineers as mentioned in Section 4.3.3 and the irrigation development of 174,000ha require a fully fledged Department of irrigation within MAAIF to lead the process and achieve the set goals. The Irrigation Department shall be responsible for enacting laws in irrigation development including small holders' sector, formulating irrigation development plan including human resource development, technical support to district governments, and supervision of

irrigation development works. Simultaneously with the above, it is required to organize a Project Coordinating Committee to operate a comprehensive monitoring and evaluation and management of the Project and their implementation. The committee members shall be representative officials of the concerned authorities and agencies, i.e., MAAIF as the chair organisation, NARO, NAADS, NEMA, MW&E, WID, DWD and concerned local governments.

4.5.2 Need for Training Programme Considering Participants' Convenience

The farmers' organisation capacity building training workshops were conducted in 22 days; stretching between January and March 2005. As the training was intensive and time constrained, many potential participants found it difficult to attend all the sessions. Thus some participants with limited capacity to learn and train others were nominated as they were less busy. The timing of the workshops was another factor in addition to those mentioned in 4.2.4. Therefore, the actual implementation of the training shall consider the timing and allocate sufficient time intervals between sessions. To minimise the cost incurred by the participants, it is also advised to conduct the training closer to their community.

4.6 Wetland Environment Conservation

4.6.1 Need for MAAIF-NEMA Close Coordination

NEMA requested MAAIF to submit the Project Briefs of the 4 P/Ps prior to undertaking the construction works of the related irrigation facilities. The Study Team thus assisted MAAIF in the preparation of the 4 Project Briefs, which were submitted to NEMA on August 16, 2004. It was confirmed, between the persons in charge at MAAIF and NEMA, that NEMA would probably exempt the EIA execution because all 4 P/Ps were small in scale, and this was to be informed to MAAIF after 21-day period, which was the time needed for the normal procedure of screening by NEMA. The actual procedure, however, took about 5 months until the EIA exemption as presented below[1].

1) Aug. 16, 2004: MAAIF submitted 4 Project Briefs to NEMA
2) Oct. 07, 2004: NEMA requested MAAIF to conduct comprehensive assessment
3) Oct. 15, 2004: MAAIF submitted counter-comments
4) Nov. 19, 2004: NEMA issued formal approval, but raised many other wetland conservation issues which have to be undertaken by MAAIF
5) Jan. 07, 2005: MAAIF requested NEMA to waive off permits issues to facilitate P/Ps implementation
6) Jan. 12, 2005: NEMA issued a letter to MAAIF to grant the waiver for the

[1] : The Study Team could not sufficiently assist MAAIF because it was not assigned to Uganda for about 3-month period from September 9 to December 6, 2004, and this was one reason for the long time it took until NEMA's decision to exempt the EIA

permits during the P/P stage

As lessons learnt from the above, it can be pointed out that the coordination between MAAIF and NEMA shall be more closely conducted in the next phase of project implementation. From this standpoint, the importance of Project Coordinating Committee establishment can be again pointed out.

4.6.2 Need for Review of Environmental Laws/regulations on Wetlands Considering Small Farmers' Development

It is believed that the wise use concept stressed by NEMA and WID in dealing with national wetlands and the many laws and regulations pertaining to their ownership, use and access have been well understood by local farmers and officials concerned during the workshops and activities undertaken along the environmental conservation programme of this study.

However, certain issues related to poor farmers and the laws and/or Government remain still unclear; needing to be adequately addressed and thus requiring appropriate recommendations to MAAIF for their solution in consultation with concerned stakeholders. The main issues are discussed below.

(1) Buffer Zones

Policies and laws on wetlands use and management are fairly new (enactment in 1995 and onward) and do not clearly address certain issues related to poor farmers who have been using these wetlands well before 1995.

For example, regulations require buffer zones (of 30 and 100 m). Some rice schemes like in Bugiri and Pallisa (which existed before enactment of the laws in 1995) are too small to have reserve for buffer zones even of 3-5 m (new limits set by NEMA). Therefore, NEMA in cooperation with MAAIF should physically visit concerned area and establish whether those wetlands need buffer zones or not.

(2) Wetlands Water Permits

Laws do not also clearly address the issue of water permit fees for poor farmers. These fees include the cost of processing an application for a water permit set at Ush. 450,000. In addition, annual charges of Ush. 200,000 for abstraction up to 400 m^3 of water per day, Ush. 1,000,000 for abstracting more than 400 m^3 but less than 1000 m^3 of water per day, and Ush. 3,000,000 for abstracting 1000 m^3 per day or more are payable. Though acquiring a water permit is necessary for poor farmers, it is recognized that fees involved are very high considering that in some seasonal wetlands water for cultivation may be sometimes not even enough for cultivation.

Based on these considerations, farmers are advised to form associations to cut costs. Furthermore, MAAIF should negotiate with DWD to ask for reduced rates and long grace period for schemes depending mainly on rainfall such as in Bugiri and Pallisa. For schemes benefiting from a continuous flow such as Sipi River in Sironko, MAAIF should negotiate with DWD to make initial payments affordable and

increased as farmers' income increases.

(3) Wetland Association (WA) and Community Wetland Management Plan (CWMP)

Laws request that wetland users form WA and prepare CWMP. Though CWMP is cheaper than EIA and contributes well in community participation and ownership of the Project, cost of carrying out CWMP is unaffordable to most farmers. WID could help communities in the preparation of CWMP.

(4) Farmers and Government

Farmers still fear government and think that their land may be taken from them. Quite often, many refuse to associate themselves with wetland associations, and this affects wise use practices. Wetland's law enforcers are telling them that they are illegal users, which is one of the reasons why they fear government officials and donors coming to talk to them about being organized for wise use of wetlands. Farmers are afraid, and this constrains not only the high potential to develop rice production, but also the wise use of wetlands since encroachment will continue. For further development, DAOs, DEOs and DWOs are requested to promote trust through the mobilization and sensitisation of farmers on the laws, regulations and policies on wetland. Government should also develop trust, promoting field trips to P/P areas and discussion between target farmers and developed farmers, encouraging interaction and transparency and raise awareness through informal gathering. Government should be impartial and must not practice double standards. Political interference should be avoided as much as possible.

(5) Monitoring Water and Soil Quality

Regular water quality and soil fertility monitoring has helped to establish and show that rice cultivation can be carried out with minimal impact to seasonal wetlands. Monitoring should be continuous to ensure the wise-use or sustainable use of wetlands. Though there is enough capacity at the district level to continue monitoring, limited resources will hinder this activity in future. Therefore, initial funds should come from Government (MAAIF, NEMA, WID and DWD) and development partners. Later, capacity and resources should be included in district budgetary system, MAAIF and NEMA facilitating DAOs and DEOs work plans for environment monitoring

(6) Wetland Demarcation

Inventories of national wetlands have been carried out by WID since 1999-2000. Though these inventories make available many bio-physical data on wetlands, they fail to integrate the needs of the people living close to these wetlands who depend on them for their livelihood.

WID is expected in collaboration with NEMA to include the social dimension into the wetlands inventories and demarcate these ecosystems as reserve areas for

conservation and/or restoration and production areas for rice cultivation and other food crops to alleviate poverty and ensure food security.

4.7 Feedback to the D/P and A/P

The lessons learnt from the P/Ps, which shall be taken into account in the finalisation of the D/P and A/P, are few. As examined above, most of these lessons are positive; indicating the appropriateness of the programmes applied to the P/Ps. Some are related to institutional and administrative matters which cannot technically be resolved. Regarding the latter, ways to resolve the matters were examined and presented in Section 5.2 as recommendations to the concerned authorities and agencies.

Nevertheless, considerable parts of the D/P and A/P shall be modified based on the important lessons learnt from the P/Ps, as presented in this Section.

4.7.1 Modification of D/P

(1) Overall D/P

The overall D/P shall be modified based on the following lessons:

1) The size of one unit area for the development of an irrigation scheme was revised down to 10 ha, although it was set at 20 ha in the draft D/P (see Section 4.2.6); and
2) The number of districts in the Study area has increased from 13 to 21 in the course of the Study period.

Even though the latter point is not related to the lessons learnt from the P/Ps, the increased number of district administrations has a great effect on the implementation of the D/P, since the draft D/P was formulated for 13 districts in the It/R.

The major points pertaining to the modification of the D/P from the lessons learnt are as follows:

1) Increase in number of Pilot Schemes; proposed number of Pilot Schemes during the D/P period is increased from 1,014 to 2,000 schemes,
2) Increase in number of local technical officers to be trained; total number of local technical officers to be trained in the respective technologies is increased as shown in the table below:

Number of Local Technical Officers to be Training in the D/P

	D/P (draft)	D/P (final)	Balance
PIE/DIO	65	105	40
Officers in charge of extension	193	200	7
Farmers' groups development. officers	136	224	88

(2) Modification of Number of Small Impounding Dams for Construction

The number of small impounding dams for construction is increased from 10 to 22, following the lessons learnt from the P/Ps (see Section 4.3.2). Because of this

modification, related activities and costs required for the construction is also increased, i.e., number of F/S and EIA to be undertaken, land compensation for reservoir area, etc.

(3) New Planning for Qualified Irrigation Engineer Training

Although qualified irrigation engineer training was not planned in the draft D/P, including such a plan is essential in the final D/P according to the lessons learnt from the P/P (see Section 4.3.3).

(4) Modification of Target Yield of Lowland Paddy

The target yield of lowland paddy is modified to 5 tons/ha, although it was 4 tons/ha in the draft D/P. This modification is considered to be applicable, if actual yields achieved by the farmers in 13 P/P areas are taken into account (see Sections 4.4.1 and 4.4.2).

4.7.2 Modification of A/P

In the P/Ps, the construction of irrigation facilities was carried out only in 4 P/P areas among 13. The 4 P/P areas were selected from 4 A/P areas which were identified as the ones with respective area-specific constraints evaluated mainly from the irrigation development point of view, i.e., priority areas for rehabilitation (Group-1), improvement (Group-2), new development for crop diversification from upland to lowland paddy (Group-3), and completely new development in seasonal wetland (Group-4). The A/P for the land and water resources development and environment conservation was therefore formulated for these 4 A/P areas; covering only 177 km^2 of catchment areas in total or less than 5% of the Study area (37,024 km^2). On the other hand, the A/P for the other components was formulated as the one to cope with overall constraints covering all the Study area (or previous 13 districts) including the above catchment areas.

However, the said A/P shall be modified as one in which all the proposed components are implemented covering all the Study area or 21 districts, although the approach to the respective districts for the land and water resources development will still follow the concept of grouping them into Group-1 to -4.

The modification is proposed based on the following lessons learnt from the P/Ps:

1) The need for irrigation development is very high in the whole Study area, and some districts outside of the previous A/P areas have already commenced their irrigation development works; applying the technologies introduced by the P/Ps. In addition, capacity of farmers and local technical officers are considerably high for the development (see Sections 4.2.1 and 4.2.2).
2) The performance of 9 P/P areas was generally good in their organisation development and improvement of paddy cultivation technology, although irrigation facilities were not constructed in these P/P areas. The 9 P/P areas are now performing their role as a centre for paddy sub-sector development in each district. It is expected that their role for the irrigation development will be

reinforced, if irrigation facilities are provided for these P/P areas.

In addition, it is noteworthy that participatory farmers basically well understood the necessity of buffer zones, and all farmers in the newly developed 2 P/P areas stopped cultivation in the buffer zones. Also from this aspect, the previous A/P for the land and water resources development and environment conservation shall be modified to cover all the Study area.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The objectives of implementation of the P/Ps, which were established in the planning stage, were achieved as described for each objective as follows:

(1) Objecive-1: Verification of the projects/programmes formulated in the draft A/P and D/P

Most of all the projects/programmes formulated in the draft A/P and D/P were implemented in a small-scale in the P/P. As a result, the effectiveness of these programmes was verified as evaluated in Chapter 3 and 4.

The method applied to the P/Ps in which comprehensive programme was implemented through participatory approach according to the concept of the draft A/P and D/P has functioned well and worked effectively; bringing out the will of the farmers and local government technical officers to carry out the sustainable irrigation development.

It can therefore be concluded that all the programmes formulated in the draft A/P and D/P will be basically applicable to the future implementation of the Project, although some lessons learnt from the P/Ps shall be reflected in the course of finalisation.

(2) Objecive-2: Record of partial achievement of the development target in the P/P site

This can be explained according to the key items set for verification in the P/Ps. which were considered in the planning stage. First, “increase of unit yield of lowland paddy” was achieved in all 13 P/P areas within 18-month period. Second, “development of management capacity of farmers’ organisations” progressed also in all 13 P/P areas, and their numbers with CBO status were increased from one to nine. Third, “capacity building of farmers and government officers for the wise use of wetland” was confirmed in the 4 P/P areas where irrigation facilities were constructed.

(3) Objecive-3: Building the capacity of Ugandan counterpart personnel including staff of local government and the communities concerned

The P/Ps were implemented jointly with the counterparts from central and local governments. As a result, they learnt well the method of participatory development and technologies applied to the respective programmes in the P/Ps, i.e., construction of small-scale irrigation facilities, lowland and upland paddy cultivation, farmers’ organisation development, and wetland wise use. Similarly, the beneficiary farmers also learnt well these technologies through various training courses and workshops organised in the P/Ps. It can be therefore concluded that the capacity building of the counterparts and beneficiary farmers was achieved to a considerable degree in the implementation of the P/Ps.

(4) Objecive-4: Reflection of lessons learnt to draft A/P and D/P for their finalisation

The A/P and D/P presented in the Main Report was formulated after some revisions made; reflecting the lessons learnt from the P/Ps.

5.2 Recommendations

5.2.1 Recommendations to MAAIF

It is recommended to MAAIF to take the initiative as the leading Ministry for implementing the Project, in close coordination and collaboration with the other concerned authorities and agencies. However, there is a need to resolve the following hurdles as early as possible:

1) To organise a "Coordinating Committee" to operate a comprehensive monitoring and evaluation, and management of the Project and its implementation. The committee members should be the representative officials of key stakeholders and agencies, i.e., MAAIF as the chair organisation, NARO, NAADS, NEMA, MW&E, WID, DWD, and concerned local government officials;
2) To formulate and issue a practical policy for wetland development and conservation. The important issues that have to be taken into consideration in the formulation are presented in detail in Section 4.6.2 and are summarized as follows:
   - Unclear policy on buffer zones in the existing irrigation schemes as well as in the new developments to be carried out,
   - Expensive wetland water permits and annual water charges for small-scale farmers,
   - Unaffordable costs of carrying out CWMP for most farmers, and
   - Farmers' fear of government intervention.

   Regarding the above, it is crucial to demarcate possible development areas (arable land) for agricultural production, in collaboration with NEMA and WID;
3) To establish an Irrigation Department in MAAIF. This new department is to be responsible for enacting laws in irrigation development, including the small holders' sector, formulating irrigation development plans, including human resource development, technical support to district governments, supervision of irrigation development works, etc. The information presented in the final page of this chapter will contribute to MAAIF in enacting laws related to the irrigation development. In irrigation development planning, it is proposed that the issues in the boxed article on the last page of this chapter be considered;
4) To support concerned local government to organise a Task Force (TF) for wetland development and conservation at the district level. The institutionalisation of this TF is also needed under MAAIF initiative. At the same time, the institutionalisation of PIE is also necessary at the district level through a District

Irrigation Officer (DIO) in order to promote sustainable irrigation development in each district;

5) To give priority to paddy production in PMA and improve access to the NAADS programme.

5.2.2 Recommendations to NARO

It is recommended that NARO enhance the paddy research in the Doho Rice Scheme, and regularise more intensive research work in order to find out which varieties are to be recommended for paddy production. The varieties adaptability test introduced by the P/Ps should be repeated. It is recommended that more varieties are tested. Candidate varieties are made available in the international rice research institutes, i.e., IRRI and WARDA as well as in the advanced rice producing countries in Asia.

Preservation of the foundation seeds as well as the multiplication of the extension seeds of recommended varieties are also essential in NARO management. Finally, NARO should take charge of the administration related to seed production and its supply and distribution system. As for the multiplication of paddy seeds, the Doho Rice Scheme already has the most capable functions for creating a seed farm. For the supply and distribution of the paddy seeds to growers, it is necessary to create an institutional support system linked with the present function of the NAADS/Seed Company.

NARO shall also have an institutional support function for testing and selecting performing chemical fertilizers and agro-chemicals to be recommended, especially for paddy production, and then for advising the concerned trading companies for importing the most advanced fertilisers and chemicals.

In conducting paddy research, NARO is recommended to establish more close linkage with Makerere University, because it also undertakes research activities for crop production. Reinforcement of such a linkage will provide an effective function in paddy research for students and will create new researchers.

5.2.3 Recommendations to NEMA

NEMA, in collaboration with MAAIF, WID and the concerned local governments, shall correct the contradictory messages on wetland use that have been spread so far by some local leaders, civic and technical people, and hence, satisfy/relieve farmers' anxiety in the wise use of wetlands. It is proposed that NEMA, in collaboration with WID and MAAIF shall, as early as possible, demarcate the priority areas for reserves and/or conservation of the natural wetland environments as well as arable wetland (mainly seasonal wetland) acceptable for agricultural production. Demarcation of these particular areas is essential and crucial to promote a conservation movement for wetlands in parallel with a practical land use for economic activities. The existing inventory map of wetlands and its relevant information must be useful for this land demarcation.

5.2.4 Recommendations to NAADS

NAADS needs to take up paddy production in the current programme as one of the promising crops for its scheduled programme. First it needs to extend practical programme services, preferably to the respective P/P areas, to accelerate the modernisation of paddy farming. Paddy production and such by-products as straw, husks and bran have a great added-value potential as not only staple foodstuff, but also industrial materials for various purposes, for instance, rice flour for food processing, alcohol and bran-oils for industrial use, fodder processing for animals and fish, straw-mats, rope, straw-sacks, compost for mushroom cultivation, etc. Thus, the paddy products would in the near future become one of the most important resources for generating rural industries, and hence, contribute to the socio-economic development of the eastern region.

In the Doho Rice Scheme, the foundation seeds of the promising paddy varieties have been well preserved, and in part, the extension seeds of the recommended paddy varieties have also been multiplied sufficiently for commercial seed production. Besides, potential paddy seed growers were trained through the workshop, and they have also experienced two practical exercises in the field. Thus, they are now ready to start paddy seed production, even at a commercial level. Based on the above, NAADS is therefore requested to apply its programme to the Doho Rice Scheme and assist in the promotion of the commercialisation of seed production in line with the present function of NAADS/Seed Company with the close collaboration of the authority and agencies concerned.

5.2.5 Recommendation to Local Government

The local government of the respective districts is recommended, as the implementing agency of the Project, to take the responsibility of leading the development work and then managing the performance of O&M work following the completion of the Project. To smoothly and efficiently conduct this work in the field, the concerned district offices should reinforce their working function, including staff assignment and capacity building and training of the assigned staff. In this regard, as presented in Section 5.2.1, the PIE should be institutionalised as the DIO responsible for sustainable irrigation development in each district. To deal with the preparatory work, the local government must prepare an allocated budget using a part of the local government development fund (LGDF) from LGDP.

In addition, the local government needs to organise a Task Force (TF) for wetland development and conservation to effectively support paddy growers. The TF members should include DAO, NAADS coordinator, CDO, DEO, DWO, DCO and they should coordinate the interventions relevant to paddy growers. Because farmers and farmers' organisations, as necessary functions, have to acquire the knowledge in construction and management of irrigation facilities, paddy production, wetland management and collective marketing, all supporting services related to these technologies should be provided in a coordinated manner.

Multi-functionality of Paddy Field Irrigation

Conservation of Land

Paddy fields store rainwater temporarily. This function prevents a rapid rainwater flow, and therefore the damage that would be caused by flooding in the surrounding or downstream areas can be prevented or reduced. Moreover, fields also have a function to prevent disasters such as landslides. Paddy fields are thus contributing greatly to the conservation of land.

Fostering Water Resources

A large volume of water is stored both within and underneath paddy fields. Water led into and stored in paddy fields gradually penetrates into the ground and becomes groundwater, a part of which is slowly returned to the downstream areas rather than flowing directly through the river. Thus, paddy fields have functions to foster groundwater, an essential water resource, as well as to stabilize rivers and streams. Moreover, both paddy fields after harvest and other fields also contribute to fostering groundwater by assisting the penetration of rainwater into the ground.

Preservation of Natural Environment

There are a vast number of microorganisms, such as bacteria, living in farmland, including paddy fields and other farmland. Organic wastes such as garbage and livestock excretion are composted and recycled efficiently as resources. The existence of an enormous number of microorganisms and bacteria that exist in farmland enables plants to absorb decomposed organic matter easily through cultivation of farmland. Moreover, the plants that are grown in the fields maintain the air essential for the life of the people and animals, by absorbing carbon dioxide and emitting oxygen. In addition, fields and farm ponds greatly contribute to the preservation of the natural environment, by providing favourable habitats for various life forms.

Preservation of Wetland Environment

Normally, about 30% to 40% of irrigation water from paddy fields will be returned to the downstream area, unlike upland crop irrigation. The return flow will saturate wetland and maintain the wetland environment.

Source: Ministry of Agriculture, Forestry and Fishery, the Government of Japan