Republic of Mozambique
DNEA, Ministry of Agriculture

Republic of Mozambique
The Project
For Rice Productivity Improvement
In Chokwe Irrigation Scheme
(PROMPAC)
Work Completion Report

October 2014

Japan International Cooperation Agency (JICA)

Rural Development Institute Ltd.

Republic of Mozambique
DNEA, Ministry of Agriculture

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The Project
For Rice Productivity Improvement
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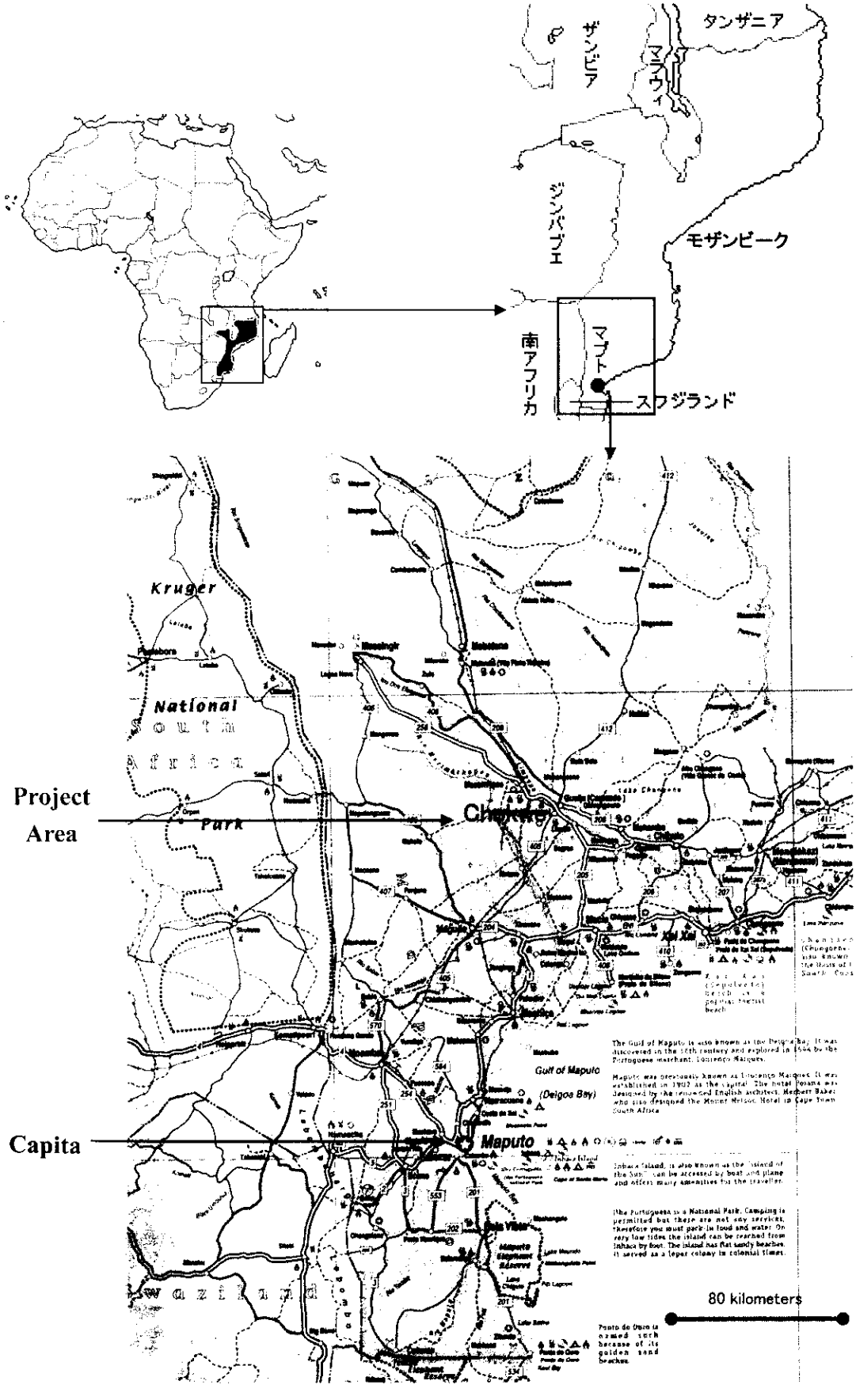
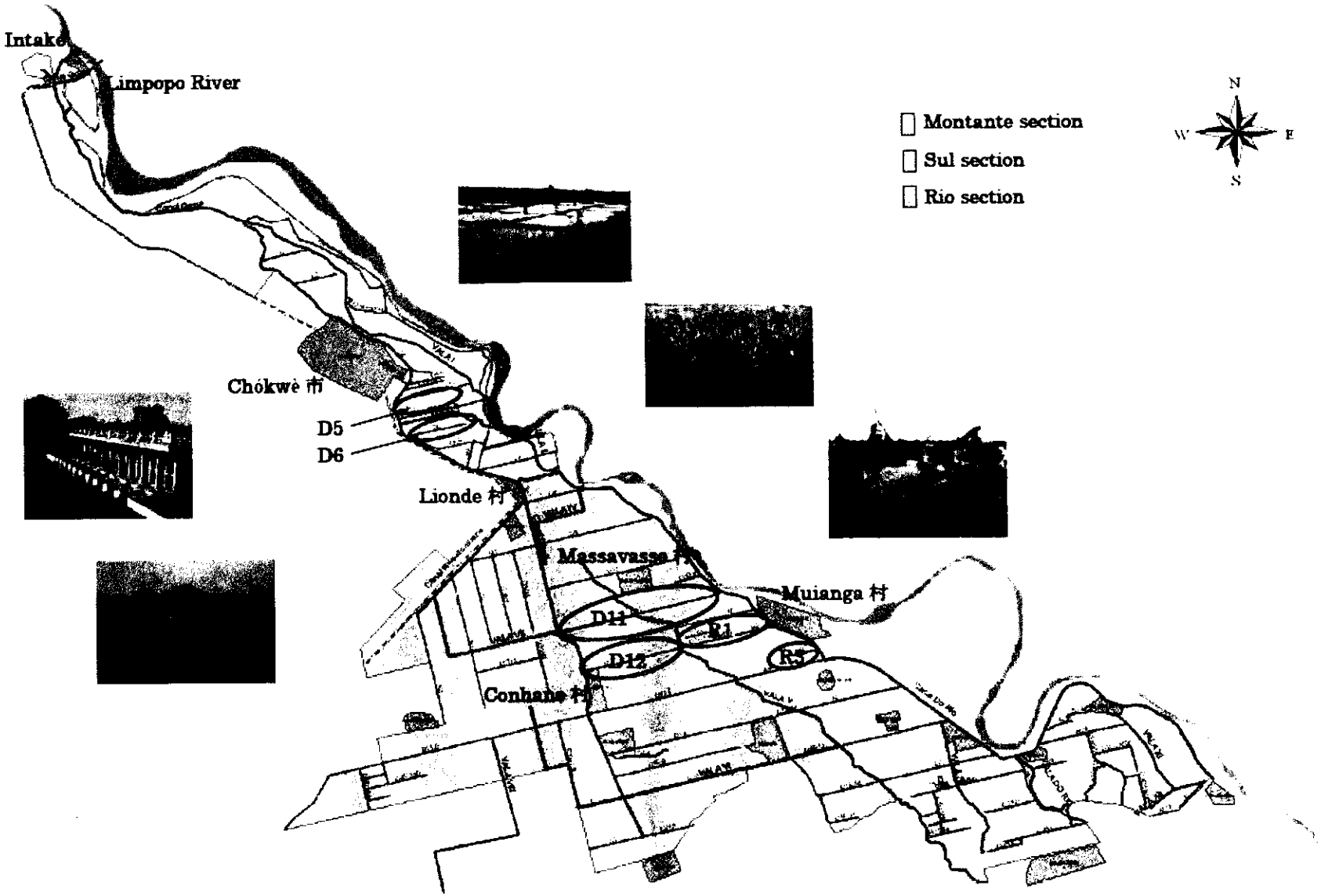
Location of the Project Area



Map of the Chokwe Irrigation Area



Map of the Project Area

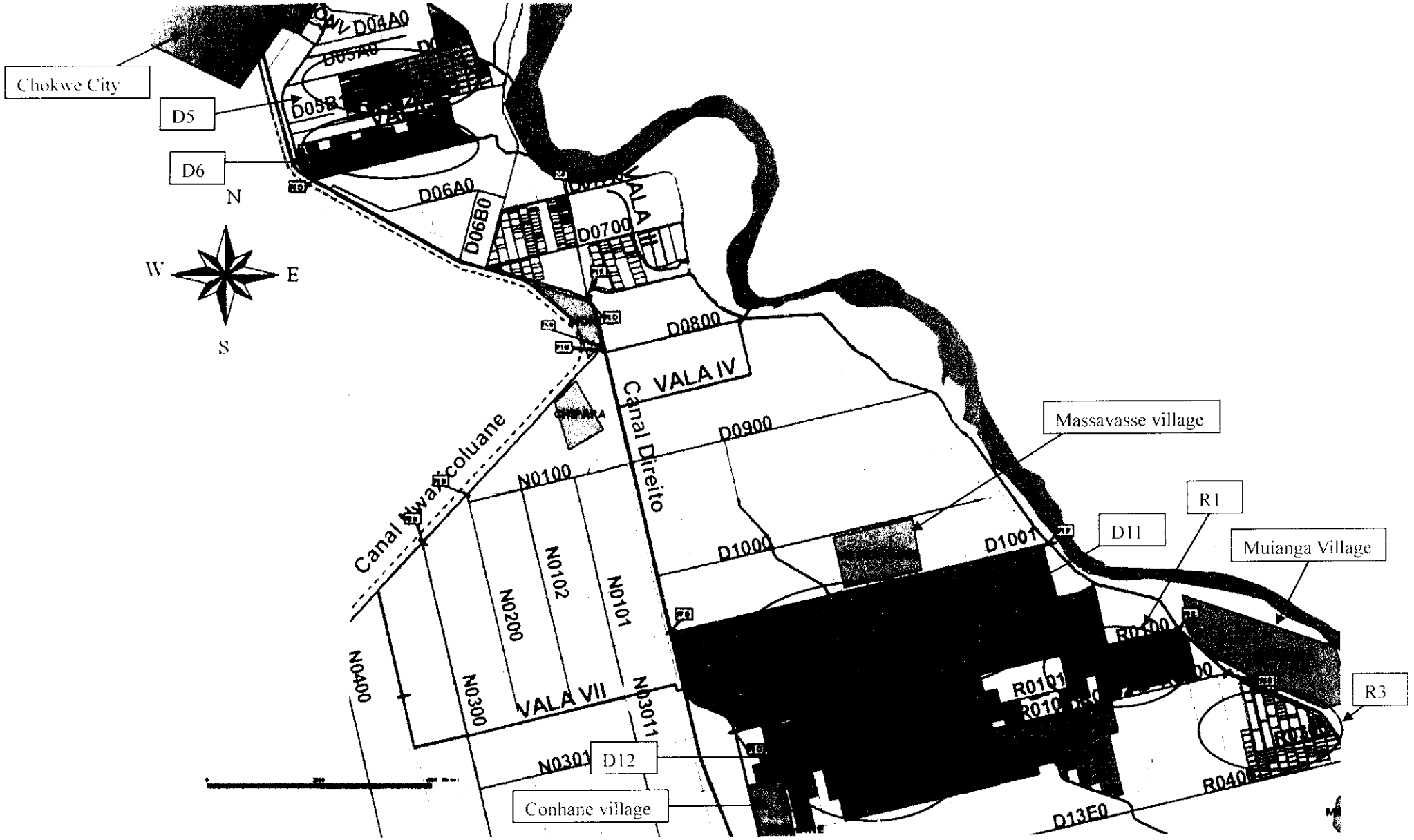


Image References

<First Operation Year>

JCC-1: Explanation on the Project (March 2011)

Explanation by the Baseline Surveyor (April 2011)

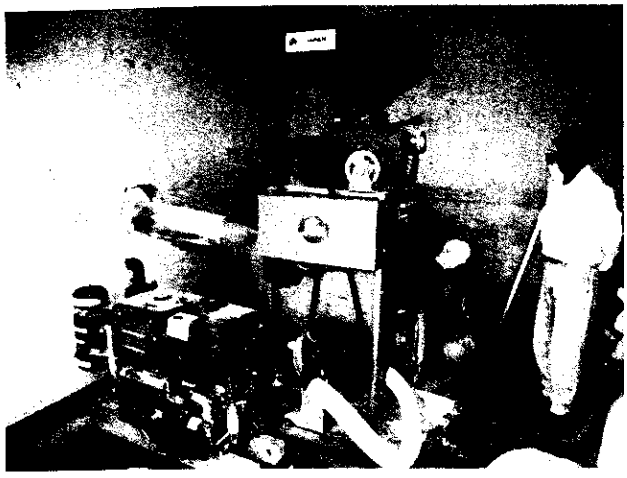
Manufacturing Trial Seeder by Expert (May 2011)

Yield Survey in D5 (April 2011)

<Second Operation Year>

Puddling by the power tiller (October 2011)

Direct Sowing at Wet Field (October 2011)



Rice Milling Machine after Test Operation (October 2011)

Extension Agents and FSG Training (Basics for Transplanting) (November 2011)

OJT on Transplanting (December 2011)

OJT on Canal Upgrading in D5 (June-July 2012)

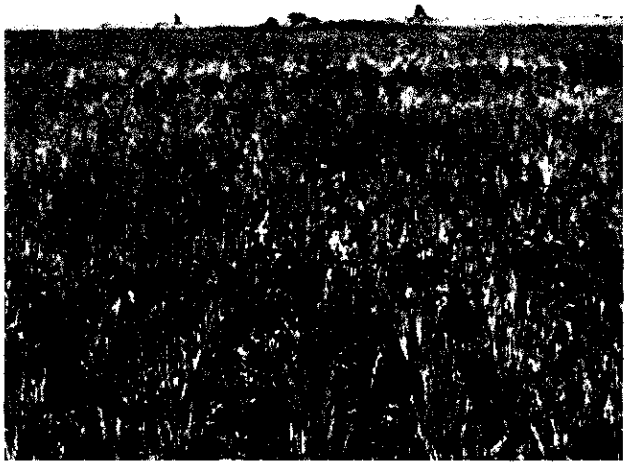
OJT on Puddling (December 2011)

JCC-4· Progress Report by C/P (August 2012)

<Third Operation Year>

Agreement Confirmation with FSG members in D11 (October 2012)

OJT on Manual Seeder in D12 Demonstration Field (November 2012)



Direct Sowing (Line Sowing) with Manual Seeder after Weeding (D12) (January 2013)

Training on Book Keeping (R1 & R3) (January 2013)

Farmers Training in D11 (direct sowing) (November 2012)

Nursery Bed at Verification Field for Variety Test (EAC) (November 2012)

Training on Manual Seeder in SDAE
(April 2013)

Variety Test in Verification Field in D12
(January 2013)

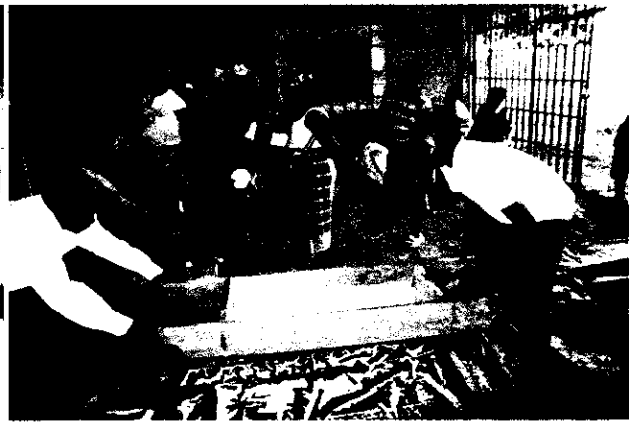
Sampling six varieties at Demonstration Field
(D11) (April 2013)

Yield Components Analysis (SDAE)
(May 2013)

Field Day at Six Variety Demonstration Field
(D11) (March 2013)

Training on Variety Attribution (SDAE)
(July 2013)

Milling Machine Maintenance (Muianga)
(April 2013)



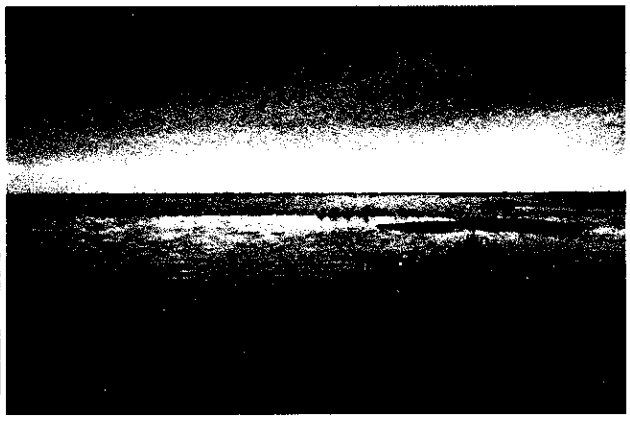
Grading Demonstration by Sieve (Muianga)
(May 2013)

JCC-5 (November 2012)

Signing MM, Joint Evaluation Committee
(January 2013)

<Flood Damage in Chokwe>

Flooded Chokwe (approx. 1.5m deep)
(January 2013)



Verification and Demonstration Fields in D5 and D6 under Water (January 2013)

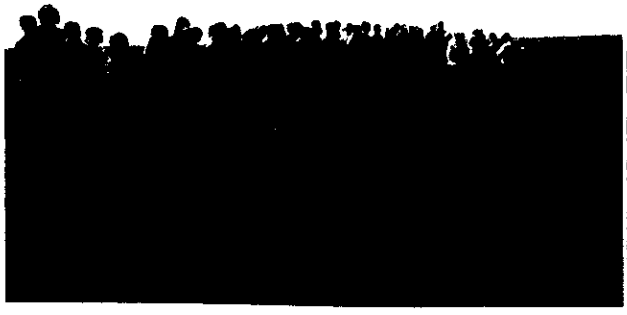
<Fourth Operation Year>

Second OJT on Manufacturing Manual Seeder (target: private welding company personnel, EAC workshop technical staff, etc.) (December 2013)

Germination (Direct and Line sowing) (D5 Verification Field) (January 2014)

Training on FSG Revolving Fund, Book Keeping, Field Day Preparation, target: Extension agents, etc. (January 2014)

Training on Book Keeping (D5 FSG members) (February 2014)



Field Day (D11) FSG Members of D5, D6, D11 and D12 visited D11 and D12 (February 2014)

Field Day on the Transplanting Technique, target D5 and D6 FSG members (EAC Experimental field) (March 2014)

Field Condition (EAC Experimental field) (March 2014)

Threshing for Yield Survey in Variety Test Block (EAC Experimental field) (April 2014)

Confirming Book Keeping: Extension agent (left) and FSG member (right) (D5) (May 2014)

Survey on the Number of Hill at FSG Demonstration Field (D5) (June 2014)

OJT on Simple Leveling by Water (D12) (May 2014)

Rice Sales by Farmers (June 2014)

Interview by Joint Terminal Evaluation Team (D11) (June 2014)

Discussion about Farming Revolving Fund (D12) (July 2014)

Reporting about the Yield Survey Result and Exchanging Opinions (July 2014)

Tasting the Rice Comparing Varieties (July 2014)

Final Seminar, Opening (August 2014)

JCC-9 (November 2014)

Acronyms and Abbreviations

(in alphabetical order)

Acronyms	English ／ Portuguese	Japanese
CPL	Cooperativa de Popança e Crédito de Limpopo	リンポポセービング＆クレジット協同組合
DNEA	National Directorate of Agricultural Extension	農業普及局
DPA Gaza	Provincial Directorate of Agriculture, Gaza	ガザ州農業局
EAC	Chokwe Agricultural Research Station	ショクエ農業試験場
FAROX	Federal Agricultural Research Oryzae Cross	Federal Agricultural Research Oryzae（ナイジェリア）育成の稲品種群 FAROX
FDD	Fund for Development of District in Chokwe	ショクエの郡開発融資
FSG	Farming Support Group	営農支援グループ
HICEP	Chokwe Hydraulic Public Corporation	ショクエ灌漑公社
IRRI	International Rice Research Institute	国際稲研究所
IRGA	Instituto Rio Grandense do Arroz	ブラジルリオグランデドスル水稲研究所育成の稲品種群 IRGA
ITA	International Institute of Tropical Agriculture（IITA）	国際熱帯農業研究所(IITA)育成の稲品種群 ITA
MIA	Moçfer Industrial Alimentáres	モズフード食品事業会社
MINAG	Ministry of Agriculture	農業省
PROMPAC	The Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	ショクエ灌漑地区稲作生産性向上プロジェクトの略称
SDAE	District Services of Economic Activities	郡経済活動事務所

Republic of Mozambique

The Project for Rice Productivity Improvement in Chokwe Irrigation Scheme

Project Work Completion Report

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Authorization

This report is the Project Work Completion Report, composed in accordance with the Article 8 of Terms of Reference (TOR) specified in the contract between Japan International Cooperation Agency (JICA) and the Rural Development Institute Ltd., regarding the "Project for Rice Productivity Improvement in Chokwe Irrigation Scheme in the Republic of Mozambique" (hereinafter referred to as "the Project").

This Project Work Completion Report states Project activities and their challenges, contrivance and lessons upon operating the Project and recommendations to meet with the overall goals of the Project.

1. General Outline of the Project

1.1 Background of the Project

The Republic of Mozambique (hereinafter referred to as "Mozambique") has the population of 20.37 million (2007, Statistics Bureau), and the total land area of 800,000 km^2 (agricultural land: 180,000 km^2). Agriculture is the key industry of the country, which shares approximately the 20% of GDP and 80% of total employed population. Rice is the main crop second to maize and its production area stretches 204,000 ha, producing 240,000 tons of rice (2009, average paddy yield 1.27 t/ha). In recent years, the demand of rice has increased to 550,000 ton per year, among which 300,000 ton is imported. This trend makes the improvement of rice production an urgent issue.

The Chokwe Irrigation Scheme (the total of 26,000 ha of land possible to be irrigated) of the Chokwe District in Gaza Province, is the largest irrigated area in Mozambique and was a vigorous agricultural community, including rice cultivation; however, the production volume has been remarkably reduced after a long stagnation due to internal warfare and great flood of the Limpopo river.

The Scheme has been under the management of the Hydraulics de Chokwe EP (hereinafter referred to as "HICEP"), yet the irrigation facilities have not been properly operated nor managed due to the lack of accumulated technical knowledge concerned with facility maintenance and water use management. At the same time, activities to offer agricultural technology dissemination, farming assistances, and agricultural technology development for farmers have been made available by the Chokwe District Services for Economic Activities (hereinafter referred to as "SDAE") and the Chokwe Agricultural Experimental Station (hereinafter referred to as "EAC") have been insufficient in establishing technical supervision, loans, and farming assistance system for small-scale farmers in the area. This is due to the lack of knowledge and experience of involved personnel and poor coordination between concerned agencies.

The "Integrated Agricultural Development Project for Small-Scale Farmers in the Chokwe Irrigation Scheme" was conducted from March 2007 to March 2010 upon the request made by the government of Mozambique for the purpose of improving agricultural productivity of small-scale farmers in the Chokwe Irrigation Scheme. This project had D4 and D7 in the up-stream area as target areas, and was conducted to improve agricultural technology, mainly concerned with rice cultivation, irrigation facility maintenance and water use management, farming support system, and practice of personnel and technical staffs of involved institutions. As its framework, the National Directorate of Agricultural Extension (hereinafter referred to as

"DNEA") was the responsible agency and the Provincial Derectorate of Agriculture, Gaza, (hereinafter referred to as "DPA Gaza") was the coordination agency, while the Chokwe District Services for Economic Activities (SDAE), the Chokwe Agricultural Research Station (EAC), and the Chokwe Hydraulic Public Corporation (HICEP) were the implementing agencies. As a result at the final evaluation carried in December 2009, it was confirmed for the project goals to have met, as the average paddy yield at the target area achieved 5 t/ha, the set indicator, (D4 area: 3.83 t/ha → 5.1 t/ha, D7 area: 3.22 t/ha → 5.3 t/ha), and the improvement in collecting water fee was also recognized. The rice productivity rose in the nearby area of the target area also by 1.3 times more in 2009 compared to that of 2007, which increased rice yield by 1.9 times.

The effectiveness of the techniques for improving transplanting rice cultivation disseminated among small-scale farmers (about 0.5 – 1 ha) at the upstream of the Chokwe Irrigation Scheme has been clearly recognized; however, the dissemination and adoption is not enough yet. In addition, in order to improve rice productivity of the other areas than the upstream area in the future, the issue of improving direct sowing method suitable for the farming size of 1 – 5 ha still remains. Under these circumstances, a technical cooperation project to improve rice productivity in the Chokwe Irrigation Scheme was requested by the government of Mozambique.

1.2 Outline of the Project Work

Being launched in February 2011, this project had its first operation year (February to August 2011) as a preparatory term, its second operation year (October 2011 to August 2012), its third operation year (October 2012 to August 2013) and its fourth operation year (October 2013 to October 2014). The work has the purpose to achieve project goals by implementing activity works based on the Record of Discussion (R/D).

The overall goal and the expected outputs of the project are as stated in 1.4 below; the detailed activities are stated in Chapter 2.

1.3 Framework of the Project

1.3.1 Cooperation Term

February 2011 – November 2014 (for three years and ten months)

1.3.2 Mozambique Counterpart

Responsible Agency:	National Directorate of Agricultural Extension, Ministry of Agriculture; DNEA, MINAG
Coordinating Agency:	Provincial Directorate of Agriculture, Gaza; DPA Gaza
Implementing Agencies:	District Services for Economic Activities; SDAE
	Chokwe Agricultural Research Station: EAC
	Chokwe Hydraulic Public Corporation; HICEP

1.3.3 Target Beneficiaries and Area, etc.

The small-scale farms of less than 5 ha total cultivation land, located in the up-and midstream rice

cultivated area within the Chokwe Irrigation Scheme in Gaza Province (approximately 2,000 ha) shall be the target areas for the project. Approximately 2,000 farm households, extension workers, technical staff of the experimental station, etc. are the target beneficiaries of the project.

1.4 Objective, Expected Output, and Activities

1.4.1 Overall Goal of the Project

1) Farmers' annual yield from rice production in the target area of the Chokwe Irrigation Scheme is increased.

【Indicator】 Small scale farmer's annual income increases 45% in the target area by year of 2017

2) Rice production in the entire Chokwe Irrigation Scheme is increased.

【Indicator】 Rice production increases by 80 % in the Chokwe Irrigation Scheme by year of 2017.

1.4.2 Project Purpose

1) Rice productivity in the target area of the Chokwe Irrigation Scheme is increased.

【Indicator】 Average yield of rice is increased 1.1 t/ha in the target area by the end of the Project.

1.4.3 Expected Outputs

1) Improved rice cultivation techniques of transplanting are disseminated to the target farmers.
2) Improved rice cultivation techniques of direct sowing are developed.
3) Improved rice cultivation techniques of direct sowing are disseminated to the target area.
4) Activities of farmers groups are strengthened in the areas of the demonstration farms.
5) The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.

1.4.4 Outline of the Project Activities

Activities related to [Output 1]

1-1 To examine and develop effective extension methods.

1-2 To train extension workers and leaders (FSG farmers) on the rice cultivation techniques of transplanting.

1-3 To set up demonstration farms for the rice cultivation techniques of transplanting with the initiative of extension agents and leaders (FSG farmers).

1-4 To train farmers (general farmers) on the improved rice cultivation techniques of transplanting with the initiative of extension agents and leaders (FSG farmers).

1-5 To provide field training for FSG and non-FSG farmers on irrigation facility maintenance and water use management.

Activities related to [Output 2]

2-1 To set up trial and verification plots demonstrating the rice cultivation techniques of direct sowing.

2-2 To improve and verify the rice cultivation techniques of direct sowing at the demonstration farms.

Activities related to [Output 3]

3-1 To train extension agents and leaders (FSG farmers) on the rice cultivation techniques of direct sowing.

3-2 To set up demonstration farms for the rice cultivation techniques of direct sowing with the initiative of trained extension agents and leaders (FSG farmers).

3-3 To train farmers (general farmers) on the improved rice cultivation techniques of direct sowing with the initiative of extension agents and leaders (FSG farmers).

Activities related to [Output 4]

4-1 To organize farming support group (FSG) in each Water Users Association within the area where demonstration farms are set up.

4-2 To train farming support groups (FSG) farming related activities.

4-3 To support farming support groups' (FSG) activities.

Activities related to [Output 5]

5-1 To hold periodical coordination meetings to mutually review activities of SDAE, EAC, and HICEP.

5-2 To monitor the progress of activities conducted by SDAE, EAC, and HICEP based on the Action Plan.

2. Activities (Work)

2.1 Concept of Project Work Implementation

2.1.1 Basic Concept of Work Implementation and Remarks

The basic concept and remarks are stated below, in order to meet and achieve the project purpose and expected outputs, so detailed works are carried out.

Output 1. Improved rice cultivation techniques of transplanting are disseminated to the target farmers.

[Basic Concept]

(1) The effective dissemination method to the small-scale farmers in the upstream area shall be examined by taking into consideration the experiences learned from the previous project.

(2) The ability of extension agents and FSG farmers shall be improved sufficiently to apply the rice cultivation techniques of transplanting.

(3) The ability of target farmers shall be improved well enough to manage and maintain the irrigation facility and water use of the demonstration farm.

(4) The technology transfer by farmers themselves (the Farmer to Farmer method) is maximized as a way of disseminating the rice cultivation techniques of transplanting.

[Remarks]

(1) Strengthening the "Farmer to Farmer" technical transfer method, having FSG leaders as core players.

(2) Verifying by farmers' participation. Transferring improved techniques to leading farmers' through setting up and managing demonstration farms.

(3) Improving skills of the counterpart and extension agents through demonstration farm management (OJT).

Output 2. Improved rice cultivation techniques of direct sowing are developed.

[Basic Concept]

(1) The current problems in regard to the existing rice cultivation techniques of direct sowing are clarified in order for the techniques to be improved and verified.

[Remarks]

(1) Clarifying technical factors that constrain research on site as well as productivity improvement in regard to traditional rice cultivation techniques of direct sowing.

(2) Screening of constraining factors and conducting verification test for developing technical improvement.

(3) Verifying improved techniques at farms

Output 3. Improved rice cultivation techniques of direct sowing are disseminated to the target area.

[Basic Concept]

(1) The effective dissemination method, adopted for the rice cultivation techniques of transplanting, is

adopted to extend the improved rice cultivation techniques of direct sowing.

(2) The ability of extension agents, FSG farmers, and farming advisers in the private sector (farming advisers of the MIA/CPL) is improved in regard to dissemination of the rice cultivation techniques of direct sowing.

(3) The ability of target farmers is improved to manage and maintain the irrigation facility and water management of the demonstration farm.

(4) The technology transfer by the "Farmer to Farmer" method is maximized as a way of disseminating the rice cultivation techniques of direct sowing.

[Remarks]

(1) Strengthening the "Farmer to Farmer" technical transfer method, having FSG leaders as core players.

(2) Verifying by farmers' participation. Transferring improved techniques to leading farmers' through setting up and managing demonstration farms.

(3) Improving skills of the counterpart and extension agents through demonstration farm management (OJT).

Output 4. Activities of farmers groups are strengthened in the areas of the demonstration farms.

[Basic Concept]

(1) The experiences learned from the previous technical project shall be maximized to realize technology transfer by the "Farmer to Farmer" method.

[Remarks]

(1) Assisting a farming revolving fund through micro finance and improving FSG farmers' ability of financial management.

(2) Managing rice milling activities, improving the ability of keeping books.

(3) Verifying rice milling activities and a farming revolving fund system.

Output 5. The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.

[Basic Concept]

(1) The coordination among three plan implementing agencies is strengthened even more.

[Remarks]

(1) Monitoring of project work progress and self-evaluating and digitization of degrees of achievement.

(2) Monitoring of Action Plan implementation progress and self-evaluating and digitization of degrees of achievement.

(3) Sharing information in regard to work progress and degrees of achievement among three plan implementing agencies.

2.2 Items of Project Activities (Work)

2.2.1 Operation Term of the Project

The whole operation of the Project is to be implemented for forty-six months, starting in February 2011 and ending in November 2014.

The first operation year: February 2011 – August 2011
(Establishment of implementation system, a preliminary survey and technology transfer activities)
The second operation year: October 2011 – August 2012
(On-going full-scale technology transfer and monitoring)
The third operation year: October 2012 – August 2013
(On-going full-scale technology transfer and monitoring)
The fourth operation year: October 2013 – October 2014
(On-going full-scale technology transfer, monitoring, and summarizing outcomes)

2.2.2 Activities (Work) of the Project

【1-1】 To prepare the draft of the Work Plan and the Work Implementation Plan (first year) based on the existing sources and information.

【2-1】 To present and discuss on the draft of Work Plan (first year) (DNEA, the Project implementing agencies and JCC).

【2-2】 To establish a steering committee for the mutual reviewing of the activities of the Project implementing agencies.

【2-3】 To establish the Project implementing system.

【2-4】 To conduct the Baseline Survey.

【2-5】 To prepare the Detailed Plan of Operation.

【2-6】 To examine and improve the effective extension method for rice cultivation techniques of transplanting.

【2-7】 To select the sites of trial and verification farms for rice cultivation techniques of direct sowing.

【2-8】 To monitor the progress of activities conducted by the implementing agencies based on the Action Plan.

【3-1】 To prepare, present and submit the Work Progress Report (first year)

【3-2】 To prepare, present and submit the Work Plan (second year)

【4-1】 The draft of the Work Plan (second year) shall be presented and discussed (DNEA, the Project implementing agencies and JCC)

【4-2】 To establish a steering committee in order to mutually review the activities of the Project implementing agencies.

【4-3】 The progress of the Action Plan shall be monitored.

【4-4】 The effective dissemination method shall be examined to extend rice cultivation techniques of transplanting.

【4-5】 The training of the rice cultivation techniques of transplanting shall be organized for extension agents and FSG farmers.

【4-6】 The demonstration farms for the rice cultivation techniques of transplanting shall be established by extension agents and FSG farmers.

【4-7】 The training program of rice cultivation techniques of transplanting for general farmers shall be held, with the initiative taken by extension agents and FSG farmers.

【4-8】 The training regarding irrigation facility maintenance and water use management within the demonstration farms shall be organized.

【4-9】 The rice cultivation techniques of direct sowing shall be established and verified.

【4-10】 The training of the rice cultivation techniques of direct sowing shall be organized for extension agents and FSG farmers.

【4-11】 The farming support groups (FSG) in the demonstration area within the target area shall be supported.

【5-1】 The Work Operation Progress Report (second year) shall be drawn up, explained, and submitted.

【5-2】 The Work Plan (third year) shall be drawn, explained, and submitted.

【6-1】 The draft of the Work Plan (third year) shall be explained and discussed. (DNEA, the Project implementing agencies and JCC)

【6-2】 To establish a steering committee in order to mutually review the activities of the Project implementing agencies.

【6-3】 The progress of the Action Plan shall be monitored.

【6-4】 The effective dissemination method shall be examined

【6-5】 The training of rice cultivation techniques of transplanting shall be organized for extension agents and FSG farmers.

【6-6】 The demonstration fields of rice cultivation techniques of transplanting shall be established by extension agents and FSG farmers.

【6-7】 The training of rice cultivation techniques of transplanting for farmers shall be organized, with the initiative taken by extension agents and FSG farmers.

【6-8】 The training regarding irrigation facility maintenance and water use management of the demonstration fields shall be organized.

【6-9】 The rice cultivation techniques of direct sowing shall be improved and verified.

【6-10】 The training of rice cultivation techniques of direct sowing shall be organized for extension agents and FSG farmers.

【6-11】 The demonstration fields of rice cultivation techniques of direct sowing shall be established by extension agents and FSG farmers.

【6-12】 The training of the improved rice cultivation techniques of direct sowing for general farmers shall be organized, with the initiative taken by extension agents and FSG farmers.

【6-13】 The farming support groups (FSG) in the demonstration fields within the target area shall be supported.

【7-1】 The Work Progress Report (third year) shall be drawn, explained, and submitted.

【7-2】 The Work Plan (fourth year) shall be drawn, explained, and submitted.

【8-1】 The draft of the Work Plan (fourth year) shall be explained and discussed. (DNEA, the Project implementing agencies and JCC)

【8-2】 To establish a steering committee in order to mutually review the activities of the Project implementing agencies.

【8-3】 The progress of the Action Plan shall be monitored.

【8-4】 The effective dissemination method shall be examined

【8-5】 The training of rice cultivation techniques of transplanting shall be organized for extension agents and FSG farmers.

【8-6】 The demonstration fields of rice cultivation techniques of transplanting shall be established by extension agents and FSG farmers.

【8-7】 The training of rice cultivation techniques of transplanting for farmers shall be organized, with the initiative taken by extension agents and FSG farmers.

【8-8】 The training regarding irrigation facility maintenance and water use management of the demonstration fields shall be organized.

【8-9】 The improved rice cultivation techniques of direct sowing shall be improved and verified.

【8-10】 The training of rice cultivation techniques of direct sowing shall be organized for extension agents and FSG farmers.

【8-11】 The demonstration fields of rice cultivation techniques of direct sowing shall be established by extension agents and FSG farmers.

【8-12】 The training of the improved rice cultivation techniques of direct sowing for general farmers shall be organized, with the initiative taken by extension agents and FSG farmers.

【8-13】 The farming support groups (FSG) in the demonstration fields within the target area shall be supported.

【9-1】 The Work Completion Report shall be drawn, explained, and submitted.

【Others】 Other necessary works during each operation year shall be done as and when required.

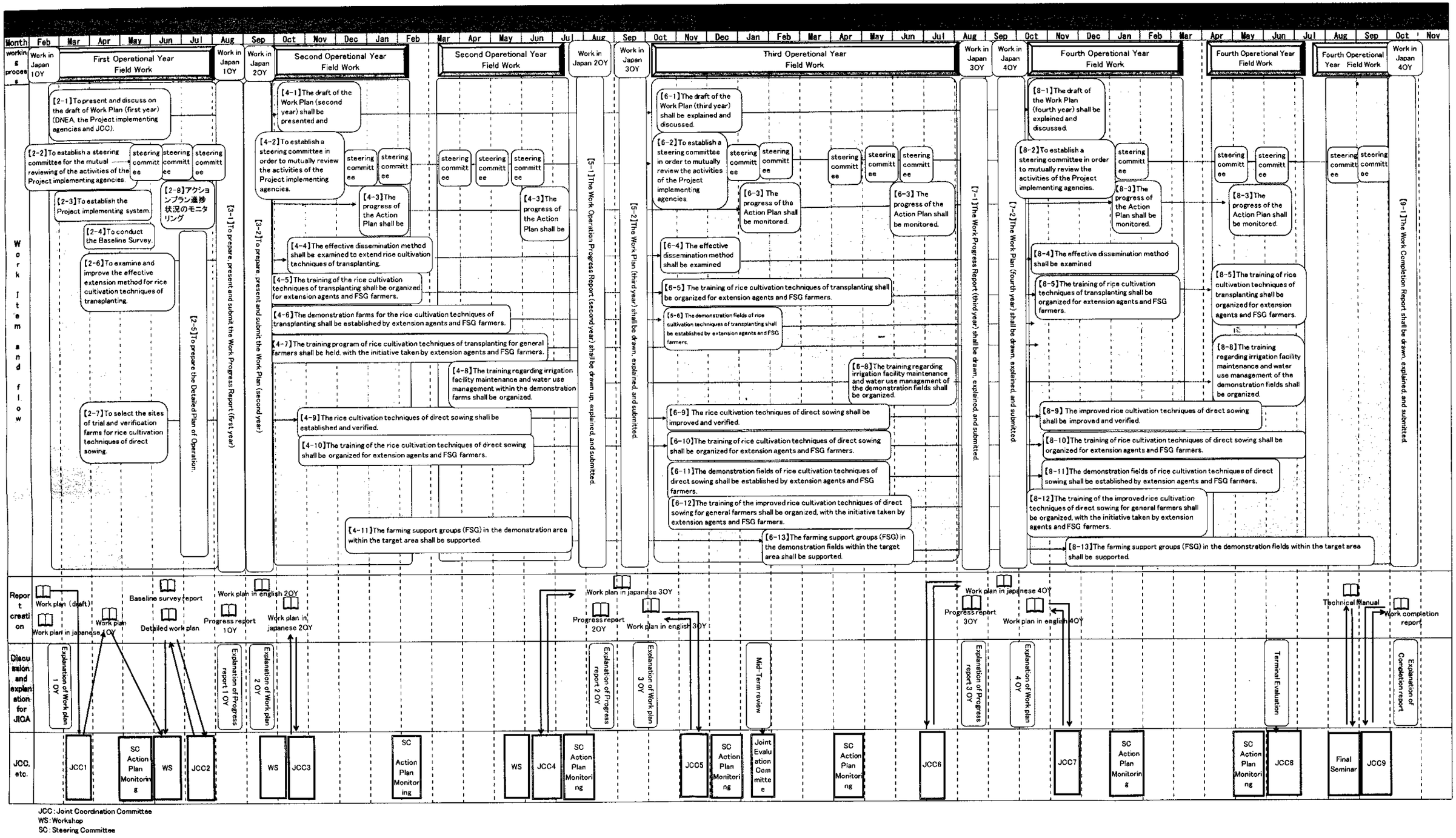
2.3 Project Implementation Flowchart

The implementation term of this Project was from February 2011 until November 2014. The Project activities are shown on Figure 2-3-1, "the Work Flowchart."

The activities and works were planned with a particular focus on being done on site, so that the minimum amount of project work was done in Japan. Some works were continued during the absence of the Project expert(s); therefore, these works were led by counterpart personnel and were not specified on the work flowchart.

The D5 and D6 were severely damaged by the flood that occurred during the third operation year, so " 【6-7】 The training of rice cultivation techniques of transplanting for farmers shall be organized, with the initiative taken by extension agents and FSG farmers" was not realized. As for the fourth year, FSG farmers in D5 and D6 were seriously concerned with the flood reoccurrence and chose not to go ahead with the rice

cultivation with the transplanting techniques as originally planned. As a result, FSG farmers in D5 adopted the planting method of direct sowing, where as with D6. There was no rice cultivated in that year as a consequence of this, two activities planned for the fourth year, was not realized. These were: " 【8-6】 The demonstration fields for the rice cultivation techniques of transplanting shall be established by extension agents and FSG farmers" and " 【8-7】 The training for the rice cultivation techniques of transplanting for farmers shall be organized, with the initiative taken by extension agents and FSG farmers"



JCC : Joint Coordination Committee
WS : Workshop
SC : Steering Committee

Figure 2.3.1 The Work Flowchart (First～Fourth Operation Year)

3. Work Implementation

3.1 Outline

This Project began, during the first operation year, with the conducting of a Baseline Survey in April and May, 2011. A Detailed Work Plan of the Project and the PDM-1 were drawn up based upon the results of this survey, and JCC-2 approved them in June 2011. The land area and the number of registered farmers within the Project target area are shown on the table 3.1.1.

The Project activities were in full progress during the second year. These activities included training on the rice cultivation techniques of transplanting, training on irrigation facility maintenance and management, considering the direct sowing method on both flooded and well-drained fields, establishing the model farms for the transplanting of rice cultivation techniques, establishing FSG and making the farming revolving fund available. Results of all these activities were reported in JCC-4, held in July 2012.

In addition to the activities mentioned, the third year saw the establishment of verification and demonstration fields for the direct sowing rice cultivation techniques. A large scale flood occurred in January 2013, while the mid-term review was under survey. The Project target areas were affected by this flood to a large degree. Although the Project goals were favorably expected to be achieved at the time before the flood occurred, as a result of the flood, the Project implementation team was suggested to reconsider PDM (especially in regard to numerical value indicators). The flood damage to D5 and D6 areas were catastrophic, where the rice in D11 and D12 areas was harvested with a low yield. However, the implementing agencies together recognized that there was no necessity to extend the term of the Project cooperation. The PDM, suggested by the mid-term review survey delegate, was approved at JCC-6 in July 2013 as the PDM-2. Despite the catastrophic damage of the flood, a Field Day was organized in D11 targeting all of the FSG farmers, along with a series of training courses on the use of the man-powered row paddy seeder, individual book keeping sessions offered to each FSG farmer and sharing the results of a variety of tests.

In the fourth year, FSG farmers in D5 area decided to do direct sowing as they were concerned with the possible reoccurrence of the flood, while in D6 target area, rice was not cultivated at all during this time. These changes made it impossible to establish the demonstration fields for transplanting rice cultivation as originally planned, but the demonstration as well as verification fields for direct sowing rice cultivation were established as planned. The rice variety performances and different sowing methods were compared and tested in the verification and trial fields. As for the demonstration fields for the direct sowing rice cultivation, FSG farmers experienced applying fertilizers and spraying herbicide under the supervision of the counterpart, resulting in a high yield. At the same time, these FSG farmers held a Field Day for non-FSG farmers on the demonstration field for the direct sowing rice cultivation technique, in order to share and extend some of these related techniques. Training sessions on the man-powered row paddy seeder as well as workshops on how to manufacture the seeder were also held, while the field tour for FSG farmers, trainings on book keeping and on transplanting rice cultivation techniques using the trial field were also organized and realized. Moreover, the farming survey was conducted to FSG and non-FSG farmers, in order to understand the conditions for rice cultivation as a whole. The rate of rice earnings was analyzed based on the survey as well as an assistance series for FSG farming revolving fund and book keeping, etc. which was provided. The evaluation survey at the time of completion began in May 2014. Its outcome was presented and approved

during JCC-8 held on June 12. The Project goals were not achieved agreeably if considering only what the indicators show, particularly due to the flood damages. Yet, the original goal of the Project (promoting the rice cultivation by the small-scale farmers) was recognized as having resulted in prominent progress. A number of suggestions were made, such as a documentation of the Project achievement, an enhancement of training opportunities, a reinforcement of coordination among involved agencies, the continuing use of the farming revolving fund and giving a thorough consideration to the break-even point regarding production and revenue. Having these suggestions in mind, a number of technical manuals on all of the related techniques were compiled, as part of the documentation of the achievements of the Project. In addition, the direct sowing rice cultivation posters were printed with many illustrations and distributed to farmers. Lastly, the final seminar was held for a wide range of people involved with rice cultivation in one way or other, in order for the Project achievement to be shared and spread. The achievement was reported and issues and suggestions for future consideration were made at JCC-9.

Table 3.1.1 Outline of Target Area

Irrigation Area	Cultivation Area (ha)	Registered Farmer
D5	247	324
D6	163	156
D11	999	301
D12	710	423
R1	186	350
R3	169	169
Total	2,474	1,723

3.2 Assignment Plan and Dispatch Record of Japanese Experts

The dispatch record of Japanese experts and the assignment plan are specified in the table 3.2.1 and the Figure 3.2.1.

Table 3.2.1 (1) Dispatch Record of Japanese Experts

Name	Expertize	Period	Company
Akio MAEDA	Chief Adviser & Rice Cultivation Technique	2011.2.26-2011.4.26 2011.6.9-2011.7.8 2011.10.12-2012.2.8	Rural Development Institute Ltd.
Kiyoshi MASUBUCHI	Chief Adviser & Rice Cultivation Technique	2012.3.31-2012.4.28 2012.6.9-2012.8.7 2012.10.12-2013.2.8 2013.5.5-2013.8.2 2013.10.19-2014.1.16 2014.4.12-2014.7.10 2014.8.2-2014.9.30	Rural Development Institute Ltd.
Nobuharu MORITA	Extension / Farmers' Organization	2011.4.21-2011.6.19 2011.10.12-2012.2.8 2012.3.31-2012.7.28	Rural Development Institute Ltd.

Table 3.2.1 (2) Dispatch Record of Japanese Experts

Name	Expertize	Period	Company
Masahiro OTAKE	Extension / Farmers' Organization	2012.10.12-2013.3.10 2013.4.5-2013.8.2 2013.10.19-2014.1.16 2014.4.12-2014.7.10 2014.8.2-2014.9.30	Rural Development Institute Ltd.
Teruhisa NAMBA	Agronomy	2011.4.21-2011.5.20 2011.10.15-2012.12.13 2012.3.31-2012.5.29 2012.10.12-2012.12.10 2012.10.12-2013.12.10 2013.4.5-2013.5.4 2013.10.19-2013.11.17	Rural Development Institute Ltd.
Yorio IITSUKA	Agri. Machinery / Equipment & Mechanization Post-harvest Processing	2011.10.15-2011.12.13 2012.6.9-2012.7.8 2012.10.12-2012.11.25	Rural Development Institute Ltd.
Toru HAMANAKA	Agri. Machinery / Equipment & Mechanization	2013.10.19-2013.12.17 2014.4.12-2014.6.16 *1)	Rural Development Institute Ltd.
Takashi KURAUCHI	Irrigation Water Management	2012.5.12-2012.7.10 2013.6.4-2013.8.2 2014.5.12-2014.7.10	Rural Development Institute Ltd. Contractor
Kenji SUEMITSU	Socioeconomics & Marketing	2011.4.1-2011.5.30	Rural Development Institute Ltd.
Naoyoshi KAWANO	Socioeconomics & Marketing	2014.4.12-2014.7.10	Rural Development Institute Ltd.
Yumiko TAKEDA	Coordination / Training	2011.2.26-2011.4.26 2011.6.9-2011.7.8 2011.10.12-2012.1.9 2012.6.9-2012.8.7	CDC International Corporation
Samueru TANAKA	Coordination / Training	2012.10.12-2013.2.8 *2) 2013.3.6-2013.8.2 *3) 2013.10.19-2012.12.17	Rural Development Institute Ltd.
Asako RIERA	Coordination / Training	2013.12.19-2014.3.17 *4) 2014.4.12-2014.7.10 *4) 2014.8.2-2014.9.30 *5)	Rural Development Institute Ltd.
Kenji SATO	Project Support	2012.3.31-2012.6.12 *1)	Rural Development Institute Ltd.

*1) Expenses on RDI for entire duration on site

*2) Expenses on RDI as of day 76 for another 45 days on site

*3) Expenses on RDI as of day 60 for another 90 days on site

*4) Expenses on RDI as of day 30 for another 60 days on site

*5) Expenses on RDI as of day 30 for another 30 days on site

	Expertize	Name	Company	Grade	Year	First OP(2011)	Second Operation Year(2011/2012)	Third Operation Year(2012/2013)	Forth Operation Year(2013/2014)	First OP (MM)	Second OP (MM)	Third OP (MM)	Fourth OP (MM)
					Month	2 3 4 5 6 7 8	9 10 11 12 1 2 3 4 5 6 7 8	9 10 11 12 1 2 3 4 5 6 7 8	9 10 11 12 1 2 3 4 5 6 7 8 9 10				
Fieldwork	Chief Adviser / Rice Cultivation Technique	Akio MAEDA	Rural Development Institute Ltd.	2	Plan	(Travel frequencies: 2 times)	(Travel frequencies: 1 time)			3.00	4.00	–	–
					Result	26 (60) 26 9 (30) 8	12 (120) 8			3.00	4.00	–	–
	Chief Adviser / Rice Cultivation Technique	Kiyoshi MASUBUCHI	Rural Development Institute Ltd.	2	Plan		(Travel frequencies: 2 times)	(Travel frequencies: 2 times)	(Travel frequencies: 3 times)	–	3.00	7.00	8.00
					Result		31 (30) 29 9 (60) 7	12 (120) 8 5 (90) 2	19 (90) 16 12 (90) 10 2 (60) 30	–	3.00	7.00	8.00
	Extension / Farmers' Organization	Nobuharu MORITA	Rural Development Institute Ltd.	3	Plan	(Travel frequencies: 1 time)	(Travel frequencies: 2 times)			2.00	8.00	–	–
					Result	21 (60) 19	12 (120) 8 31 (120) 28			2.00	8.00	–	–
	Extension / Farmers' Organization	Masahiro OTAKE	Rural Development Institute Ltd.	3	Plan			(Travel frequencies: 2 times)	(Travel frequencies: 3 times)	–	–	9.00	8.00
					Result			12 (150) 10 5 (120) 2	19 (90) 16 12 (90) 10 2 (60) 30	–	–	9.00	8.00
	Socioeconomics / Marketing	Kenji SUEMITSU	Rural Development Institute Ltd.	3	Plan	(Travel frequencies: 1 time)				2.00	–	–	–
					Result	1 (60) 30				2.00	–	–	–
	Socioeconomics / Marketing	Naoyoshi KAWANO	Rural Development Institute Ltd.	3	Plan				(Travel frequencies: 1 time)	–	–	–	3.00
					Result				12 (90) 10	–	–	–	3.00
	Agronomy	Teruhisa NAMBA	Rural Development Institute Ltd.	3	Plan	(Travel frequencies: 1 time)	(Travel frequencies: 2 times)	(Travel frequencies: 2 times)	(Travel frequencies: 1 time)	1.00	4.00	3.00	1.00
					Result	21 (30) 20	15 (60) 13 31 (60) 29	12 (60) 10 5 (30) 4	19 (60) 17	1.00	4.00	3.00	1.00
	Agri. Machinery / Equipment/ Mechanization	Yorio IITSUKA	Rural Development Institute Ltd.	3	Plan		(Travel frequencies: 1 time)	(Travel frequencies: 1 time)		–	2.00	1.50	–
					Result		15 (60) 13	12 (45) 25		–	2.00	1.50	–
	Post-harvest Processing	Yorio IITSUKA	Rural Development Institute Ltd.	3	Plan		(Travel frequencies: 1 time)	(Travel frequencies: 1 time)		–	1.00	1.00	–
					Result		9 (30) 8	27 (30) 26		–	1.00	1.00	–
	Agri. Machinery / Equipment / Mechanization	Toru HAMANAKA	Rural Development Institute Ltd.	3	Plan				(Travel frequencies: 2 times)	–	–	–	2.00
					Result				15 (60) 17 12 (60) 16	–	–	–	2.00
	Irrigation Water Management	Takashi KURAUCHI	Rural Development Institute Ltd.	3	Plan		(Travel frequencies: 1 time)	(Travel frequencies: 1 time)	(Travel frequencies: 1 time)	–	2.00	2.00	2.00
					Result		12 (60) 10	4 (60) 2	12 (60) 10	–	2.00	2.00	2.00
	Coordination / Training	Yumiko TAKEDA	CDC International Corporation	4	Plan	(Travel frequencies: 2 times)	(Travel frequencies: 2 times)			3.00	5.00	–	–
					Result	26 (60) 26 9 (30) 8	12 (90) 8 9 (60) 7			3.00	5.00	–	–
	Coordination / Training	Samueru TANAKA	Rural Development Institute Ltd.	4	Plan			(Travel frequencies: 2 times)	(Travel frequencies: 1 time)	–	–	4.50	2.00
					Result			12 (75) 25 (45) 8 8 (60) 4 (90) 2	19 (60) 17	–	–	4.50	2.00
	Coordination / Training	Asako RIERA	Rural Development Institute Ltd.	4	Plan				(Travel frequencies: 3 times)	–	–	–	3.00
					Result				18 (30) 17 12 (30) 10 2 (30) 30	–	–	–	3.00
Work Japan	Chief Adviser / Rice Cultivation Technique	Akio MAEDA	Rural Development Institute Ltd.	2	Plan					0.40	0.10	–	–
					Result	21 (3) 1 (9)	13 (3) 25			0.40	0.10	–	–
	Chief Adviser / Rice Cultivation Technique	Kiyoshi MASUBUCHI	Rural Development Institute Ltd.	2	Plan	3 days				–	0.10	0.20	0.30
					Result		8 (3) 10	(3) 11 5 7	1 9	–	0.10	0.20	0.30
										11.40	29.20	28.20	29.30

Field Work　Work in Japan　Expenses on RDI

Figure 3.2.1. The dispatch record of Japanese experts and the assignment plan

3.3 Joint Coordination Committee (JCC) and Steering Committee (SC)

The JCC (Project Joint Coordination Committee) is the decision making organ concerned with the Project policy, and its core members are, therefore, counterparts from the other organizations involved such as National Directorate of Agricultural Extension (DNEA), Provincial Directorate of Agriculture, Gaza (DPA GAZA), District Services for Economic Activities (SDAE), Chokwe Hydraulic Public Corporation (HICEP), Chokwe Agricultural Research Station (EAC), as well as the JICA Mozambique Office and the Project Experts' Team. The Project held nine meetings of the Joint Coordination Committee (JCC).

The implementing agencies of the Project set up the Steering Committee (SC) for the purpose of coordinating related work and activities and monitoring the Action Plan and a few meetings were held every year to consider the works progress.

Table 3.3.1 (1) Outline of JCC and SC Meetings

Title	Date	No. of attendee	Target	Venue	Agenda
JCC-1	18 Mar. 2011	22	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Confirmation of the Action Plan progress ・Approval on the first year Work Plan
JCC-2	30 Jun. 2011	27	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Confirmation of the Action Plan progress ・Explanation on the outline of the Baseline Survey ・Presentation of the PDM-1 and the Detailed Work Plan
SC-1, 1st OY	15 Mar. 2011	7	SDAE、HICEP、EAC	SDAE Meeting RM	・Role allotment for JCC-1 ・Future plan
SC-2, 1st OY	06 May 2011	7	SDAE、HICEP、EAC	SDAE Meeting RM	・Introduction of newly assigned experts ・The progress of the Action Plan ・Future plan
SC-3, 1st OY	16 Jun. 2011	8	SDAE、HICEP、EAC	SDAE Meeting RM	・Suggestion for setting PDM-1 of the Action Plan ・Discussion / report of machinery procurement ・Greeting by experts before returning
JCC-3	28 Oct. 2011	23	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Progress on reconstruction of irrigation facilities (HICEP) ・Variety Test and Seed propagation (EAC) ・Agriculture extension, report on training (SDAE) ・2011/12 rice production report (MIA) ・Presentation of the Work Plan (2nd OY)
SC-1, 2nd OY	21 Oct. 2011	12	SDAE、HICEP、EAC	SDAE Meeting RM	・Introducing experts and counterparts for the 2nd OY ・Preparation for JCC-3
SC-2, 2nd OY	16 Dec. 2011	10	DPA Gaza、SDAE、HICEP、EAC	SDAE Meeting RM	・Report on project progress ・Report on Action Plan progress
SC-3, 3rd OY	27 Jan. 2012	8	DPA Gaza、SDAE、HICEP、EAC	SDAE Meeting RM	・Report on Action Plan progress ・Report on Flood affected area ・Report on Action Plan progress

Table 3.3.1 (2) Outline of JCC and SC Meetings

Title	Date	No. of attendee	Target	Venue	Agenda
SC-4, 2nd OY	19 Jul. 2012	10	DPA Gaza、SDAE、HICEP、EAC	SDAE Meeting RM	・Report on Action Plan progress ・Sharing information on the monitoring result ・Confirmation of activity design ・Preparation for JCC-4 ・Consideration of PDM
JCC-4	26 Aug. 2012	25	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Confirmation of work progress and achievement for 2nd OY ・Detailed activity achievement HICEP ・Detailed activity achievement EAC ・Detailed activity achievement SDAE ・Presentation of Work Plan (3rd OY)
SC1, 3rd OY	26 Oct. 2012	10	SDAE、HICEP、EAC	SDAE Meeting RM	・Consideration of Work Plan (3rd OY) ・Preparation for JCC-5
JCC-5	22 Nov. 2012	29	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Conference room of the Limpopo Hotel	・Approval of Work Plan (3rd OY) ・Confirmation on activities for 3rd OY
SC-2, 3rd OY	16 Jan. 2013	9	SDAE、HICEP、EAC	SDAE Meeting RM	・Schedule of mid-term review, consideration of observation locations ・Consideration of PDM amendment
SC-3, 3rd OY	20 Jun. 2013	10	DPA Gaza、SDAE、HICEP、EAC	SDAE Meeting RM	・Report on flood damages ・Consideration on PDM amendment
SC-4, 4th OY	19 Jul. 2013	6	SDAE、HICEP、EAC	SDAE Meeting RM	・Report on flood damages ・Consideration of PDM amendment
JCC-6	26 Jul. 2013	22	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Approval of PDM-2 ・Report on flood damages ・Explanation on the achievement of activities in 3rd OY
SC-1, 4th OY	21 Nov. 2013	9	SDAE、HICEP、EAC	SDAE Meeting RM	・Discussion and approval of Work Plan (draft) (4th OY)
JCC-7	25 Nov. 2013	22	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Discussion and approval of Work Plan (draft) (4th OY)
SC-2, 4th OY	08 Jan. 2014	10	SDAE、HICEP、EAC	SDAE Meeting RM	・Confirmation of Action Plan progress ・Preparation for final evaluation / seminars, etc.
SC-3, 4th OY	23 Apr. 2014	10	SDAE、HICEP、EAC	SDAE Meeting RM	・Introduction of newly assigned experts ・Monitoring of Action Plan ・Content of final evaluation ・Discussion on content of technical manuals
SC-4, 4th OY	14 May 2014	6	SDAE、HICEP、EAC	SDAE Meeting RM	・Monitoring of Action Plan ・Confirmation of necessary documents prior to the final evaluation ・Confirmation of the list of questions for the final evaluation

Table 3.3.1 (3) Outline of JCC and SC Meetings

Title	Date	No. of attendee	Target	Venue	Agenda
JCC-8	12 Jun. 2014	23	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	SDAE Meeting RM	・Presentation, discussion and approval of the result of the final evaluation
SC-5, 4th OY	27 Jun. 2014	9	SDAE、HICEP、EAC	SDAE Meeting RM	・Preparation for the final seminar
SC-6, 4th OY	12 Aug. 2014	7	SDAE、HICEP、EAC	SDAE Meeting RM	・Preparation for final seminars ・Presentation of final seminars
SC-7, 4th OY	10 Sep. 2014	7	SDAE、HICEP、EAC	SDAE Meeting RM	・preparation for JCC-9 ・Activity Plan for post-Project
JCC-9	19 Sep. 2014	18	DNEA, JICA office, involved persons to rice cultivation, DPA Gaza, SDAE, HICEP, EAC	Meeting RM, Chokwe county bldg.	・Presentation, discussion and approval of Project achievement and post-project work plan.

The JCC-1 meeting had reports and presentations relating to the progress of the Action Plan as well as the activities of the implementing agencies. The overall work plan for the Project and the Work Plan for the first operation year were explained. Through the workshop styled discussion, opinions were summarized and the "Work Plan (1st OY) was approved.

The JCC-2 continued to confirm the progress of the Action Plan and gave an outlined explanation of the Baseline Survey outcomes and a presentation of the PDM-1 as well as of the Detailed Work Plan. These were all approved by the committee.

The JCC-3 had implementing agencies report on their work progress according to the Action Plan. A private company based in Chokwe, MIA, was invited to this meeting in order to earn an understanding of their activities through an explanation of their business outline at the period of seeding that year. MIA was also requested to explain what MIA thinks the inevitable items are that will, from their point of view, improve rice cultivation production. The Project presented the Detailed Work Plan for the second operation year, and involved personnel gave input during discussions regarding the plan.

The JCC-4 offered an opportunity for target personnel, prior to the meeting, to have an onsite observational tour to see the rice milling machine in Masavasse that the Project and established FSG (D5). The main agenda of the JCC meetings were the work progress reports from the three implementing agencies in regard to progress monitoring of the Action Plan, the amendments of the Project target value (PDM indicators) and the operation work plan of the third operational year. The JCC attendees forwarded their opinions on further necessary efforts to farmers, the extension method and reconsideration of approaches to farmers.

The JCC-5 meeting discussed and approved the Work Plan for the third operational year. The Work Plan (3rd OY) expressed the targets in more detail, based on comments offered during the JCC-4 meetings. A number of issues were discussed at the meeting, such as the in detail activities of the Work Plan, the manual seeder in regard to the direct-sowing cultivation technique, the administration of the farming revolving fund, making requests for the personnel of the Chokwe Irrigation Scheme, who manage the irrigation water on a

daily bases, the need to have training relating to the management of irrigation water, etc. The chairman's statement included other issues, such as the effect on other provinces of the technique packages developed in Chokwe, the curtailment of labor costs by adopting agricultural machinery, the consideration of adding more value to the rice by milling it, holding a Field Day to extend the cultivation techniques to farmers as well as extension agents, the trainings for HICEP staff who are in charge of daily water management, the adoptability of both direct sowing and transplanting cultivation techniques, etc.

The JCC-6 had reports on the activities achieved during the third operational year. At the same time, the results and comments from the mid-term evaluation were reported. PDM indicators were reconsidered and discussed, and any amendments made were approved. Moreover, the flood damage of 2013 was reported. The chairman made comments on two points: the reinforcing of the management of the farming revolving fund for the Project to become autonomous and more developed and creating manuals for the improved techniques that were developed in Chokwe, with visual aids, in order to extend these techniques to local farmers.

The JCC-7 discussed and approved the Work Plan of the forth operation year. A number of discussions were made, and topics included the detailed activity reports of the Work Plan, the operation and management method of the farming revolving fund for farmers affected by the flood, the counter measures against salt damage as well as flooding and profitability. For the Chairperson's statement, the chair suggested the continuous management of the Project's farming revolving fund through offering loans by the Fund for the District Development of Chokwe (FDD) to farmers. Also, the expansion of demonstration fields, the ripple effect of improved techniques to other provinces and the counter measures against the flood were mentioned.

The JCC-8 had a presentation of the evaluation at its completion, which was approved. Some other issues were also discussed, such as the utilization of the agricultural machinery and the possibility of extending improved techniques to other provinces. The Chairman's statement was on the importance of the coordination among implementing agencies and the extension of improved techniques to other provinces.

The JCC-9 had a presentation of the achievement of the project through four years and the post-project work plan to achieve the project overall goal after three years. The Chairman's statement was on the importance of activities continuation after project completion to disseminate developed rice cultivation technique by the project more.

3.4 Record of Machinery and Equipment Procurement

3.4.1 Record of Machinery and Equipment Procurement

Regarding the machines that failed to be procured during the first year, due to miscommunication with an on site trader, the Project succeeded to rearrange the contract and procure the necessary machinery during the second year through a different trader. Therefore, all of the procurement on site was carried out as planned.

During the third year, some expendables parts were supplied, for the machinery already provided, such as chisel plows and the blades of the rotavator, although there was no procurement of new machinery. It took an exceptionally long time to obtain these parts, due to the disagreeable coordination between the National

Directorate of Agricultural Extension, Ministry of Agriculture, and customs brokers, but those parts were eventually procured within the operational year. Among the donated machinery, in particular the agricultural machinery, special attention was paid on handing, operating and managing this machinery. After handing them over to the care of the counterpart, a number of trainings were offered by the Project experts (agriculture machinery/mechanization, post-harvest processing).

As for the selection of the tractor, the principle piece of machinery, six types, by three makers, were selected as candidates. These were studied carefully and comparisons about price, specifications regarding the operation and performance in the flooded fields and whether or not the machinery matches to the small and middle scale farmers' use were all made. In the end, two makers models were left after such a thorough consideration (John Deere and New Holland) after further consideration including interviews to shops and studying the actual machinery as well as after-sales services considerations such as providing spare parts, etc., the 5503-4WD made by John Deere was finally selected. The procurement of high price machinery and equipment was conducted and complied with the JICA Guidelines for Machinery and Equipment Procurement. It took an unexpectedly a long time to exchange the contract, due to the hesitation shown by the trader. Although the contract has a clear statement of the warranty period, the trader hesitated to clearly state the warranty time and value on the contract. The reason was because of the constant price fluctuation in Mozambique, caused by vigorous economy of the country. (Please referred to Appendix 6 for the record of procurement of machinery and equipment)

3.4.2 Current Operation of Provided Materials, Machinery and Equipment

The machinery and equipment procured during the Project term have been properly utilized. In regard to the rice milling machines which were set up in Muianga and Masavasse, training sessions in the management methods and book keeping were given to a group of personnel designated to manage these machines, so it has been possible for the milling machines have been constantly in use. Both of the demonstration farms as well as the verification fields have been properly set up with the use of tractors and other appropriate accessories such as the rotary and the chisel plough. These pieces of equipment have also been well managed.

3.4.3 Maintenance and Management of Materials, Machinery and Equipment

The machinery has been stored in the storage facility of the Project office (SDAE) and the project manager takes responsibility for the facility as well as the machinery. He supervises the keeping of materials, machinery and equipment by making it an obligation to keep a maintenance and management ledger (an operation management ledger for agricultural machinery), therefore proper maintenance management has been carried out.

Due to the flood of 23rd January 2013, two power-tillers, the rice milling machine of Muianga, and one motor bike was soaked. However, the prompt maintenance soon after the government withdrew the evacuation order from Chokwe made it possible for them to be in use again. There have been no issues that have occurred, in regard to their maintenance, since then.

3.5 Provision of Conveniences by the Counterpart Organization and Implementing Agencies

3.5.1 Current state of the provision of conveniences by the counterpart organization and implementing agencies

In accordance with the provisions of the concerned Article on R/D, the condition of the third year is as follows.

Table 3.5.1 Present Condition of Provision of Conveniences by the Counterpart Organization and Implementing Agencies

No	Items of Convenience Provision	Condition
1	To secure the safety of project implementing members	・Provided information of medical institutions in Chokwe, and arranged prioritized assistance ・Provided information on issues to be alert to around Chokwe ・Installed a security fence for the Project office
2	To exempt alien registration procedures and expenses	・Filling applications to extend VISA of experts ・No exemption on VISA related expenses
3	To exempt tax upon income, allowance, and survey expenses	・Applied by JICA Mozambique Office all at the same time
4	To provide convenience upon sending and using operational budgets	・Assisted in applying conveniences of simplified handling at financial institutions
5-a	Provision of data, information, and sample	・Provided information from C/P upon request from the Project ・Consideration should be given to sort out data and information stock
5-b	Posting counterparts in required areas	・Consideration should be given to the shortage of counterparts
5-c	Allocation of space and desks for the project counterpart office	・Established within the first year
5-d	Issuance of identification	・No convenience to be given
5-e	Allocation of mutual space and necessary office furniture for working collaboratively and meetings	・Established within the first year

3.5.2 Problems and Issues in regard to the Provision of Conveniences by the Counterpart Organization and Implementing Agencies

The information from the C/P organizations was provided, regarding dangerous issues around Chokwe and any other related issues, to secure safety for the Project members. Nevertheless, the communication at the time of the flood of January 2013 was very difficult with complicated and confused information. This resulted in insufficient action being taken to deal with this difficult situation. At the same time, regarding to 5-a "Provision of data, information, and sample," the data management system is rather closed and it is not yet in the position where all of the information is shared among C/P organizations. The 5-b "Posting counterparts in required areas" is to be stated in Chapter 5.

3.6 Public Relations

The Public Relations of the Project has promoted coordination and cooperation among various

organizations in order to achieve the project objectives. This has been done through opportunities to discuss matters with the involved organizations at JCC and/or on other occasions and releasing the work objectives of the Project, etc. During the fourth year, the Project invited people who are highly interested in the rice cultivation project (from agencies of Ministry of Agriculture, research institutions, private sectors, assisting organizations, NGOs and local administrative organs) to the final seminar, for the purpose of promoting the activities and achievements of the Project and the improved rice cultivation techniques, as well as to exchange opinions. At the same time, the Project information was introduced on the JICA ODA site, making it possible to circulate its progress and related information for the wider public to view.

There have also been a number of opportunities for C/P personnel to give presentations about the Project achievements and the improved techniques, such as during various occasions held by the Ministry of Agriculture. The C/P has also dealing with media as well.

Moreover, newsletters, manuals and posters were made as a means of PR. The newsletters contained periodical information about the activities of each C/P organization and the progress they made during each operational year. These newsletters were distributed to the organizations involved. Manuals were also made, on all of the techniques that the Project dealt with, in a very easy to understand manner, in order to promote the improved rice cultivation techniques. At the same time, posters with many illustrations were made and distributed to farmers to extend the information about the rice cultivation techniques as well as about the Project.

Table 3.6.1(1) Outline of Public Relations

Opportunities	Activity Outline
JCC	The work progress of the Project was given to JCC attendees (personnel from local autonomies, research institutes, private sectors, academia, representatives of farmers' associations, Water Users Association, etc.)
Final Seminar	The activities and achievement of the Project and the improved rice cultivation techniques were presented to people from outside, who are highly interested in the rice cultivation project, and opinions were exchanged.
Opportunities of exchanging opinions among involved organizations	Opportunities to exchange opinions with MIA were realized to forward the objectives of the Project and to build a network between involved personnel on the Project site, in order to promote coordination and collaboration concerned with the Project activities.
ODA web site	It has become possible for the outline of the Project as well as the relative information to become available to the wider public through the internet.
Participation and Presentation on various occasions	The Project achievement and the improved techniques were introduced on various occasions held by the Ministry of Agriculture
PR through media	The C/P proactively dealt with media interviews.
Project Newsletter	The newsletters dealt with the Project work progress of the implementing agencies and were distributed to local autonomies as well as to FSG, etc.

Table 3.6.1(2) Outline of Public Relations

Opportunities	Activity Outline
Manuals and posters	In order to gain a wider public understanding all of the techniques that the Project dealt with were collected into manuals with thorough explanations. Posters were also made with a number of illustrations. These posters were distributed to farmers.
Trainings	A specially designed polo shirt with a Project logo mark was created and was distributed to FSG and rice cultivation related personnel during the Field day; at the same time, detailed information on the Project activities was shared.

3.7 Work in Japan

Regarding the work in Japan, the Operation Plan, the Work Plan, the Work Progress Report and the Work Completion Report were made and submitted. At the time of completion of the on-site work for the fourth operational year in October 2014, the Work Completion Report was made and submitted within the Project term.

4. Progress of Detailed Work Plan

4.1 Improved rice cultivation techniques of transplanting are disseminated to the target farmers (Output 1)

4.1.1 Examination and development of effective extension methods

According to the HICEP statistics over the most recent five years, the average cultivation field area for rice paddy in the Chokwe Irrigation Scheme has been 5,000ha. The total field area has tended to be less since 2012. Among the total of 26,000ha of land available for cultivation within the scheme, 19.2% is used for rice paddy, 17.9% for upland crops and approximately 70% has been abandoned or unused.

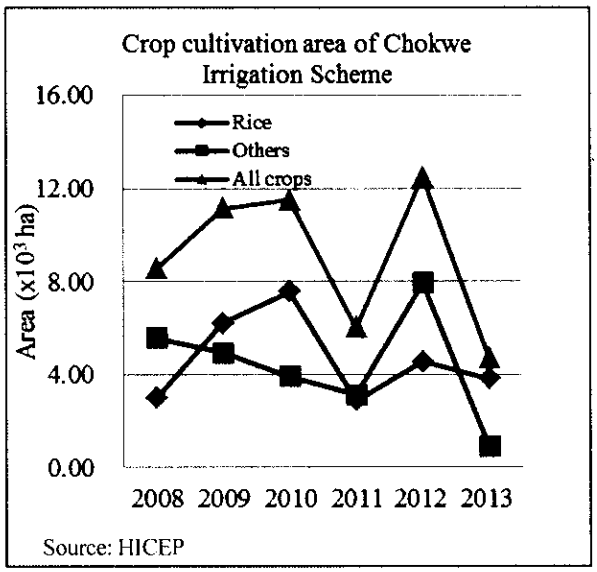


Figure 4.1.1 Transition of crop cultivation are in Chokwe Irrigation Scheme

Possible reasons for the stagnation in using available land for rice paddy cultivation may be that the irrigation facilities are getting old and that there is a long distance between the cultivation land and the residential areas. It is also assumable that the farmers are not motivated. As of the second operational year, the Project has promoted several ideas to motivate such farmers for rice paddy cultivation along with the improvements in rice cultivation techniques The promoted ideas are the establishment of a relationship with the private sector in the field (especially MIA) to work in coordination, with each other, the introduction of new paddy varieties other than ITA312 and the verification of profitability of rice paddy cultivation. Occasionally, the Project heard farmers say "transplanting paddy is very expensive and isn't profitable," but the Project found out that there were not really any valid reasons for them to believe so. The technology to gain high paddy yield is also not necessarily the most economically efficient. Therefore, the Project has carried out a survey to study the total cost of rice paddy cultivation from plowing the land to harvesting, since 2012. At the same time, the Project studied the group attribution of farmers in six Project target areas (D5, D6, D11, D12 R1 and R3). The details are as follows.

(1) Formulation of improved techniques

As of 2012, the demonstration field for rice cultivation of transplanting was also used for verifying the influential factors to the paddy yield and yield components. Those factors were land preparation, plowing method, puddling, leveling and quality of seedling (age of seedling) The effect between the methods of preparing land and plowing to the yield gained was verified in the fields of FSG farms in D5 and D6 by comparing the improved method of using a chisel plow and a rotavator, with the conventional method, using a disc plow and a disc harrow. The table 4.1.1 shows the results which found no significant differences in yield between two fields prepared by two different methods. As for the effect on the yield components, there were not any notable differences either. Although there was no relation between the rate of filled spikelet and 1,000 grain weight, when the degree of influence of yield components was compared to the yield, there was, however, a relation recognized in the number of panicle per unit area.

Table 4.1.1 Effect of methods in preparing land and plowing to yield and yield components

Treatment	Hill/m^2	Panicle/m^2	Spikelet/panicle	Spikelet/m^2	Filled spikelet (%)	1000 grain weight (g)	Yield (t/ha)
Improved (average)	36.3	273	107.6	29,004	74.7	26.4	5.68
	0.339ns	0.809**	0.456ns	0.810**	0.47ns	0.157ns	-
Traditional (average)	35.8	236	109.3	26,285	76.9	27.05	5.36
	0.062ns	0.800**	0.432ns	0.949**	-0.619ns	0.269ns	-

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

As for the influence of puddling and leveling to yield and yield components, the puddling and leveling with a use of a power tiller and the conventional manual puddling and leveling were practiced in the FSG farms in D5 and D6, to verify their effect. As the table 4.1.2 shows the results the puddling and leveling with the use of a power tiller did contribute to higher yield. It was also found that the field prepared by the power tiller had a higher number of panicle per unit area. Perhaps, the puddling and leveling with the power tiller contributed in preventing the erosion of the nitrogen fertilizer. There was a remarkably high correlation recognized between yield and the number of panicle per unit area.

Table 4.1.2 Effect of puddling and leveling by power tiller to yield and yield components

Treatment	Hill/m^2	Panicle/m^2	Spikelet/panicle	Spikelet/m^2	Filled spikelet (%)	1000 grain weight (g)	Yield (t/ha)
Power tiller (average)	50.2	315	105	32,920	76.2	25.97	6.51
Manual (average)	36.0	221	112	24,692	79.2	27.13	5.26
	0.561*	0.795**	0.154ns	0.155ns	0.154ns	-0.377ns	-

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

In regard to the study to see the effect by the different seedling qualities to the yield and yield components, seedlings of two different ages (young ones at five-leafing stage and another at eight-leafing stage) were transplanted in FSG farm fields in D5 and D6. The table 4.1.3 shows the results. There were correlations recognized in the yield and the number of panicle per unit area, the number of spikelet per unit area, the rate of filled spikelet and 1,000 grain weight, which verified that the older seedlings lower the yield to a large degree. To have a good number of panicle per unit area was found to be very important

again. It was quite possible that old seedlings at eight-leafing stage were too close to the effective tillering stage, a condition which lowered the number of panicle per unit area, resulting in the low yield.

The correlation between yield and yield components were found at 1% standard in the number of panicle per unit area, the number of spikelet per unit area and the rate of filled panicles. For the field planted with the older seedlings, only the number of panicle per unit area showed a correlation. A positive correlation to the overall yield and yield components was found at 1% standard with the number of panicle per unit area and the number of spikelet per unit area, where the negative correlation was found with the 1,000 grain weight. No correlation was found between the number of spikelet per panicle and the yield in any of the target fields. This might have been due to a variety of characteristics.

Table 4.1.3 Effect of seedling age to yield and yield components

Young seedling (average)	314.0	101	31,833	71.6	25.6
Old seedling (average)	235.0	93	21,930	68.8	26.2
Young seedling	0.830**	0..016ns	0.727**	0.792**	-0.920**
Old seedling	0.757**	0.080ns	0.423ns	0.420ns	-0.158ns
Whole data	0.951**	0.538ns	0.934**	0.475ns	-0.764**

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

(2) Reinforcement of coordination with MIA

The Project began activities to reinforce the coordination with MIA from the year 2012, through introducing the MIA recommended variety to the Chokwe Irrigation Scheme, establishing verification/demonstration fields in cooperation with MIA and organizing Field Days. MIA provided three of their recommendation varieties, so the variety test was realized at EAC. A demonstration of these varieties of rice was made available in 2012 at four demonstration fields in D5, D6, D11 and D12. Although some of these demonstration fields were completely damaged by the flood 2013, including the variety test field within EAC property and demonstration fields in D5 and D6, the attributes of target varieties were confirmed at the demonstration fields in D11 and D12. This variety test was carried out also in 2013, setting up demonstration fields to compare the varieties; therefore, the attribution of the target rice variety was studied over two cropping seasons, 2012 and 2013.

(3) Introduction of promising varieties

The ITA312 is the representative rice variety in the Chokwe Irrigation Scheme. Yet the quality has been deteriorating as quality screening has not been taking place for some time and also seeds of other varieties and species have been mixed in. Although there are MIA recommendations for seed varieties, there have been no demonstration fields for farmers to learn about them. Under these circumstances, most of the farmers have used ITA312. Having this current situation, six rice varieties were tested for their attributes and productivity over two years, 2012 and 2013. These six varieties are IRGA409, Farox and Alvorada, which are recommended by MIA, and Macassane and Vembe, recommended by EAC, along with ITA312 as a target plot. As a result, five (IRGA409, Farox, Alvorada, Macassane and ITA312) out of six varieties were found equally profitable, which means these four recommended varieties were not inferior to ITA312. One, on the other hand, the Vembe variety, grows in an extremely short time and it was also found low in shattering resistance. For these reasons, this particular variety was considered unsuited to the Chokwe Irrigation Scheme.

(4) Survey on rice paddy cultivation expenditure and machine fees

Rice cultivation techniques to realize high revenue is absolutely necessary in order to motivate farmers in their rice cultivation. Machines can be used for rice cultivation: power tillers for puddling and for transplanting and rotavator plowing and a manual seeder for seeding and for direct seeding. However, the expenses involved in introducing such machines as a new technology were not confirmed. Farmers need to see their yield increase through the demonstration of newly introduced techniques as well as to believe that their income will increase by using them, before they can become convinced about the merits of rice cultivation. Therefore, a series of research and study was carried out from 2012, including interviews on the cultivation expenditure of conventional cultivation techniques, a location survey on cultivation expenditure using the improved techniques at verification/demonstration fields, another location survey on the operation amount of cultivation activities with machinery and its operation costs.

Table 4.1.4 Work volume of each item of machinery (2012-2014)

Type of work	Machinery	Model of machinery and implement	Working width (m)	Working speed (km/h)	Field work performance (ha/hour)	Field work efficiency (hour/ha)	Fuel consumption ? lit/h)	Remarks
Plowing	Rotary tiller? tractor traction	NIPLO MXK2000	2.0	2.70	0.28	3.62	7.95	Tractor: JD5503 75HP ? gera: A1/B3? revolution: 1500/2000rpm
Plowing	Chisel plow, tractor traction	SGANO MSC8PSL	2.2	3.39	0.35	3.94	3.91	Tractor: JD5503 75HP ? gear: A3/B2? revolution: 1500rpm
Puddling	Power tiller	Yanmar YZC-D	0.6	2.14	0.07	17.52	0.76	Average of leveling and without leveling
Seed sowing	Manual seeder	Chokwe made	1.0	3.41	0.31	3.59	-	Unit of field work capacity: ha/Man . hour Seed coverage: 95.7%

In June 2014, the conventional rice labor cost was identified through a survey on the costs of two cases: one was the costs performed by FSG farmers in the Project target area and another was the costs performed by non-FSG member farmers. It was understood that the cost of the conventional rice cultivation accumulated largely through related activities such as nursing seedlings, transplanting, weeding and harvesting. In regard to rice cultivation of direct sowing, the costs were originally approximately 50% of that of transplanting. Yet the cost of plowing with a use of a rotavator for row seeding using a manual seeder was increased the overall costs. The volume of work, the work efficiency and the costs to use machinery was calculated by adding up hours and expenses spent for establishing verification/demonstration fields from 2012 to 2013. These hours and expenses are from related activities such as plowing by a disc plow and disc harrow chisel plow, clod crushing by a rotavator, puddling by a power tiller and seeding by a manual seeder. The rice paddy labor cost, the detailed work volume and cost of machines used in the fields are shown in the Table 4.1.4.

(5) Survey on the attributes of farmers in each target area

There were some differences found among Project target areas, such as the male to female ratio, the degree of farmers' enthusiasm toward institutionalization and the degree of interest toward the new techniques. Therefore the Project decided to research the actual condition of farmers and farming in eight

areas for the purpose of contributing towards a sense of direction in regards to the technical extension efforts. Two more Project target areas (D4 and D7) were added to the six areas (D5, D6, D11, D12, R1 and R3) surveyed in 2012. The result is outlined as follows.

The male to female ratio of all survey target areas was 56% woman and 44% man. The number of men and women as registered farmers was different among the eight target irrigated areas. The female ratio in D5 was 96% where it was only 31% in D11.

Approximately 80% of all the farmers are originally from Chokwe. There are some farmers who have come into Chokwe from elsewhere and their place of origin may vary between the eight areas. Although approximately 20% of farmers were from other areas, D12 area in particular had 35% of its farmers coming from outside of Chokwe. On the other hand, almost all the farmers in D6 and R3 are from Chokwe. Many of those farmers originally from elsewhere are from Guija or Chibuto. Farmers originally from Chokwe said that they have resided in Chokwe for about forty-four years, where those farmers originally from elsewhere said that they have resided in Chokwe for about thirty years. There was fifteen years difference regarding the number of years to have been settled in Chokwe.

The average rice cultivation area of the eight areas in Chokwe Irrigation Scheme is 1.1ha, and the average paddy yield is 1.91t/ha. The negative correlation (r=0.275**). The yield was different between eight areas, and the highest yield was found in D11. The average rice cultivation field of farmers whose field was smaller than 1ha was 0.52ha and the average yield was 2.17t/ha. Looking closely into the size of cultivation fields, approximately half of farmers in D11 cultivated rice in fields larger than 2ha (the average rice cultivation field was 2.65ha). On the other hand, the majority of farmers in D4, D5 and D6 were having fields smaller than 1ha, having 0.5ha as the average field size. It is also understood that a small number of farmers in D12 and R1 are cultivating rice in fields of a 3ha scale.

Approximately 45% of farmers are selling their paddy to MIA and 15% to Inancio de Aousa. Other 40% answered that they sell their paddy somewhere else, but it is assumed that most of their paddy is consumed at home. The sales destinations of farmers in the eight areas were quite different from one area to another. In D5, D6 and D11, more than half of farmers are selling paddy to MIA, where farmers in D12 and R3 are presumably consuming at home. It is understood that MIA is the main buyer of paddy in the Chokwe Irrigation Scheme.

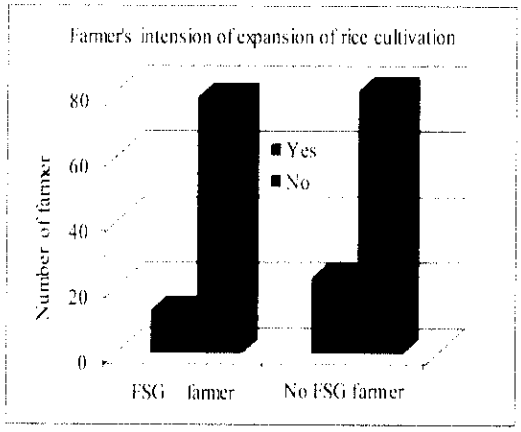
The five main working processes for rice cultivation are land preparation, transplanting, harvesting, milling and selling. Asked whether or not farmers work together, approximately 88% answered "no." This was the case throughout the eight areas since no significant difference was recognized in the farmers' answers. However, it is presumed that a number of farmers may work together at the time of planting and harvesting. The possibility of collaboration between farmers for milling and selling paddy is presumed to be small.

Considering the social interaction and trustworthy relationship between farmers, target farmers have built up the socially mutual relationship with neighbors, friends and relative whom they see frequently. They actively participate in social events also, but these events are rather limited and tend to be religious like Sunday services and their mutual relationship is not based on community events such as those to do agriculture related work together. The highest degree of trust felt by most, was towards relatives. Farmers who are originally from outside of Chokwe have resided in Chokwe for twenty-eight years on average,

except the forty years reported from a farmer(s) in D12. The majority of these farmers that came into Chokwe did so at the end of the civil war in Mozambique. It may be possible that this fact has something to do with their sense of social interaction as well as the trustworthy relationship between farmers.

(6) Farmers' consciousness toward rice cultivation

The overall objective of the Project cannot be achieved without the farmer to farmer extension where FSG farmers who obtained improved techniques share those techniques with other farmers in general. This is indispensable. In order to realize the extension of the improved techniques to farmers in general it is important to lift their interest toward rice cultivation and to let them know about the methods of rice cultivation. In 2014, when the interview about rice paddy cultivation expenditure was carried out, another survey in regard to rice cultivation by farmers was conducted. This survey found that the majority of farmers were having low motivation in expanding the size of their field; 86% of FSG farmers and 78% of non-member farmers said that they did not have any intention to expand their currently cultivated field. Their reasons were "not profitable," "the financial shortage" and "being satisfied with the current condition."

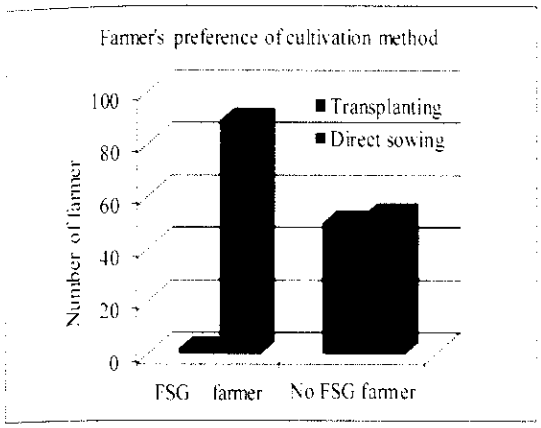


Reason why no	FSG? farmer	No FSG farmer	Total	%
No profit	26	30	56	28.9
No money	19	34	53	27.3
Enough	31	11	42	21.6
No answer	14	23	37	19.1
No time	1	4	5	2.6
No land	0	1	1	0.5

n = 194, FSG:91, NoFSG:103

Figure 4.1.2 Degree of interest toward rice paddy cultivation

What method of rice cultivation are target farmers interested in? Approximately 70% of them showed their interest in the direct sowing method. Sorted into types of farmers, almost 98% of FSG farmers favored the direct sowing method where non-member farmers were split with approximately 50% each for the transplanting and the direct sowing method. This result may be strongly influenced by the verification and demonstration fields for rice cultivation of direct sowing, which were implemented into FSG farms from 2013 to 2014. As to the question regarding what these farmers think about the merits of the direct sowing method, the most popular answer was low cost. Of the FGS farmers in particular, 91% said that this was the reason.



Reason why	FSG? farmer	No FSG farmer	Total	%
Low cost	83	51	134	69.1
Stable production	4	23	27	13.9
High yield	3	17	20	10.3
Tradition	0	11	11	5.7
Other	1	1	2	1.0
No answer	0	0	0	0.0

n = 194, FSG:91, NoFSG:103

Figure 4.1.3 Degree of interest toward rice paddy cultivation methods

Two most important issues that are absolutely necessary in order to extend the improved rice cultivation techniques to FSG farmers as well as non-member farmers are the "profitable rice paddy cultivation techniques" and the "acquisition of funds for initial investment."

Both FSG farmers as well as non-FSG farmers were interviewed, on another occasion, regarding to the constraining factors and risks in cultivating rice. The interview presented fourteen possible factors that may constrain the rice cultivation activities of farmers in the Chokwe Irrigation Scheme. Target farmers were requested to choose one out of four answer choices to each of the fourteen questions, having 4 as the biggest constraint down to 1 as not a constraint. The numerical total of each farmers answer and the total number to which every one of the target farmers answered 4 are used as indicating numbers, and the Project analyzed the data to understand what sort of matters may have made farmers reluctant to cultivate rice. The top three answers that both FSG and non FSG farmers chose as constraining factors were the low selling price, the mal-drainage of paddy fields and high labor costs. Other answers of FSG farmers were, in order from the highest number to lowest were, fertilizer, high material costs like herbicide and tractor rental fees. As for non-FSG farmers, low yield and high material costs like herbicide followed by the already mentioned top three factors. Consequently, it has been clarified that a large number of farmers are concerned with the economic potential and the high labor costs.

Table 4.1.5 Constraining Factors of Rice Cultivation

FSG farmer				No FSG farmer			
Type of constraints	Farmer' evaluation score	Full score (91 * 4 = 364)	Index	Type of constraints	Farmer' evaluation score	Full score (103 * 4 =412)	Index
1 Low selling price of paddy rice	358	364	0.98	1 Low selling price of paddy rice	390	412	0.95
2 Drainage problem	334	364	0.92	2 Drainage problem	384	412	0.93
3 High labor cost (transplanting, harvesting etc.)	321	364	0.88	3 High labor cost (transplanting, harvesting etc.)	355	412	0.86
4 High input price (fertilizer, herbicide etc)	308	364	0.85	4 Low yield	353	412	0.86
5 Lack of money for tractor hireling	299	364	0.82	5 High input price (fertilizer, herbicide etc)	348	412	0.84
6 Lack of money to hire labor	292	364	0.80	6 Lack of money to hire labor	333	412	0.81
7 Low yield	291	364	0.80	7 Lack of family labor	318	412	0.77
8 Lack of family labor	275	364	0.76	8 Not making profit	318	412	0.77
9 Low accesss to credit	264	364	0.73	9 Lack of money for tractor hireling	316	412	0.77
10 Not making profit	256	364	0.70	10 Low accesss to credit	306	412	0.74
11 Lack of rice cultivation techniques	210	364	0.58	11 Lack of rice cultivation techniques	273	412	0.66
12 Availability of tractor (Low No of tractor)	202	364	0.55	12 Availability of tractor (Low No of tractor)	264	412	0.64
13 Not enough land suitable for rice cultivation	187	364	0.51	13 Weak extension system	251	412	0.61
14 Weak extension system	157	364	0.43	14 Not enough land suitable for rice cultivation	216	412	0.52

The next question dealt with the risk factors, which were analyzed in the same way as those that dealt with the constraint factors. Among the nine given risk factors to cultivate rice, the top three risk factors perceived by both FSG and non FSG farmers were the occurrence of natural disasters such as floods, the high labor costs of transplanting and the rough plowing of the field (uneven depth of plowing and clod crushing by hired tillers). Although the order was different, both FSG farmers and non-FSG farmers thought that the cost of harvesting and poor germination through direct sowing were also risky.

As an overall summary, five things can be said: 1) Farmers think that the rice cultivation is not profitable farming, 2) FSG farmers are highly interested in the direct sowing method since its labor costs are relatively lower than transplanting, 3) non-FSG farmers are not interested in direct sowing as much as FSG farmers, 4) cultivation expenditure is one of the factors that makes farmers reluctant to begin rice cultivation and 5) cultivation expenditure is also a risk factor for rice cultivation. It is extremely difficult to deal with natural disaster related concerns as natural disasters are out of our control. It is also rather difficult to relieve

farmers' concerns regarding the paddy selling price as it is a matter concerned with the markets. Nevertheless, other factors of concern can be overcome by improving the techniques of rice cultivation, such as high cultivation expenditure, poor germination of direct sowing and field plowing. It is made clear that certain issues should be improved and solved in order for rice cultivation to be practiced more widely in the Chokwe Irrigation Scheme. These issues are the development of rice cultivation techniques to get a higher yield by economical techniques, the reconsideration of plowing fees as an initial investment, the collateral against financing to purchase seed, fertilizer, herbicide and such, the new business of paddy sales as a mean to increase the profitability and the improvement of the paddy milling business.

Table 4.1.6 Risk of Rice Cultivation

FSG farmer					No FSG farmer			
	Type of risk	Farmer' evaluation score	Full score (91 * 4 = 364)	Index	Type of risk	Farmer' evaluation score	Full score (103 * 4 412)	Index
1	Naural disaster like flood	345	364	0.95	1 Naural disaster like flood	371	412	0.90
2	Transplanting (Risk of high labor cost)	310	364	0.85	2 Transplanting (Risk of high labor cost)	345	412	0.84
3	Land preparation (Risk of un-even land preparation)	294	364	0.81	3 Land preparation (Risk of un-even land preparation)	327	412	0.79
4	Harvesting (high cost)	285	364	0.78	4 Bradcasting (Risk of low germination)	304	412	0.74
5	Bradcasting (Risk of low germination)	281	364	0.77	5 Harvesting (high cost)	297	412	0.72
6	Transplanting rice cultivation (High input but high yield)	262	364	0.72	6 Direct sowing rice cultivation (Low input and low yield)	296	412	0.72
7	Direct sowing rice cultivation (Low input and low yield)	261	364	0.72	7 Transplanting rice cultivation (High input but high yield)	289	412	0.70
8	Weeding (high cost)	254	364	0.70	8 Weeding (high cost)	268	412	0.65
9	Fertilizer application (high cost)	151	364	0.41	9 Fertilizer application (high cost)	157	412	0.38

(7) Validation of rate of earnings by comparing cost fluctuation of rice cultivation and gross income

According to the interview with farmers in 2014, 86% of FSG farmers and 78% of non-FSG farmers answered that they don't intend to expand their cultivation field with the reasons that they are not-profitable, there is a shortage of financial resources and that they are satisfied with the present condition. At the same time, these farmers were concerned with some issues before starting rice cultivation such as the paddy selling price, poor drainage of their field and the high cultivation expenditure. Almost all FSG (98%) favored the direct sowing method, where non-FSG farmers were approximately 50% in favor towards both methods. What was understood from these findings was: 1) farmers are not convinced about the profitability of rice cultivation, 2) the direct sowing method is favored since its labor cost is relatively low, 3) the main factor to make farmers reluctant towards rice cultivation is cultivation expenditure and 4)

cultivation expenditure is also thought as a risk factor except when taking into account the possibility of a natural disaster like flooding. Two of the biggest concerns for both FSG and non-FSG farmers are profitability and cultivation expenditure. Therefore, a reduction in cultivation expenditure, the growth of revenue and the improvement of profitability through the development of a sales business for milled rice that adds value to their production are urgent issues that need to be dealt with.

A validity assessment of the rate of return is essential before recommending farmers new technology and/or techniques, since there are many cases where technology and techniques to promise high yield do not always offer the best cost performance. Cultivation expenditure fluctuates when changes are made to work procedures, like plowing or seeding. There is a big difference between two expenditures when the seedling is transplanted or seed is directly sown. It is also dependent on decisions made regarding the spraying of herbicide or weeding manually and to harvest manually or use the combined harvester, etc. The Project studied the cultivation costs spent, throughout the processes from seeding to harvesting, by one-hundred and ninety-two FSG and non-FSG farmers. The plowing method was studied closely as well. The target FSG fields were plowed both by a disc plow and a disc harrow as a conventional method and farmers were interviewed about the labor costs. The volume of labor necessary for plowing and clod crushing with a use of a chisel plow and a rotavator was recorded, along with the labor costs for seeding with a manual seeder. Moreover, the machinery utilization fees were added up. The rate of return of four methods was verified: the conventional transplanting techniques, the improved transplanting techniques, the conventional direct sowing techniques and the improved direct sowing techniques.

Four items were validated: the cultivation method (nursing seedlings and transplanting, direct sowing in rows and direct broadcasting), the fertilizer application (amount and cost), the weeding (manual weeding and applying herbicide as well as spraying fees), the harvesting (manual harvest and mechanical harvest). These variable costs were calculated for the four types of already mentioned cultivation techniques. The gross income was presumed by the yield obtained from each field, and the net income was found by subtracting the variable cost from the gross income. The figures for each rate of return were compared and contrasted between the net income and the variable cost. Please note that these costs do not include other costs mutual to all the different cultivation techniques, such as water fees, field fees, fees concerned with scaring birds away and so on. An outline concerning the four target cultivation techniques is as follows.

Table 4.1.7 Outline of Four Types of Technical Factor

Technical component	Improved transplanting	Traditional transplanting	Improved direct sowing	Traditional direct sowing
Land preparation	Disk plow x 1 · disk harrow x 1 · puddling (power tiller)	Manual plowing and manual puddling	Disk plow x 1 · disk harrow x 1 · rotary cultivation · plotting	Disk plow x 1 · disk harrow x 2 · plotting
Sowing (nursery)	Flood nursery	Upland nursery	Line sowing (manual seeder)	Broadcasting
Transplanting	20cm x 25 cm, 3 seedlings hill, line planting	1 seedling hill, random planting	-	-
Seed rate (kg ha)	50	100	120	150
Fertilizer application	Urea 150 kg ha, split application (3 times)	No fertilizer application	Urea 170 kg ha, split application (3 times)	Urea 50 kg ha, all at a time
Weeding	Manual	Manual	Herbicide application Propanil: 10 lit ha MCPA 3 lit ha)	Herbicide application Propanil: 15 lit ha MCPA 3 lit ha)
Harvest	Manual	Manual	Combine harvester	Combine harvester

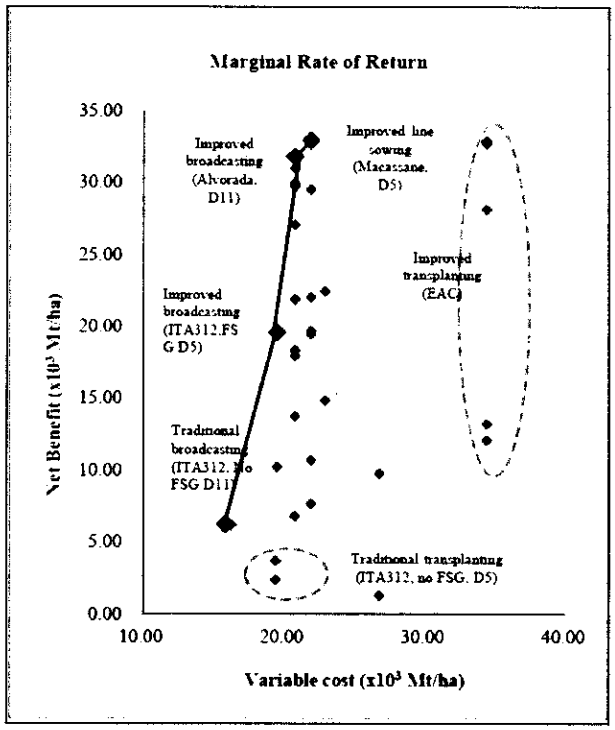


Figure 4.1.4 Rate of Return by Improved/Conventional Cultivation Techniques

First of all, the net income of the FSG fields that applied the improved direct sowing (broadcasting) ITA312 (D510) is compared with the non-FSG field that applied the conventional direct sowing (broadcasting) ITA312 (D1142). The variable cost was increased from 15.38 ($\times 10^3$ Mt/ha) to 19.49 ($\times$103 Mt/ha), resulting in an increase in the net income from 6.27 ($\times 10^3$ Mt/ha) to 19.61 ($\times 10^3$ MT/ha). This is the result of appropriate urea application and weeding by spraying herbicide, which realized a 3.64 rate of return. Compared to the FSG field that applied the improved direct sowing (broadcasting) ITA312 (D510)

with the same cultivation method but using a different rice variety, Alvorada (a promising variety) (D11-2), the rate of return was found to be quite high, 9.70. This result was due to the higher yield. Although the variable cost was increased by 6.5% through increasing urea from 100kg/ha to 170kg/ha and reducing the seed amount from 150kg/ha to 120kg/ha, the yield was increased to approximately 2t/ha. The next comparison was done for another promising variety, Macassane, between row seeding (D5-1) and broadcasting (D11-2). Due to the use of a manual row seeder, a new cost, that of using a rotavator for clod crushing at the time of plowing, was added, causing a 5.5% increase in its variable cost. Although the gross income was also increased by 3.5%, the rate of return was 0.99, concluding that row seeding did not realize a high return of rate. In summary, as for direct sowing, the urea amount should be changed from 100kg/ha to 150kg/ha and use herbicide so that the yield would be increased from 4t/ha to 5t/ha. If 5t/ha of yield can be realized, the broadcasting will result with the highest rate of return. Using another promising rice variety other than ITA312, it is plausible to get an even higher yield. It then becomes very promising to have a better rate of return.

Compared with direct sowing, the transplanting method has factors to increase the variable cost, such as the nursing of seedlings, transplanting and harvesting. The average variable cost for the conventional direct sowing method is 17.71 ($\times 10^3$ Mt/ha), where the variable cost of the conventional transplanting is 30.50 ($\times 10^3$ Mt/ha), which is approximately 70% more. This high variable cost is due to the expense spent on plowing (man-power and animal power), seedling nursing and transplanting, manual weeding and manual harvesting. It is often the case that conventional transplanting does not apply fertilizer or applies 50kg/ha of urea all at one time, which results in the average yield of 2.65t/ha. In this way, transplanting doesn't seem to merit the extra effort, instead only making the financial situation tighter. In the Chokwe Irrigation Scheme, a number of rice farmers are depending on family labor or the hiring of helper(s). Therefore, it is quite possible that many farmers are in debt especially when they count family labor as labor costs as well.

Even though the high productivity was verified from the improved row transplanting method, some cost like puddling by power tiller, seedling nursing and transplanting, manual weeding and harvesting, cause an increase in the figures for variable costs. This makes the average variable cost of improved transplanting 34.40 ($\times 10^3$ Mt/ha), approximately 1.5 times more than the improved direct sowing. Indeed, a high yield can be possible, however, due to the high cost, the rate of return is low, and it is therefore difficult to recommend the improved row transplanting. At the same time, the cost of manual weeding and harvesting can be reduced by approximately 63% if herbicide and mechanical harvesting are introduced, lowering the overall costs required by the transplanting method.

According to the 2014 yield survey results of FSG demonstration fields in D5, D11 and D12, approximately 66% of the yield in target fields is distributed between 4t/ha and 5t/ha. It is very realistic to more or less aim in raising the 4t/ha yield to a 5t/ha yield, through introducing the economical improved techniques. Regarding the transplanting method, urea application (100kg/ha) and herbicide as well as mechanical harvesting introduction will make it plausible to have the higher rate of return. Also for the direct sowing method, broadcasting, urea application (100kg/ha) and herbicide as well as mechanical harvesting are all technical factors that secure a higher rate of return. Although the economic efficiency of row seeding was not verified at the verification field at this time, the inadequate field management at the early growth stage, say approximately one month after seeding, contributed to a failure in realizing the high

productivity. Appropriate field management includes irrigation after seeding (leaving seedlings above water), water management and fertilizer application after germination and timely herbicide spraying. The high yield rise from 5t/ha to 6t/ha by direct sowing requires some factors other than rice cultivation, like adequate field leveling, proper maintenance of tertiary drainage canals and so on.

Table 4.1.8 Variable Costs and Rates of Return of Improved/Conventional Rice Cultivation Techniques

Num.	Cultivation method	Technology level	Variety	Variable cost (VC) (x 10^3 Mt/ha)	Yield (ton/ha)	Gross benefit (GB) (x 10^3 Mt/ha)	Net benefit (NB) (x 10^3 Mt/ha)	ΔVC	ΔNB	Marginal Rate of Return (MRR)
EAC1	TP	Improved	Alvorada	34.40	7.92	67.31	32.92	-	-	-
EAC2	TP	Improved	Farox	34.40	5.47	46.52	12.12	-	-	-
EAC3	TP	Improved	IRGA409	34.40	5.61	47.65	13.26	-	-	-
EAC4	TP	Improved	ITA312	34.40	7.90	67.14	32.74	-	-	-
EAC5	TP	Improved	Macassane	34.40	7.36	62.56	28.16	-	-	-
D557	TP	Traditional	No FSG (ITA312)	32.50	2.70	22.95	-9.55	-	-	-
D564	TP	Traditional	No FSG (ITA312)	30.68	2.80	23.80	-6.88	-	-	-
D565	TP	Traditional	No FSG (ITA312)	30.68	2.60	22.10	-8.58	-	-	-
D559	TP	Traditional	No FSG (ITA312)	28.11	2.50	21.25	-6.86	-	-	-
D508	BC	Improved	FSG (ITA312)	26.75	4.30	36.55	9.80	-	-	-
D529	BC	Improved	FSG (ITA312)	26.75	3.30	28.05	1.30	-	-	-
D11-3	LS	Improved	IRGA409	22.89	4.44	37.78	14.88	-	-	-
D11-5	LS	Improved	ITA312	22.89	5.34	45.36	22.47	-	-	-
D5-1	LS	Improved	Macassane	21.89	6.45	54.85	32.96	1.14	1.12	0.99
D5-3	LS	Improved	IRGA409	21.89	3.83	32.59	10.70	-	-	-
D5-6	LS	Improved	Alvorada	21.89	4.87	41.40	19.51	-	-	-
D11-1	LS	Improved	Alvorada	21.89	6.05	51.45	29.56	-	-	-
D12-1	LS	Improved	ITA312	21.89	4.89	41.58	19.69	-	-	-
D12-2	LS	Improved	Macassane	21.89	3.48	29.57	7.67	-	-	-
D12-3	LS	Improved	Farox	21.89	5.17	43.93	22.04	-	-	-
D5-2	BC	Improved	Macassane	20.75	5.94	50.49	29.74	-	-	-
D5-4	BC	Improved	IRGA409	20.75	4.60	39.11	18.36	-	-	-
D5-5	BC	Improved	Farox	20.75	6.09	51.75	31.00	-	-	-
D5-7	BC	Improved	Alvorada	20.75	5.02	42.64	21.89	-	-	-
D11-2	BC	Improved	Alvorada	20.75	6.19	52.58	31.83	1.26	12.22	9.70
D11-4	BC	Improved	IRGA409	20.75	4.56	38.73	17.98	-	-	-
D11-6	BC	Improved	ITA312	20.75	5.97	50.73	29.98	-	-	-
D12-4	BC	Improved	ITA312	20.75	5.63	47.82	27.07	-	-	-
D12-5	BC	Improved	Macassane	20.75	3.24	27.57	6.81	-	-	-
D12-6	BC	Improved	Farox	20.75	4.06	34.51	13.76	-	-	-
D510	BC	Improved	FSG (ITA312)	19.49	4.60	39.10	19.61	3.67	13.34	3.64
D501	BC	Improved	FSG (ITA312)	19.49	3.50	29.75	10.26	-	-	-
D1225	BC	Traditional	No FSG (ITA312)	19.39	2.72	23.12	3.73	-	-	-
D1219	BC	Traditional	No FSG (ITA312)	19.39	2.56	21.76	2.37	-	-	-
D1220	BC	Traditional	No FSG (ITA312)	16.22	2.64	22.44	6.22	-	-	-
D1142	BC	Traditional	No FSG (ITA312)	15.83	2.60	22.10	6.27	-	-	

Note: cultivation method; TP: transplanting, BC: Broadcasting, LS: Line sowing

4.1.2 Training in the rice cultivation techniques of transplanting for extension agents and FSG farmers

A total of fifteen training courses attracted a total of four-hundred and seventeen people for the rice cultivation techniques of transplanting from 2011 to 2014. These courses were held for FSG farmers in target areas for transplanting, namely D5 and D6. These courses covered the basics of transplanting techniques, and furthermore including OJT on rice nursery, seeding, regular planting, mechanical land preparation and puddling. Due to the flood that occurred in January 2013, fifty FSG farmers in D5 shifted the planting method for the 2013/2014 cropping season from transplanting to direct sowing, where sixteen FSG farmers in D6 decided to give up on rice for that cropping season. They were deeply concerned with the possible reoccurrence of the flood during occasions where there was a high water level, as the repair work on the secondary drainage canal next to the field was not completed. These changes and decisions limited the resources available to hold training courses for extension agents and FSG farmers on the rice cultivation techniques of transplanting. The training sessions used the trial fields set up for a variety of tests in EAC property. The training courses held from 2011 through 2014 are listed in the Table 4.1.9.

Table 4.1.9 Training Courses for the Improved Rice Cultivation Techniques for Transplanting

Name of the Course	Date	No. of Participants	Target Participants	Remarks
Land preparation by power tiller (OJT power tiller)	18 Oct. 2011	4	Machinery operator of HICEP, SDAE and FDA 2 technician of FAC	Operation of power tiller and land preparation by power tiller
Land preparation by tractor (OJT tractor and attachiment)	15 Nov. 2011	8	Machinery operator of HICEP, SDAE and FDA 2 technician of FAC	Land preparation by tractor and attachment
Basic techniques of transplanting rice cultivation	25 Nov. 2011	19	Project C/P, extension agent, technicain of FAC and MIA	Basic knowledge of transplanting rice cultivation
Case study of small scale rice cultivation in Ghana	25 Nov. 2011	19	Extension agent, teehician of FAC and MIA	Small scal rice cultivation
Mechanized land preparation (OJT land preparation)	29 Nov. 2011	33	Extension agent, FAC technician and FSGmember farmer (20)	Plowing and rotary cultivation
Nursery preparation (OJT)	29 Nov. 3011	33	Extension agent, FAC technician, FSG member farmers (20)	Preparation of nursery and seed sowing
Mechanized rice cultivation	5 Dec. 2011	13	Extension agent and technician of FAC	Mechanized rice cultivation techniques and maintenance of machinery
Technique for high yielding of transplanting rice cultivation	15 Dec. 2011	12	project C/P, extension agent, technicain of FAC and MIA	Yield survey, yeild component, highyielding techniques
Landpreparation for transplanting rice cultivation (OJT puddling)	19 Dec. 2011	32	Extension agent, FAC technicain, FSG member farmers (20)	Puddling by power tiller, leveling of field
Transplanting of transplanting rice cultivation (OJT transplanting)	19 Dec. 2011	32	Extension agent, FAC technicain, FSG member farmers (20)	Line planting, plant density, quality of seedling
Field day of variety	22 March 2013	63	Extension agent, Farmers of D11, D12, D5 and D6	Variety characterisities of promissing variety at D11 variety verification plot of transplaning
Variety characteristics of promissing variety for transplanting rice cultivation	10 July 2013	27	Extension agent, FSG farmers of D11, D12, D5 and D6	Results of variety trial and characterisities of promissing variety
Improved rice cultivation techniques *(1)	7 Feb. 2014	18	Extensionagent, Lider farmers of FSG	Lecture of improved rice cultivation techniques of transplanting and direct sowing by C/P
Field day of transplantingrice cultivation	11 March 2014	39	FSG member farmer of D5 and D6	Variety characteristies of promissing variety at FAC field (variety trial plot)
Improved rice cultivation techniques *(2)	3 July 2014	65	FSG member farmers of D5, D6, D11, and D12	Variety characteristies and grain production of promissing variety of transplanting, result of verification of promissing variety of direct sowing, and yield of demonstration plot of direct sowing
		417		

Note: *(1) and (2) overlaped with direct sowing training

Training courses designed from 2012 onwards were aimed at the introduction of promising varieties parallel to the improved techniques. Farmers are usually conservative in accepting new techniques, when they have been practicing already established rice cultivation techniques. So extension efforts on the improved transplanting cultivation techniques were combined with the introduction of new rice varieties, as

it was thought to be more welcoming by those conservative farmers. So the Project organized a Field Day at verification fields in D11 in 2013, in order to consider the attributes and productivity of these new varieties. According to a questionnaire survey to understand the degree of farmers' interest toward the target variety, it was found that farmers answered that they became more and more interested in other varieties than ITA312.

Table 4.1.10 Degree of Farmers' Interest toward Promising Varieties

Variety	Farmer's preference		Criteria (num. of farmer)						
	Num. of farmer *1	%	Maturity days	Price	High yielding	Palatability	Grain size	Panicle size	Other
Alvorada	5	23.8	1	2	5	2	3	1	1
Farox	3	14.3	0	2	2	0	2	0	0
IRGA 409	4	19.0	1	4	3	1	1	0	1
ITA 312	11	52.4	3	4	7	1	2	1	0
Macassane	13	61.9	0	3	8	0	2	3	1
			5	15	25	4	10	5	3

Note: *1; Total num. of farmer answered: n = 26

New verification fields had been scheduled to be established in D5 and D6 as of the year 2014, in order to compare regular planting and random planting using four different rice varieties other than ITA312. However, due to the flood of January 2013, FSG farmers in D5 changed from transplanting to direct sowing and FSG farmers in D6 gave up on rice cultivation. Consequently, this plan was not realized.

4.1.3 The establishment of demonstration fields for the rice cultivation transplanting techniques by trained extension agents and FSG farmers

Beginning with the efforts in 2011, one FSG each in D5 and D6 was established, with a total of twenty farmers as members, ten members in each group. The establishment of demonstration fields started in 2012, with a total of 10ha all together, with 0.5ha at each location, being set up as demonstration fields. The techniques demonstrated were transplanting cultivation, the conventional seedling nursing method, utilization of thirty day old seedlings, conventional transplanting (random planting), weeding and fertilizer management (urea 100kg/ha, applied on three occasions, first time: 50% of urea at the time of seven to ten days after transplanting, second time: 25% at the time of seven to ten days after the first application, third time: 25% at the time of twenty to thirty-five days after the second application). There were no significant constraining factors against rice cultivation during the year 2012, and an average yield of 5.99t/ha (demonstration fields in D5 and D6) was recorded, marking a good start for extending the improved rice cultivation techniques of transplanting that were developed during the first phase (please refer to the Appendix 6 for the record of these demonstration fields).

In 2013, the number of FSG and registered farmers increased. The number of FSG in D5 became two, increasing members to twenty-six farmers. In D6, the number of members increased to sixteen. The demonstration fields were established in a total area of 21ha with forty-two farmers' fields in D5 and D6, the target areas for transplanting. However, the flood in January 2013 affected all of these forty-two fields

with extensive damage soon after the transplanting took place, and so these were not harvested. The transition of demonstration fields for the improved transplanting techniques since 2012 is shown in table 4.1.11 (please refer to Appendix 6 for the locations of demonstration fields in detail).

Table 4.1.11 Transition in Numbers of FSG Group and FSG Farmers in Target Areas for Transplanting

Irrigation block		2012		2013		2014		Remark
		No.	%	No.	%	No.	%	
D5	No of FSG	1	0	2	200	0	0	Direct sowing in 2014
	No of farmers	10	0	26	260	0	0	
	Area (ha)	5	0	13	260	0	0	
D6	No of FSG	1	0	1	100	1	100	Suspended rice cultivation in 2014
	No of farmers	10	0	16	160	16	160	
	Area (ha)	5	0	8	160	0	0	
Total	No of FSG	2	0	3	150	1	50	-
	No of farmers	20	0	42	210	16	80	
	Area (ha)	10	0	21	210	0	0	

Since the harvest in 2013 was not possible due to the flood damage, the verification fields, set up for variety comparisons on six varieties for transplanting and established in D11 and D12, were used as demonstration fields for the improved transplanting techniques, so that the trial to extend the cultivation techniques to extension agents and FSG farmers could still be conducted. In 2014, it was difficult to cover labor cost for transplanting in D5 because of the flood the previous year. So a series of discussions was held among FSG, Project managers and other involved personnel, and they reached a decision to set up some demonstration fields for direct sowing techniques. As for the D6 area, the Vala II canal, located next to the fields, was damaged by the flood at its outlet point into the Limpopo River. Since this canal was not completely repaired, there remained a possibility of flood reoccurrence and farmers in D6 reached the consensus that they would not be cultivating rice that season or setting up the demonstration fields. Consequently, the trial fields set up in EAC property for variety comparison was substituted as demonstration fields for the improved rice cultivation techniques for transplanting. The location detail of these demonstration fields in D5 and D6 are shown in figure 4.1.5.

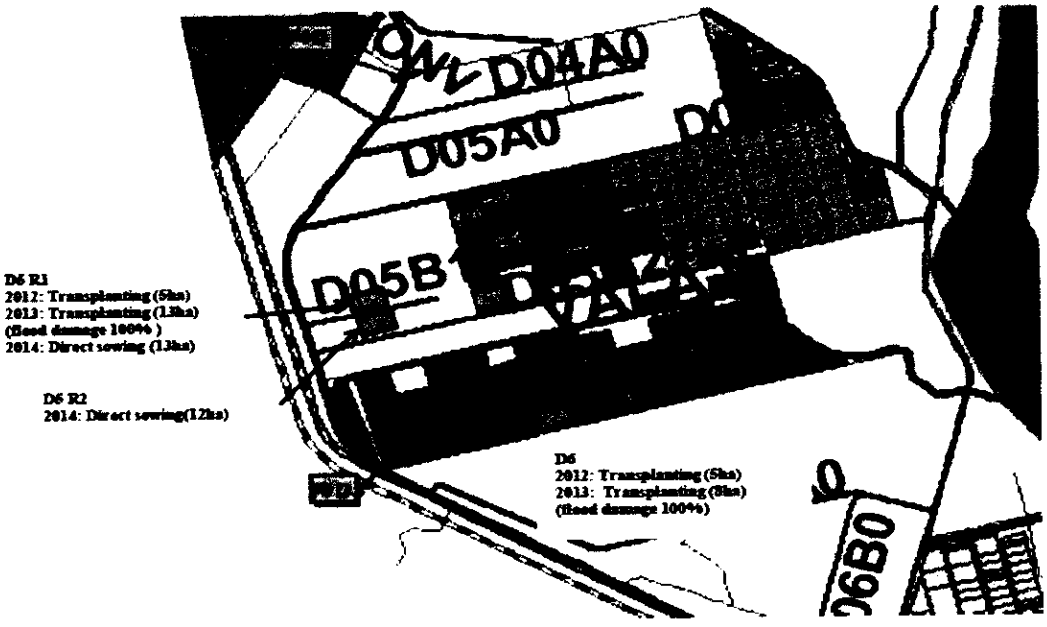


Figure 4.1.5 Location Map of the Demonstration Fields in D5 and D6

4.1.4 The training program for the rice cultivation techniques of transplanting for non-FSG farmers with the initiative taken by extension agents and FSG farmers

Again, the flood caused such serious damage to the D5 area and FSG farmers in D5 decided to shift their seeding method to direct sowing, where the initial financial investment is relatively small. FSG farmers in D6 also had to make a decision since the drainage outlet flap gate to the Limpopo River of the secondary drainage canal (Vala II) next to the field was not repaired, leaving open the possibility of flood reoccurrence in the instance of the water level rising. Therefore, rice cultivation in 2014 in D6 was not done. Under these circumstances, regarding the transplanting of rice cultivation within the Project target areas, the demonstration of the improved techniques of transplanting at FSG fields was not realized as of 2014, except in the trial area of EAC for variety comparison.

The disastrous flood was first noticed with an inundation in the town of Chokwe at nine o'clock in the morning on January 23, 2013. The water level rose quite rapidly soon after that, and by the evening of the same day, the water level reached approximately 1.5m even in the central areas of Chokwe. This was the beginning of the flood which caused such a severe damages to not only the Project target transplanting areas of D5 and D6 but also the Chokwe Irrigation Scheme as a whole. The next morning, the morning of January 24, the water level had lowered to approximately 80cm in the central area of Chokwe, yet the fields in D5 and D6 were still completely under water. As for the D11 area, although the access route to Massavasse was flooded, flooding of the fields was not confirmed. The access route to Conhane in the D12 area was not flooded. The condition of and the damage to the fields in the Project target areas of D5, D6, D11 and D12 is listed in the Table 4.1.12.

The fields in two Project target areas, D5 and D6, were 100% under the water and paddy fields were full of muddy sediments. The duration of the flooded state was unknown, but it is assumed that fields in D5 and D6 were under water for about one whole week. The water lever on the next day of flood's occurrence

(January 24, 2013) seems to be between 70cm to 100cm in the photo.

- There were no target fields damaged by complete inundation in D11 and D12. There was a shortage of irrigation water due to the damage to the irrigation canals.
- Almost all of FSG farmers in these four areas are showing their intention to cultivate rice next cropping season (as of January 2013)
- Farmers in D5 and D6, where the inundation damage was so severe, began cultivating maize and kidney beans in March and April.

Table 4.1.12 Damage Condition of the Flood of January 2013

Block	Total num. farmers answered	Estimated damage (%)	Cause of damage		Farmers' intention (num. of farmer)				Remarks
			Mud accumulation	Washing out	Abandon field	Try again next season	Farmers try next season (%)	No idea what to do	
D5	26	90.8	100	0	0	26	100.0	0	-
D6	16	100.0	100	0	0	16	100.0	0	-
D11	13	24.3	0	0	0	12	92.3	0	Shortage of water
D12	10	0.0	0	0	0	10	100.0	0	Shortage of water
	65	53.8	-	-	-	64	98.1	0	-

In order to study the economic influence caused by the flood in the Project target areas, the income from rice cultivation was estimated. The income was estimated as follows: for the farmers in D5 and D6, who did not have any harvest, the amount invested (labor, materials, etc.) before the flood was considered as income and for those farmers in D5 and D6, who harvested, the cost from seeding to harvesting was added up and subtracted from the post-harvest revenue. Moreover, any flood damage of livestock, food and agricultural materials, etc. were converted into the paddy value, which added up to be between 1.35t and 2.05t. This is assumed to be equivalent to the loss of one whole rice cultivation season. This flood damage assessment does not include any damage to residential buildings and home furnishings. Some farmers may have been in debt after the flood. If all of the real damage were to be considered, it can be assumed that the flood will have had quite a serious economic impact on target farmers.

Table 4.1.13 Estimation of Flood Damage upon Family Finances of Target Farmers

Unit: Mt./household

Item	D5 (26)	D6 (16)	D11 (12)	D12 (10)
Estimated income loss of rice cultivation	5,760	5,638	4,471	16,516
Values of damage (food, livestock and agricultural material)	11,310	11,804	6,965	0
Estimated total loss	17,070	17,443	11,436	16,516
Loss equivalent to paddy (ton)	2.01	2.05	1.35	1.94

Note: ( ) at irrigation block indicates the number of farmers.
Price of paddy = 8.5 Mt/kg

4.1.5 The training sessions for farmers obtain knowledge about the management and maintenance of irrigation facility as well as water management

(1) OJT for Participatory Facility Rehabilitation Works by Farmers' Group

1) Information from Farmers gained through Interview in 2012

Obtained information from farmers through a few interviews in May/June, 2012 is as follows.

- D5 Area: "Drainage is the largest problem. We hope dredging of drains by HICEP equipment. After that, we maintain them by ourselves. Along D5 secondary irrigation canal, leakage water is stagnant." (Nelson Mandera Association).
  D5B Area: "Drainage is the largest problem on facility operation and maintenance" (FSG).

- D6 Area: "Drainage is the largest problem. In particular, drain outlet (flap gates crossing the Defense Dike were damaged.) of No.2 Main Drainage Canal (*Vala* 2) to the Limpopo River was placed higher than the condition before repair. Slightly upstream of the Defense Dike, another deteriorated gate structure was placed, which is bottle neck to drainage flow. In case of heavy rainfall, water level of No.2 Main Drainage Canal is often too high to drain excess water smoothly from farm plot through tertiary drainage canal. We hope solution of the problems." (FSG)

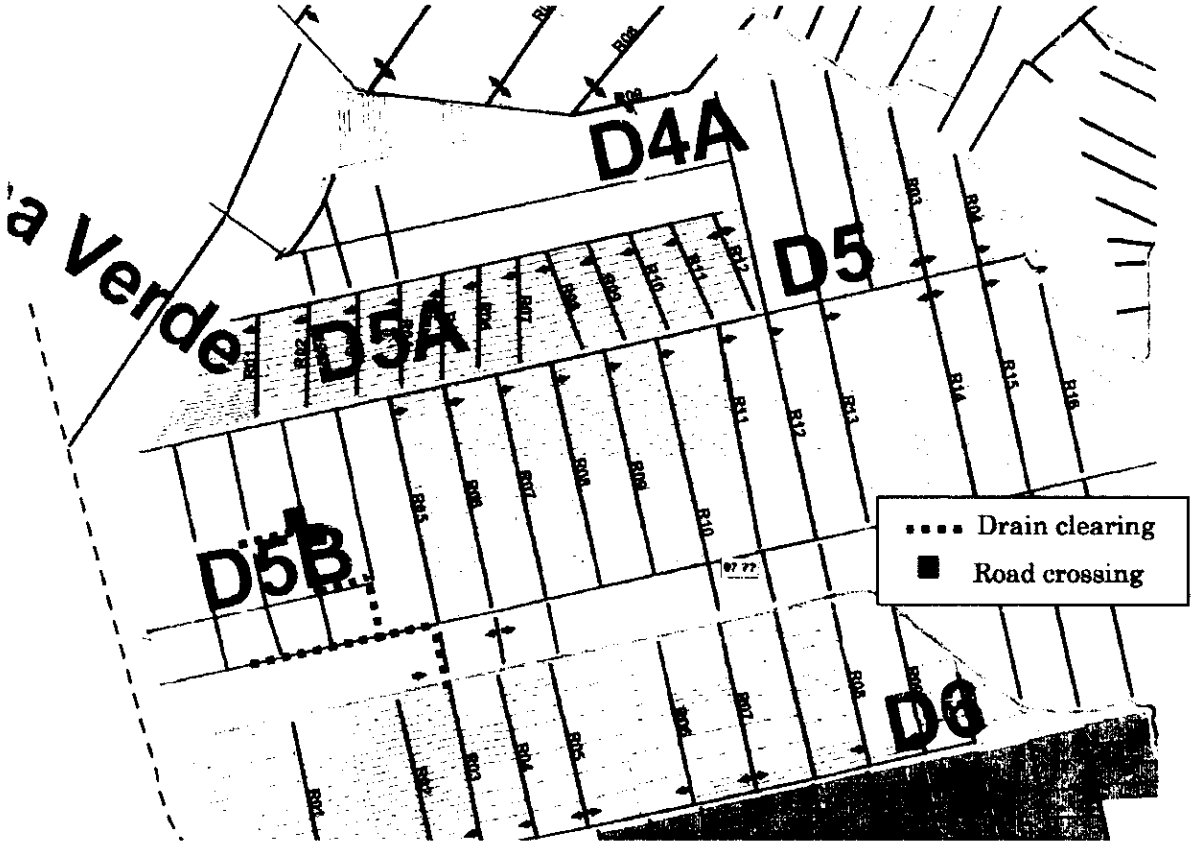
- D11 Area: "Drainage is a problem. Repair of tertiary irrigation canal or concrete flume can be done mostly by ourselves." "Planted rice seedlings in a plot were totally damaged without harvest due to flood in January 2012. Improvement of lowered flow capacity of a tertiary drainage canal is desirable." (Aredonze Association)

2) Measures in D5 Area in 2012 and 2014

Since drainage route that farmers' group pointed was not easy to see and to confirm due to heavy vegetation cover, discussions with the group were carried out to seek an approach method. Based on the discussion results, the farmers' group cleared the vegetation along the drainage route of about 1.4 km by 5 days works of total 141 person-days in June, 2012. The route includes reverse gradient part and irrigation canal used as dual purpose canal in a part. From such findings, it is considered that the drainage route is not effective as it is.

Checking again surrounding site conditions with the group, taking the team owned information in rainy season into consideration, and discussing with the group, construction of two drain culverts crossing farm road was decided to be done. For easy works to construct culverts, polyvinyl chloride (PVC) pipes (300 mm in diameter, 5.8 m long), being lighter comparatively, were selected. The pipes are set not so deep, so they were covered with concrete against tractor and other impacts. Number of participated people to the works is 51 in total for 7 days in June and July, 2012. The works can be applied at sites of similar conditions and were performed as one of on the job (OJT) trainings.

In 2014, additional drainage (actually used as dual purpose canal) improvement works were conducted, including soil digging or dredging by tractor under control of PROMPAC, soil removal by FSG, drain pipe culvert setting as well as another drain construction and so on as in Figure 4.1.19.



Prepared by PROMPAC Consultant Team Source of base map: HICEP

Figure 4.1.6 OJT for drainage improvement in D5 Area in 2012

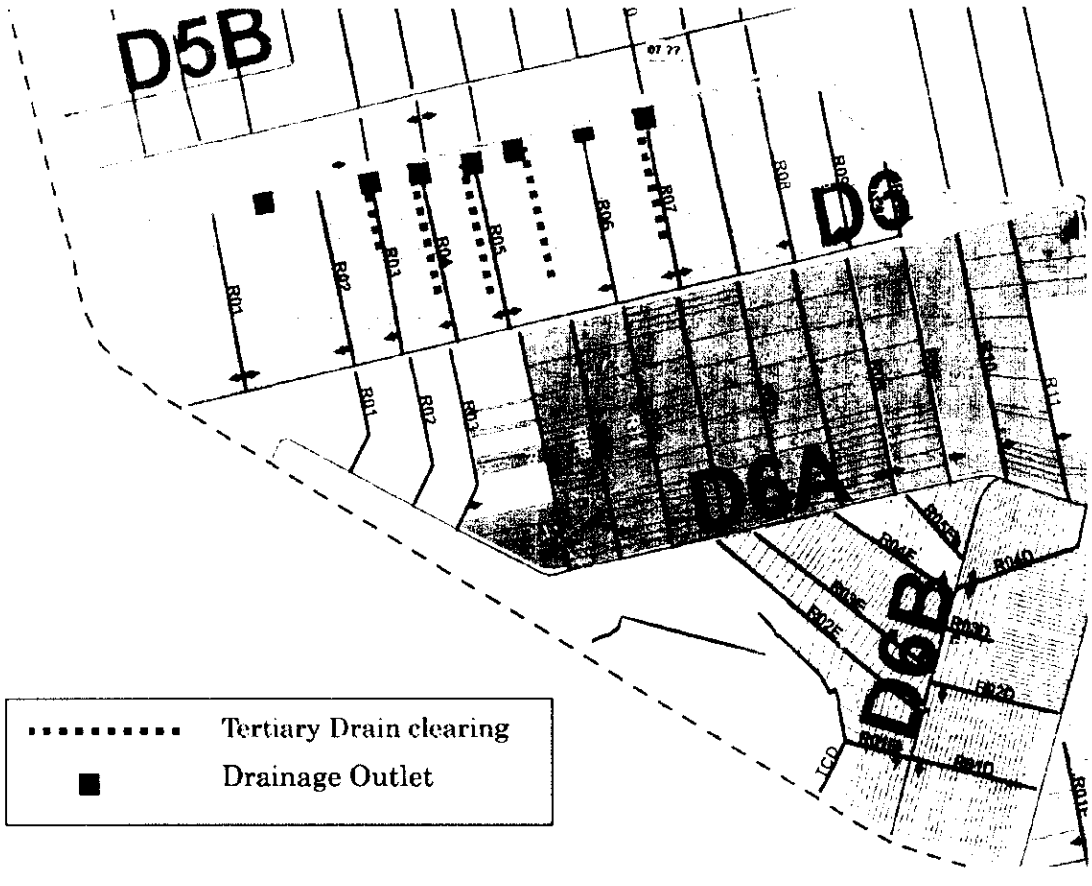
3) Measures in D6 Area in 2012

The target tertiary drainage canals were designed to connect and drain to No.2 Main Drainage Canal (Vala 2) and some of the drain outlets were probably constructed before, though the drain outlets are not confirmed fully now. Based on the reconnaissance survey and satellite image (Google Earth), it is judged that the drains pass through low land or swampy old river channel course covered with bushes like cattail or bulrush. As the drains were not seen and conditions were not known in the low land, selected approach was clearing of the drains in discussion with the farmers group. After 5 days clearing by a total of 142 person-days in June 2012, the tertiary drains became seen and recognized. At the same time, it was found that drain outlets to the Main Drainage Canal were not functional, with thin (about 20 cm wide) and shallow (about 50 cm deep) ditches partly dug crossing the maintenance road of No.2 Main Drainage Canal, to which drainage water flowed in as little flow.

From above, improvement of the drain outlets, being requested to be made by the group, was decided to be done by themselves as OJT in corporation with the Project including HICEP, EAC and SDAE. Considering ease of procurement and construction, PVC pipes (D 300 mm, L 5.8 m) were used for drain outlets of 6 tertiary drainage canals as illustrated in Figure 4.1.7 Also, a PVC pipe (D 150 mm, L 6.0 m) was employed for drain outlet for surplus irrigation water at the end of a tertiary irrigation canal. A gate box was installed at each drain outlet to stop reverse water intrusion in case that water level of the main drainage canal is higher than that of tertiary drainage canal. Such construction methods that are familiar with the farmers and the agencies, were selected as much as possible. Reinforcement bars were not used for the gate

box made of concrete blocks and mortar. In total 88 farmers participated for the drain outlet works in 12 days in June to July, 2012.

Dimension of Drain Outlet Culvert: In accordance with the report of "Consultancy Services for Studies and Supervision of the Rehabilitation of Main Drainage System and Secondary and Tertiary Infrastructure at Chokwe Irrigation System, Design and Tender Documents, January 2010, Consultec, cec and Ingerop", a design unit drainage discharge of 5.6 lit/s/ha (24 hour rainfall = 80 mm, runoff coefficient = 60 %, allowable inundation period = 50 hours) was used in the report in 2004 by BRL ingenierie. After experience of 2012 flood, HICEP has an idea that the unit drainage discharge is too small and it should be revised. In this report, it is assumed to be 10 liter/s/ha. Drainage area of concerned tertiary drainage canal in D6 area is estimated at approximately 13 ha (650m x 200m), then design discharge at the drain outlet is calculated 130 lit/s. Cross sectional area of pipe of D 300mm being about 0.07 m^2, flow velocity is estimated at about 1.9 m/s, which is lower than allowable maximum velocity (5 m/s). Velocity head may be around 0.18 m and head loss is estimated to be about 0.3 m at the outlet. In D6 area, soil cover thickness is more than 0.6 m. Hence, use of PVC pipe with diameter of 300 mm is not problematic. When large excavators pass over the outlet, they should pass cautiously to avoid any large impact against the pipe.



Source of base map: HICEP

Figure 4.1.7 OJT for drainage improvement in D6 Area in 2012

4) Measures in D11 Area in 2012

Based on interview information in the field in June 2012, maintenance measures of the irrigation and

drainage facility were discussed with farmers' group and SDAE extension worker. Further, through field visits, four (4) tertiary irrigation canals (R11, R20, R22 and R45 in D11 area) were selected for repair by farmers themselves. Also, a tertiary drainage canal of about 1.0 km long was decided to be cleared and dredged by the farmers group. In eight (8) days, 151 farmers in total took part in clearing and dredging of the tertiary drainage canal.

U-shaped reinforced concrete flume of 4 m long is basically used for the tertiary irrigation canal. According to the extension worker and farmers, Portuguese flume of about 60 years old is stronger than new flume made in rehabilitation works around 10 years ago. The former flume has dense distribution of reinforcement bar and its aggregates are of a better quality. The farmers say that spare flumes can be transported by cattle or some way and are usable where necessary.

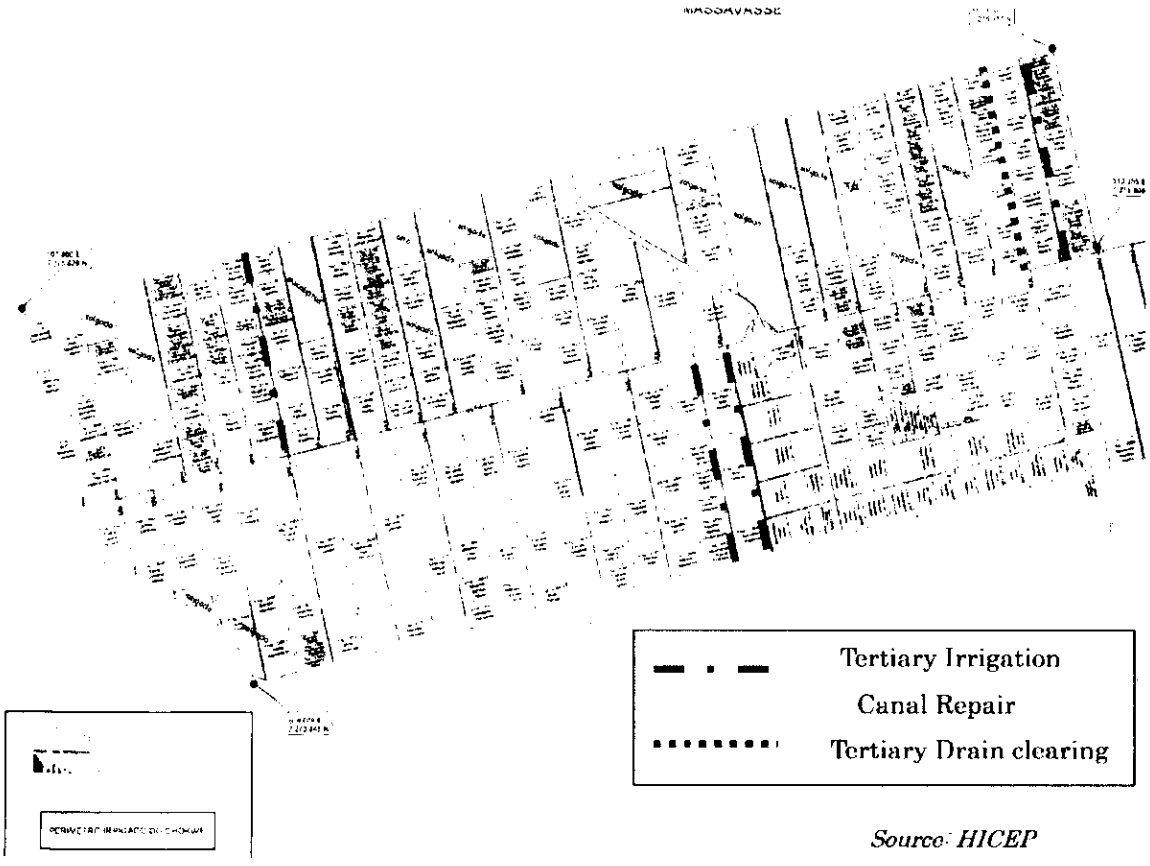


Figure 4.1.8 OJT for irrigation/drainage facility maintenance in 2012 in D11 Area

5) Analysis on water management problems in D11 area (southwestern part)

- Land use

Including salinity damaged areas and swampy poor drainage areas, problems here are also those of the whole Chokwe Irrigation Scheme. New land use planning considering present conditions is desirable. Construction of large scale secondary drain network in D13 by Wanbao suggests one of the land improvement approaches.

In addition to original use as agricultural land, change of the land use to designation for fodder or grass

land, pasture, fish pond, water surface or swampy area as wild bird habitat, and combination of various environments are expected to be studied. Excavated soil for fish pond may be used to make higher embankment space, where flood shelter can be constructed as one of disaster prevention plan. Tree planting on the embankment or along road to make shade is an idea.

- Road improvement

Such improved road as useful in the rainy season is desirable.

- Irrigation canal

In near future, as actual irrigation area increases, balance between water supply and demand may be tense, and both secondary and tertiary irrigation canals are expected to be functional as designed.

Tertiary irrigation canal was mainly constructed as flume and some of them are used continuously. On some tertiary irrigation canals, flume type is used at the crossing with main drain only, and two earth canals made by farmers are used for irrigation along both sides of the original flume line. In such case, farmers informed that earth canals can distribute water more quickly. It seems that earth canal can be treated more easily by farmers. Surplus irrigation water should be drained to secondary drain.

- Backwater by V43S Secondary Drainage Canal (Secondary Drain)

Surplus water of rain and irrigation in southwestern part of D11 area, through tertiary drainage canals, collects to V43S secondary drain (V8 in the Basic Design Study 2001) and flows down to Main Drain 5 (Vala 5) in the plan. In June 2013, water level of V43S was rather high near concrete slab of small bridge around planned demonstration farm for the next cropping season. Field plots adjacent to the secondary drain are partly inundated and stagnant water is seen in the tertiary drains near the secondary drain due to backwater of the secondary drain.

- Relation between paddy yield and distance from the secondary drain

Simplified paddy yields in 2012-13 season in the D11 demonstration farm are obtained from Figure 4.1.4 and shown in Figure 4.1.9.

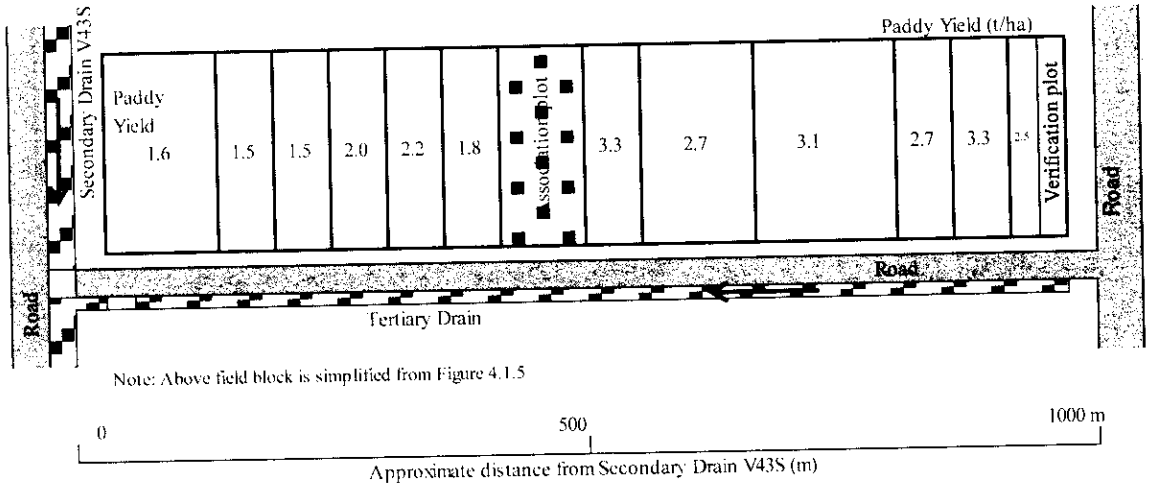


Figure 4.1.9 Paddy Yield by Distance from Secondary Drain V43S

As in Figure 4.1.10, profile of the tertiary drain is sloped downward with slight undulation.

Relation between the yield and roughly estimated average distance from V43S secondary drain is presented in Table 4.1.14 and Figure 4.1.10. Though the yield is a result from plural factors, it seems that the approximation and correlation coefficient of 0.79 suggest effect of the distance to the yield. Leave of every 100 m from V43S may increase the yield of 0.18 t/ha in the condition. There seems two groups divided in the middle or by the distance, namely less than 500m with less than 2.5 t/ha, and more than 500m with more than 2.5 t/ha.

This relation suggests negative effect of backwater from V43S. Drainage condition is worse near the drain. It is noted that drainage condition is not always worse near drain in general.

Distance (m)	Ave. Yield (t/ha)
70	1.6
160	1.5
220	1.5
280	2.0
340	2.2
400	1.8
520	3.3
610	2.7
745	3.1
850	2.7
910	3.3
955	2.5

Table 4.1.14 Yield vs Distance

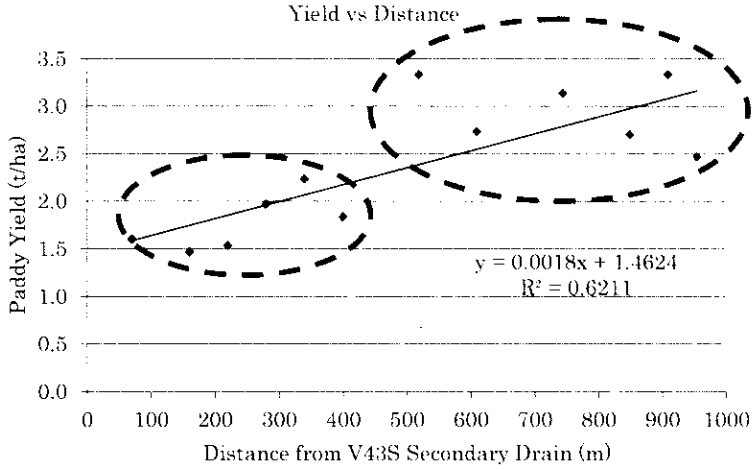


Figure 4.1.10 Correlation of Distance and Yield

- Relation between paddy yield and level difference between paddy field and drain water level

Above correlation between the distance and the yield in Figure 4.1.10 suggests that difference between paddy field ground level and water level of the tertiary drain increases as the distance becomes longer at the time of direct sowing.

- V43S Secondary Drain (SD)

V43S SD flows along southern border of D11 west area, starting from left (east) side of Canal Direito to Vala 5. According to information of farmers and extension staff in 2013, an Indian company (Global Agro Investment LDA) raises up water level of the drain to take the drain water for irrigation of a part of D12 area near Vala 5, in the rainy season by putting sand bags or so at the gate of outlet of the drain and a road crossing. Also, it is informed that in the rice cropping season, water level of the drain is higher than now. This worsens drainage condition of the southwestern part of D11 area. This heightening of drain water was not happened in 2013-14 rice season.

A staff of the company explained that it is necessary because their field cannot take irrigation water from D12 Secondary Irrigation Canal (SIC), of which canal bed longitudinal slope is reverse near the fields. Site check result seems to support the explanation. It is also observed that water level of D12 SIC was not sufficiently high against some of the intake gate sills for tertiary irrigation canal. Clearing and cleaning as well as sediment dredging are required for not only D12 but also D11 area.

6) Measures in D11 area in 2013

- Training subject in June-July, 2013

Through interview and so on, it is made clear that for farmers in D11 area, the most serious problem is poor drainage. Unstable intake of irrigation water due to lack of flume at drain crossing is also serious problem. In 2012-13 rice cropping season, FSG and the consultant team experienced unsuccessful germination of seeds just after direct sowing due to inundation in some of the plots. Some farmers tried to drain such inundated water on the field to tertiary drains by ditch crossing farm road, but only incomplete drainage was attained.

Based on the above, improvement of on-farm level drainage and irrigation facility in the planned demonstration farms in D11 area was selected as a subject of the training.

As in Figure 4.1.10, two tertiary irrigation canals of R12 and R14 were expected to supply irrigation water to selected demonstration farms of D11 area in 2013-14 rice cropping season. These canals are branched off from D11 secondary irrigation canal and cross No.7 main drain (Vala VII), then reach to the target field block. At the crossing, a flume (4 m) of R14 and two flumes (8 m) of R12 fell down and missing. In order to keep stable water supply to the demonstration farms, gain of flow capacity at the crossing was also decided to be one of the training subjects.

- Implementation of training

The training was implemented as OJT at site for a month in July 2013.

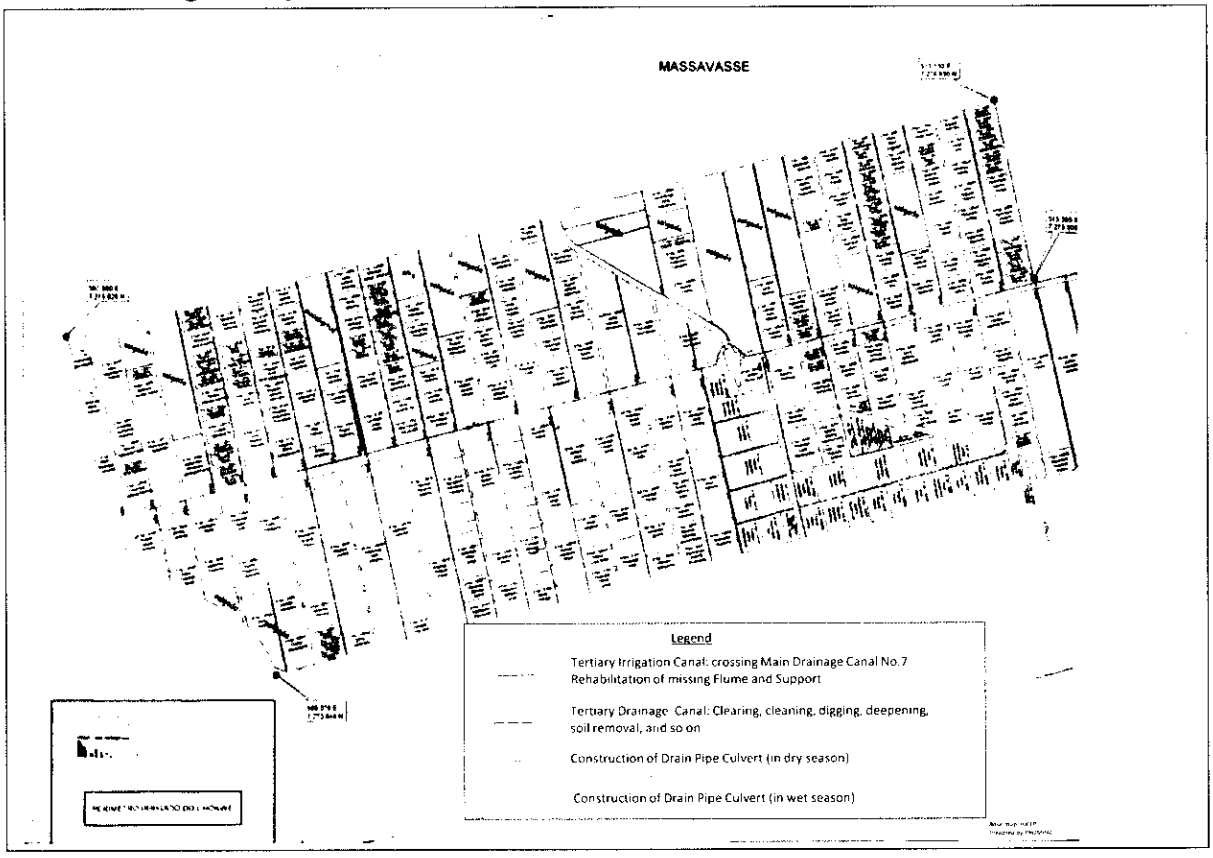


Figure 4.1.11 OJT for irrigation/drainage facility maintenance in 2013 in D11 Area

- Tertiary irrigation canal

As a result of discussion with FSG and extension officer on repair at crossing of R14 tertiary irrigation canal with Main Drain 7 or Vala VII, it was decided that a precast concrete support be installed and a flume be replaced manually after transported by tractor. R14 canal covers a farm block (about 32ha) or two field blocks, where a part or 25ha of planned demonstration fields is included. For such case that this method would not be adaptable due to difference of interval between supports and flume length or difficulty in manual treating of the flume, an optional method was prepared using 2 polyvinylchloride (PVC) pipes of 160 mm diameter (This option was not selected finally.).

As for precast concrete support, at least 3 types are observed, out of which the largest one was used with 4.5m long and approximate weight of 570kg. Length and approximate weight of the flume are 4m and 430kg, respectively. One of the reasons why the training was not always done effectively, is that there are few spaces around the sites to store the PVC pipe of 5.8m length, and the tractor must transport the required pipes each day. Also, those cement bags that are used other days should be stored in rice mill house or SDAE warehouse, so frequent purchase, transportation, loading and unloading are needed, resulting in delay of sending materials to site sometimes. If the works are done in the rainy season, effectiveness may be much lower due to poorer road condition.

Main work items of the training were collection of the main drain information, transportation of concrete support and flume, sand bag preparation and distribution around the support base, excavation for the base, adjustment of length of the support (4.5m to approx. 3.5m) and installation, form setting using divided old flume, transportation of concrete aggregates (sand and gravel), manual removal of excess water and input of mixed cement and aggregates, cure, timber transportation, scaffolding and flume setting, and disassembling of scaffolding.

Sudden and repeated participation to village ceremony by one of the core farmers delayed the works about 4 days. Shortening cure period of the support base concrete a day, the repair was completed within just the limit of time.

R12 tertiary irrigation canal supplies water to another farm block, where remaining 7 ha of the demonstration fields were included for 2013-14 rice cropping season. Of the main drain, water depth was 1.0 – 1.5 m, and an old concrete support lies in the water. Base concrete for the support was up to near the water surface. Installation and reuse of the concrete support were considered, but it was judged impossible by manual work within a limited short time. Though durable period is shorter, assembled timber support method was selected as easier one. To repair missing two flumes, double of two pipes connection (total 4nos, φ160mm) was employed as comparatively light superstructure.

Major work contents included transportation of timber and pipe, assembling of timbers for support, pipe joining and setting, fixing and water stopping at pipe ends by concrete, increase and strengthening of timber support through re-use of scaffolding timbers used at R14 crossing.

The OJT was completed just within the time limit or on July 30, affected by the delay of above R12 works.

- Tertiary drain

Based on discussion with FSG farmers and extension officer in D11 area, improvement of tertiary drains related to the demonstration fields in 2013-14 rice cropping season was implemented. Target drains are 2

drains in D11 area.

HICEP has not yet named the tertiary drains, so tentative names are used here.

Tentative name of tertiary drain in D11 area; west drain (about 950m) is between R12 and R14 canals, and east drain (about 950m) lies between R14 and R16 tertiary irrigation canals. Both drains flow from north to south and join secondary drain V43S, which flows eastward and reaches main drain 5 or Vala 5.

Improvement of the target tertiary drains consists of combination of clearing and cleaning, tractor plowing and soil removal, manual soil removal, manual digging, construction of cross drain or drain pipe culvert that crosses farm road or wide soil deposits, and so on.

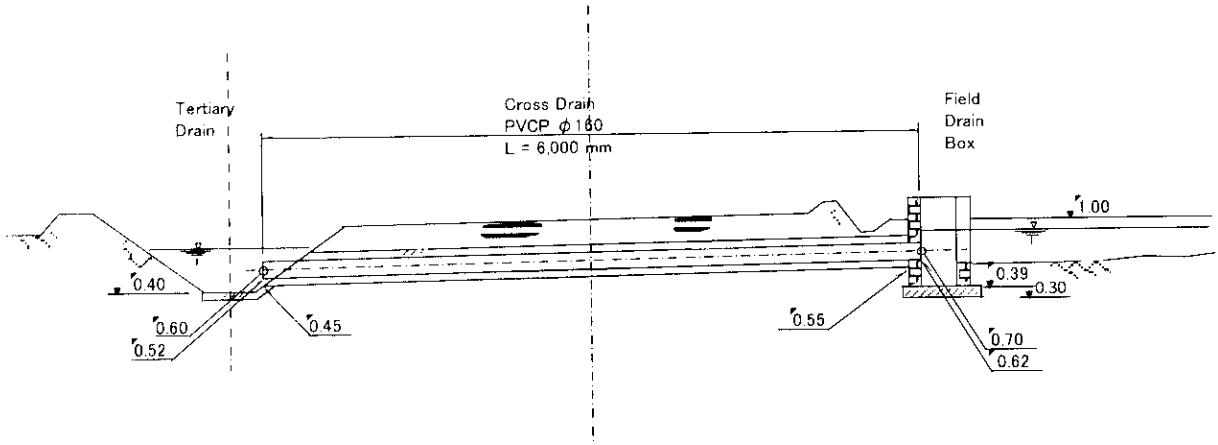


Figure 4.1.12 Drain Pipe Culvert

The cross drain is composed of PVC pipe of φ160mm and drain inlet box made of concrete blocks and mortar. In total 13 numbers of the cross drain were constructed by July 30, of which 11 are in D11 area and 2 are in D12 area. Additional 2 drain pipe culverts were constructed by EAC staff later in the rice cropping season in 2012-13.

7) Measures in D12 area in 2013

In D12 area, sight check was carried out but time was not enough to interview to farmers in a 2 months period from May to July, 2012.

- Training subject in June-July, 2013

Through interview and site observation, it is informed that for farmers in D12 area, the most serious problem is poor drainage. In 2012-13 rice cropping season, FSG and the consultant team met the same unsuccessful germination of seeds as in D11 area, just after direct sowing due to inundation in some of the plots. Some farmers tried to drain such inundated water on the field to tertiary drains by manually dug ditches, but only incomplete drainage was attained.

Based on the above, improvement of on-farm level drainage facility in the planned demonstration farms in D12 area was selected as a subject of the training.

For D12 area, it is judged from farmers' information and sight check that no particular repair work is necessary but minor works at the time of cropping. Therefore, repair work was not carried out this time.

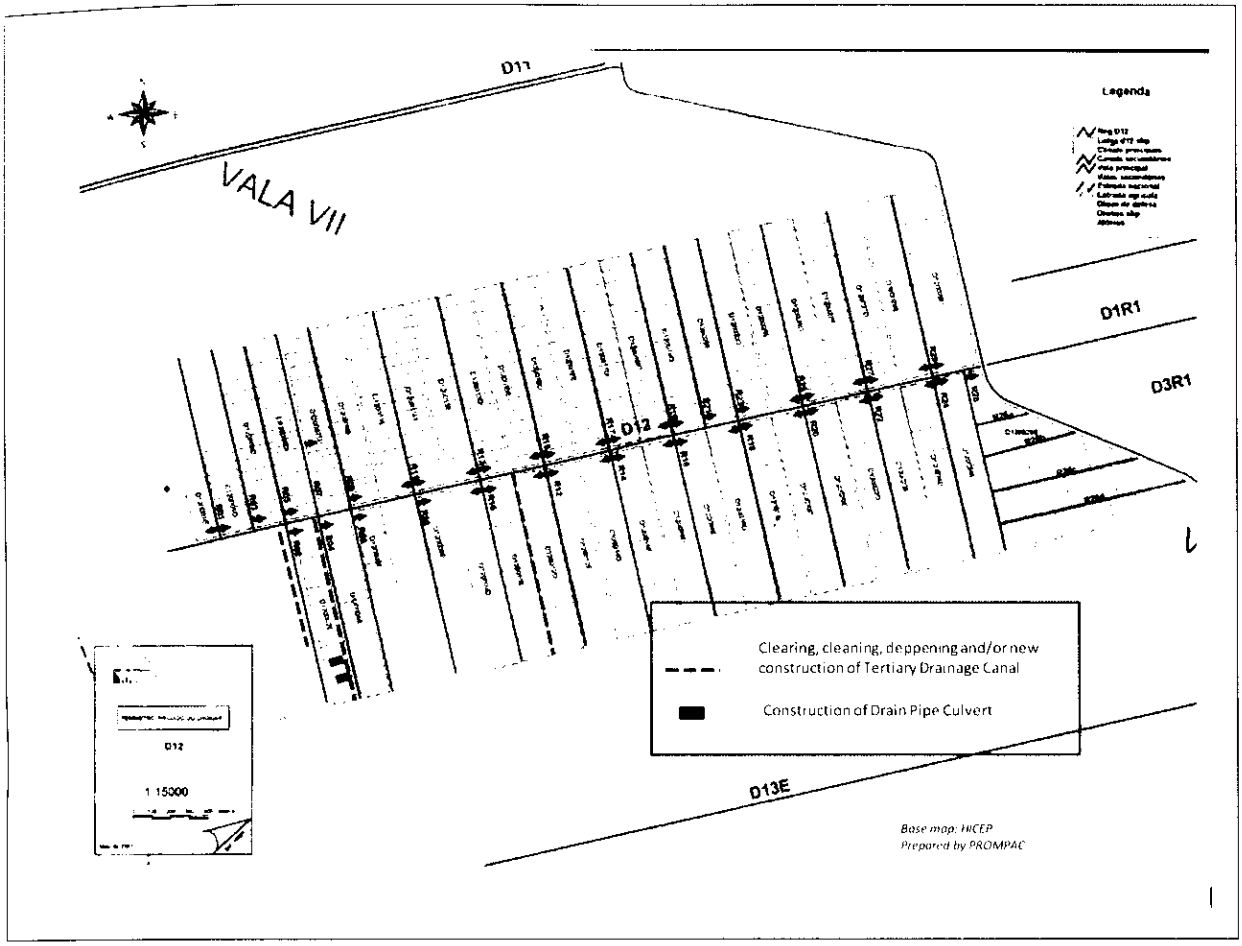


Figure 4.1.13 OJT for drainage facility maintenance in 2013 in D12 Area

Similarly as for D11 area, target tertiary drains in D12 area are given tentative names. In southern area from D12 secondary irrigation canal, tertiary drain of the most western side along the fields is called west tertiary drain (about 620m) here, and next or east one is called east tertiary drain (about 950m). East side of additional demonstration fields in Ramal 7 is tentatively named additional tertiary drain (about 950m). Before the training, the additional tertiary drain was not identified on the ground except for northern part of about 200m long. A farmer mentioned that the drain was re-filled soon after the construction of Chokwe Irrigation Scheme. However, it seems hard to confirm details of the history. In this area, there exists V46S secondary drain along northern side and V47S secondary drain along southern side. Both of the secondary drains flow east and join main drain 5 or Vala V. Farmers informed that middle portion in the field blocks is higher and drainage water separates to northward and southward, except for west tertiary drain, which connects only to V46S. Design of the drainage system also suggests this matter and the drain profile in Figure 4.1.13 shows the matter clearly.

Improvement of the target tertiary drains consists of the same combination as in 6), except that tractor plowing was performed only for the additional tertiary drain. The cross drain is composed of PVC pipe of φ160mm and drain inlet box made of concrete blocks and mortar. Two numbers of the cross drain were constructed by July 30.

8) R1 and R3 Areas

Since rehabilitation works by IDB finance have been going on in Rio Sector including R1 and R3 areas, the areas are not selected as target of OJT for maintenance works.

9) Training on Maintenance of Irrigation and Drainage Systems, and Issues on OJT

This training was conducted in the meeting room of SDAE on July 4, 2012.

- HICEP presentation and the followed discussion

In the training meeting, HICEP presented irrigation and drainage systems, maintenance of the systems, water management issues of tertiary irrigation canal, improvement of tertiary drainage canal and drain outlet and so on. Based on this presentation, an active discussion was carried out including the items mentioned below.

In response to concerns of farmers' group on maintenance works of No.2 Main Drainage Canal and tertiary irrigation canal (flume), HICEP stated "dredging by excavator along No.2 Main Drainage Canal will start as of next week (on around July 10, 2012)", "repair cost of U-shaped flume is high", and "Chinese government's preparation for a plan of 10,000 ha rehabilitation. On leakage from flume joint, an opinion suggested possibility of two cases, namely farmer's fault case and non-farmer's fault case. On the flume repair, HICEP explained that HICEP was sometimes out of the process. HICEP mentioned its preparedness for intervention to maintenance issue of secondary drainage canal along left (north) side of D11 Secondary Irrigation Canal. HICEP put stress on talking between HICEP and farmers, and noted that for farmers it be no need of waiting for this kind of meeting but should contact to HICEP anytime.

Countermeasures against damage to irrigation facility by cattle and handrail to bridge on Direite Primary Irrigation Canal near D6 Intake were requested. "The cattle are necessary for animal traction, and they can stay on the road. In case they come into irrigation facility, penalty is MT 3,000/each.", a farmer said.

A question came out, "In D12 area, only two farmers use land (4 ha) in a filed block of 16 ha. Maintenance is difficult in such case. What plan or idea does HICEP have for unused land?" HICEP answered "There are such cases. Infrastructure (land) tax of 600 MT/ha/year will be collected to avoid this situation." SDAE added the starting date of August 2012 and mentioned "Farmers should get together or be organized for maintenance of infrastructure."

A question of one of the farmers' leaders is "HICEP/SIREMO maintained secondary and tertiary canals before, and what would be new if we pay water fee?" HICEP answered "At that time SIREMO was responsible for all irrigation system. Now HICEP should be responsible for primary/main and secondary canals"

Regarding the flume damage, a comment is that someone takes iron and concrete as his construction material. And an opinion followed "Those persons who damage flume for construction purpose should be fined 8,000 MT/flume." Against a complaint that sometimes snake stays under replaced old flume, SDAE responded "Let leave/dispose such flumes".

- Presentation on OJT for maintenance of on-farm level facility by the Consultant Team
- D5 Area

OJT activities were introduced and some questions on the informed drainage flow route were presented.

Continuation of maintenance works is requested to the farmers' group.

- D6 Area

OJT activities were presented and insufficient communication was pointed out with examples. Number of drain outlet to be improved was informed as 5 at first but changed later to be 7 sites (1 site for surplus water from the end of irrigation canal). Such information should be transferred soon. When delayed like this time, additional time and cost (including transportation cost from Maputo) are needed (actually spare material was used). Incorrect information on the number of farmers that can participate in the drain outlet works, caused delay in the construction and influenced the whole schedule negatively. Sooner communication is stressed to save time reasonably. Continuous maintenance of the tertiary drainage canals was requested to the farmers' group.

- D11 Area

OJT contents were presented, where insufficient maintenance works such as dredging and cutting of drainage canal were suggested. Of existing drainage culvert of the canal, lower half of cross sectional area of the concrete pipe is filled with sediment. The drainage canal bottom level is the same level as the sediment surface level, and recovery of flow capacity is not sufficient.

10) Results of OJT in 2012 and Consideration

- Results and Lessons

Visible effect is that water level of the target tertiary drainage canals in D6 area lowered by at least about 20-30 cm due to clearing of the canal and improvement/construction of drain outlets. Drainage capacity of 6 tertiary drainage canals in D6 area was enhanced clearly.

Repair of the tertiary irrigation canals (concrete flume) in D11 area was effective to certain extent mainly by mortar filling at and around the flume joint. Two drainage culverts (actually dual purpose) in D5 area and a tertiary drainage canal in D11 area, where no flow was observed in July 2014, were appreciated by farmers. They said the facility were effective in the rainy season.

Through OJT works done in relatively short time, one of the positive lessons gained is possibility of effective maintenance works being carried out in combination with farmers' group and members of EAC, HICEP and/or SDAE. Another lesson is that better team works can be done by the group with strong leadership.

One of the negative lessons may be difficulty in keeping sufficient communication without sufficient monitoring support.

(2) OJT for Simple Leveling

1) Background and Purpose

As mentioned in above (1), the most serious problem of on-farm level water management using irrigation and drainage facility is poor drainage condition at present. In other words, tertiary drainage canal is not fully functional in many places.

In irrigation and drainage systems, relation of elevation or height among canal, field and water is quite important. For example, effective drainage is difficult without level difference of more than certain value between average ground level of field plot and drain bed. To keep difference of the levels is not always sufficient condition but necessary condition.

Usually the causes of the poor drainage is not one but plural. In case that water level of secondary drainage canal is not low enough, flow capacity of the related tertiary drainage canal is often smaller than required. Since water flows according to difference of the energy or head of water, important is relation between concerned ground elevations or difference of the elevations. The elevation difference (Δ, Figure 4.1.14) can be seen when it is large. However, it is not easy to know by sight in flat land like CIS, though careful observation of water movement may let us know it to certain extent.

Profile or longitudinal section of the canal presents important information on hydraulic condition of the canal. The canal profile is prepared by topographic survey. In PROMPAC (the Project) simple leveling was selected not only to prepare canal profile but also to know ground elevation pattern in a field plot.

Purposes of the simple leveling as OJT in the Project are two items. One is that the farmers are expected to be more sensitive to scale of the elevation difference than before and they may use the method someday when necessary, after the experience of simple leveling. Another is hydraulic analysis can be done using obtained profile and plan as done in the report.

The simple leveling was practised by farmers as OJT in D5, D6, D11, D12, R1 and R3 areas from the end of May to the beginning of July, 2014. The Manual includes explanation and obtained results of simple leveling.

Table 4.1.15 Material for tool

Material
Flexible transparent plastic tube: D 6mm 5m x 3
PET bottle: 0.5 liter, used x 2
Bar for scale: L 2.5m x 3
Oily color pen: Red, Blue & Black (example) x 1
PET bottle: 1.5 liter, used x 3
Convex: 5 m x 1
Rope: 10 m x 1
Wooden stake: L 50 cm x 10 (as required)
Vinyl tape, glue and others: L.S.

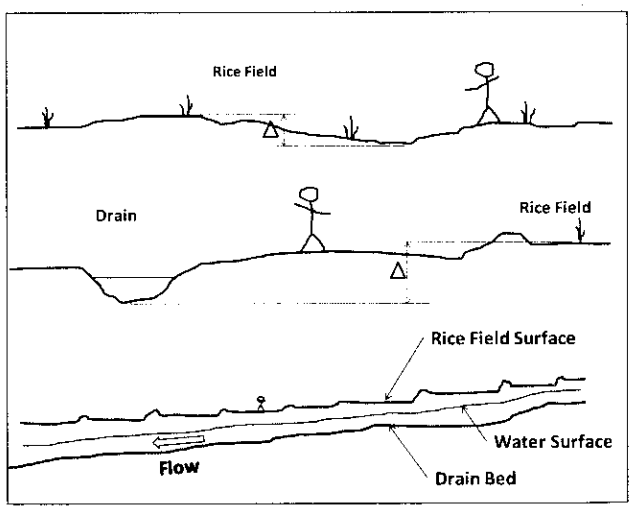


Figure 4.1.14 Target of simple leveling

2) Tool and cost

Without topographical survey equipment such as auto-level, simple leveling with low cost and simple tools though with lower accuracy was tried. Materials for the simple tools (Figure 4.1.15) are presented in Table 4-1-I-x. For the tools, total cost is estimated at 1,050 MT. Detailed cost estimate can be seen in the Manual.

Used PET bottle with tube

Marking readings on simple scale

Figure 4.1.15 Simple tools for simple leveling

3) Temporary Bench Mark (TBM)

Elevation (EL) difference is measured by the simple leveling. However, absolute elevation based on some authorized datum such as mean sea level (Figure 4.1.16), cannot be measured when there is no authorized bench mark (BM).

In CIS, on farm level simple leveling is usually conducted without BM near the site. In this case, temporary BM (TBM) is selected to get relative elevation. Roughly speaking, ground elevation in CIS is mostly 20 - 40 meters above mean sea level (mamsl) according to information from Google Earth.

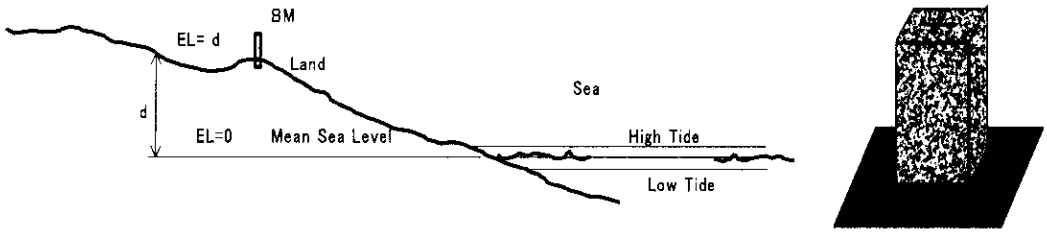


Figure 4.1.16 Elevation (EL) in "masl" and bench mark (BM) example

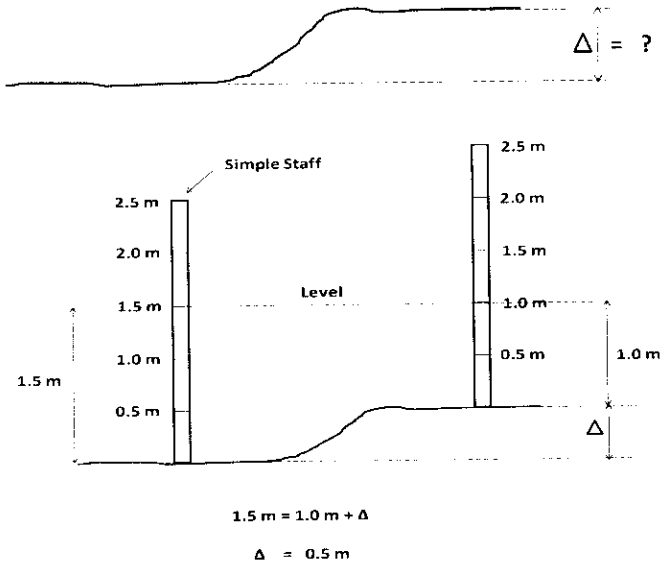
TBM is usually placed at stable and easily recognized position, such as concrete structure, metal surface and so on. Some of the TBMs selected in OJT simple leveling in 2014 in PROMPAC can be seen in photographs below.

Temporary elevation of TBM is set 5.00 m in OJT leveling in 2014.

Using the TBM elevation in this report, measurement results are expressed as profile and plan for easy understanding.

4) Measurement

Difference of elevation (Δ) is measured as illustrated in right side and below.



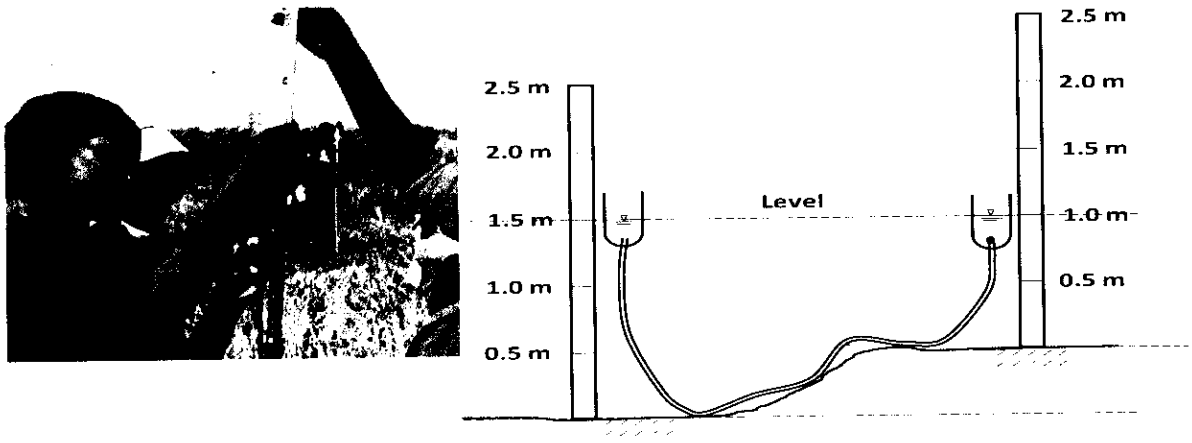


Figure 4.1.17 Simple Leveling in use of simple level and simple staff

In above case (Figure 4.1.17), Δ= difference of staff readings = 1.50 – 1.00 = 0.50 m.

Through trial and error method, it was decided that one bottle should be fixed at constant height for quicker measurement. For profile leveling, water level was kept at 1.50 m in general at base point. The base point is such point that already EL can be known by calculation. Next point is such point of which EL is to be measured based on the base point EL. Distance between the points were decided 10 m in the OJT.

It needs certain time before water levels of two bottles become equal. Adjustment of height of the bottles is required at the both points for time saving as suggested in Figure 4.1.18.

Detailed basic cares are listed up in the Manual. Out of the cares, important items are to avoid air mixture in the tube, to keep staff bottom just at the same level even though it is turned during measurement and to read water level after being stable. If the bottom level moves, the height of move becomes an error.

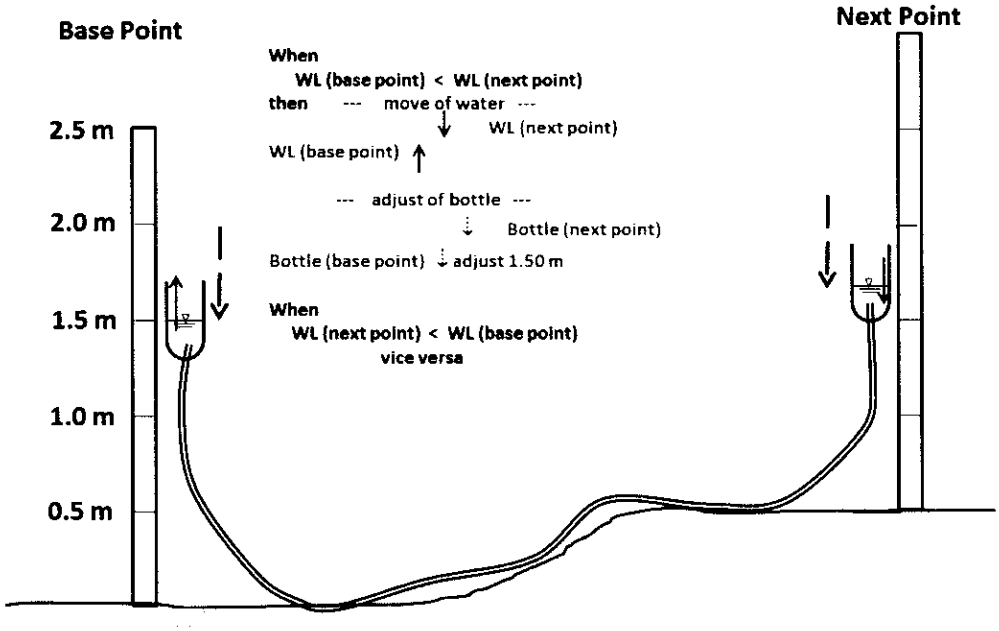


Figure 4.1.18 Adjustment of the bottle heights for water to be leveled

5) Recording with calculation

Format of Table 4.1.16 is selected and employed sheet after trial and error.

A top dark shaded cell is for tentative elevation of TBM. Shaded cells are filled with measured values at site. Blank cells are to be filled through calculation.

In the column of remarks, any note should be written. The notes include TBM with its structure, drain filled with straw, undulating field just after ploughing with the site location, unseen drain, soil bund, and so on.

Table 4.1.16 Sample recorded and calculated sheet for simple leveling

Simple Leveling Record Sheet

Place: R1, along and east of R3TC
Date/Time: June 12-16, 2014

Recorder: Calvin
Recorder: Kurauchi

No.	Accumulated Distance (m)	Base Point on drain bed H (m)	Base Point on drain bed WL (m)	Next Point on drain bed H (m)	Next Point on drain bed EL (m)	Next Point on field H (m)	Next Point on field EL (m)	Remarks
0	*0*	② *0.50*	③ 5.50		① **5.00**			**TBM**
1	*10*	⑥ *1.00*	⑦ 4.80	④ *1.70*	⑤ 3.80			Irrigation C.
2	*10*	⑫ *1.50*	⑬ 4.85	⑧ *1.45*	⑨ 3.35	⑩ *1.65*	⑪ 3.15	
3	*20*	⑯ *1.50*	⑰ 4.66	⑭ *1.69*	⑮ 3.16	⑱ *1.39*	⑲ 3.27	
4	*30*	*1.50*	4.77	*1.39*	3.27	*1.49*	3.28	
5	*40*	*1.50*	4.78	*1.49*	3.28	*1.35*	3.43	
6	*50* <b>	*1.50*	<c> 4.77	*1.51*	<a> 3.27	*1.41*	3.36	
7	*60* (i)	*1.50*	(ii) 4.88	<d> *1.39*	<e> 3.38	(iii) *1.56*	(iv) 3.32	
8	*70*	*1.50*	4.89	*1.49*	3.39	*1.48*	3.41	
9	*80*	*1.50*	4.79	*1.60*	3.29	*1.36*	3.43	
10	*90*	*1.50*	4.87	*1.42*	3.37	*1.37*	3.50	
11	*100*	*1.50*	5.02	*1.35*	3.52	*1.60*	3.42	
12								
13								

Calculation

A cycle of the calculation is as shown below.

<a> Firstly, known ELa is the starting point as base point, either EL of TBM or drainage canal bed level. (3.27 m in Table I-3)

<b> Water level is kept at 1.50 m or some other constant height.

<c> WL = ELa +1.50 at base point (3.27 + 1.50 =4.77)

<d> At next point with usual distance of 10 m, water level is adjusted to stable condition and staff height is read Hd. (1.39 m)

<e> WL – Hd = ELe (4.77 – 1.39 = 3.38 m)

6) Results

· D5 Area

Simple leveling was carried out along R20 of D5 Secondary Irrigation Canal (SC) and along rectangular route to D5B-SC as shown in Figure 4.1.19.

Profile of former case is illustrated in Figure 4.1.20. Difference of west side field level and bed level of tertiary drainage canal (partly filled with soil or cannot be seen) or its route is little and insufficient. For drainage improvement, three options may be considered. One is construction and deepening of the tertiary drain. Another is construction of road crossing pipe culverts from field to the secondary drain. The third is combination of the first and second methods.

Anyway, it is necessary to study drainage system in the area up to Main Drainage Canal No.2 (Vala II) for study of the countermeasures.

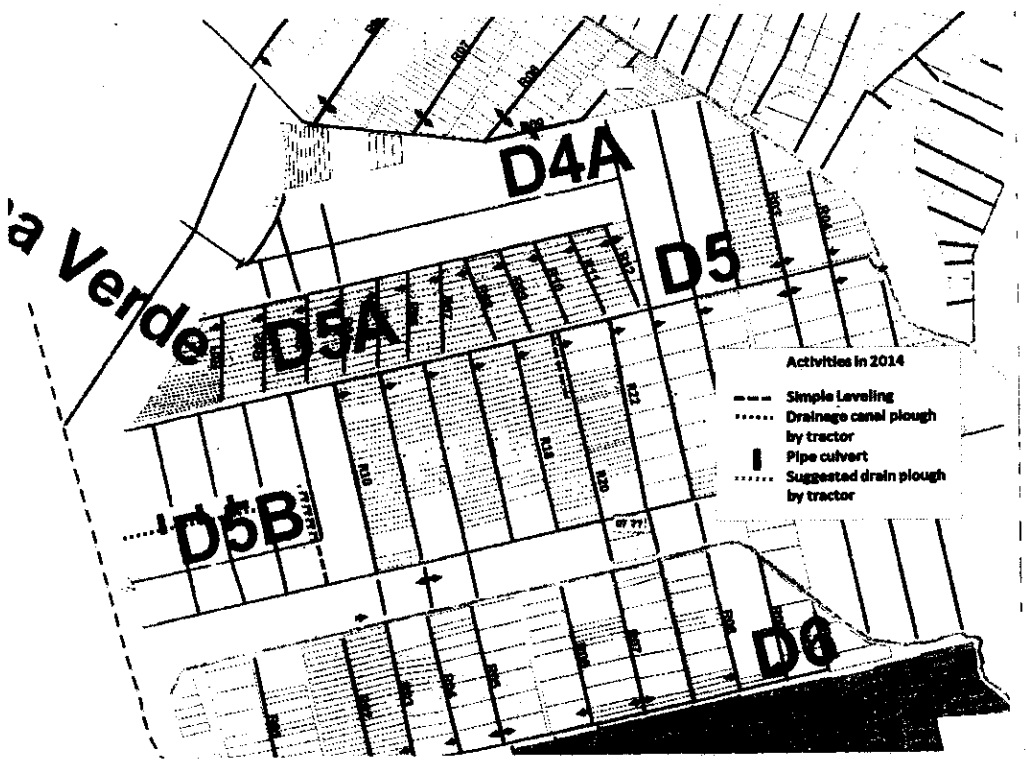


Figure 4.1.19 Simple Leveling and drainage improvement works in D5 area in 2014

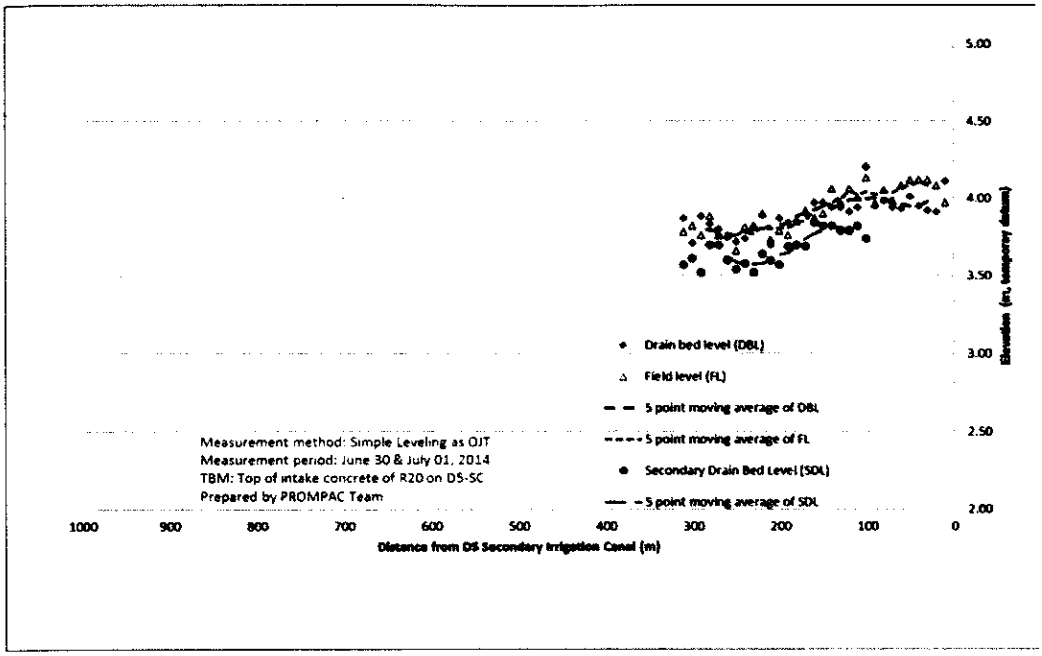


Figure 4.1.20 Profile of route of Tertiary Drainage Canal along R20 TC in D5 area

On the latter case in D5B area, profile of a tertiary drainage canal is presented in Figure 4-1-21. The drain is shown by blue break line in D5B area in Figure 4.1.19. Along the drain, drainage condition is poor at place to place.

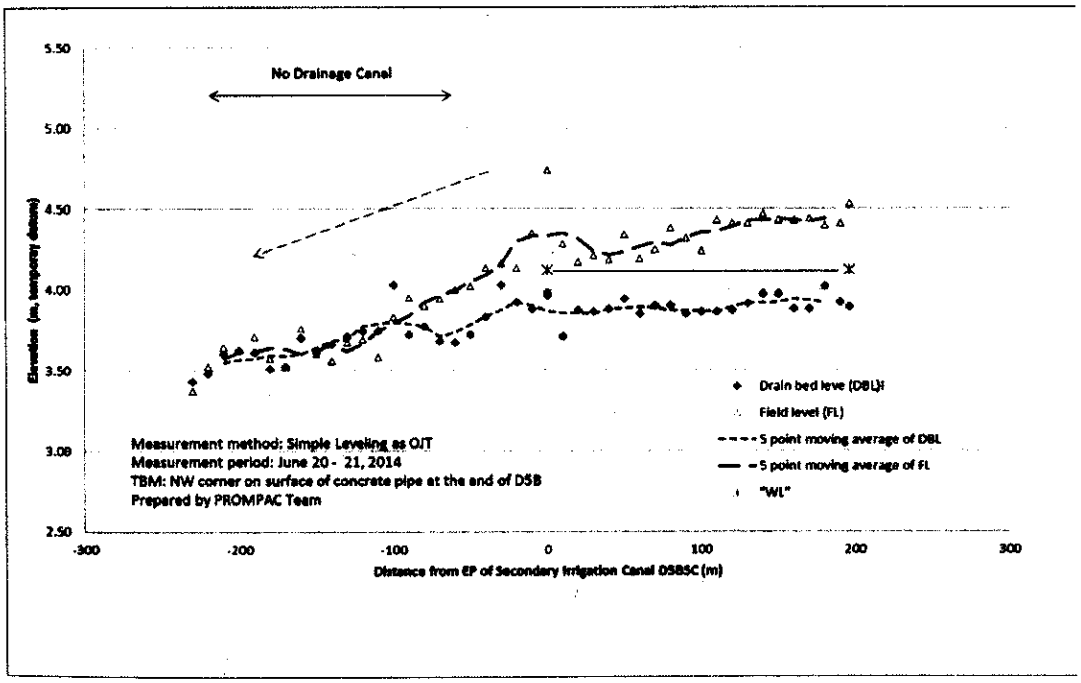


Figure 4.1.21 Profile of Tertiary Drain and its candidate route in D5B area

Since farmers wished to drain stagnant water after harvest in August 2014, tertiary drainage canal was dug by tractor from the end of D5B SC to northern direction in parallel with original tertiary irrigation canal of "caleiras". It results in improvement of drainage condition during rice cropping.

If farmers sometimes want to store water in the drainage canal, simple gate should be provided or

farmers may control by soil or sand bags.

Based on exchange of ideas with farmers' group, the tertiary drainage canal (actually used as dual purpose canal) was ploughed by a tractor in June 2014 as illustrated in Figure 4.1.19. In addition, three pipe culverts were constructed for easy irrigation and drainage water flows in June-July 2014.

- D6 area

Selected alignment is along R13 tertiary irrigation canal as in Figure 4.1.22. The tertiary drain

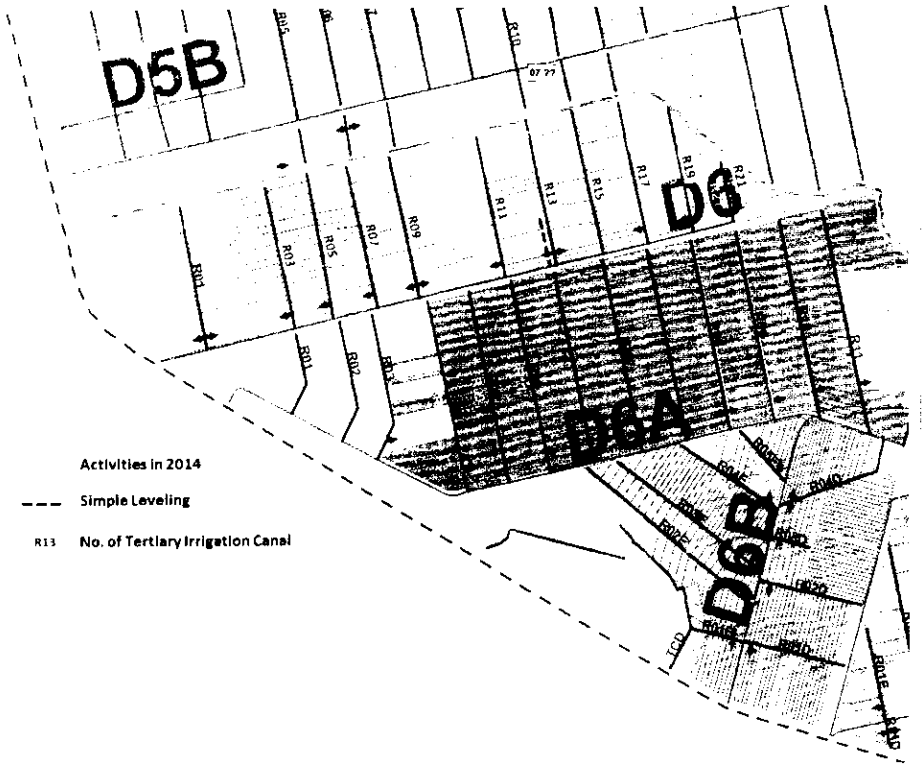


Figure 4.1.22 Simple Leveling in D6 area in 2014

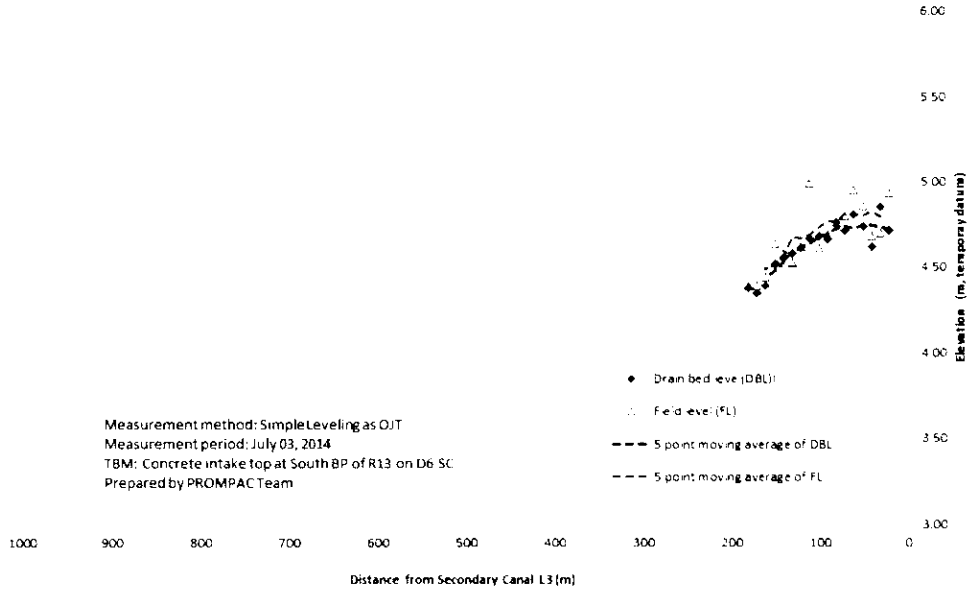


Figure 4.1.23 Profile of tertiary drainage canal route along R13 TC from D6 SC

exists intermittently. Difference of field and drain bed is little or nearly zero. Since land slope is rather steep at around 1/250 as can be seen in Figure 4.1.23, drainage can be effective, if tertiary drainage canal be dug properly.

The drainage canal was one of the six tertiary drainage canals cleared and cleaned in 2012. At the downstream end, pipe culvert was constructed in 2012 to connect Main Drainage Canal No.2 (Vala II).

- D11 area

As in Figure 4.1.24, simple leveling was performed along the tertiary drainage canal located east side of demonstration farms in 2012. The drain is between R16 and R18 tertiary irrigation canals.

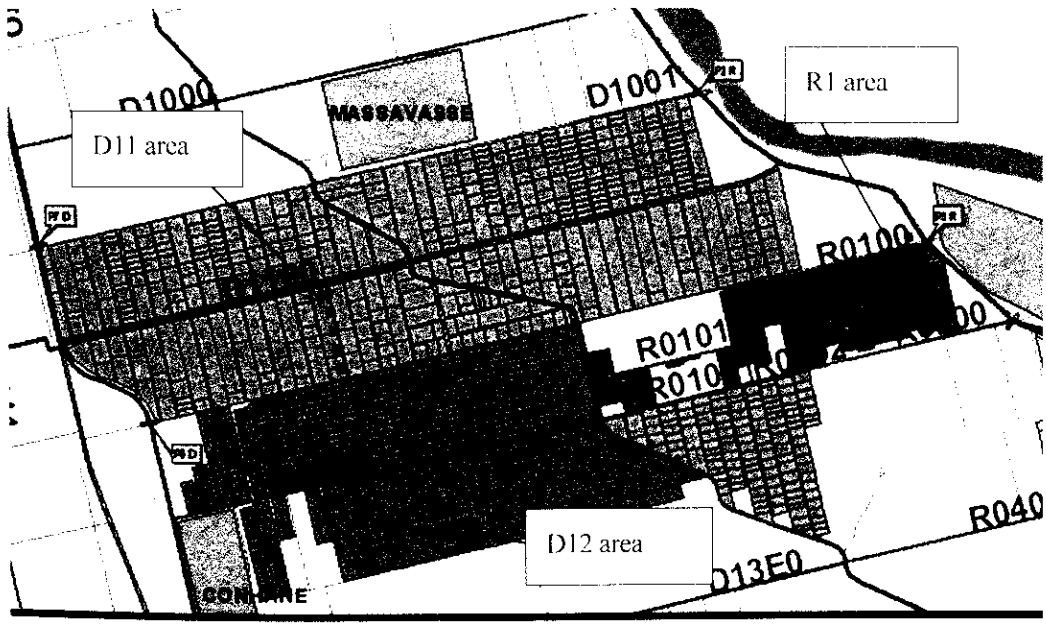


Figure 4.1.24 Simple Leveling as OJT in 2014 in D11, D12 and R1 areas

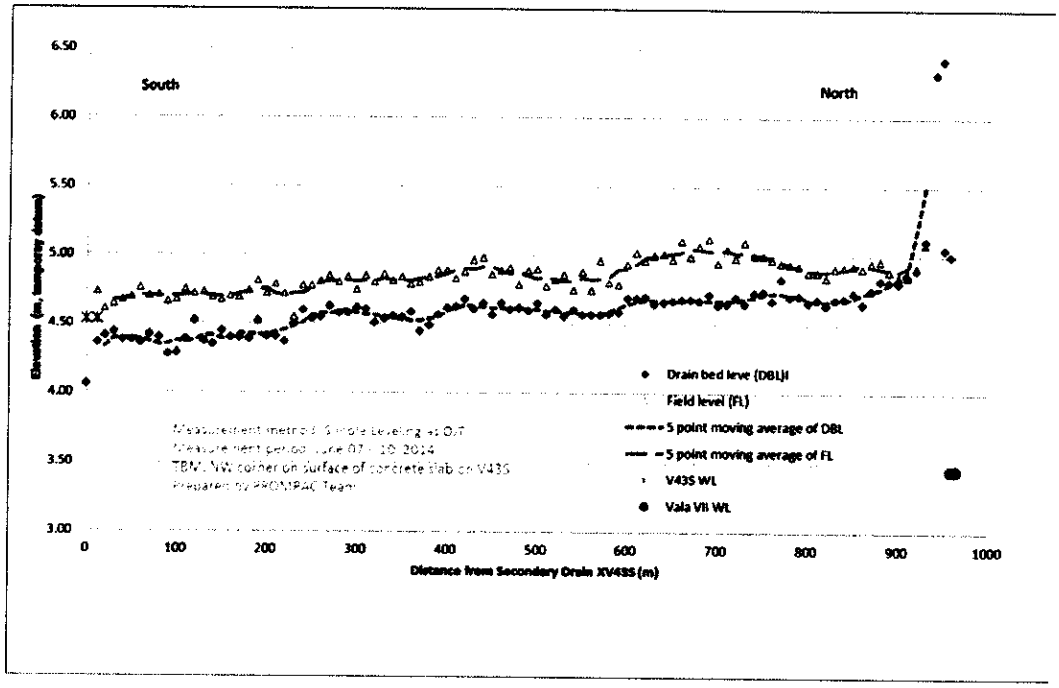


Figure 4.1.25 Profile of tertiary drainage canal between R16 & R18 in D11 area

Profile of the tertiary drainage canal is in Figure 4.1.25. Profiles of the east and west tertiary drainage canals in Figures 4.1.26 and 4.1.27 were gained by preparatory simple leveling with mainly the agencies staff using bubble level in July 2013. Both canals are along the experimental farm zone for 2013-2014 rice cropping season. The maintenance works for the canals were carried out as OJT in June to July 2014. The profiles are those after the maintenance works.

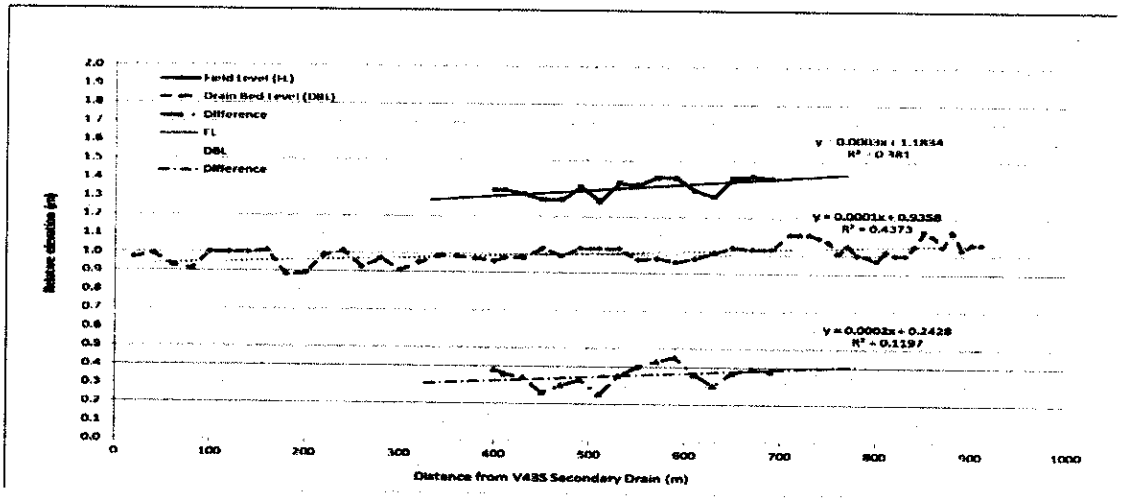


Figure 4.1.26 Profile of the east tertiary drain (R14-R16 irrigation canals) in D11 area

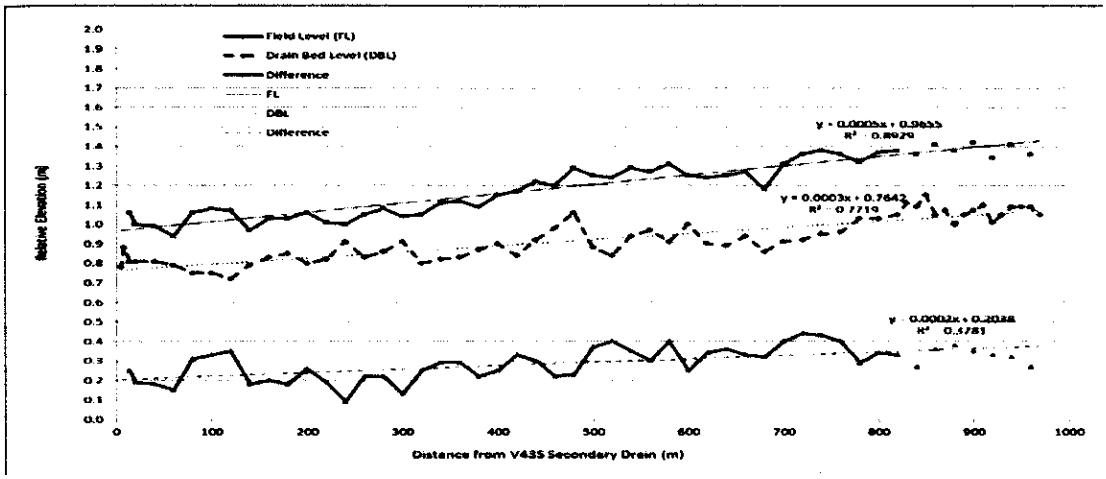


Figure 4.1.27 Profile of the west tertiary drain (R12-R14 irrigation canals) in D11 area

For both of the drain bed profiles, gradient of the drain bed is gentler that that of rice fields. So, the level difference between rice field and drain bed (Δ) becomes smaller as nearer to V43S secondary drain. Drainage of surplus field water is more diifucult as nearer to the secondary drain. The gap Δ is recommended at 0.5 m or more to drain water smoothly. It is considered that the gap on the figure may let the drainage rather effective along the upstream portion.

- D12 area

Location of the simple leveling is east side of Ramal 7 in southwestern sub-area of D12 area as shown in Figure 4.1.24. Except for northern part of 200 m, the tertiary drainage canal was newly ploughed by a tractor and dug as OJT in July 2013. The obtained profile is seen in Figure 4.1.28.

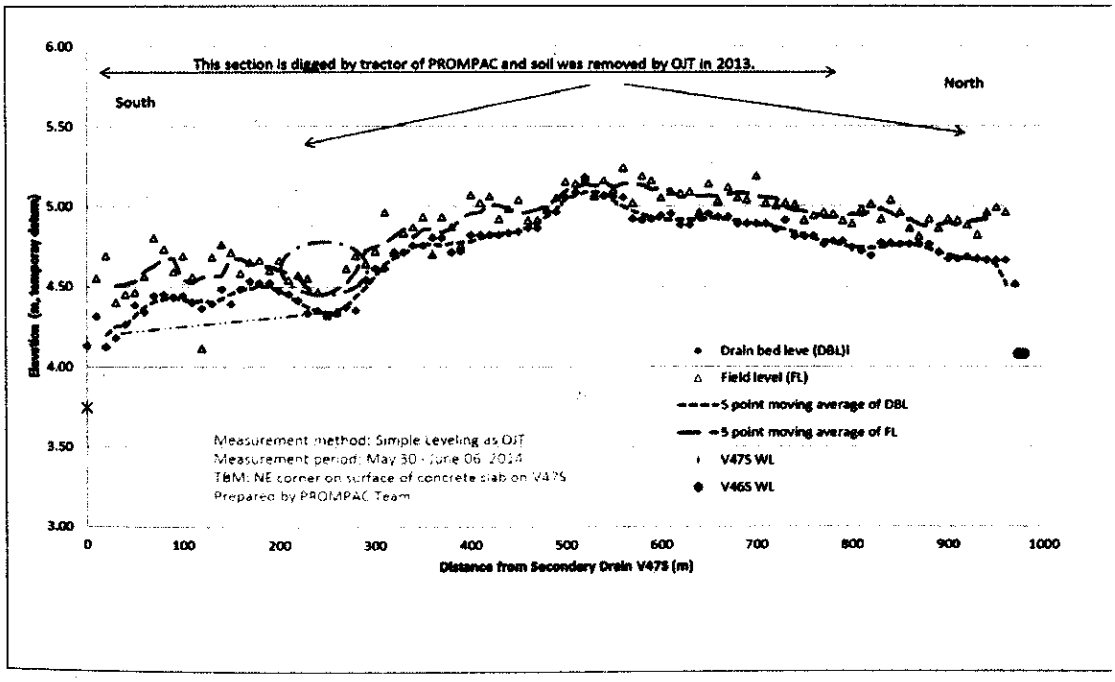


Figure 4.1.28 Profile of Tertiary Drainage Canal along Ramal 7 in D12 area

As farmers talk, there is a clear peak in the middle. Drained water from the field flows to south and north directions in the drainage canal according to its location. There is a remarkable depressed part between 200 m and 300 m from V47S secondary drain. For smooth drainage, it is recommended to cut the bed of tertiary drainage canal for a distance of about 210 m from 40 m to 250 m from V47S as illustrated by red break line in the profile. Also, recommendable is such deepening of the canal bed that reach to 0.5 m of Δ.

- R1 area

Location of the target tertiary drainage canal is illustrated in Figure 4.1.24. As a result of the simple leveling as OJT, a profile is prepared as in Figure 4.1.29. Here, tertiary drainage canals were constructed recently as a portion of rehabilitation project. According to a HICEP staff (cantoneiro), the drainage canal does not function well and sometimes flooded water in the secondary drain comes up reversely from downstream.

The profile explains causes of such problems. Upstream 200 m, the profile shows adverse slope and almost the same level of the field and drainage canal bed, by which drainage cannot be done smoothly. For a distance of about 300 m from 250 m to 550 m from R1 secondary irrigation canal, the drainage canal bed level is not lower than the field level, resulting in difficulty in drain rice field water effectively to the drainage canal. As a whole, design flow direction to south is against land slope to north. It is not easy to improve this condition basically, one is because the adverse land slope and another is that unknown downstream hydraulic condition influences this drainage canal. Improvement of downstream drainage system may be necessary to improve the tertiary drainage canal. Further study is required to make sure the condition.

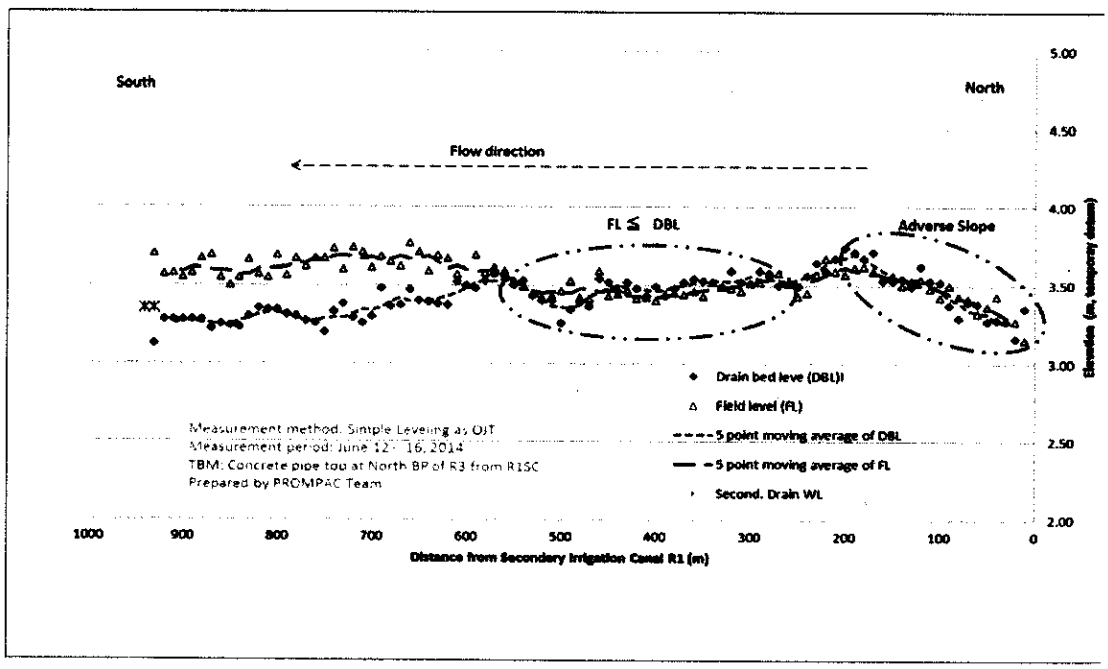


Figure 4.1.29 Profile of tertiary drainage canal along R3 tertiary irrigation canal in R1 area

- R3 area

It is informed that tertiary drainage canal here is well functional but flood in 2013 eroded a part of field and sedimented on another part. In a field lot, level gap is large and undulation occurred. Therefore, profile

of the drain is made only for short distance and spot leveling was conducted in a field lot. The contour map is in Figure 4.1.30 (location: S24°39'09", E33°11'21").

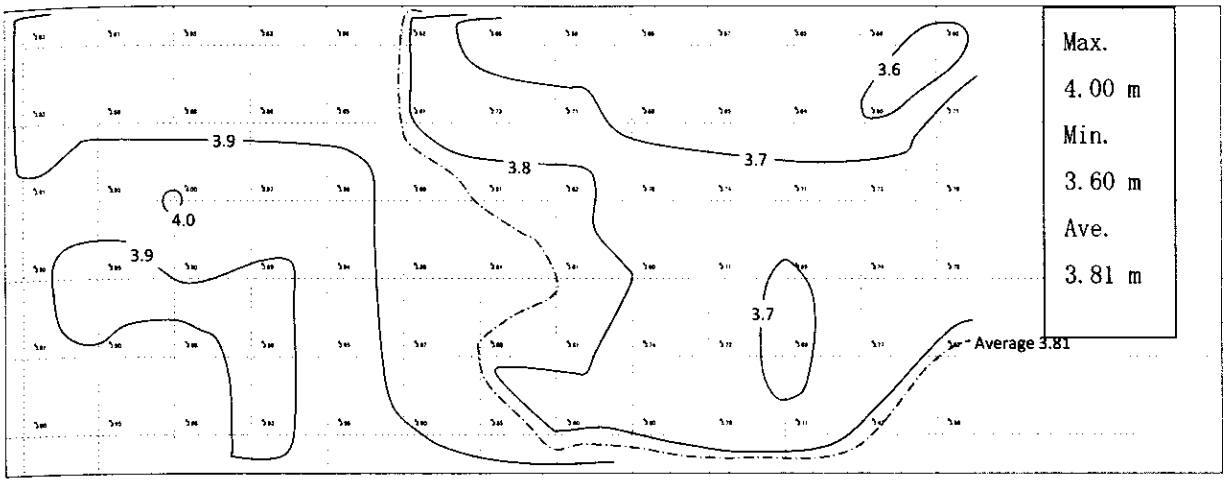


Figure 4.1.30 Contour map in a field lot in R3 area

In Figure 4.1.30, difference of the highest and lowest ground levels is 0.40 m. The field lot is divided into lots (canteras) for rice cropping in such condition. To improve this undulation, move of soil is desirable. Quaternary drain or temporary field drain may be effective for drainage in field lot.

(3) Participants in Training

1) Training in 2012

In June and July, 2012, the training for maintenance and improvement of the irrigation/drainage facility was done as on the job training (OJT) in the field. In addition, room training was done in SDAE with presentation and discussion.

Table 4.1.17 Total number of the training paticipants in 2012

Total number of the OJT paricipants is 573, and 595 including SDAE room

(person)

Field/room	OJT				Room	Trainee
Area	D5	D6	D11	total	SDAE	Total
Drain maintenance	141	142	151	434		434
Pipe culvert	51	88	0	139		139
Presentation/Discussion					22	22
Total	192	230	151	573	22	595

Source: PROMPAC

Number of net participant farmers is 148 and details are shown in Table 4-1-I-xx, where 72 % is occupied by female farmers. Members of FSG in D5(B) area are women and well organized with strong leadership. Women cover 82 % and 22% in D6 and D11 areas, respectively.

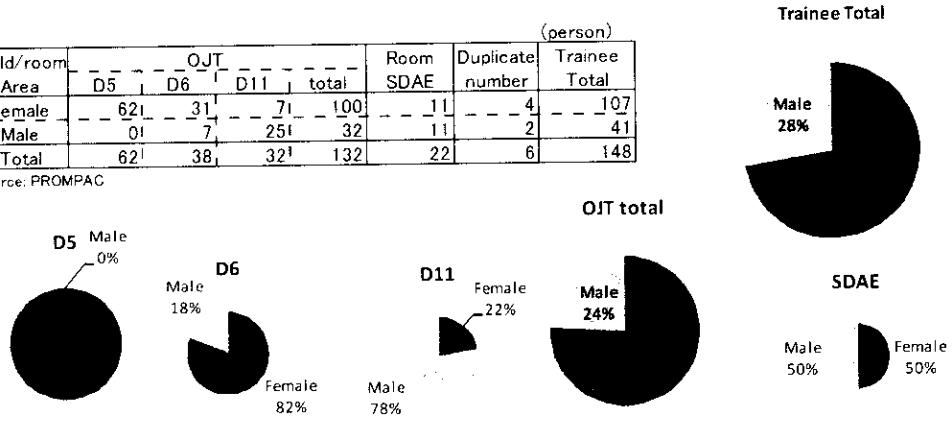
In the dry season after rice cropping season, many male farmers (if they can be called farmers) leave their home and go to Republic of South Africa to get temporary works as seasonal workers. Female farmers' role in the field is quite important particularly in the dry season.

Table 4.1.18 Number of net participants for training of irrigation water management

(person)

Field/room	OJT				Room	Duplicate	Trainee
Area	D5	D6	D11	total	SDAE	number	Total
Female	62	31	7	100	11	4	107
Male	0	7	25	32	11	2	41
Total	62	38	32	132	22	6	148

Source: PROMPAC



2) Training in 2013

In June and July, 2013, the training for on-farm level maintenance, repair and improvement of the irrigation and drainage facility was done as OJT in D11 and D12 areas. As presented in Table 4.1.19, net and total numbers of the participants are 209 and 975, respectively. The reason why male ratio (63%) is larger in D11 area is that the irrigation repair works required hard powerful workers to treat heavy concrete flume and support.

Table 4.1.19 Number of participants in OJT for water management in 2013

(unit: person)

Area		D11	D12	Total	Share (roughly estimated)	
Total (Gross)		541 *1	434 *2	975	*1 40%: irrigation canal 20%: drainage canal 40%: pipe culvert	*2 0%: irrigation canal 80%: drainage canal 20%: pipe culvert
Net	female	39	47	86		
	male	66	57	123		
	total	105 *1	104 *2	209		

(PROMPAC Consultant)

3) Training in 2014

From May to July, 2014, OJT for the simple leveling was conducted in target 6 areas and number of the participants is presented in Table 4.1.20. Total and net numbers of the participants are 850 and 771, respectively. Female farmers occupied 73% of the net participants in average, being more than 50% in each area. Share of the female farmers was high (more than 80%) in D5, D6 and R3 areas and low (less than 60%) in D11 area. Asking participation of many farmers and to avoid duplicated participation as much as possible, the duplication was not so much at only 9%.

Table 4.1.20 Number of participants in OJT for simple leveling in 2014

(unit: person)

Area		D5	D6	D11	D12	R1	R3	Total	(%)
Total (Gross)	female	145	38	84	102	118	118	605	71%
	male	22	7	78	54	64	20	245	29%
	total	167	45	162	156	182	138	850	100%
Net	female	126	38	80	91	115	110	560	73%
	male	20	7	62	47	62	13	211	27%
	total	146	45	142	138	177	123	771	100%

(PROMPAC Consultant)

4) Training for farmers as a whole

Overall training participants for irrigation water management are 1,041 in net and 2,726 in gross as summarized in Tables 4.1.21 and 4.1.22, respectively. The net number is 60% of the total registered farmers in the target areas. In PDM2, index 1-2 of output 1 regarding water management is "more than 50% of the farmers are trained". The attained net number is 120% of the index.

Table 4.1.21 Number of net participant farmers in training for irrigation and water management

Area	Registered farmer (no.)	Participant Farmer (net number) 2nd 2012	3rd 2013	4th 2014	total	duplication	Total (net no.)	(%)
D5	324	62	-	146	208	21	187	58
D6	156	38	-	45	83	5	78	50
D11	301	32	105	142	279	29	250	83
D12	423	-	104	138	242	16	226	53
R1	350	-	-	177	177	0	177	51
R3	169	-	-	123	123	0	123	73
Total	1,723	132	209	771	1,112	71	1,041	60

(source) PROMPAC

The training consists of two items, namely maintenance/improvement of irrigation/drainage facility and simple leveling. The former was carried out mostly in 2012 and 2013, and slightly added in 2014 as presented in Tables 4.1.23 and 4.1.24 (336 in net and 1,873 in gross). The simple leveling was concentrated in 2014 as OJT as shown in Table 4.1.25 (771 in net and 853 in gross).

Table 4.1.22 Number of total participant farmers in training for irrigation/water management

Area	Registered farmer (no.)	Participant Farmer (total number) 2nd 2012	3rd 2013	4th 2014	Total (gross no.)	(%)
D5	324	192	-	495	687	212
D6	156	230	-	45	275	176
D11	301	151	541	162	854	284
D12	423	-	434	156	590	139
R1	350	-	-	182	182	52
R3	169	-	-	138	138	82
Total	1,723	573	975	1,178	2726	158

(source) PROMPAC

Table 4.1.23 Number of net participant farmers in training for irrigation facility maintenance

Area	Registered farmer (no.)	Participant Farmer (net number) 2nd 2012	3rd 2013	4th 2014	total	duplication	Total (net no.)	(%)
D5	324	62	-	25	87	25	62	19
D6	156	38	-	-	38	0	38	24
D11	301	32	105	-	137	5	132	44
D12	423	-	104	-	104	0	104	25
R1	350	-	-	-	0	0	0	0
R3	169	-	-	-	0	0	0	0
Total	1,723	132	209	25	366	30	336	20

(source) PROMPAC

Table 4.1.24 Number of total participant farmers in training for irrigation facility maintenance

Area	Registered farmer (no.)	Participant Farmer (total number) 2nd 2012	3rd 2013	4th 2014	Total (gross no.)	(%)
D5	324	192	-	325	517	160
D6	156	230	-	-	230	147
D11	301	151	541	-	692	230
D12	423	-	434	-	434	103
R1	350	-	-	-	0	0
R3	169	-	-	-	0	0
Total	1,723	573	975	325	1873	109

(source) PROMPAC

Table 4.1.25 Number of net participant farmers in training for simple leveling

Area	Registered farmer (no.)	Participant Farmer (number) number in net 2nd 2012	3rd 2013	4th 2014	net (%)	number in gross 2nd 2012	3rd 2013	4th 2014	gross (%)
D5	324	-	-	146	45	-	-	170	52
D6	156	-	-	45	29	-	-	45	29
D11	301	-	-	142	47	-	-	162	54
D12	423	-	-	138	33	-	-	156	37
R1	350	-	-	177	51	-	-	182	52
R3	169	-	-	123	73	-	-	138	82
Total	1,723	0	0	771	45	0	0	853	50

(source) PROMPAC

(4) Training for cantoneiros

1) Role of cantoneiro

As mentioned in see Annex6 (6-3), "Cantoneiro" being HICEP member, is in charge of operation and maintenance of principal and secondary irrigation canals and keeping communication with farmers.

2) Interview to cantoneiro

In the 5th JCC held in November 22, 2012, training to the cantoneiro was proposed by HICEP and was recommended by the chairperson (DNEA). Keeping it in mind, interview to several cantoneiros were carried out in July 2013, and it is known that main problems of cantoneiro includes insufficient transportation tools such as bicycle or motorcycle, long distance or wide cover of move, insufficient communication tools including radio.

3) Training to cantoneiro

The training to cantoneiro was conducted in July 2 and 4, 2014 by PROMPAC, HICEP and EAC in the meeting room of SDAE in seminar type. Since daily activities of the cantoneiro cannot stop anytime, 46 cantoneiros in total were separated to two groups and expected to one of 2-day trainings. The participants were 15 in July 2 and 8 in July 4, so 23 members or 50% of the staff attended. In the same week, several important events were performed by HICEP, resulted in not so high attendance to the training. About half of the trainees were new faces as the cantoneiro.

HICEP presented basic system of CIS, importance of keeping communication on time, method and form of the transfer of information, and so on. With EAC staff, the expert introduced activities of OJT and explained the simple leveling. An exsercise of the simple leveling also performed using simple tools. Issues coming out in discussion are included in the following 4).

4) Information from questionnaire

In the training, questionnaire was distributed and the cantoneiros filled it. Major answers or comments are as follows.

- The most serious problem on the works

  Lack of padlock on gates, steering wheel, invisible numbers on staff gauge, equipment; no payment for works on Saturday, Sunday and holiday; schedule in winter (too dark to read staff gauge in winter); lack of tape, radio, etc.; arrival delay in rainy season, overflow from Secondary Canal (SC), hard walk in rainy season, lack of water without cleaning, lack of coordination with colleagues about diary program, damage to canal and gate by cattle, delay in works due to poor transportation, overtime work,
- Problems on irrigation water management

  Lack of SC cleaning, staff gauge repair, flume; farmer's gate opening/closure without control, insufficient irrigation water due to canal damage
- Problems on irrigation facility maintenance

  Insufficient canal cleaning; sediment, lack of grease, lack of padlock; tertiary canal is higher than SC;
- Problems on drainage control

  Lack of gate; poor cleaning; leave surplus irrigation water flow;
- Problems on drainage facility maintenance

  Lck of cleaning; too much job of cantoneiro; rust, lack of lubricate oil; cattle damage
- Problems on collection on irrigation fee

  Delay in bill and receipt after farmer's payment; delay in delivery of receipt, it is necessary to provide the receipt for cantoneiro one or two weeks before farmer harvest crops, in order to collect money easily; after harvest difficult to find farmer,; lack of law to force farmers pay: delayed or no payment; payment after harvest: delay of invoice
- Any idea or comment

  The invoices have to be delivered before harvest; Farmer has to listen to the instructions; HICEP should adopt a system to control gate by cantoneiro but not by farmer; renewal of gates; Lack of uniforms, boots and etc.

(5) Recommendation

Based on the analysis of the profile in (2) 6) above, the identified problem and recommendable countermeasure are shown in Table 4.1.26.

Table 4.1.26 Problem and recommended countermeasure

Area	Problem	Countermeasure
D5 R20	Poor drainage	Survey of secondary drain and check of the system, Study drainage system
D5B	Poor drainage/irrigation water	Dig tertiary drain by tractor and man power, and construct pipe culvert (implemented in September, 2014)
D6	Poor drainage against heavy rainfall	Dig tertiary drain by livestock and manpower
D11	Stagnant water ponding	Prepare profile of secondary drain and try to lower its water level
D12	Depression in the middle of ramal	Excavate drain bed downstream of the depressed portion
R1	Poor drainage and back water intrusion from downstream secondary drain	Study drainage system Survey of SD and its system Excavate drain bed Change depressed field to fish pond Heighten low field by excavated soil
R3	Large level gap in ramal	Cut soil in higher part and move it to lower part

(source: PROMPAC)

Regarding irrigation/drainage and water management, it is recommended that for farmers, proposal, opinion, request and so on should be transferred to HICEP staff directly or through leader of group and HICEP should respond to them timely.

Along the Direito Irrigation Canal, grass cutter hired by HICEP should not throw cut grass into the canal water but put on the bank. The cut grass in water interfere the flow and damages the structures such as regulator and intake.

On cantoneiro works, morning water level reading at 6 am should be reconsidered for winter season. It may be better to change at 7 am, for example, because it is still dark at 6 am in winter and foggy sometimes.

Level checking along canal should be conducted by HICEP at sites where downstream elevation is considered higher than upstream one.

Procedure to collect irrigation fee should be checked and changed if found necessary. Not a small number of cantoneiros propose change of timing on invoice and receipt delivery.

4.2. The development of improved direct sowing rice cultivation techniques (Output 2)

4.2.1 To establish trial and verification plots

(1) Field survey on conventional rice cultivation techniques of direct sowing

The field survey on the conventional rice cultivation techniques of direct sowing in the Chokwe Irrigation Scheme was carried out as of 2012, which helped contribute towards identifying solutions to the problems of cultivation and the issues to be considered. The results of the field survey clarified a number of problems in each process such as field plowing, seeding volume, post-seeding irrigation, and the volume of fertilizer, weeding, and more. In the Chokwe Irrigation Scheme, plowing takes place first utilizing a disc plow and a disc harrow attached to a large scale tractor, followed by the clod crushing, broadcasting seeds and covering soil again by disc harrow. The plowing by a large scale tractor tends to be too deep, reaching to as much as 30cm in depth, making germination rather difficult. There were many rice farmers who used too much seed per field of 1ha, between 150 and 200kg/ha. This is extremely high. Perhaps, the excessive amounts of seed are sown so as to deal with bird damage as well as mal-germination, yet this trend may be too dense a sowing method that it leads to possibly lowering the yield.

The division of the field into small plots is done by a disc plow, which is the same one used for covering soil over seeds. The internal irrigation canals are made at the same time. A field of 1ha is divided into forty plots in the case for direct sowing (in Chokwe, this small plot of land is called canteiro as a conventionally used area unit), and those plots are to ease the process of leveling and irrigating of the field. Although the first irrigation of the field is introduced after the seeding, in order to encourage the germination, the introduction of the first irrigation traditionally covers the field entirely. Combined with the fact of an unleveled filed condition, flooding the field has not helped germination but has instead encouraged weed growth. Herbicide is commonly prayed as a way of weeding (approximately half of farmers are manually weeding), but some fields are still crowded with weeds due to the wrong spray timing and inadequate amount of herbicide. Generally speaking, it is necessary to drain the field before spraying herbicide. But in some cases, the herbicide is not sprayed adequately because of a bad condition of tertiary drainage canals. Approximately 60% of farmers are applying all of the 50 to 100kg per ha of urea at the tillering stage, yet there are also a number of farmers who do not apply any fertilizer at all. If the number of panicles are insufficient the yield becomes low accordingly. Based on the survey results, the problems and issues to be improved are listed up and the challenges to develop new direct sowing techniques are recognized. The actual condition and challenges of the conventional direct sowing techniques are as the Appendix 6 (6-3) shows.

Table 4.2.1 Effect of Different Direct Sowing Method on Yield and Yield Components

Sowing method	Panicle/m^2	Spikelets per panicle	Spikelet $10^3/m^2$	Filled spikelets (%)	1000 grain weight (g)	Yield (ton/ha)
Imprpved	280	84.7	23.17	79.0	25.35	4.66
Traditional	262	79.1	19.41	58.5	24.76	2.89

(2) Manufacturing a Trial Manual Row Seeder

There are two methods of direct sowing: using a manual row seeder and broadcasting seed all over the field. Traditionally, farmers have practiced broadcast seeding and have not seeded in rows with a use of a manual row seeder. It is assumed that a large consumption of seed and dense seeding are what farmers thought of as countermeasures towards poor germination and a growth deficiency of rice plants. Although this broadcasting method seems established among rice farmers in general, it is necessary to review some of the traditional practices such as reducing the amount of seed sown, maintaining a proper density of seed, appropriate fertilizer application, weeding and manure management, etc., in order to realize a higher yield. The Project decided to deal with row seeding using a manual row seeder, as one of the tasks for the improvement of the direct sowing seeding method. Two trial manual row seeders were created for flooded fields and well-drained fields, these had trial test at EAC in 2012. The seeder for flooded fields was for four rows, with a space of 25cm between each row, and 110cm width for all four rows. Since puddling should be finished prior to seeding, this manual row seeder was designed to be equipped with a wheel of 60cm diameter and it drops seed directly on to the field.

To maintain the action of seeding accuracy, this seeder was also designed to seed in a field of the ±3cm mean degree of leveling. As for the manual row seeder for a well-drained field, it was designed to seed two rows on the field after clod crushing, with a space of 30cm between two rows, with a 68cm width for the seeding section. Its wheel has a 51cm diameter. The field mean degree is the same with the other row seeder.

Table 4.2.2 Specification of Trial Seeder

Specification	Wet land	Dry land
Num. of sowing line	4	2
Working width (cm)	110	68
Wheel width (cm)	110	50
Row to row distance (cm)	25	30
Hill to hilll distance (cm)	15	15
Seed drum diameter (cm)	35	40
Wheel diameter (cm)	60	90
Total length (cm)	226	213
Sowing	Direct drop	Direct drop
Max. acceptance of uneven level of field (cm)	± 3	± 3

These trial manual row seeders were tested for their field performance at trial fields set up at EAC. The land preparation of flooded fields prior to this test included puddling by a power tiller and leveling. Unfortunately, since the fields in the Chokwe Irrigation Scheme are made of alluvial soil, which is characterized by small soil particles made by the Limpopo River, the aggregated structure was destroyed by puddling. The seeds sank deep into the mud and could not germinate. As for the well-drained fields, the trial manual row seeder performed well and germination also turned out well enough for the Project to adopt the

seeder. In the beginning, this seeder was designed for one person to pull and seed two rows at the same time. Yet it took a significantly longer time to seed each unit area, so the seeder was re-designed for two persons pulling to seed four rows together. The performance of this seeder was repeatedly tested on site, so that the seeder was tuned to perform better. The manual row seeder for well-drained fields had a furrow cutting function. A series of test were done to identify the most agreeable field condition for this seeder to perform at its best, such as a test on the furrow cutter performance and also a comparison of different seed volume applied to test fields. Based on the results of these tests, the seeder came to be improved. The manufacturing cost of this seeder is shown on table 4.2.4, and the prices shown for parts are based on the prices available in May 2012.

Table 4.2.3 Specifications of Improved Model of Trial Seeder

Specification	Modification
Furrow cut	Furrow cut depth 2 to 4 cm Furrow cut angle 5 to 10°from ground
Stable seed drop	Window breaking
Hill to hill distance	13.5 cm for seed rate of 100 to 120 kg/ha
Seed covering	Iron chain (2 chains) to assure more than 90% of seed covering
Pulling huddle	Adjustable function
Wheel diameter	100 cm for better field working performance

Table 4.2.4 Manufacturing Cost for Manual Row Seeder

Material	Specification	Unit price (Mt.)	Quantity required for 1 unit of seeding machine	Estimated cost (Mt.)
Iron pipe	Ø 21mm, 5m	481	1unit	481
Iron pipe	Ø 27mm, 5m	772	1/2 unit	386
PC pipe	Ø 27mm, 5m	184	1/4 unit	46
Reinforced iron bar	Ø 10mm, 6m	152	2 pieces	304
Reinforced iron bar	Ø 8mm, 6m	100	1piece	100
Galvanized sheet	Thickness0.2mm, 2×1m,	550	1sheet	550
clamping band	Medium size	25	4 pieces	100
Aluminum rivet	3×13mm, 50pieces/box	120	2 boxes	240
Hinge (small)	Small size	30	4 pieces	120
Bolt & nut	Ø 8mm, length 8cm	50	1piece	50
Bolt & nut	Ø4mm, length 6cm	20	8 pieces	160
Rectangular iron pipe	3cm×3cm, 4m	300	1unit	300
Iron plate	Thickness 0.8mm, 1.2×2m	880	1/5 sheet	176
Chain	Ø 25mm, 1m	280	1m	280
Paint	White, 500cc	280	1/5 can	56
Painting brush	Medium size	150	1piece	150
Thinner	500cc/bottle	80	1/5bottle	16
welding cost	-	500	-	500
Labor cost (estimated)	5MD(Man•day)	Mt.300	5MD	1,500
			Total	5,515

(3) Measurement of Field Work Volume

The field survey to measure the work load (performance) on site and work efficiency of the manual row seeder for well-drained fields began in 2012, at the same time as when the verification and demonstration fields for the improved rice cultivation techniques for direct sowing were set up at FSG farms in D5, D11 and D12. By 2013, the field test was carried out to take multiple measurements at nineteen locations in total. The work load was calculated by using figures obtained through recording the hours of seeding in the verification and demonstration fields and measurements of the field size. The distance of the long side of the field and the seeding time for twenty seeding were recorded to calculate the average performance speed. The rate of soil covering was also calculated by multiplying 1m of seeding distance by the total distance of four uncovered rows. The work time for seeding one row was recorded for twenty rows to get the average seeding time. According to these calculations, the average performance speed was 3.41km/h, the average work load was 0.31 ha/h and the average rate of soil covering was 95.7%. The actual data for this is shown on table 4.2.5. Through the two years of the trial term, farmers found the seeding with the manual row seeder under scorching sun in November, when a cropping season begins, rather hard and many of them expressed the idea of having animals for pulling the seeder.

Table 4.2.5 Performance Load of Manual Row Seeder

Sample number	Place	Date	Working hour (min)	Working area (m^2)	Working speed ?km hour?¦	Field work performance (ha hour)	Field work efficiency (hour ha)	Number of seeder	Seed covering ?%?	Remarks
1	D11	10 Nov. 2012	103.0	3,829	2.76	0.22	4.49	2	94.8	one rotary
2	D12	23 Nov. 2012	33.8	888	2.23	0.22	5.59	2	95.5	one rotary
3	D5	30 Nov. 2012	4.3	181	2.53	0.25	4.00	2	97.2	one rotary
4	D6	1 Dec. 2012	2.1	96	2.94	0.29	3.68	2	97.8	one rotary
5	D11#1	8 Nov. 2013	26.0	975	3.31	0.23	4.44	2	91.9	one rotary
6	D12 #1	15 Nov. 2013	29.0	1,628	3.14	0.34	2.97	2	94.3	one rotary
7	D12 #2	28 Nov. 2013	27.0	1,560	4.56	0.35	2.88	1	-	two rotary, no coverage count (rain)
8	D12 #2'1	28 Nov. 2013	7.0	240	4.56	0.21	4.86	2	-	two rotary, no coverage count (rain)
9	D12 #3	29 Nov. 2013	24.0	1,800	4.01	0.45	2.22	2	97.0	Plot#3 two rotary
10	D11#2	4 Dec. 2013	29.0	1,800	3.56	0.37	2.69	2	96.6	Plot#2, one rotary
11	D11#3	4 Dec. 2013	25.0	1,800	4.03	0.43	2.31	2	96.8	Plot#3 one rotary
12	D5 #1	10 Dec. 2013	18.0	1,275	4.39	0.43	2.35	2	95.3	Plot#1 one rotary, Macassane
13	D5 #2	10 Dec. 2013	21.0	1,275	4.40	0.36	2.75	2	95.2	Plot#2 one rotary, IRGA409
14	D5#3	10 Dec. 2013	23.0	1,445	3.82	0.38	2.65	2	94.0	Plot#3 one rotary , Farox
15	D5 #4	10 Dec. 2013	21.0	1,360	4.12	0.39	2.57	2	95.9	Plot#4, one rotary, Alvorada
16	D11	10 Nov. 2012	103.0	3,829	2.76	0.22	4.49	2	94.8	one rotary
17	D12	23 Nov. 2012	33.8	888	2.23	0.22	5.59	2	95.5	one rotary
18	D5	30 Nov. 2012	4.3	181	2.53	0.25	4.00	2	97.2	one rotary
19	D6	1 Dec. 2012	2.1	96	2.94	0.29	3.68	2	97.8	one rotary
				Av.	3.41	0.31	3.59		95.7	

(4) Verification of work load and usage fee of plowing machines for establishing row seeding system

The seeding with the manual row seeder required the field to be ready through plowing and clod crushing. If the clod in the field is larger than 4cm diameter, both of the seeding and covering would not be done properly. In order to improve the clod crushing efficiency, it is necessary to introduce the plowing with a rotavator and clod crushing with a chisel plow, in addition to conventional ways of plowing and clod crushing with a disc plow and a disc harrow. The work load and work efficiency of plowing with a rotavator and other equipment such as a chisel plow have been measured since 2012, parallel to the establishment of verification and demonstration fields at FSG farms in the Scheme for row seeding. Based on the results, the usage fee of related equipment was calculated. The measurement was done in the same way as in the time of the manual row seeder. In regard to plowing by a rotavator, the measurement was recorded at eighteen locations from 2012 to 2013 and the average figure was calculated. The rotavator NIPLO MXK2000, working width of 200cm, and the tractor JD5503 75HP were used for these field surveys. The work load of the rotavator was 0.28ha/h, 2.70km/h working speed and 7.95L/h fuel consumption. Table 4.2.6 shows the result for plowing and clod crushing by a rotavator.

Table 4.2.6 Measured Value of Work Load of Plowing and Clod Crushing by Rotavator

Sample number	Place	Date	Area m^2	Working hour (min)	Field work performance (ha/hour)	Field work efficiency (hour/ha)	Gear ratio revolutions	Fuel consumption (lit/hour)	Working speed (km/hour)	Remarks
1	D11	10 Nov. 2012	3,658	72.0	0.30	3.28	A1 1500rpm	n.a.	n.a.	-
2	D11	do	3,999	81.0	0.30	3.38	A1 1500rpm	n.a.	n.a.	-
3	D11	do	3,472	67.0	0.31	3.22	A1 1500rpm	n.a.	n.a.	-
4	D11	do	1,245	26.0	0.29	3.48	n.a.	n.a.	n.a.	Operated by Sitoe
5	D12	14 Nov. 2012	5,000	123.0	0.24	4.10	A1/2400rpm	8.68	n.a.	-
6	D6	29 Nov. 2012	4,224	69.5	0.36	2.74	A1 2000rpm	n.a.	1.92	-
7	D5	28 Nov. 2012	2,896	42.1	0.41	2.42	B1/1500rpm	n.a.	1.90	-
8	EAC	-	5,000	58.0	0.52	1.93	n.a.	9.31	4.68	By Izuka
9	D11	7 Nov. 2013	4,800	245.00	0.12	8.51	A1/2000rpm	6.05	1.88	2 rotary cultivation
10	D12	15 Nov. 2013	4,960	166.00	0.18	5.58	A1/2000rpm	7.01	2.83	2 rotary cultivation
11	D12	28 Nov. 2013	1,800	87.00	0.12	8.06	A1/2000rpm	-	2.69	2 rotary cultivation
12	D12	29 Nov. 2013	1,800	44.00	0.25	4.07	A1/2000rpm	4.09	2.68	1 rotary cultivation
13	D11	4 Dec. 2013	1,800	44.00	0.25	4.07	A1/2000rpm	8.86	2.71	2 rotary cultivation
14	D11	4 Dec. 2013	1,800	48.00	0.23	4.44	A1/2000rpm	8.13	2.69	2 rotary cultivation
15	D5	10 Dec. 2013	1,275	46.00	0.17	6.01	A1/2000rpm	6.65	2.72	2 rotary cultivation
16	D5	10 Dec. 2013	1,275	19.00	0.40	2.48	A1/2000rpm	11.68	2.75	1 rotary cultivation
17	D5	10 Dec. 2013	1,445	24.00	0.36	2.77	A1/2000rpm	8.25	2.83	1 rotary cultivation
18	D5	10 Dec. 2013	1,360	49.00	0.17	6.00	A1/2000rpm	8.69	2.79	2 rotary cultivation
				Av.	0.28	3.62		7.95	2.70	

The work performance of chisel plowing was measured to seek the possibility of substituting the conventional plowing with a disc plow and a disc harrow, when the previous crop of the subject field was maize or something else. Chisel plowing was found be very favorable, keeping the soil in the field more than that of disc plow, and the plow depth was also shallower. The chisel plow used for this study was SGANO MSC8PSL, with a performance width of 220cm, used alongside the JD5503 75HP tractor. This measurement was carried out four times from 2012 to 2014. The work performance of plowing by the chisel plow was 0.35ha/h, with the work speed being 3.39km/h and a fuel consumption of 3.9L/h. The usage fee of the equipment was calculated based on the result of these measurements. Table 4.2.7 showed the results.

Table 4.2.7 Measured Value of the Work Load when Plowing by Chisel Plow

Sample number	Place	Date	Area m^2	Working hour (min)	Field work performance (ha/hour)	Working efficiency (hour/ha)	Gear ratio revolutions	Fuel consumption (lit/hour)	Working speed (km/hour)	Remarks
1	D11	21 Nov. 2012	4,950	45.00	0.66	1.52	B2/n.a.	3.30	6.00	After disk plowing
2	D6	27 Nov. 2012	4,224	81.38	0.31	3.21	A3/1500rpm	n.a.	2.85	Twice (no plowed field)
3	D5	28 Nov. 2012	2,896	57.98	0.30	3.34	A3/1500rpm	4.33	3.10	Twice (no plowed field)
4	D11	4 Nov. 2013	4,800	222	0.13	7.71	A3, 1500rpm	4.11	1.62	Two plowing, no disk plowed field
				Av.	0.35	3.94		3.91	3.39	

Other than the target items for measurements, such as plowing and clod crushing, the field work efficiency of puddling by power tiller as a land preparation for transplanting as well as the measured value of milled rice were also measured during this time. The usage fee of equipment was also calculated based on the measurement of the work load. The result of studies on other machinery and equipment as well as the detailed information on the usage fee of machinery and equipment can be seen on Appendix 6.

4.2.2 The development and verification of direct sowing rice cultivation techniques

(1) Establishment of verification block

Starting with the verification of the rice cultivation techniques of direct sowing in 2012, a total of 5.2ha worth of verification field had been set up by 2013. In 2012, four fields were set up for ITA312 and eight plots were set up for comparison studies between row seeding and random broadcasting, which in total amounted to 1.24ha. From 2013, four varieties were added to the study, so a total of five rice varieties were seeded both in rows and randomly broadcasted in twenty plots. Moreover, another three plots were added to demonstrate random broadcasting of promising varieties, so as a grand total, twenty plots and 3.96ha were set up for demonstrating and verifying various rice varieties. The last three plots for demonstrating random broadcast seeding for promising varieties were added later, after a consideration was given to the shape of verification fields provided by FSG farmers.

Table 4.2.8 Establishment of Verification Block

Location	2012		Variety	2013		Variety
	Plot area (ha)			Plot area (ha)		
	Line sowing	Broadcasting		Line sowing	Broadcasting	
D5	0.30	0.00	ITA312	0.55	0.58	Macassane, Farox, Alvorada, IRGA409
D6	0.12	0.11	ITA312	0	0	-
D11	0.26	0.13	ITA312	0.46	0.92	ITA 312, Alvorada, IRGA409 (Macassane, Farox)*
D12	0.21	0.11	ITA312	0.68	0.77	ITA312, Macassane, Farox (IRGA409)*
	1.24			3.96		

Note: Variety * for demonstration

Cropping for the verification block in 2012 was standardized as: row seeding by manual row seeder, seed amount 100kg/ha, urea 150kg/ha applied on three occasions (first application: 35% of total urea, after the herbicide spray about twenty-five to thirty days after the showing-seedling irrigation introduction, about the four to five leafing stage; second application: another 35% in ten days after the first application; third application: remaining 30% in thirty to thirty-five days after the second application), and the rice plant growing condition was monitored. The 12L/ha of Propanil and 3L/ha of MCPA were diluted by 200L of water and sprayed over rice plants at the four to five leafing stage. 150kg/ha of seed was randomly broadcast and the applied fertilizer management was based on that of the row seeding field. As for the verification block in 2013, the standard of row seeding by manual row seeder, was set, and the seed amount

100kg/ha for row seeding and 120kg/ha for broadcasting, urea 170kg/ha was applied three times (application timing was the same as that of the verification block in 2012). The herbicide spraying was done based on the practice in 2012 as well.

Four varieties, of rice Macassane, Alvorada, IRGA409 and Farox were added as target variety ITA312 in 2012, in order to confirm the validity of yield of Macassane and Farox and to seek the possibility of introducing Macassane, a popular variety among FSG farmers. Macassane and Farox were found to be suitable varieties for random broadcast seeding among the four target varieties, after being verified on a variety comparison study for transplanting cultivation, held last year.

(2) Analysis of verification result

In 2012, the row seeding block and the broadcast seeding block are established within the demonstration fields of FSG farmers in D11 and D12. The same blocks were also established within the verification fields of the same FSG farmers. Having one more block for the broadcast seeding in a non-member farmer's field, the total of five blocks were studied to realize technical improvements and the productivity of row seeding as well as broadcast seeding done by conventional techniques. Row seeding was done by the manual row seeder, and broadcast seeding was done in the traditional farming method. As table 4.2.9 and table 4.2.10 show the detail of the yield survey and yield components, a high yield was realized from the row seeding field of the verification block. In regard to FSG farmers demonstration fields, row seeding and broadcast seeding in D11 did not show any significant differences in their yields, but there was a significant difference between two yields in row seeding fields in D12. The broadcast seeding block in non-FSG farmers field had a low yield in both D11 and D12. When the relation between yield and yield components was studied, there was a positive correlation found between the number of panicle per unit area and the yield, which indicated the contribution of the number of panicles toward an increase in the yield. Based on these data results, in 2012, the row seeding by the manual row seeder was confirmed as effective for a higher yield.

Table 4.2.9 Effect of Row Seeding and Broadcast Seeding to Yield and Yield Components

	Grain yield (ton/ha)	Panicle per m^2	Spikelet per panicle	Spikelet 10^3 per m^2	Filled spikelet's (%)	1000 grain weight (g)
Line sowing (verification plot)	6.80	298	117.4	35.35	87.4	22.77
Broadcasting (verification plot)	4.70	307	85.7	26.34	80.2	22.21
Line sowing (FSGs field)	4.84	313	92.8	29.15	74.5	22.29
Broadcasting (FSGs field)	4.51	350	81.2	28.42	74.3	21.32
Broadcasting (out of model area)	2.40	264	71.9	18.97	66.4	19.27
ANOVA						
Significance	**	ns	**	**	*	*
C.V. (%)	12.0	-	7.7	9.9	7.9	5.3
LSD.01	1.25	-	15.5	6,124	13.6	2.54
LSD.05	0.88	-	10.9	4,306	9.6	1.78

Note: **, * : Significance at 1 and 5% level respectively. ns : no significant differences.

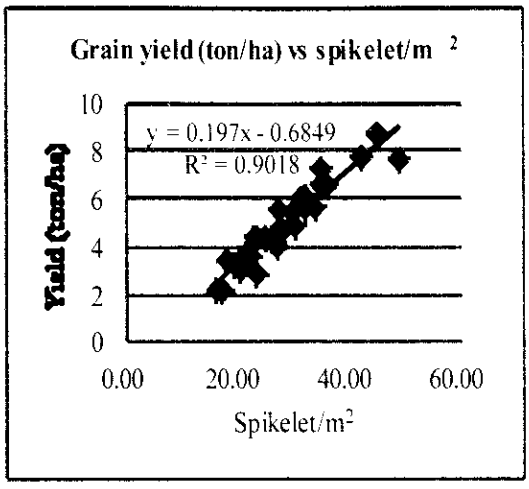


Figure 4.2.1 Correlation between Yield and the Number of Panicle per Unit Area in D11 and D12

Table 4.2.10 Effect of Row Seeding and Broadcast Seeding to Yield Components in D12

	Grain yield (ton/ha)	Panicle per m^2	Spikelet per panicle	Spikelet 10^3 per m^2	Filled spikelet's (%)	1000 grain weight (g)
Line sowing (verification plot)	8.02	408	111.7	45,481	79.1	22.38
Broadcasting (verification plot)	5.90	346	92.1	31,807	79.8	23.29
Line sowing (FSGs field)	4.73	232	108.4	25,527	80.6	23.03
Broadcasting (FSGs field)	3.60	300	72.7	21,769	70.8	23.37
Broadcasting (out of model area)	3.25	279	71.0	19,327	72.8	23.29
ANOVA						
Significance	**	**	**	**	ns	ns
C.V. (%)	7.9	13.0	8.3	8.4	-	-
LSD.01	0.90	91.5	17.0	5,433	-	-
LSD.05	0.63	64.3	11.9	3,827	-	-

Note: **, * ; Significance at 1 and 5% level respectively, ns ; no significant differences.

The verification result in 2013 did not identify any significant differences between yields of row seeding and broadcast seeding. As for the average yield for five varieties of row seeding and broadcast seeding, yields of Alvorada and ITA312 were high. There was no significant difference between the seeding methods of five varieties in terms of their effect on the yield. However, Almorada and Macassane were identified with the potential for an increase in yield when row seeding is applied.

Table 4.2.11 Effect of Different Seeding Method to Yield

Variety	Line sowing	Broadcasting	Av
Alvorada	6.02	5.60	5.81
Farox	5.02	5.07	5.05
IRGA409	4.14	4.58	4.36
ITA312	5.11	5.80	5.46
Macassane	4.97	4.59	4.78
	5.05	5.13	

Sowing method: ns, CV:12.8%

Variety: ns, CV: 24.7%

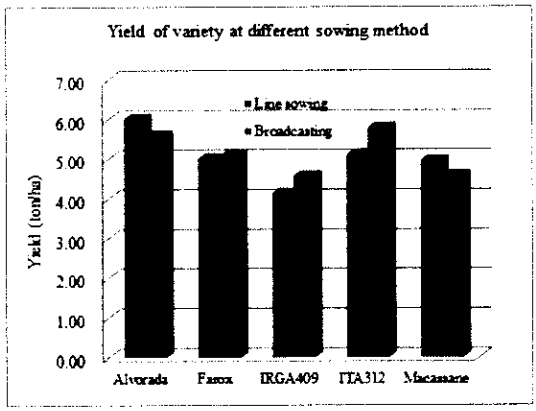


Figure 4.2.2 Yield Difference of Four Varieties by Line sowing and Broadcasting

Regarding the correlation between the yield and the number of hills per unit area as well as between the yield components and the number of hills per unit area, a significant negative correlation was found between the number of panicle per hill and the number of spikelet per panicle, when the number of hills per unit area increased. This means that the number of spikelet decreased remarkably when the number of hills per unit area increased. Similarly, the filled spikelet percentage and 1,000 grain weight also tended to decrease when the number of hills per unit area increased, although there was no significant difference found. It is assumed that the number of hills per unit area in the field where broadcasting was applied increased and made up for the decrease in the number of spikelet per unit area, so there was no difference in the yield between those fields where the broadcasting method was applied.

Table 4.2.12 Effect of Line sowing and Broadcasting to Yield and Yield components

Variety	Sowing method	Hill m^2	Yield (ton/ha)	Panicle hill	Spikelet panicle	Filled spikelet (%)	1000 grain weight	Spikelet x10^3 m2
Alvorada	Line sowing	33.0	6.02	11.7	132.5	75.3	26.3	51.17
Farox	Line sowing	52.25	5.02	9.35	88.74	82.75	25.52	43.70
IRGA409	Line sowing	74.25	4.14	5.35	93.84	82.00	24.22	37.20
ITA312	Line sowing	35.00	5.11	8.73	127.98	79.34	28.04	37.78
Macassane	Line sowing	45.13	4.97	8.33	94.71	81.08	28.93	37.80
Alvorada	Broadcasting	129.75	5.60	3.25	80.88	73.43	25.80	33.85
Farox	Broadcasting	152.00	5.07	2.70	83.14	80.70	25.28	33.44
IRGA409	Broadcasting	124.00	4.58	2.60	81.00	83.13	23.73	26.05
ITA312	Broadcasting	79.75	5.80	4.80	120.61	81.84	27.30	46.38
Macassane	Broadcasting	92.00	4.59	4.10	72.10	78.54	29.42	26.94
			0.1661	0.8173	0.5917	0.3208	0.3922	0.1495
			ns	**	**	ns	ns	ns

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

(3) Drawing up the manual for cultivation techniques

The manual for direct sowing cultivation was drawn up based on the verification results collected in 2012 and 2013. The manual for transplanting cultivation drawn during the first phase was partly amended. Those two manuals were put together as the manual for rice cultivation. As for PR to farmers, posters about direct sowing rice cultivation were printed as extension support material to attract non-member farmers to direct sowing rice cultivation.

4.3 The dissemination of improved direct sowing rice cultivation techniques to the target area (Output 3)

4.3.1 Training for extension leaders on improved direct sowing rice cultivation techniques

The training programs on the rice cultivation techniques of direct sowing and the establishment of the verification and demonstration fields began in 2012. A series of training courses were offered to extension agents and FSG farmers and were held at the verification and demonstration fields set up mostly at FSG farmers' fields in D11 and D12, which were both the direct sowing cultivation blocks. These training courses were on row seeding by the manual row seeder, workshops on the making of the manual row seeder, the presentation of the verification results collected in the direct sowing cultivation block as well as the results of the yield survey carried out for the demonstration fields, the organizing of a Field Day for observing fields of each FSG farmers and exchanging opinions, and so on. Altogether, a total of sixteen courses, attracting four-hundred and seventy-two participants, were held between 2012 and 2014.

During the fourth operational year in particular, the training courses were held for the counterpart, extension agents and FSG executives and focused on themes related to reviewing the direct sowing cultivation techniques and organizing the Field Day and so on, so that they can plan and organize the Field Day successfully.

The Field Day, held in D11 with the initiative of the counterpart, offered a variety of information. First of all, an extension agent explained about the land preparation and the row seeding techniques with the manual row seeder, followed by the field visit to the verification fields for the row seeding, where methods

of fertilizer application and weeding were explained. Next, the group was taken to FSG demonstration fields where each FSG gave a talk on how they had maintained each field while showing their fields. Some participants asked questions about how to use the manual row seeder or how to procure agricultural machinery. On the other hand, other FSG farmers pointed out that the row seeding with the manual row seeder contributed to labor-saving, yet it makes it necessary to prepare the land by the rotavator, which is difficult to procure in Chokwe. A similar Field Day was held also in D12. There, the improvement idea of the manual row seeder applicable to animal power was suggested and opinions were exchanged upon the low paddy sales price that is making it difficult to make a profit.

On the Field Day (Feb. 28, 2014) held for all the FSG farmers, an observation tour around demonstration fields in D11 and D12 was organized. Each FSG farmer was asked to explain about the management of their field. The group saw the excellent fields closely at the same time. In addition, extension agents explained the list of important points regarding the rice cultivation techniques of direct sowing and opinions upon rice cultivation in general were exchanged among FSG farmers.

The workshop to make the manual row seeder, designed for Project counterpart, extension agents, EAC technical staff and target farmers, was held twice (the first one being for eleven days and second one for seven days) in 2012 under the initiative of the Project expert. Four trial seeders were made during those two workshops. Furthermore, in 2014, another two workshops were held twice (the first one being for twelve days and second one for nine days) for target farmers and mechanical repair/maintenance persons in private business under the initiative of the tutored counterparts. Another four trial seeders were made during these workshops as well. The Project expects that the manufacturing method of the manual row seeder was understood well enough through holding these four workshops.

Through the course of repeating the manufacturing process of the seeder, some processing problems arose. First of all, the processing time in mounting the side board to the seed drum is too long, and should be shortened. Currently, the steel plate used for both side board and steel drum is 0.4mm thick. The processing time may be shortened if a steel plate of 1.5mm thick is used instead and welded around the circumference of the seed drum plate to attach the steel drum to the side board without the need to mount the side board onto the steel drum in the original time consuming manner. As there tends to be an ongoing increase in material costs, it is necessary to reduce the material costs while considering the durability of the manual row seeder. For example, a round steel pipe for the chassis can be used also for the handle instead of the square steel pipe. Through a close study of the manual row seeder used by small-scale farmers, the ideal welding location and an optimization of the amount of welding should be realized, as these are necessary of the reinforcement of the seeder and its cost reduction.

Table 4.3.1 Implementation Record of Technical Training on Direct Sowing Rice Cultivation

Name of the Course	Date	No. of Participants	Target Participants	Remarks
Line sowing by manual seeder	8 Nov. 2012	15	FSG member of D11	Demonstration and OJT of line sowing
Line sowing by manual seeder	23 Nov. 2012	17	FSG member of D12	Demonstration and OJT of line sowing
Line sowing by manual seeder	30 Nov. 2012	34	FSG member of D5 and D6	Demonstration and OJT of line sowing
Productivity of improved direct sowing rice cultivation	22 March 2012	51	FSG member of D11, D12, D5 and D6	Result of demonstration plot of improved direct sowing (line sowing)
Manual seeder production workshop	4 Nov. 2013	7	Project C/P, extension agent and farmer	Production of manual seeder (2 units of prototype produced)
Line sowing by manual seeder	8 Nov. 2013	19	FSG member of D11	Demonstration and OJT of line sowing
Line sowing by manual seeder	15 Nov. 2013	23	FSG member of D12	Demonstration and OJT of line sowing
Manual seeder production workshop	28 Nov. 2013	4	Technician of private workshop and FAC, project C/P	Production of manual seeder (2 units of prototype produced)
Line sowing by manual seeder	4 Dec. 2013	26	FSG member of D5	Demonstration and OJT of line sowing
Manual seeder production workshop	29 Jan. 2014	3	Technician of private workshop and farmers	Production of prototype of seeder conducted (2 units) by project C/P
Improved rice cultivation techniques *(1)	7 Feb. 2014	18	Extension agent, Lieder farmers of FSG	Lecture of improved rice cultivation techniques of transplanting and direct sowing by C/P
Field day of direct sowing rice cultivation	18 Feb. 2014	33	FSG member farmers and non FSG member farmers at D11 demonstration field	Technology transfer of improved direct sowing cultivation conducted by project C/P
Manual seeder production workshop	25 Feb. 2014	5	Farmers of D11 and D12	Production of prototype of seeder conducted (2 units) by project C/P
Field tour	28 Feb. 2014	88	Member of FSG of D11, D12, D5 and D6	Exchange experience and technical information of direct sowing among FSG at D11 and D12 demonstration field
Field day of direct sowing rice cultivation	6 March 2014	64	FSG member farmers and non FSG member farmers at D12 demonstration field	Technology transfer of improved direct sowing cultivation conducted by project C/P
Improved rice cultivation techniques *(2)	3 July 2014	65	FSG member farmers of D5, D6, D11, and D12	Variety characteristics and grain production of promising variety of transplanting, result of verification of promising variety of direct sowing, and yield of demonstration plot of direct sowing
		472		

Note: *(1) and (2) overlapped with transplanting rice cultivation training

OJT was organized in 2012 for row seeding with the manual row seeder, which was used to deal with the farmers' fields in D5, D6, D11 and D12. On the OJT, the degree of farmers' interests in various matters was investigated. It was found that farmers in the direct sowing block (D11 and D12) as well as in the transplanting block (D5 and D6) are highly interested in the clod crushing by rotavator and the row seeding using the manual row seeder.

Table 4.3.2 Degree of Farmers' Interest to Manual Seeder

Question	D5 D6 FSG				D11 D12 FSG			
	Yes, understood well	Yes, understood	Not understood	No answer	Yes, understood well	Yes, understood	Not understood	No answer
Concept of training	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Interest in rotary cultivation	100.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Function and operation of manual seeder	38.5	19.2	42.3	0.0	100.0	0.0	0.0	0.0
Advantage of manual seeder	76.9	0.0	7.7	15.4	90.3	9.7	0.0	0.0
Interest in manual seeder	69.2	15.4	3.8	11.5	83.9	9.7	6.5	0.0

Number of answer: n 57

In 2012, after the yield survey on the verification fields for direct sowing, a training course was organized for FSG farmers in D5, D6, D11 and D12, regarding the introduction of the manual seeder. Questions were asked throughout the course, such as those relating to the advantages and productivity of row seeding. The majority of farmers, who participated in this course, showed a high level of interest in introducing the manual seeder and had positive images about the row seeder in regard to its productivity and its ability to aid making weeding easier, etc. A survey was conducted during a training session held in 2012 about the yield of the verification fields for direct sowing, in order to understand the degree to which FSG farmers' are interested in the line seeding method. Many answers were favorable about the expectation of a high yield, convenience of fertilizer management and so on.

Table 4.3.3 Degree of FSG farmers' understanding toward Line Sowing

Advantage	Number of answer	%
Easy for weeding	17	21.8
Expected high yield	32	41.0
Less seed required	8	10.3
Plant grows in line	19	24.4
No answer	2	2.6

Number of answer: n=51

4.3.2 The establishment of direct sowing demonstration fields with initiative of extension leaders (FSG farmers)

(1) Establishment and management of demonstration fields for the rice cultivation techniques of direct sowing

The establishment of FSG in the direct sowing block started in 2012. The number of FSG members at the time of the establishment was twelve in D11 and ten in D12. Demonstration fields were first established also in 2012: twelve plots, 16ha in total in D11 and ten plots, 16ha in total in D12. These fields demonstrated broadcast seeding as a direct sowing cultivation, seeding 150kg/ha of seed with 100kg/ha of urea, which were applied three time according to the growth condition (first application: 35% of total amount applied twenty-five to thirty days after the showing-seedling irrigation, about the four to five leafing stage; second application: another 35% applied approximately ten days after the first application; third application: remaining 30% applied thirty to thirty-five days after the second application). As herbicide, 12L/ha of Propanil and 3L/ha of MCPA were diluted with 200L of water and were sprayed at the four to five leafing stage. The field plowing of the verification field in 2012 took place before the field was completely dried after the rain, so clod crushing was not enough and required that this was redone another time. In addition to the broadcast seeding block, two row seeding blocks with the use of the manual row seeder were set up in two farmers' demonstration fields.

Table 4.3.4 Number of Established Direct Sowing Demonstration Fields

Irrigation block		2013		2014		Remark
		No.	%	No.	%	
D5	No of FSG	0	0	3	0	Direct sowing in 2014
	No of farmers	0	0	50	0	
	Area (ha)	0	0	25	0	
D11	No of FSG	1	0	1	100	-
	No of farmers	12	0	24	200	
	Area (ha)	16	0	32	200	
D12	No of FSG	1	0	1	100	-
	No of farmers	10	0	17	170	
	Area (ha)	16	0	25	156	
Total	No of FSG	2	0	5	250	-
	No of farmers	22	0	91	414	
	Area (ha)	32	0	82	256	

* : Increasing rate based on 2nd implementing phase

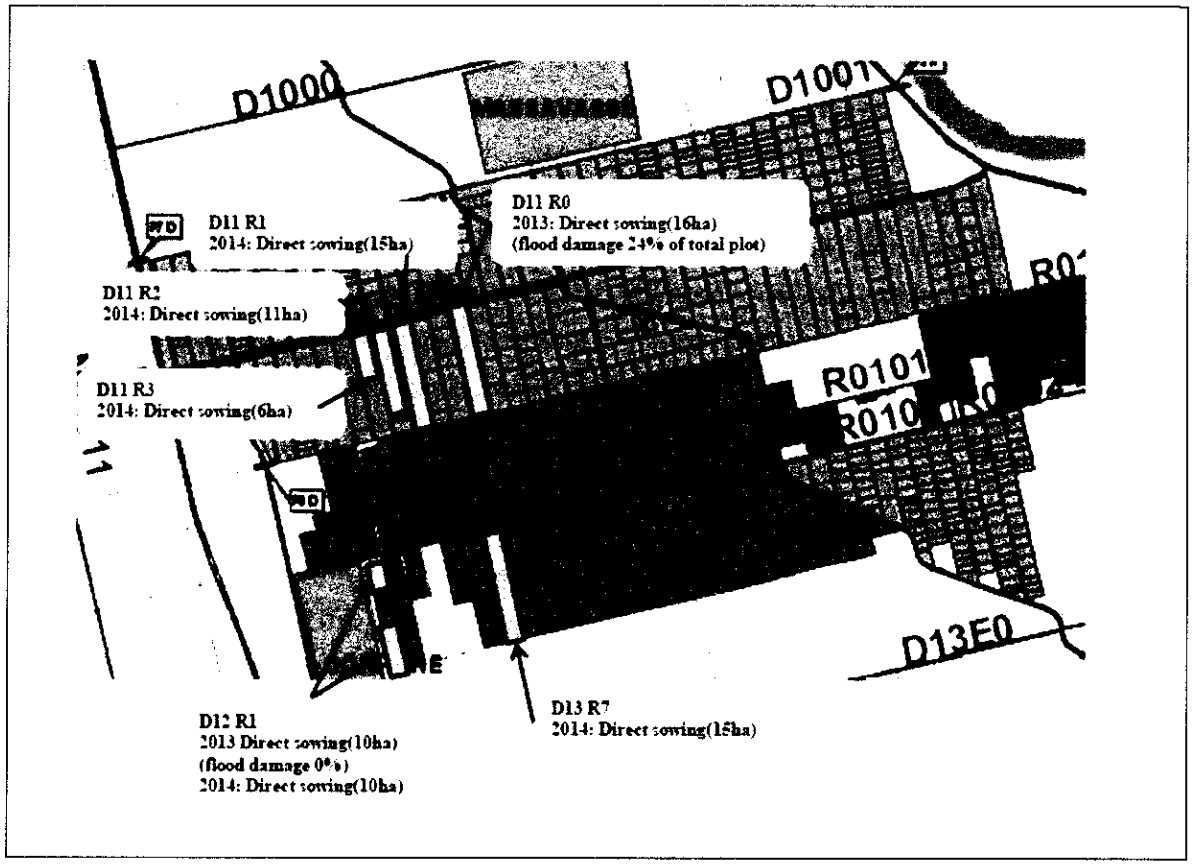


Figure 4.3.1 Location of Direct Sowing Demonstration Fields (D11 and D12)

There are two crucial times to determine the outcome of direct sowing cultivation: the first is the irrigation flooding only the lower stem of rice seedling, which should be done after the seeding, and the field management up until the plant establishing stage, which is the four to five leafing stage. Some of the fields in D11 and D12 had a rather poor germination, as the seedlings of a part of the field were covered with water completely. This was due to the uneven level of the field, the field inundation at the time of the seedling showing irrigation application and mal-management of the drainage canals. At the same time, some fields had salt damage due to the dried state of the fields after germination. The flood, which occurred in January 2013, did not spill over into demonstration fields in D11 and D12, but left the primary irrigation canal in a bad condition. The repair work of which prevented irrigation for about one whole month. Although the verification block of twelve plots was set up in D11, the harvest of three plots, amounting to 1.75ha of field coverage, were abandoned, due to poor germination and the overwhelming growth of weeds. Three plots (6ha) out of ten in the verification block in D12, seriously affected by the shortage of irrigation water, were also abandoned before harvesting. Again, this was due to poor germination and the overwhelming growth of weeds. Even among these seven plots, 4.5ha of field were also abandoned before harvesting. Farmers in D11 and D12 were evacuated. They could therefore not manage fertilizer application and weeding, so the average yield of the demonstration fields was 2.19t/ha in D11 and 2.03t/ha in D12, a very low yield.

Table 4.3.5 Yield of Direct Sowing Verification Block 2012

D11

Farmer's name	Area planted (ha)	Area harvested (ha)	Yield	Un harvested area		Hills per m^2
			ton/ha	ha	%	
Cerinho**	0.50	0.50	3.40	0.00	0.0	58
Luisa Sitoe	1.00	1.00	1.80	0.00	0.0	60
Carolina Ubisse	1.00	1.00	3.00	0.00	0.0	72
Milagre Tivane*	2.00	2.00	3.56	0.00	0.0	44
Ercilia Lumbela	2.00	2.00	2.44	0.00	0.0	66
Alfeu Chambel*	1.00	1.00	2.40	0.00	0.0	101
Helia Muthobene	1.00	1.00	1.88	0.00	0.0	65
Aguida Cambaco	1.00	1.00	2.25	0.00	0.0	54
Fillipe Ubisse	1.00	1.00	1.20	0.00	0.0	199
Angelina Ubesse	1.00	0.78	1.74	0.22	22.3	73
Albertina Nuvunga	1.00	0.44	1.86	0.56	55.6	33
Milagrosa Tivane*	1.50	0.53	0.70	0.97	64.4	52
			2.19			73.1

D12

Farmer's name	Area planted (ha)	Area harvested (ha)	Yield	Un harvested area		Hills per m^2
			ton/ha	ha	%	
Ciriciosa Macuanaze**	1.50	1.00	1.20	0.50	33.3	128
Feliciano Alberto	1.00	0.50	2.50	0.50	50.0	140
Lidia Nhacumbe	2.00	1.00	1.20	1.00	50.0	109
Antonio Chirindza	1.00	0.75	1.33	0.25	25.0	207
Natalia Cuna	1.00	0.44	1.70	0.56	56.0	144
Luerencia Nhavane	1.00	0.27	3.76	0.73	73.4	65
Helena Sitoe	2.00	1.00	2.48	1.00	50.0	131
			2.03			132.0

The yield survey was carried out on nineteen plots in the direct sowing verification block of D11 and D12 in 2012, in order to see the effect of the number of hills per unit area to the paddy yield and to the yield components. The samples were taken from three $5m^2$ spots within each verification block, with twenty samples in total having been taken. According to this survey, if the number of hills per unit area increased, the number of panicle per hill and the number of spikelet per panicle decreased. It was also found that the number of paddies per unit area increased when the number of hills per unit area exceeded $50/m^2$ but the filled spikelet percentage decreased, resulting in a low yield as a consequence.

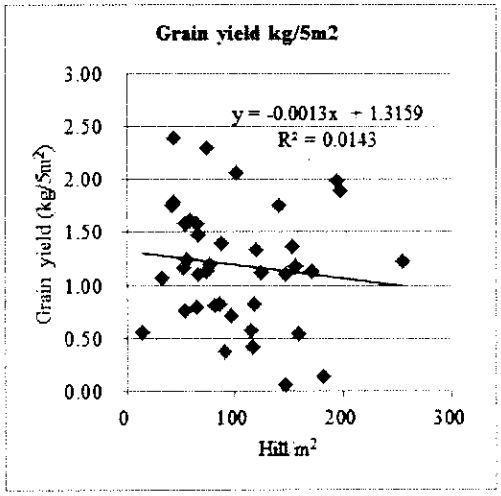


Figure 4.3.2 Correlation between the number of hills per unit area and yield for direct sowing cultivation

The overall yield in 2012 was low, due to the flood. Yet in all the demonstration fields, studies were conducted to ascertain the relationship between the yield outcome and the location of each field, sampling three $5m^2$ areas each from all the demonstration fields in D11 and D12. Sampling locations and yield were divided into five levels of yield (less than 25% of the average yield, between 25% and 50%, between 50% and 75%, between 75% and 100% as well as more than the average). The sampling locations are specified in Figure 4.3.3. In D11 area, the tertiary canal runs from right to left on the figure and its inlet, at upper part of the figure, takes in the irrigation water. The slope of the field is not so visible, yet the excessive water is drained from the outlet of the tertiary drainage canal, at the lower part of the figure. The plots of low yield in D11 area were concentrated at the lower left of the figure, the edge of the irrigation canal. The harvest plots that were given abandoned are concentrated on the 3 area, at the left on the figure.

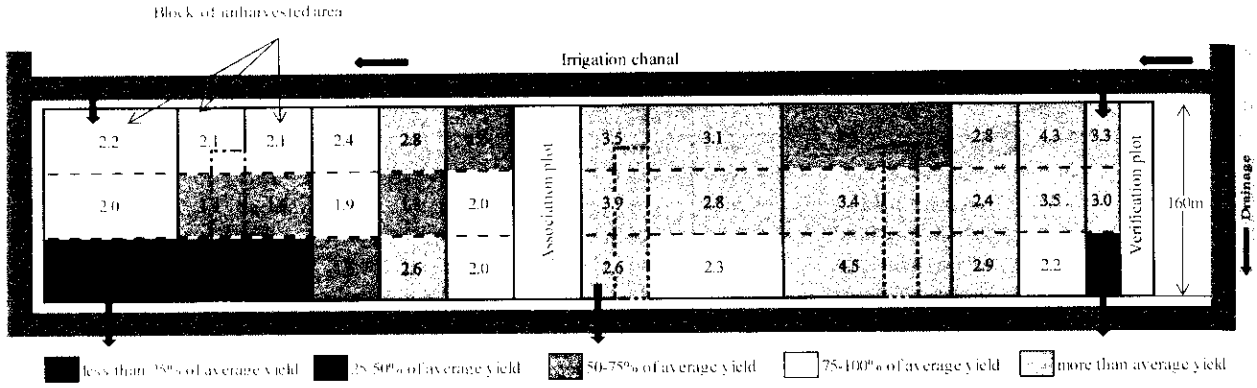


Figure 4.3.3 Location Map of the Sampling in Demonstration Fields of D11 Area

As for D12 area, the tertiary canal runs from the left of the figure, and the inlet at the bottom takes in the irrigation water (Figure 4.3.4). The surface asperity is visible and the degree of leveling is extremely disagreeable. The excessive water is drained from the tertiary drainage canal at the top of the figure. Some farmers drain the excessive water of their fields from the secondary drainage canal instead (along the road at the bottom of the figure). The plots of low yield in D12 are mostly located at the edge of the irrigation canal on the right of the figure. Although there are plots neglected for harvest in most of the demonstration fields, the plots where more than 50% is neglected for harvest are mostly located by the drainage canal, in the upper part of the figure.

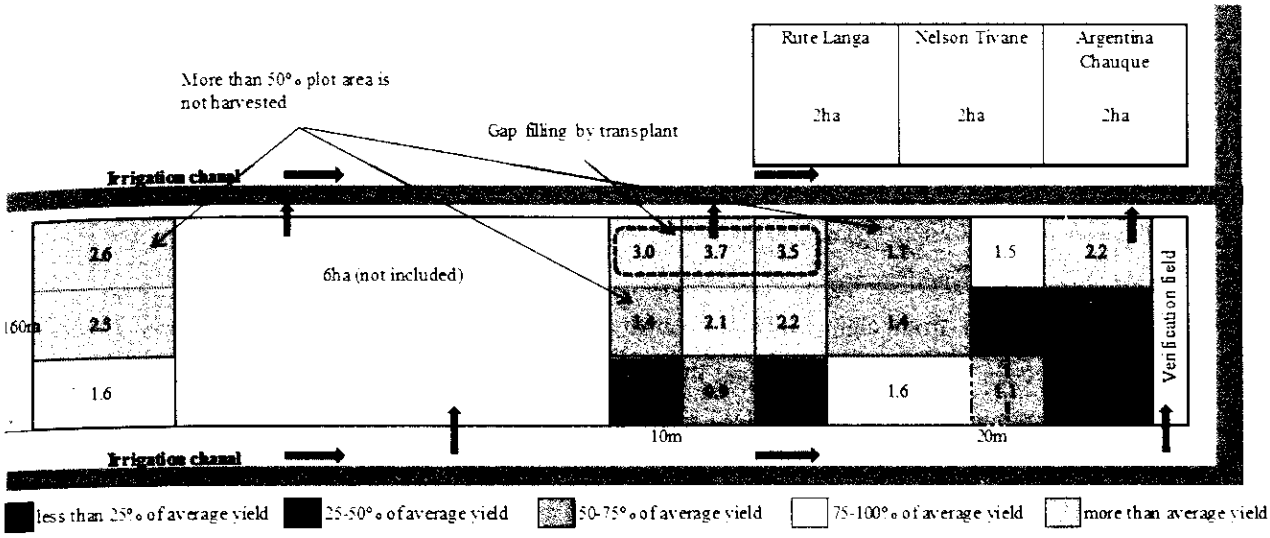


Figure 4.3.4 Location Map of Yield Sampling at Demonstration Fields in D12

In the demonstration fields for direct sowing in D11 and D12 this time, the yield became less and less as the fields got nearer to the edge of the irrigation canal. The neglected areas were also seen nearby the edge of the irrigation canal in both D11 and D12. The low yield and appearance of the abandoned areas are both due to the poor management of fields from the seeding period to the plant establishment period. Specifically, poor germination and exuberant weeds after the seeding are the principle problems, and areas with these problems were also areas that were noted for low yield as well as for being neglected.

The number of FSG member farmers in the direct sowing block in D11 and D12 increased significantly in 2013. As a consequence, the number of plots increased as well, resulting in twenty plots in D11 with a total of 32ha and seventeen plots in D12 with a total of 25ha in each verification block. A total of fifty FSG farmers in D5 block were converted from transplanting to direct sowing within the block, so fifty more plots, a total of 25ha, were added to make up a grand total of ninety-one plots amounting to 82ha within the demonstration block. The focus for the study of the demonstration was the same as that of 2012, the standard of cultivation variety.

The weather in 2013 remained agreeable and FSG farmers were all so careful to leave the upper parts of the young seedlings above water when the first irrigation water was introduced after the seeding stage, something that was learnt after the unfortunate experience of the previous year. Subsequently plant growth was favorable. Although some of FSG farmers in D5 showed some hesitation towards the direct sowing method, as this was a new experience for them, they made a collective effort to adopt the new seeding method and everything it entails, after having converted their seeding method from transplanting last year. A poor yield was recorded in a part of D5, which was due to poor growth. This area was located close to the edge of the irrigation canal, where the tertiary irrigation canal had not been maintained well. There was also one plot in the verification block of D5 that had been neglected by harvest time. As for D11, there were no notable problems. Yet there was still one plot nearby the edge of the irrigation canal in the verification block that had been neglected by harvest time due to poor growth caused by the inundation of the field after the seeding stage. Three other plots, also nearby the edge of the irrigation canal, had salt damage. There were two plots of 3ha nearby the edge of the irrigation canal also in D12 that had been neglected by harvest

time as they were damaged by salt.

The yield survey of the verification blocks was carried out in 2012 in order to study the relationship between the yield and the yield components, as well as the number of hills per unit area. Two samples at two different 5 m^2 plots in the verification field were used to analyze the yield components, along with twenty solid samples. After the harvest, the number of hills per unit area from each verification block was investigated. Some plots, that had already been plowed before this survey was carried out, were excluded from the study of the yield components and the number of hills per unit area.

The average yield from eighty plots of verification blocks in D5, D11 and D12 was 3.8t/ha, but approximately 66% of the entire plots had the yield between 4 and 5t/ha. A significant difference in the average yield among three blocks (D5, D11 and D12) was not found. The number of hills per unit area in each of these plot was somewhere between eighty and one-hundred and twenty respectively.

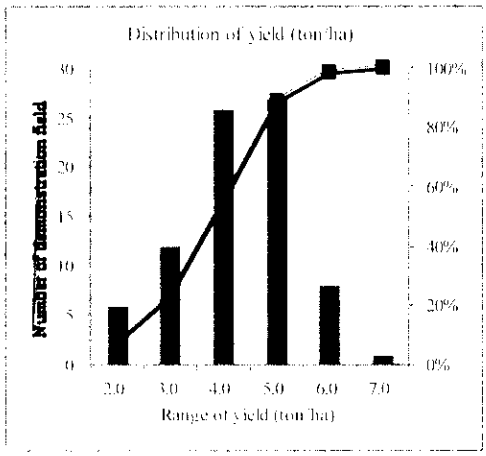


Figure 4.3.5 Distribution of Yield

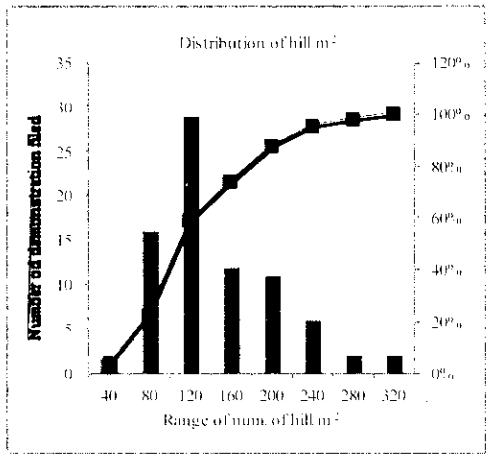
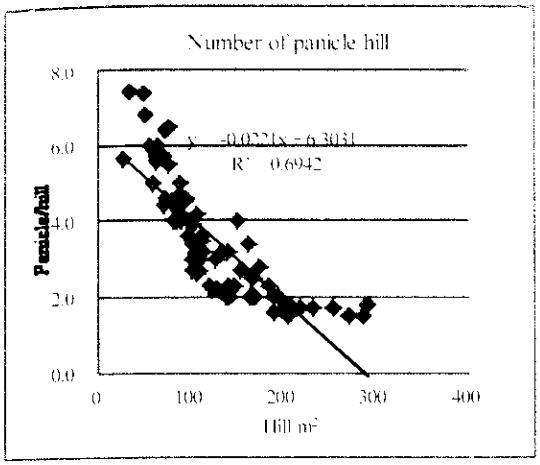


Figure 4.3.6 Distribution of the number of hills per unit area

There was a negative correlation found between the number of hills per unit area and the number of panicle per hill, the number of spikelet per panicle and the filled spikelet percentage. This result clearly indicates that the increase in the number of hills is related to the decrease in the other aspects. However, there is not a significant correlation between the number of hills and the number of spikelet. This seems to be the case that the number of hills per unit area covered for the reduced number of panicle per unit area as well as the number of spikelet per panicle.

Table 4.3.6 Relationship between the number of hills per unit area and yield as well as yield components

Plot	Hill m^2	Panicle hill	Spikelet per panicle	Fille spikelet (%)	1000 grain weight	Yield (ton/ha)	Spikelet $x10^3/m^2$
D5	149.0	3.0	96.2	79.4	24.5	3.6	36.7
D11	98.1	4.2	110.9	81.3	24.1	4.0	38.9
D12	90.8	4.3	107.2	85.2	24.5	4.0	37.0
n = 80	-	0.8332 **	0.3893 **	0.3166 **	0.0719 ns	0.1003 ns	0.0259 ns



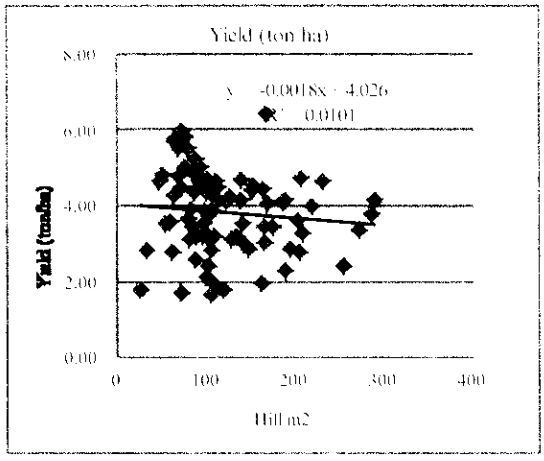


Figure 4.3.7 Correlation between the number of hills per unit area and the number of panicle per hill

Figure 4.3.8 Relationship between the number of hills per unit area and yield

The yield survey and the study of relationship of locations of the field were carried out in 2013 for the demonstration fields. Three locations of $5m^2$ each were sampled. The yield of those three sampled locations were categorized into five levels (less than 25% of the average yield, between 25% and 50%, between 50% and 75%, between 75% and 100% and more than the average yield) and are located in figure 4.3.9 through figure 4.3.11.

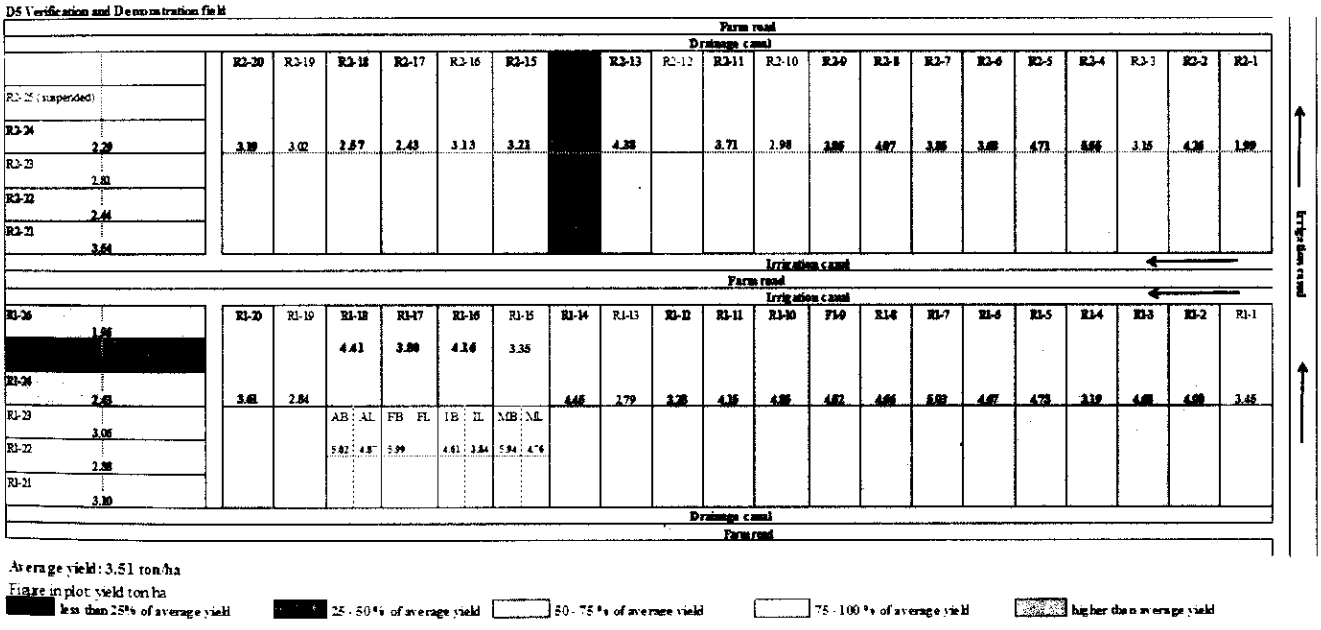


Figure 4.3.9 D5 Field Yield Map

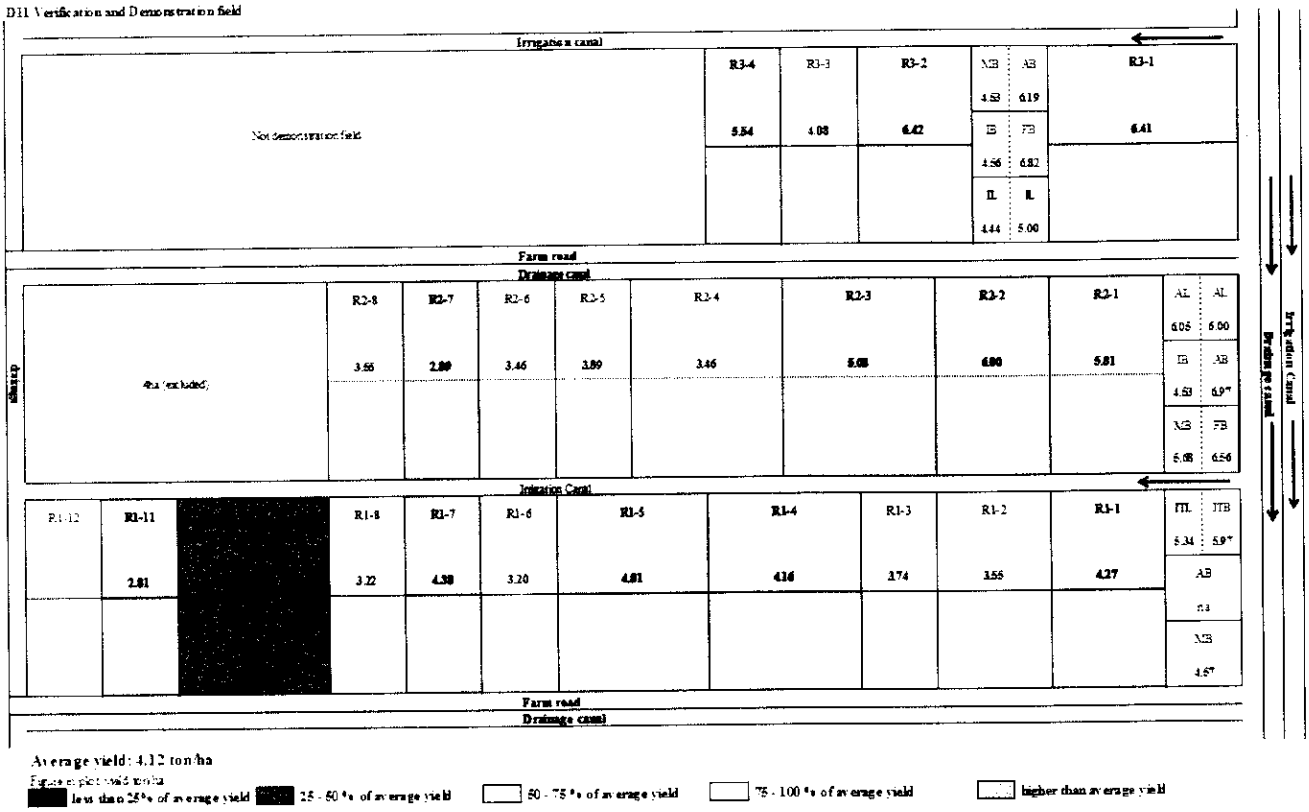


Figure 4.3.10 D11 Field Yield Map

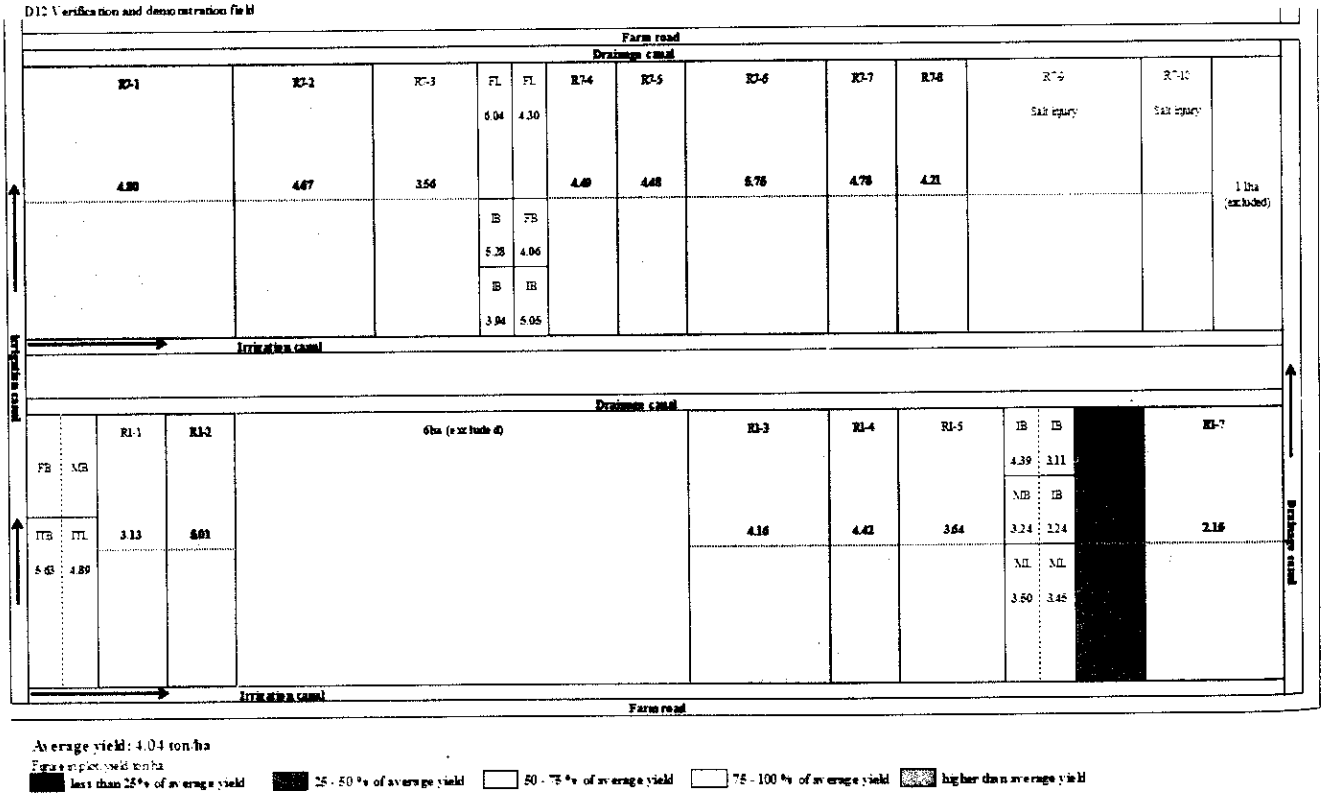


Figure 4.3.11 D12 Field Yield Map

In a similarity to the results found in 2012, three newly set up verification blocks within D5, D11 and D12 (set up in 2013) had neglected and low yield plots nearby the edge of the tertiary irrigation canal, which was away from the inlet. It is assumed that water management becomes more difficult when the plot is located close to the edge of the canal.

(2) Technical problems of the rice cultivation techniques of direct sowing from the perspective of farming expenses

1) Introduction

There was a significant disparity between yields of the verification and demonstration blocks during the third operational year. It was agreed that mutually necessary field preparation and the appropriate water management from seeding to the plant establishment stage should be applied appropriately. Appropriate field preparation means to level the surface of the field evenly and to crush any clods thoroughly. Generally speaking, in the Project area, the rough plowing takes place using the disc plow, followed by the clod crushing which is done by the disc harrow and then seeding. Right after the seeding, another round of clod crushing would be done along with the covering over of seeds with soil. After fields are divided into small plots called canteiro (1ha=forty to forty-five canteiro), the irrigation starts. If seeding takes place in a field with insufficient clod crushing, some seeds would drop between clods. Germination would depend on the size of the clod, and some would actually not germinate. Insufficient field leveling constrains the germination process by pooling water in the lower part of the field. Although there are still some improvements that should be made to the present method of clod crushing and field leveling by disc plow and disc harrow, there is a limitation to what can be achieved as well. Therefore, what is of crucial importance is the appropriate management of water by each individual farmer. Appropriate water management means: to maintain that the field is wet enough from the seeding to the plant establishment stage, not to inundated the field and not to have it dry out but to be kept wet enough. This water management requires frequent visits to the field to check the irrigation water and drainage conditions. For this purpose, the Project recommends the "permeating irrigation method." It is absolutely necessary to pay close attention to the wet condition of the field, especially until germination takes place.

Based on the above recognition, the Project coached FSG farmers thoroughly in the fourth operation year, in regard to the field management, starting from the seeding time until seedling reached to the plant establishment stage. During land preparation, there was rain after the rough plowing. But the clod crushing was done after waiting for the field to be dried well, after having learnt from the experiences of the third year. The field condition for the seeding was much better than that of the previous year because of this. Many farmers experienced poor germination due to the poor water management at the beginning of the plant growth stage during the third year, so the irrigation was closely monitored this time, which resulted in some improvements in the germination condition. Some farmers were very careful in controlling irrigation water, to the extent that sometimes the Project thought that it was, perhaps, slightly too careful. The Project had recommended 150kg/ha of seed amount for directly seeded fields, but since germination was very good, some fields were overly crowded. If these levels of management by farmers continued in the future, it may become necessary to review a reduction in the seed amount. Meanwhile, there were some first time FSG farmers who could not successfully manage the water management at early stage of plant growth, unlike

those farmers who had had the bitter experience regarding the previous/earlier years water management. These farmers, with the experiences of the third year, showed such an apparent effort in not repeating the same things during the fourth year. Clearly it is necessary to learn from field experiences.

Through the course of the rice cultivation process that FSG farmers performed and managed properly during the fourth operational year, the Project could find/identify new issues for improvement. The Project organized an interview with FSG farmers as well as non-FSG farmers within the Project areas, except D6 where there was no rice cultivated for that year, in order to understand their farming conditions including the investment made from the land preparation to harvest (materials, financial resources, labor, etc). The following paragraph deals with the issues of the rice cultivation techniques of direct sowing to be improved, based on the results of the interview. The number of target farmers is shown in Table 4.3.7

Table 4.3.7 Number of Target Farmers

Irrigation Block	FSG member (91)			FSG Non-member (103)					Total
	D5	D11	D12	D11	D12	R1-3	D5	R1-3	
No.	50	24	17	20	17	15	36	15	194
Cultivation method	Direct sowing (143)						Transplanting (51)		

Note: ( ) indicates number of farmers

The labor force structure of the target farmers is shown in table 4.3.8. Rice farmers in the Project area have very little labor with only one to two members of each family managing the rice cultivation, regardless of the cultivation method. In addition, many families have members who are working away from home. Some of these workers are employed on a daily basis, where others are migrant workers working in South Africa. And all of them were men. These non-agricultural jobs were bringing in 52% of the households total income (other farming conditions, yield and revenue condition, etc. are listed on the Appendix 8 (8-3)). It was made rather clear that rice cultivation in Chokwe has been managed by only one or two members per household (most of whom are women) and that because of this condition, rice farmers have to depend on the hiring laborers for transplanting, seeding and harvesting , work that requires a great deal of physical labor. The shortage of labor can be viewed as one of constraining factors for the rice cultivation in the Project target area. Therefore, the simplification and/or lessening the load of each working process (streamlined process, mechanization etc.) is seen as necessary for farmers to manage rice cultivation within the family. As the overall goal of the Project states, the final goal of the Project is to realize a rise in income for rice farmers. The components of rice income are gross income (paddy price × yield) and farming expense, so the tasks are to improve the yield and to minimize expenditure at the same time. Therefore, among farming expenses, working processes that require labor cost, such as transplanting, weeding and harvesting, are closely examined, along with yield results, to identify the direct sowing related technical issues that can be improved (bird scaring is excluded here, even though it requires a labor cost, since it is categorized as different from technical cooperation).

Table 4.3.8 Labor Structure of Target Farmers

Item		D5 FSG member (50)	D12 FSG member (24)	D32 FSG member (17)	D5 FSG Non member (20)	D12 FSG Non member (17)	R1-3 FSG Non-member (15)	D5 FSG Non-member (36)	R1-3 FSG Non-member (35)	Total (1941)
Cultivation method		Direct sowing	Direct sowing	Direct sowing	Direct sowing	Direct sowing	Direct sowing	Trans-planting	Trans-planting	
Family member (No.)	Ave.	4.12	4.54	4.23	5.25	4.88	4.80	4.39	4.60	4.85
	S.D.	1.32	2.54	0.92	1.25	1.22	1.78	1.15	1.24	1.50
Work for rice (No.)	Ave.	1.20	1.54	1.47	2.10	2.00	2.67	1.53	2.13	1.68
	S.D.	0.40	0.93	0.51	0.72	0.71	1.05	1.00	1.13	0.89
Full time famers (No.)	Ave.	1.08	1.17	1.24	1.40	1.53	1.53	1.06	1.20	1.22
	S.D.	0.34	0.82	0.44	0.60	0.53	0.52	0.41	0.68	0.54
Day labor (non-agri. No)	Ave.	0.62	0.13	0.06	0.10	0.06	0.00	0.56	0.20	0.32
	S.D.	0.90	0.64	0.24	0.31	0.24	0.00	0.61	0.72	0.67
Permanent job (No.)	Ave.	0.38	0.25	0.18	0.45	0.59	0.13	0.64	0.27	0.39
	S.D.	0.85	0.44	0.39	0.51	0.62	0.35	0.96	0.59	0.71
Working at SA (No.)	Ave.	0.48	0.29	0.47	0.60	0.43	0.40	0.86	0.33	0.46
	S.D.	0.50	0.75	0.51	0.60	0.51	0.91	0.86	0.72	0.61

Note: ( ) indicates the number of farmers

2) Transplanting

Table 4.3.9 is a summary of farming expenses for the different cultivation techniques, in regard to transplanting. As the table indicates, there is a significant difference at 1% level for transplanting works when expenditure of transplanting cultivation and direct sowing cultivation are compared. The reason as to why FSG farmers in D5 practiced the direct sowing method this season is that they could not finance the labor costs of transplanting, due to the damage caused by the flood. The labor cost is a rather big burden for rice farmers who practice transplanting rice cultivation.

On the other hand, the direct sowing rice farmers were also found to be spending approximately 2,200Mt/ha to transplant seedlings. Although it is common for direct sowing rice farmers to transplant seedlings to fill the empty space where germination was poor, this was done to such an extent that their expenditures increased significantly. In other words, the merit of direct sowing, which is its low cost, is lost. The demonstration fields for the rice cultivation techniques for direct sowing set up by the Project also required an extra labor to fill quite a few empty spaces in the field which has drainage problems. The results of poor germination are generally due to inappropriate land preparation and the management of water until the seedlings reach to the plant establishment stage, so the Project has realized the need to supervise farmers accordingly.

Table 4.3.9 Expenditure for Transplanting

Item	Planting methods				t
	Transplanting (51)		Directsowing (143)		
	Mean	S.D.	Mean	S.D.	
Cultivation area (ha)	0.52	0.23	1.09	0.71	-5.64 ***
Expense (Mt/ha)	3,653.80	2,513.19	2,260.24	718.43	6.00 ***

Note: ***<1%

: ( ) at the planting methods indecates the number of farmers

3) Weeding

In the Project target area, it is common to weed manually. However, in regards to the direct sowing cultivation, a large number of non-FSG farmers were also spraying herbicides. The size of field for direct sowing is usually more than 1ha and manual weeding has its limits (The cultivation area of FSG farmers in D5 is 0.5ha, but this is due to the fact that they were practicing transplanting until the previous cropping season. So the 0.5ha size of field for direct sowing is rather unusual). Table 4.3.10 shows the expenditure categorized by weeding methods. It was found that one-hundred and twenty-six farmers were applying a herbicide spray for weeding, but one-hundred and eight farmers, 86.7% of the total, were also weeding by hands, adding to an increase in the overall cost. The reason was because these farmers were not convinced with the effects of the sprayed herbicide. Their manual weeding was simply additional work, which is not strictly necessary. This situation requires improvement, since there would be little merit in spraying herbicide other than adding an extra expense. Some FSG farmers commented on the difficulty in weeding

The herbicide, sprayed to demonstration fields of the rice cultivation techniques of direct sowing, is used by farmers in general within the Project area. The Project has suggested that it be sprayed when the seedlings reach to the four to five leafing stage. But the spray timing tended to be delayed as the growth of seedlings differed from one field to another. It was also necessary to drain the irrigation water from the field before spraying herbicide. One of the reasons why there was little beneficial effect from herbicide was that perhaps the field was not drained well enough. This can be difficult to do, particularly to those fields where there is a drainage problem(s) and the surface level is uneven. There are some technical problems concerned with spraying like such as leaving patches caused by spraying unevenly as well as something beyond human control such as rain falling after spraying.

Frequent irrigation and drainage between the time of seeding to herbicide spraying is necessary and the effects would be visible when a land is prepared appropriately. The issues of transplanting and weeding are mainly caused by the irrigation and weeding as well. Therefore, it is important to supervise farmers about each aspect of the work from land preparation to herbicide spraying to help them understand this as a closely connected process.

Table 4.3.10 Expenditure on Weeding

Item	Weeding methods								
	Manual (66)			Herbicide (18)			Both (108)		
	Mean		S.D.	Mean		S.D.	Mean		S.D.
Cultivation area (ha)	0.66	b	0.42	1.28	a	0.73	1.06	a	0.72
Weeding Expense (M/ha)	1,361.92	a	1,236.25	3,364.61	b	436.69	5,528.04	c	1,607.64

Note: *Mean in the same row with the same letter are not significantly different (P<0.05)

: ( ) at the Weeding methods indicates the number of farmers.

:2 farmers who did not weed are not included in the analysis.

4) Harvesting

There are two ways to harvest rice, by hand or by combined harvester. The process of harvesting by hand involves three types of work: 1) mowing, 2) moving and mounting mowed rice plants and 3) threshing. As for the other method done by the combined harvester, it is possible to combine the mowing and threshing

process. Comparing operational cost between these two harvesting methods, there is a significant difference at 1% level, and the operation cost of harvesting by hand requires a higher operation cost of 1.82 times than that of by a combined harvester. (Table 4.3.11).

HICEP owns seven combined harvesters, but this number is still not sufficient enough and a number of farmers expressed their difficulty in reserving one during the optimal harvest time of their fields. Since the mechanization of the harvest is directly connected to the reduction of the operation cost, a swift resolution to the shortage of combined harvesters is much awaited with anticipation. The combined harvester is usually used by farmers with a field equal to or larger than 1ha, and, if including more information, who practice the direct sowing method. Even though the cultivation area of each FSG farmer in D5 is 0.5ha, the their harvest was dealt with using a combined harvester as their fields are consolidated as two ramars (13ha/ramar). The operator of the harvester made a comment pointing out that it was rather inefficient to discharge paddy every time after harvesting was done on each 0.5ha field. HICEP owns only large-scale harvesters with an operation width of 5m. It may be necessary to introduce small-scale combined harvesters for small-scale farmers.

Table 4.3.11 Expenditure on Harvesting

Item	Harvesting methods				(t)
	Manual (80)		Harvester (95)		
	Mean	S.D.	Mean	S.D.	
Cultivation area (ha)	0.58	0.28	1.26	0.75	-7.76 ***
Expenses (Mt/ha)	6,780.53	4,839.14	3,722.62	401.19	6.14 ***

Note: ***<1%

: ( ) at the Harvesting methods indicates the number of farmers.

: 17 farmers who harvested by both manual and harvester and 2 farmers who could not harvest are not included in the analysis.

5) Yield

The Project has assisted all FSG farmers equally regarding land preparation and materials (seed, fertilizer and herbicide), but the yield of each FSG farmer has shown a significant difference. There must be some constraining factors that greatly impact beyond the material injection or rice cultivation techniques of direct sowing. It is understandable if these factors included problems related to irrigation and drainage. As it has been mentioned before, water management until the seedlings reach to the plant establishment stage is most significant for the direct sowing cultivation. So Figure 4.3.12 show the yield of two types of farmers, among FSG farmers, with and without the occurrence of problems in irrigating and/or draining the water during this cropping season. The figure clearly shows that the yield of the farmers, who had problems in irrigation and/or draining water, was remarkably low. Particularly, HICEP stopped water distribution as a flood countermeasure during this cropping season. During this time, a part of D5 and D12, where land was relatively higher, had difficulties in irrigating their fields, which may have caused the low yield. At the same time, a number of fields nearby the drainage canals were having drainage problems. It was difficult to manage water in such fields from seeding to the stage of plant establishment, and insufficient water management may have also caused poor germination. The fields with poor drainage tend to have a high

saline concentration. This could also be another reason for the poor germination rate.

Generally speaking, direct sowing cultivation results in low yield and tends to be rather unreliable compared with transplanting. From the perspective of water management, it is difficult to practice the rice cultivation techniques of direct sowing in fields where irrigation/draining problems exist. In other words, the best situation in which to practice the rice cultivation techniques of direct sowing is to handle water management appropriately.

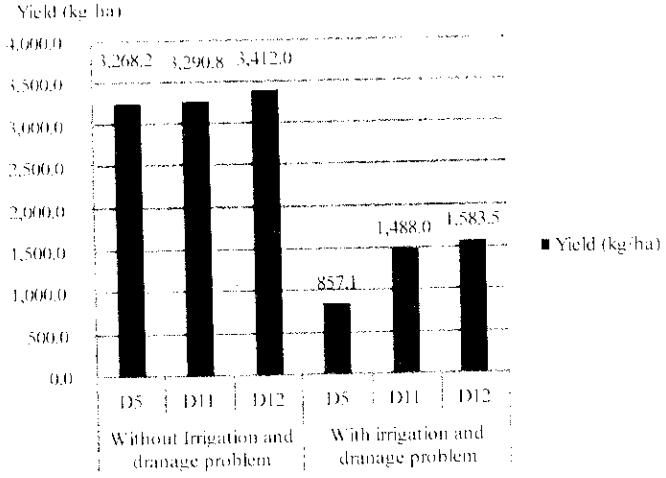


Figure 4.3.12 Difference in Yield of two different conditions of fields:
with and without problems of water management

6) Summary

A minimum requirement for the direct sowing method is to have the irrigation and drainage managed properly until the seedlings reach to the plant establishment stage. So, the choice of field is important, accordingly. Other necessary tasks are appropriate land preparation, water management and weeding, and all of these will lead operation cost to be reduced while yield to increase. In regard to the mechanization of harvesting, the shortage of combined harvesters is a problem. It is hoped that HICEP and SDAE will procure them as soon as possible.

In each irrigated target areas, demonstration fields were designed into blocks for two different methods, since the time of their establishment done by the Project FSG farmers. On top of those fields, another demonstration field has been set up for the single cultivation method also within FSG, and there are usually plots with irrigation and drainage problems, as well as plots without those problems, existing in the same ramar at the same time. Perhaps, it was necessary to pay closer attention to each of the plots. Even if the FSG was originally meant to set up the demonstration fields for the rice cultivation techniques of direct sowing like D11 and D12 blocks, it might have been okay to reconsider another technique with a consideration given to the field conditions. The operation costs for transplanting would have been reasonably higher, yet the Project could also have offered such an option to FSG. This is one of things the Project learned as well as the other issues to be improved.

4.3.3 Implementation of technical training for the rice cultivation techniques of direct sowing for non-FSG farmers with the initiative of extension agents and leaders (FSG farmers)

During the third operational year, a total of twenty-two (32ha) demonstration fields for the rice cultivation techniques of direct sowing were set up at FSG farms in D11 and D12 block. The extension of the improved rice cultivation techniques of direct sowing was carried out in these areas through OJT for row seeding with the manual seeder and operation and maintenance of demonstration fields and various training courses based on results found at verification fields. Next year, the fourth operational year, ninety-one (82ha) demonstration fields for the rice cultivation techniques for direct sowing were set up at FSG farms in D5, D11 and D12.

The flood made the Project unable to organize detailed training courses for the rice cultivation techniques of direct sowing for non-FSG farmers in the third year, still the number and the total area of demonstration fields increased in the next year by 4.17 times and 2.56 times respectively, which indicates the gradual extending of progress for the improved techniques to non-FSG farmers through demonstrations. The Field Day was also organized for the rice cultivation techniques of direct sowing, once each in D11 and D12, targeting non-FSG farmers, and thirty-three and sixty-four farmers participated respectively (Table 4.3.12). Among one-hundred and three non-FSG farmers interviewed at this time, seventy-four (71.8%) answered that they know about the verification blocks set up by the Project. Among these seventy-four farmers, forty-five (60.8%) said that they had visited one or more of the demonstration fields before. It is clear that many farmers have an interest towards the improved rice cultivation techniques for direct sowing developed by the Project. If the demonstration fields as well as verification blocks are maintained even after the Project implementation term ends, it would be possible eventually to see the beneficial effects of the Farmer to Farmer technical extension project. The Project realized the importance of continued assistance to FSG by SDAE in order to encourage this type of ripple effect to happen.

Table 4.3.12 Training for Non-FSG Farmers during the 4th OY (Direct Sowing Cultivation)

No.	Title of training	Lecture	Date	Participants	Place Target
1	Field Day	Mr. Arsenio F. Lhamine Mr.Jerinho Z. Cumbe	2014-2-18	33	Local farmers and FSG of D11
2	Field Day	Mr. Arsenio F. Lhamine Mr.Baptista A. Macuacua	2014-3-6	64	Local farmers and FSG of D12
			Total	97	

4.4 The strengthened of farmers groups activities in the areas of the demonstration field (Output 4)

4.4.1 The establishment of a farming support group in each target area

(1) Establishment of FSG

One of the main activities of the Project is the extension of the technical improvements of rice cultivation. The department of extension rural, SDAE, is a public section that offers extension services, but this department is extremely volatile. FSG was established in the target areas by the previous Project, in order to assist this section, and has contributed to the spread of technical information through the Farmer to Farmer

extension method. Based on this history, the Project has relied on technical extension through the farmer to farmer method and has continued in assisting the establishment and operation of FSG.

The transition in the number of FSG and FSG farmers is shown in table 4.4.1. At the beginning of the second operational year, the number of FSG farmers was forty-two (D5:one FSG, ten farmers, D6: one FSG, ten farmers, D11: one FSG, twelve farmers, D12: one FSG, ten farmers). In the end, the Project carried out assistance programs for one- hundred and seven FSG farmers (D5: three FSGs, fifty farmers, D6 one FSG, sixteen farmers, D11: one FSG, twenty-four farmers, D12: one FSG, seventeen farmers). The expansion in D5 block is particularly remarkable.

Table 4.4.1 Change in the Number of FSG

Irrigation block		Year					
		1st	2nd		3rd		4th	
			No.	%	No.	%*	No.	%*
D5	FSG	0	1		2	200	3	300
	Members	0	10		26	260	50	500
	Area (ha)	0	5		13	260	25	500
D6	FSG	0	1		1	100	1	100
	Members	0	10		16	160	16	160
	Area (ha)	0	5		8	160	0	-
D11	FSG	0	1		1	100	1	100
	Members	0	12		12	100	24	200
	Area (ha)	0	0		16	-	32	200
D12	FSG	0	1		1	100	1	100
	Members	0	10		10	100	17	170
	Area (ha)	0	0		16	-	25	156
Total	FSG	0	4		5	125	6	150
	Members	0	42		64	152	107	255
	Area (ha)	0	10		53	530	82	820

Note: * Increasing rate based on the time of establishment

The establishment of FSG was initiated by the assigned extension agents, who, in turn, chose the member farmers. The establishment procedures taken by FSG for the Project are listed on table 4.4.2. At its inauguration, the purpose of FSG as well as the responsibility of the Project and FSG are explained. In particular the role of the farmers revolving fund was thoroughly explained in a slow and methodical manner. The representatives and SDAE signed an agreement in the end so that the FSG was officially established.

Table 4.4.2 FSG Establishment Procedure

Step	Activity	Remarks
1	SDAE/PROPAC Discussion	● SDAE explains the purpose and function of the FSG. ➢ Establishment of demonstration fields ➢ Management of revolving funds
2	Member selection	● Ideal number of members is between 10 and 15. ● Members will play leading roles to extend rice cultivation techniques. ● Members must be enthusiastic and participate proactively in rice cultivation.
3	Appointment of executive members 1. President 2. Vice-president 3. Accountant	● President, vice-president and accountant should be appointed among members. ➢ FSG is responsible for the personnel appointment. ➢ Executive members must be literate. 1. President ● Chief Executive of FSG ➢ Represents FSG ➢ Holds and presides meetings ➢ Acts as a signatory to checks and accounting papers, along with the accountant ➢ Acts as a liaison between SDAE and extension officers, etc. 2. Vice-president ● Assistant to the President ➢ Acts as a proxy in the President's absence ➢ Executes missions instructed by the President 3. Accountant ● Manager of the farming revolving fund ➢ Collects farming revolving finance ➢ Prepares cash at time of payment ➢ Keep books ➢ Deposits / withdraws money (deals with the bank) ➢ Acts as a signatory to checks and accounting papers, along with the President ➢ Prepares monthly reports 4. Chief of Production (Additional)
4	Preparation of the member list	● Makes the Member List including information such as (1) Full Name, (2) Residential Address, (3) Irrigation Area and (4) Contact Telephone Number.
5	Sign to the Agreement between SDAE/PROMPAC and FSG	● Exchanges the Agreement between SDAE and FSG ➢ Execution of training programs as well as loans for the farming revolving fund should proceed under this agreement.

(2) Establishment of Farmers Management Group for the Rice Milling Machine

The original plan had FSG in mind to finance the farming revolving fund through the operation and maintenance of the rice milling machine. However, this was not realized. There were several situations that

needed to be addressed. 1) It was becoming more difficult to make a profit under the current condition in operating the rice milling machine in D4 and D7 during the previous Project (reason: a) there was a decrease in rice milling and selling, b) the ratio of labor cost was taking up a large portion of the total operation costs, and c) there was an increase in the rental fee of the milling machine (for the milling of home consumable rice), 2) the book on rice milling was insufficiently, kept 3) it was highly possible to create functional problems to FSG farming assistance by the revolving fund under the FSG management, because the rice milling revenues, that should be fed back to the fund, are used to manage the deficit operation in the milling business, 4) the percentage of debt collection in D5 and D6 reached approximately 90% as of July 2012, and so on. Under these circumstances, the Project made the decision to establish the "Grupo dos agricultores de gestão" (Group of Farmers Management) within WUA, separate from FSG, so that the system of the FSG revolving fund and the project to earn revenues from milling rice would be managed separately. This change in the system, this time was discussed among Project managers and counterparts and approved at JCC meeting.

4.4.2 Training for farming support groups

(1) Training for FSG on FSG and Farming Revolving Fund

FSG manages the establishment of demonstration fields and the farming revolving fund. During its inauguration, the Project explained the purpose of establishing the FSG and the role that the FSG is expected to play. The memorandum was singed and exchanged soon after that and the various assistances to FSG began. FSG assistance activities regarding the setting up of the demonstration fields are training courses covering subjects such as rice cultivation techniques of both direct sowing and of transplanting as well as OJT opportunities on land preparation related matters, such as the procurement of tractors and the provision of seeds, fertilizer and herbicide. As for the management of the farming revolving fund, training courses mainly covered book keeping where OJT primarily covered debt collection and items to keep on the book that are concerned with the fund. Table 4.4.3 lists the training courses offered to FSG (please refer to Appendix 9 (9-1) for the debt collection of the fund).

During the second year, FSG farmers in D5 and D6 experienced the management of the farming revolving fund (debt collection and injection of funds into next years rice cultivation). On the other hand, FSG farmers in D11 and D12 could not collect debt during the third year because of the flood, so these farmers were still inexperienced in doing so. Therefore, in this case, collecting debt funds was done for the first time in the fourth year. FSG activities in D6 came to a standstill as there was no rice cultivation during the fourth year. Nevertheless, all of FSG are planning to cultivate rice for the cropping season starting October 2014, through application of the direct sowing cultivation. The Project can follow up FSG with the debt collection after harvesting of the fourth year, but that is as far as the Project can do. Therefore, it is absolutely necessary for SDAE to keep assisting FSG in continuing debt collection, using the collected funds in order for FSG activities to secure their sustainability.

Table 4.4.3 Record of Training Courses for FSG

Name of the course	Date	No. of Participants	Target Participants	Remarks
Collaboration work case study of rice cultivation of small scale farmers in Ghana	25 Nov. 2011	19	Extension agent, SDAE, EAC	Rice cultivation for small scale farmers
Managing the account book for credit system	4 Jan. 2012	12	Extension agent, MIA, FSG	bookkeeping for FSG
Book keeping on revolving fund management	14 Jun. 2013	22	D5	Lecture on bookkeeping
Book keeping on revolving fund management	18 Jun. 2013	10	D11	Lecture on bookkeeping
Book keeping on revolving fund management	19 Jun. 2013	8	D12	Lecture on bookkeeping
Training for extension agents and leader farmer 1	28 Jan. 2014	24	Extension agents, FSG, Farmers' management group for rice milling machine	Follow-up training
Training on bookkeeping	11 Feb. 2014	11	FSG (D12)	Follow-up training
Training on bookkeeping	12 Feb. 2014	13	FSG (D11)	Follow-up training
Training on bookkeeping	20 Feb. 2014	40	FSG (D5)	Follow-up training
	Total	159		

(2) Installing of rice milling machine and training in its operation and maintenance

After installing a rice milling machine (June 2012) in Masavasse (D11 block) during the second year, another rice milling machine was installed in Muianga (R1-R3 blocks) in the next operational year (November 2012). The milling machine briefing session was held for the Farmers' Management Group for Rice Milling Machine, and the venue to accommodate the machine was facilitated with a bared gate, laying of concrete to furnish the floor etc. The operator of the rice milling machine was thoroughly briefed and had hands-on training sessions about the mechanical structure and the operation procedures of the milling machine. At the same time, on-site training was offered to members of the Farmers' Management Group for Rice Milling Machine in order to provide overall information about the milling machine (regarding to maintenance, including explanations on its mechanical structure, operation procedures, daily check-up points, changing parts, and so on). The details of these trainings are shown on table 4.4.4.

Table 4.4.4 Training Courses for Farmers' Management Group for Rice Milling Machine

Name of the course	Date	No. of Participants	Target Participants	Remarks
Farm mechanization (rice milling machine)	19 Oct. 2011	4	Operator for SDAE, HICEP, EAC and FDA	Operation of rice milling machine Mechanization of milling activity
Operating rice milling machine	27 June 2012 - 29 June 2012	12	Rice milling group for D11	OJT
Bookkeeping on rice milling operation	05 July 2011	19	Rice milling group for D11 and R1-3	Lecture on bookkeeping
Operating rice milling machine	8 Nov. 2012	5	Rice milling group for R1-3	Operation and maintenance
Operating rice milling machine	19 Nov. 2012	16	Rice milling group for R1-3	Operation and maintenance
Bookkeeping on rice milling operation	11 Jan. 2013	6	Rice milling group for R1-3	Lecture on bookkeeping
		62		

Due to the flood that hit the Chokwe Irrigation Scheme in January 2013, the rice milling machine set up in Muianga was soaked in the water for a few days. The milling machine was received emergency maintenance by an engineer, who lived nearby, as soon as the water withdrew. Luckily, the engine started. However, the milling function was quite impossible to use. Solidified mud was found in the internal rotating part as well as discovering that it had become rusty. This situation was taken as an opportunity to learn about maintenance, the main parts were taken out in order to change six screens and wash off the mud from the internal rotating parts. Consequently, the rice milling machine recovered its normal operating standard.

Regarding the two rice milling machines set up in Masavasse and Muianga, both had their blowing fan shafts broken in July 2013, almost simultaneously. It may have been the case that the initial failure of these parts was not detected at first, as these shafts are not parts that usually break, the cause was not detected. The spare parts were procured courtesy of Yanmer Indonesia, the manufacturer, so the repair could take place. During this time, OJT was specifically held for the operators from each group to obtain knowledge and technical skills of repairing and maintaining milling machines.

4.4.3 The support of farming support groups' activities

(1) Assistance to activities of FSG

FSG activities have largely two main tasks: 1) establishment and management of the demonstration fields and 2) management of the farming revolving fund. Those two tasks are related to each other, establishment of demonstration fields are made possible by the fund, and debt, collected after harvest, is fed back into the fund, helping finance the repeat establishment of the demonstration field next year.

Table 4.4.5 shows the establishment and management of the demonstration fields adopted by the Project. The demonstration fields should be set up in accordance with the rice season, and the plowing and clod crushing by tractor depends on the weather condition. It was therefore necessary to book the tractor well in advance and the fields were set up with the coordination of FSG, assigned extension agents and C/P. The provision of seeds, fertilizer and herbicide was dealt with mainly by extension agents. These agents also arranged the date, time and place for the provision. C/P and/or the assigned extension agent(s) explained to

the FSG farmers about how to use the tractor through OJT.

Table 4.4.5 (1) Establishment and Management of Demonstration Fields

Step	Activity	Remarks
1	Selection of demonstration field location	Reasonable Fields ● Fields good for irrigation intake and drainage outlet ➢ Check the condition of the tertiary irrigation and drainage canals ● Accessible Fields ● Fields without salt damage ➢ Check the saline condition of the soil Size of demonstration field per one farm household ● Transplanting farm: smaller than 0.5ha ● Direct Sowing farm : smaller than 2ha ➢ The larger the fields become, the harder the management becomes. Recommended Size for demonstration fields per one FSG ● 1 Ramal (13-16 ha)
2	Tractor procurement for plowing	● PROMPAC has assisted the plowing, harrowing and plotting ➢ Plowing: 1 time ➢ Harrowing: 2 times ➢ Plotting: 1 time ● FSG procures a tractor(s) for plowing, harrowing and plotting. ➢ It is easier for a group to procure a tractor(s) than an individual. ➢ This is a benefit of forming a group. ● It is necessary for FSG to make a clear agreement in advance with the operator, regarding the following points. ➢ Price, payment method ➢ Location of the fields ➢ Duration of working time ● FSG members need to check the degree of surface level of the field, before paying for it. ➢ The fields must be leveled with clod adequately crushed and generally in a good condition.
3	Procurement of seeds	● PROMPAC donated the following. ➢ Transplanting : 1ha: 60kg ➢ Direct Sowing : 1ha: 150kg ● Above is the indicated sufficient seed amount.
4	Procurement of fertilizer	● PROMPAC donated 100kg/ha of fertilizer for target fields. ● PROMPAC recommends applying fertilizer on three separate occasions. ➢ 1st application: 35kg/ha at 4 to 5 leaf stage after applying herbicide. ➢ 2nd application: 35kg/ha at 15 to 20 days after 1st application ➢ 3rd application: 30kg/ha at 30 to 35 days after 2nd application

Table 4.4.5 (2) Establishment and Management of Demonstration Field

Step	Activity	Remarks
5	Procurement of herbicide	● PROMPAC recommends spraying herbicide to those fields sown by direct sowing. ➢ PROMANIL : 1ha: 10L ➢ MCPA: 1ha: 3L ➢ Water: 1ha: 200L ● Herbicide application should be applied at the time of the 4 to 5 leaf stage. Draining water from field is required.

The Project provided a loan for FSG to finance the farming revolving fund, in order to set up the demonstration fields without delay. This farming revolving fund is designed so that FSG themselves collect the debt with interest after the rice harvest season and use the money for the next season, having the financial assistance from the Project only for the first year as a primary injection for such things as plowing, clod crushing, seed, fertilizer and herbicide (only for direct sowing). In order to foster a sense of independence among FSG farmers without depending too much on the Project, the financial assistance from the Project is limited to the above items and no assistance towards any costs related to labor or harvesting was provided.

When the demonstration fields for the rice cultivation techniques of transplanting for the third year were set up in D5 and D6, FSG in those two areas used the fund that was collected in the second year. All of the necessary financial procurement such as getting cash ready or making necessary payments were all done by FSG at that time, and the Project assisted only indirectly in, for example, arranging the use of tractor(s) and so on. Although the rice cultivation activities were not active during the third year because of the flood, this was a good example to see the effects and outcomes of FSG reinforcement efforts. Everything went "back to square one" for the fourth year, and FSG farmers in D5, D11 and D12 began with collecting debt for the fund with the initiative of FSG farmers and extension agents, having the assistance of the counterpart(s) occasionally. The collected debt must be clearly recorded in the book. FSG farmers are usually not accustomed to such a task, so the condition of debt collection and book keeping are checked. The ledger for the FSG farming revolving fund is shown in table 4.4.6.

Table 4.4.6 (1) Management of Farming Revolving Fund

Step	Activity	Remarks
1	Preparation of the farming revolving fund	1. FSG holds a meeting(s) to confirm the following points. ➢ Cash balance and account balance ➢ Members status of repayment (who finished the payment and who has not) ● The accountant should bring the book and explain all accounting related information to the members. 2. FSG should discuss how to deal with members who have not completed the repayment of the farming revolving fund. For example: ➢ FSG would not offer another loan until the repayment is completed. ➢ Other members pay off the amount on behalf of the member in question. ● Necessary expenditures should be agreed. ➢ Plowing ➢ Harrowing ➢ Plotting ➢ Seeds ➢ Fertilizer ➢ Herbicide ● Necessary repayment amounts should be agreed. ➢ Repayments should include the interest specified on the agreement. ● Any discussions and decision making processes should be done in the presence of all the members.
2	Calculation of expenditures	Expenditures per 1ha was ➢ Plowing: 2,300Mt, Harrowing: 2,300Mt, Plotting : 750Mt ➢ Seeds: 150kg/ha×17Mt=2,550Mt ➢ Fertilizer: 2bags/ha×1,550Mt=3,100Mt ➢ Herbicide: 2,320Mt ● Any time the farming revolving fund is used, the accountant should record the amount spent in the book.
3	Calculation of the repayment amount	● Members must pay the repayment amount with the interest at the agreed percentage. The interest should be calculated as follows.
4	Collect the farming revolving fund	● FSG is to hold a meeting after harvest to confirm any matters concerned with repayment of the fund. ➢ Amount of repayment ➢ Term of repayment ● The accountant is the responsible personnel to manage the revolving fund. ➢ The accountant should record the received amount in the book immediately after receiving any money. ● FSG should hold meetings even during the payout period, in order to share among the members the state of fund repayments.

Table 4.4.6 (2) Management of Farming Revolving Fund

Step	Activity	Remarks
5	Opening bank accounts for managing the fund	● Each FSG should make its own bank account to manage the farming revolving fund. ● Bank checks should be made to have a double signatory: the president and the accountant ● President and the accountant must agree on payment ● This is to prevent abuse of funds, which may be possible if only one person is in charge of the fund. ● The collected money should be deposited into bank as soon as possible. ➢ Cash should not be kept in one's hands too long. There is always a possibility of losing or using this money.

Table 4.4.7 shows the status of debt collection of the farming revolving fund as of September 22 (please refer the Appendix 9 for details).

Table 4.4.7 Collection Status of Farming Revolving Fund

FSG	D5-1 (10)	D5-2 (16)	D5-3 (24)	D6 (16)	D11 (24)	D12 (17)	Average
Repayment Rate (%)	93.4	59.4	54.2	24.8	38.4	31.8	40.3

Note: ( ) indicates the number of members

(2) FSG related issues to be solved

The following should be addressed in order to sustain FSG activities in the future.

1) Constant establishment of demonstration fields and appropriate management of the farming revolving fund

The establishment of demonstration fields and the farming revolving fund are absolutely necessary, and the fund should continue revolving by getting the rice that the demonstration fields produce as a financial resource, which, in turn is saved for the next cropping season as the revolving fund. The most important matter here is to obtain enough yield; in order words, the yield has to be substantial enough to maintain the operation cost for making rice cultivation possible. FSG farmers usually each spend, for direct sowing rice cultivation, approximately 25,000Mt/ha as their operation costs, (13,320Mt/ha of which is contributed from the fund). If this amount is converted into the paddy value, it is more or less 2,900kg/ha. Therefore, if more than 3,000kg/ha of yield is achieved, the debt for the fund as well as the operation costs for the next season can be covered. As it has already been mentioned, some work related to rice cultivation should be given careful attention. These are the selection of manageable fields for controlling water level frequently, appropriate land preparation, water management until the seedlings reach to their plant-establishment stage, draining water from the field at the time of herbicide spraying, and so on. Indeed, the support from SDAE particularly in these above mentioned works should be continued. The yield from the fields without irrigation and drainage problems exceeds 3,000kg/ha (table 4.3.12), so it is achievable.

The debt collection of the second operation al year was dealt with by FSG farmers in D5 and D6. FSG farmers in D5, D11 and D12 dealt with the debt collection next year. The Project held periodical meetings

with FSG farmers prior to harvesting. The confirmation of book keeping was given special attention in every meeting and the information was shared particularly among FSG farmers. Although it is not very difficult to share the information among FSG members, since the number is not large, still there is a possibility of creating a sense of distrust without occasions for them to be together and share the same information. It is quite important to hold periodical meetings and to continue having extension agents as well as SDAE staff to attend those meetings.

It should be noted that many FSG farmers are cultivating vegetables and/or maize in addition to their rice, in regard to the debt collection and the reuse of the farming revolving fund. It is reasonable for personnel who have been involved with the rice focused project to be concerned, principally, with the collection of the fund after the rice harvest so it can be used for the next rice cultivation season. However, from farmers' point of view, it is also reasonable to think of the possibility of utilizing this fund for additional farming, such as vegetables and/or maize, which take place after the rice. In fact, there are some FSG farmers in D11 who have proposed to repay part of their debt after selling tomatoes, that they have grown after the rice. This type of issue should have been discussed in advance and a consensus made then between FSG, extension agents and counterparts. Although FSG farmers work collectively for some tasks related to rice cultivation, such as the tractor procurement, seeding and irrigation of their fields, etc., they no longer work together to deal with other crops vegetables and/or maize. The work efficiency would be higher if they all work together as a FSG and FSG activities would also be reinforced. Working together for other crops also means that they can coordinate cropping seasons and the forthcoming rice cultivation would start smoothly. Therefore, one of the issues to be considered in the future includes keeping in mind the annual cultivation plan of FSG farmers and if possible, to consider the whole concept of assistance that integrates other crop cultivation.

2) Ongoing technical assistance by SDAE

FSG farmers lack enough overall experience to continue their activities independently. It is necessary for SDAE to continue with their assistance for at least a few more years, in order for the entire FSG activities to become sustainable, activities such as spending the farming revolving fund, establishing demonstration fields, collecting the fund debt, and so on. Particularly, FSG farmers in D11 and D12 have only one season's worth of experience in regard to the fund. Therefore, as it has been already mentioned in 1), the assistance for FSG should be continued for: technical assistance for issues such as selecting locations for and establishing of demonstration fields and dealing with field water management appropriately as well as information sharing among FSG farmers concerned with the post-harvest activities like debt collection, book keeping, etc. As the body to promote agricultural extension, SDAE should go round the Project target blocks during the time of holding periodical meetings with FSG so that the information would be shared among members without fail. The problem is that the extension function of SDAE is rather week, and that was the reason why the Project adopted the Farmer to Farmer extension method. This situation may see some improvements if SDAE and/or DNEA are required, periodically, to report the FSG activities to JICA.

(3) Assistance to activities of Farmers' Management Group for Rice Milling Machine

The milling business became fully operational during the post-harvest time of the fourth year, regardless

the shortage of paddy and the breakdown of the rice milling machine caused by the flood. The weather was agreeable during the crop season of the fourth year and a number of farmers came to use the milling service. A visible improvement in the technical aspects of the milling service has become apparent, since the book keeping of Farmers' Management Group for Rice Milling Machine is occasionally checked as well as OJT is periodically organized. Yet, particular and close attention should be paid to spending and labor cost matters.

FSG and Farmers' Management Group for Rice Milling Machine are two separate organizations, so the latter group is not involved with the management of the fund. Under the current system, the main activities of the latter group in Masavasse and Muianga is to the mill the paddy brought in by farmers, who would pay for the milling service. What should be noted here is that the Farmers' Management Group for Rice Milling Machine is an organization set up under the care of the Water Users Association, as an affiliation group. Yet the relationship between the two organizations is very week as the affiliation group to have worked quite independently from the association. This means that the members in the farmers management group has little understanding of their own situation. Therefore, it seems necessary to foster an awareness and understanding of the systematic merits of having the group as an affiliation of the association as well as an awareness of the fact that the affiliation group belongs to the overall association. At the same time, the cash flow of the group, with labor cost in particular, must be made transparent. Although the outgoings are made based on an internal agreement, the purpose of such spending is completely unclear to other farmers outside of the group. Having this in mind, the internal regulations of each Farmers' Management Group for Rice Milling Machine were amended and the signatures were exchanged between WUA. The activity report of the group was presented to WUA on the same occasion (please refer to Appendix 9 for the internal regulations).

The procurement of spare parts in the Project site requires a critical mindset due to the fact that a large number of manufacturers of fake parts are substituting for genuine parts so even if they look the same, raw materials are different and therefore not strong enough. Although counterparts and group members seldom pay attention to this fact, luckily, there was no maintenance related problems for the rice milling machine. The principle of the spark test for steel materials using electric grinders is the most effective to detect fakes, since the color, shape and volume of sparks differ from one metal element to another. These different sparks were confirmed with counterparts through an experiment. Since the visible difference in this simple test is quite obvious, the counterparts seemed to be deeply impressed and expressed their interests in applying this method in the future.

The unfortunate incidents of screw shearing seems to occur quite frequently. Some of the screw shearing incidents may be critical such as when this happens to screws in the crankcase of engines, and loose screws may cause oil leaks and bigger accidents. Therefore, it is very important to understand the way to properly tighten screws. Since the torque wrench is not available, coaching sessions with the explanation of the principles should be offered until it becomes automatic.

There was an incident that happened at the Muianga rice milling service station where the rice milling machine did not start after it had been used until the engine stopped with its fuel tank completely empty, even though the tank was filled with diesel after the incident. The Project received the news and tried air-bleeding with the counterpart in charge of agricultural machinery. OJT style of technical transfer of

air-bleeding from the engine was conducted by counterparts in charge of agricultural machinery and the operators of milling machine at the Muianga rice milling service station.

(4) Trial of selling milled rice

1) Background and purposes

The Chokwe Irrigation Scheme is a high potential area for rice cultivation with 260,000ha of irrigation available land. Rice is cultivated in the area during the rainy season, and it is presumed that the area produces approximately 7% of all rice consumed in Mozambique. The Scheme has the good fortune of having convenient access to Maputo, the capital city. It is located just 220km north from Maputo, with a motor way in good condition, connecting the two. It is about four hours drive from Maputo. A rail line is also available. With this favorable condition of access to the large market for agricultural products, there is great potential for producing value added agricultural products in the area.

Regardless of the favorable location, the rice production in the Chokwe Irrigation Scheme has stagnated. The average total milled rice production in Gaza province for the five years from 2009 to 2013 was between 9,853t and 28,199t. The production amount was even less when there was serious damage caused by the flood. Yet the average annual consumption of rice in Gaza is assumed to be 73,000t. The huge gap between rice supply and demand is filled by imported rice (Figure 4.4.1).

One of the big reasons for the stagnation in rice production is that there may be low motivation in the rice farmers in Gaza. According to the baseline survey in 2011, 72% of rice farmers in the Project area were small-scale farmers with equal to or smaller than 1ha of paddy field each, and 38% were producing rice for home consumption. Many farmers were also found to be unsatisfied with the selling price of paddy. Based on those findings, the motivation of these farmers toward rice cultivation is assumed to be low.

It seems necessary to life up the farmers motivation, in order to see the expansion of rice production in the future. As the already mentioned baseline survey suggested the reduction of costs and an increase in the production through some activities, as well as through the importance of reinforcing marketing efforts and promoting the positive image of the profitability of rice cultivation.

The purpose of the Project activities is to understand the domestically grown as well as imported rice distribution routes with particular focus on the Chokwe Irrigation Scheme, identify relative challenges in promoting domestically grown rice by trial sales, and contribute to the improvement of farmers' earnings that means to achieve the overall purpose of the Project (Distribution and its challenges of domestically grown and imported rice are shown on Appendix 9).

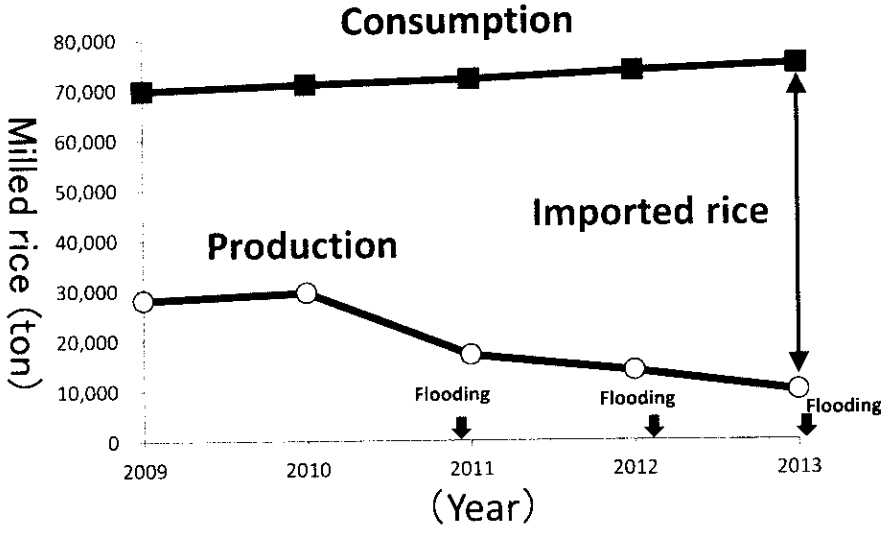


Figure 4.4.1 Consumption of milled rice in Gaza Province (source: DPA-Gaza)

2) Rice sales by FSG and Farmers' Management Group for Rice Milling Machine

From the study of consumer taste and purchasing tendency, it was apparent that the demand for domestically produced rice was high yet the supply was so low. The high demand and the comparative scarcity indicates that there is the possibility of selling domestically produced rice at a high higher price. If the sales of domestically produced rice at a higher price is verified possible, the farming profit and rice farmers motivation would both be improved.

The rice was processed and sold in Masavasse by FSG and the farmers management group for rice milling machine, in order to validate that theory. Through this validation process, some challenging issues concerned with quality improvement and distribution of domestically produced rice were highlighted by the farmers involved.

As a result, it was found possible to make constant sales of c produced rice at high price. However, the quality limitation and high cost are also clarified. In order to overcome these challenges, some countermeasures may be necessary, such as improving the quality of rice through introduction of a winnower and/or reducing operation costs by sharing the roles of labor from processing to selling rice.

The milling and packaging of milled rice was dealt with by FSG and the Farmers Management Group for Rice Milling Machine, using the currently available techniques. This was a trial/ trial was done by FSG in D11 and the Farmers Management Group for Rice Milling Machine in Masavasse. The work process is as follows.

(1) Winnowing and Drying (front garden of each farmer's home)

⇓

(2) Transporting to the rice milling service station (wheel-barrowing from each home)

⇓

(3) Test of paddy water content
(measured by moisture meter, if under 14%, dry until it rises until 14% margin)

⇓

(4) Milling rice (one-pass style rice milling machine)

⇓

(5) Removing impurities (hand work)

⇓

(6) Removing broken rice (hand work with sieve)

⇓

(7) Packaging

The rate of broken rice, in the rice that was milled by FSG, was approximately 30%. The 30% rate of broken rice indicates that the quality of this rice is even lower than the lowest ranked imported rice (the rate of broken rice: 25%). In order to realize equal to or less than 30% manually, it requires great care and is simply not economical. So, it seems impossible to improve the rice quality using the current technical ability. It is necessary to introduce some type of rice sorting machine for the removal of broken rice, in order to become competitive with imported rice.

The sales price of rice produced by the Project was set at 30Mt/kg, with consideration given to the prices of imported rice, domestically produced rice sole by a large scale rice mills and consumers' demands. This price is 1.4 times higher than the price of average quality imported rice, 20Mt/kg (Table 4.4.8).

An interview was carried out before selling the rice, with thirty-one SDAE participating in the tasting and answering to the questions, in order to judge the legitimacy of the price. Regarding the price, 32% answered that it was high, 35% appropriate and 33% cheap. The sum of people who answered that the price was either appropriate or cheap was more than two thirds, so it was decided that the 30Mt/kg price was acceptable.

Table 4.4.8 Price of Imported Rice Sold in Chokwe

Brand	Country of Origin	Price Mt/kg
Mariana	Thailand	21
Familia	Pakistan	19
Coral	Pakistan	21
Xirico	Thailand	21
Dona Ana	Thailand	34

The rice was sold directly by FSG in the towns of Chokwe. They obtained official sales permission and set up a small stand to sell their rice over four days. A total of seventy-six bags (5kg/bag) were successfully sold. They sold thirty-six bags on the first day, and the number of bags seemed to be around ten bags a day. This made the Project understand that ten bags a day is a reasonable sales expectation (Figure 4.4.2).

These trial sales on consignment were also attempted at three grocery shops. Two of these three grocery

shops sold ten bags each on over three days, and these retailers also showed their interests in having a business partnership with farmers in the future.

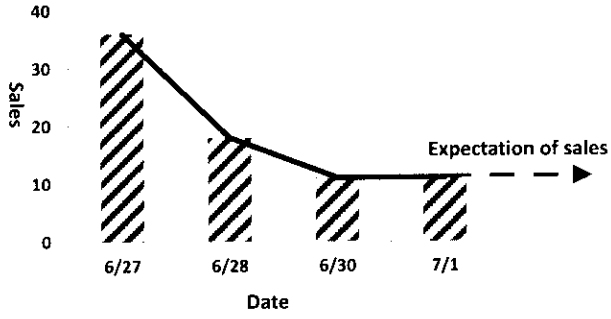


Figure 4.4.2 Sales Transition

3) Farmers' profit by processing and selling rice

The Project studied the degree of contribution towards farmers' profit by FSG processing and selling rice through focusing on three study cases: when labor is shared among farmers, when labor isn't shared and when paddy is sold directly to large scale mills (table 4.4.9). When all the costs, including processing fees, were added up, the profit that farmers get when labor is not shared was 0.19Mt per 1kg of paddy less than that of when paddy was directly sold to large scale mills. This is due to the various labor costs of rice sorting, cleaning and selling, which adds up to be about 2.75Mt. However, if the labor is shared among involved farmers, the cash gain rose by 2.56Mt per 1kg of paddy in comparison with the case when paddy is directly sold to large scale mills.

Based on the above results, it clearly became necessary to reduce the processing costs such as removing broken rice in order to increase the profit for farmers. If rice milling can be done at a middle-scale mill with a sorting machine, it becomes possible to produce as good a quality of finished rice as the imported rice and to cut the cost at the same time.

Table 4.4.9 Milling Cost and Profit of 1kg of Paddy

	Labor Share (Mt)	Labor Not Shared (Mt)	Direct Paddy Sales [1] (Mt)
Revenue[2]	15	15	8.74
Milling cost	3	3	0
Fees for cleaning and sorting	1.25	0	0
Packaging cost	0.7	0.7	0
Transportation cost	0.5	0.5	0.5
Sales cost	1.5	0	0
Revenue	8.05	10.8	8.24

Note (1) Calculation of paddy sales with 13% moisture content sold to Inanacio de Sousa

(2) The volume of milled rice for sales is approximately 50% of paddy before milling. So it is possible to produce 0.5kg of milled rice out of 1kg of paddy.

(5) Challenges of the Farmers' Management Group of Rice Milling Machine

The internal regulations of the Farmers' Management Group of Rice Milling Machine was to reviewed during the fourth operational year, and the book keeping was also improved. The basis for their group activities, as the Farmers' Management Group of Rice Milling Machine, seems to be established and to continue. Nevertheless, in order to comply and continue with the activities under the internal regulations, the periodical assistance by SDAE is indispensable. Some matters require special attention, such as reporting to the Water Users Association, securing the budget for maintenance, any unclear cash flow issues such as labor costs. Generally speaking, the WUA in Chokwe is a quiet organization. The occasions for reporting may be realized more effectively when done in cooperation with organizations in Masavasse and Muianga. The cost of maintenance and management is usually invisible and under-estimated. The government of Mozambique does not have a standard for calculating the cost of maintenance and management; therefore, the Project referred to the Japanese standard and set the annual repair cost at 4% of the sales price (23,497.44Mt/year = 1,958Mt/month) and a statement was clearly added, stating 2,000Mt/month should be saved. The farmers are most interested/ interested the most in information regarding labor costs; therefore, it is necessary to record expenditures complying with the internal regulations, without exception. Also it is important to foster farmers' understanding towards the group and its activities. The Project believes that the periodical activity report to WUA may contribute to the realization of this.

As a selling condition of the milled rice, the taste and degree of freshness is apparently better for the domestically produced rice than the imported rice. However, the domestically produced rice should improve its quality while reducing its milling cost. The distribution of domestically produced rice should be improved by involving other possible people than FSG and the Farmers' Management Group for Rice Milling Machine such as retailers and the middle-scale mill operators who can mechanically remove broken rice as well as other impurities . Although the demand for domestically produced rice has been confirmed, it is necessary to have more studies such as how much of a volume is actually demanded in the city of Chokwe. The strategies to meet with the demand (quality, amount, distribution and cost, etc.) should be identified in order to improve the supply side, which would gradually provide farmers with more profit from rice. FSG farmers in D11 put forward their wish to continue the rice milling business next year, and they are already expecting to cooperate with the personnel working at middle-scale mills and retailers in Chokwe when that happens. SDAE, as an agricultural extension body, should assist these kinds of FSG intentions and play a coordinating role to help build a bridge between the production side and the market.

4.5 The promotion of the implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies through joint monitoring among the stakeholders (Output 5)

4.5.1 Periodic meetings for mutually reviewing activities of SDAE, EAC, HICEP and related organizations

The Project adopted four tools to confirm the progress status of the Project activities and the achievement status of the projects of each operational year: Activity Log Sheet, Activity Result Report, Monitoring of

Activity and Results and Activity Implementation Program. These tools are designed not only to mutually review but also to share the information regarding the progress of their activities among implementing agencies. The reviewed progress and each operational year's achievements are reported and discussed at Steering Committee (SC) meetings as well as Joint Coordination Committee (JCC) meetings. The progress and achievement status of the final operational year of the Project is shown on table 4.5.1, where the overall progress of activities of the Project and the results of monitoring the degree of achievement are also reported on the Appendix 10 (10-1) in detail.

The result for the self-evaluated achievement status regarding twenty issues for the last Project operational year was 92.4%. For the output 1 on the extension of the improved rice cultivation techniques of transplanting, an interview on paddy cultivation operation costs and the field test for calculating utilization fees of agricultural machinery were carried out for two years from 2013. But the Project realizes that there should be at least three years to obtain accurate results on the already mentioned issues, so it was evaluated at 67% having been achieved. At the same time, a low percentage was given to the achievement evaluation on verification and demonstration fields for the improved rice cultivation techniques for transplanting. The reasons were because of the flood of 2013 which caused FSG farmers to convert the of use of their fields to direct sowing, instead of transplanting, and the cancellation of rice cultivation all together for FSG farmers in D6.

Regarding the output 2, the development and verification of the rice cultivation techniques of direct sowing, the productivity of row seeding and random broadcasting was ascertained, and the workload and work efficiency of the manual row seeder was also verified. A total of eight manual row seeders were manufactured, four of which were led by the counterpart. This contributed to the high achievement percentage. The output 3, the improved rice cultivation techniques of direct sowing to be extended, also had a good result. The total number of demonstration fields reached ninety-one (82ha) by converting the FSG fields in D5 into direct sowing cultivation in addition to the fields in D11 and D12, and so the establishment of demonstration fields was achieved as planned, resulting in a high achievement percentage.

As for the assistance towards the farmers organization, the output 4, the number of FSG was originally twenty in 2012, which increased to sixty-four in 2013 and to one-hundred and seven in 2014, approximately five times more. The farming revolving fund is under good management with debt collected at a favorable pace. The reasons include the fact that the harvest of the year 2014 was prolific, in addition to the measures of the five-year-repayment taken, even though the debt collection stagnated temporarily in 2013 because of the flood. Moreover, a number of challenges for the business prospect in milling and selling milled rice were found through trial sales of the new business in 2014. Based on these, the output has seen a great deal of achievement.

Table 4.5.1 (1) List of Progress and Achievements of the Project Activities

Accomplishment of project activity

August 2013

Activities	Indicator	Results	Accomplishment (%)
1. Dissemination of improved rice cultivation techniques of transplanting to the target farmers			
1-1. Examination and development of effective extension method	1-1 Three (3) important techniques of 8 technical components of transplanting rice cultivation are adopted by 15% of farmers in the target area for transplanting.	・Field survey of productioncost and machinery operation cost ・Field test of field working performance of machinery ・Demonstration of improved transplanting rice cultivation (FAC variety trial)	78
1-2. Training of extension leaders on improved rice cultivation techniques of transplanting		・Verification (variety introduction) D5 : (1.13 ah) line sowing/broadcasting ・Demonstration field (ITA312) D5 : 50 field (25 ha) Direct sowing	65
1-3. Establishment of demonstration farm for transplanting with initiative of extension leaders			
(1) Training of extension leaders on improved rice cultivation techniques of transplanting.	1-2 More than 50% of the farmers in the target areas where transplanting method is widely practiced are trained on appropriated techniques for irrigation facility maintenance and water use.	・Verification (variety introduction) D5 : 4 location (8plots) 4 variety (1.13 ah) line sowing/broadcasting ・Demonstration field (ITA312) D5 : 50 field (25 ha) Direct sowing ・Training FSG Field day: 1course, 39 participants Verification results: 1 course, 65 participants	77
(2) Variety trial for transplanting rice cultivation		・Variety Trial * FAC, 1 plot 6 varieties, RCBD, 3 Rep, 450m2	100
1-4. Training of farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders			
(1) Training of farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders.	ditto	・Demonstration field (ITA312) D5 : 50 field (25 ha) Direct sowing ・Training FSG Field day: 1course, 39 participants Verification results: 1 course, 65 participants	88
(2) Demonstration of variety for transplanting rice cultivation		・Verification (variety introduction) D5 : 4 location (8plots) 4 variety (1.13 ah) line sowing/broadcasting	54
1-5. Training of farmers on irrigation facility maintenance and water management.		・OJT of simple leveling method for canal maintenance and field leveling: 766 participants (D5D6D11D12R1R3) ・Training simple leveling method: 15 Cantoneiro (HICEP)	100
			80.3
2. Development and verification of Improved rice cultivation techniques of direct sowing			
2-1 Establishment of direct sowing rice cultivation techniques	2-1 The yield in trial verification plots is increased by 60% compared to the farmers' plots at the beginning of the Project.	・Manual seed production: 8 units ・Field test of seeder, field work performance ・OJT manual seeder production 4 courses (38 days), 19 participants	90

Table 4.5.1 (2) List of Progress and Achievements of the Project Activities

Activities	Indicator	Results	Accomplishment (%)
2-2. Development and verification of rice cultivation techniques of direct sowing.			
(1) Analysis of limiting factors of technical components of traditional direct sowing rice cultivation	2-2. 6 kinds of techniques are developed 2-3. Direct sowing manuals are prepared.	Limiting factors identified	100
(2) Verification of the efficiency of mechanized rice cultivation		・Field test of machinery (chisel plow, rotary) field working performance, fuel consumption, operation cost ・Yield and yield component analysis of verification plot ・Field test of power tiller (field working performance, fuel consumption, operation cost)	80
(3) Elaboration direct sowing rice cultivation manual		Direct sowing cultivation manual was prepared.	100
			92.5
3. Dissemination of improved rice cultivation techniques of direct sowing to the target farmers.			
3-1. Training of extension leaders on rice cultivation techniques of direct sowing.	3-1 More than 25% of the farmers in the target areas are trained on six (6) technical components of direct sowing rice cultivation.	・Verification (promising variety and line sowing) D11 : 4 varieties and ITA312, line sowing/broadcasting, 3 locations 18 plots (1.44 ha) D12 : 4 varieties and ITA312, line sowing/broadcasting, 3 locations 18 plots (1.44 ha) ・Demonstration field (ITA312) D11 : 24 demonstration plots (32 ha) D12 : 17 demonstration plot (25 ha)	99
3-2. Establishment of demonstration farm for direct sowing with initiative of extension leaders		・Demonstration field (ITA312) D11 : 24 demonstration plots (32 ha) D12 : 17 demonstration plot (25 ha) ・Training FSG Field day : 3 courses, 185 participants	99
3-3. Training of farmers on improved rice cultivation techniques of direct sowing.		・Demonstration field (ITA312) D11 : 24 demonstration plots (32 ha) D12 : 17 demonstration plot (25 ha) ・Training FSG Field day : 3 courses, 185 participants	99
			99.0
4. Strengthening of activities of farmers groups in the areas of the demonstration farms			
4-1. Organization of farming support group in each target area	4-1 The number of farmer's group members increases by 60%. 4-2 Account records on the operations of the rice milling machines are properly maintained and annually reported to the WUA members.	Total FSG member increased D5: 25 to 50 D11:12 to 24 D12: 10 to 17	100
4-2. Training of farming support group		(1) FSG members have understood roles and duties of FSG through OJT. (2) Conducted training on revolving funds management and bookkeeping. (3) All FSGs member cannot refund the revolving fund because their field and house were damage by flood. All of them have agreed to refund all within 5 years.	100

Table 4.5.1 (3) List of Progress and Achievements of the Project Activities

Activities	Indicator	Results	Accomplishment (%)
4-3. Support of the activities of Farming Support Group (FSG)			
(1) Support of the activities of Farming Support Group (FSG) of revolving fund management	4-3 Records of the revolving fund program are properly maintained and annually reported to the FSG members.	Revolving fund management (1) Recovering fund initiated (3rd year and 4th year) (2) Training of book keeping and annual reporting to the member	100
(2) Support of the activities of Farming Support Group (FSG) of rice milling machine operation		Support for rice milling group (1) Repairing rice milling (2) Training of book keeping (3) Elaboration of internal regulation of the group (3) Annual reporting to WUA	100
(3) Support of the activities of Farming Support Group (FSG) of rice milling machine operation		Market exploration of polished rice (1) Study on commercialization (2) Study on milling performance (cost, profitability, polishing quality) (3) Extraction of critical issue of commercialization (4) Extraction of critical issue of rice selling	100
			100
5. Promotion of implementation process of the Action Plan			
5-1. Project management through the periodic meetings to mutually review activities of SDAE, EAC, HICEP and related organizations	5-1. The progress review meetings are held at least twice a year. 5-2 Joint monitoring sheets on the progress are prepared.	5 Steering Committee and 2 JCC were organized in 3rd year.	94
5-2. Monitoring of the progress of activities conducted by SDAE, EAC, HICEP based on the Action Plan		As shown in the monitoring result of the Action Plan	86
			90.0
			92.4

4.5.2 The monitoring the progress of activities conducted by SDAE, EAC and HICEP based on their plans and programs.

Monitoring on the Action Plan progress was implemented parallel to the monitoring on Project activities. The main content of the Action Plan was the development plan of the Chokwe Irrigation Scheme after the completion of the first phase of the Project (year 2011) to year 2020, and the number targets for the three years of the first phase from 2011 to 2013 was 12, the target indicators were 7,000ha field for rice cultivation, 5,000ha for upland crops, 4.0t/ha of paddy yield as well as 28,000t of paddy production. Twelve challenges were identified under four outputs stated in the Action Plan, and the implementing agencies, SDAE, HICEP and EAC, carried out monitoring on the progress and the target attainment level in coordination with each other. The result is outlined in table 4.5.2.

Table 4.5.2 List of Progress and Achievements of Action Plan

Monitoring of action plan (July 2013 - Aug 2014)

Action plan August 2014

Activity	Target of the year (2013-2014)	Indicator (action plan)	Result obtained/accomplishment (%)
Techniques for small scale farmers in the target area are improved. (output-1)	Output 1a : Improvement of transplanting rice cultivation techniques of small scale farmers Output 1b : Improvement direct sowing rice cultivation techniques of small scale farmers Output 1c : Development and improvement of land preparation techniques Output 1d : Development of annual cropping pattern 2 cultivation seasons Output 2a : Demonstration plot on new agricultural technology (transplanting rice in D4D7, direct sowing in mid steam, upland crop in low stream) Output 2b: Capacity building of investigation, extension and irrigation	* Average yield of rice: 4 ton/ha * Rice cultivation: 7,000 ha (small scale farme:3,000ha) * Irrigated upland crop: 5,000ha * Paddy production: 28,000 ton	* Rice and upland crop cultivation: 103.2% * Rice cultivation of small scale farmers: n.a. * Average yield of rice: 56.8% * Upland crop cultivation area: 98.5% * Total rice production: n.a.
			86.2
Management of irrigation facilities and water use in the target area is improved. (output 2)	Output 3: 600 house holders of farmers in unused area Output 4: Improvement of irrigation efficiency	same as above	(1) 600 house holders of farmers: n.a.% (2) Rehabilitation of irrigation facility: 62.9%
			62.9
Farming support activities provided by extension officers for small scale farmers in the target area are strengthen (output 3)	Output 5: Farming support service reinforcement	same as above	(3) Rice milling support: 100% (4) Revolving fund management:100%
			100.0
Collaboration among SDEA, EAC and HICEP is strengthen (output 4)	Output 6a: Function of Steering committee Output 6b: Capacity building of extension staff of SDEA Output 7: Arrangement of facility and machinery	same as above	(1) Function of steering committee: 80% (2) Capacity building training: 80.0% (3) Arrangement of facility and machinery: n.a.%
			94.0
			85.8

The average percentage of the target attainment level of Action Plan during the fourth operational year was 85.8%. A low percentage was found for the output 1, the rice production volume, since the flood of 2013 affected approximately 2,000ha of field. The output 3, the maintenance and management of the irrigation facilities, was also low at 63%, due to the delay in repairing the affected drainage, farmers roads and dealing with irrigation leakage. In regard to the output 5, "the coordination of implementing agencies, SDEA, EAC and HICEP, would be strengthened," the technical skills improvement of personnel of related agencies could not be determined by the information sharing through SC and the training courses implemented by the Project. In addition the Project could not obtain data regarding the updating of facility equipment in coordination with the three implementing agencies, its progress could not be determined either. Please refer to the Appendix 10 (10-1) for the progress of the Action Plan and the monitoring results of the target attainment level.

5 Challenges, Contrivance, and Lessons on Operating the Project

5.1 Reinforcement of coordination among C/P organizations

5.1.1 Sharing a state of progress and a degree of achievement

The Project implementing agencies are three organizations, SDAE, HICEP and EAC, where DPA Gaza is the coordination agency and DNEA as the responsible agency. These three implementation agencies are implementing actual works on site in the Chokwe Irrigation Scheme. The Project has established a system for sharing important information among the involved organizations. The information on work progress and the attainment level of targets is shared among the three implementing agencies during six Steering Committee (SC) meetings held every year. DPA Gaza, the coordination agency, and DNEA, the responsible agency, also share information during Joint Coordination Committee (JCC) meetings, that are held twice annually. During JCC meetings, the work plan and the work progress report of the relevant operational year are reported while the outcomes are checked.

In regard to managing the field work progress, various issues need to be addressed separately and categorized into the challenges to be solved during the Project term, the countermeasures to each challenge and the progress and achievements of each challenge made during each relevant operational year. Of course, some challenges may be solved within one year but others may require the entire duration of the cooperation term. The Project divided the issues into five categories, which are stated in PDM, to be addressed and dealt with closely. In order to manage the progress smoothly for each operation year, the Project also created a set of worksheets so that sets of important information can be effectively and clearly reported, discussed and approved during the JCC at the end of each operational year. These worksheets are: 1) the "Project implementation plan" to state a detailed work plan throughout the Project term, 2) the "Activity Log Sheet" to plan activities as a whole, stating objectives, implementation methods, implementation period, implementation responsible personnel, expected outcomes and the budget for each activity and 3) the "Activity Result Report" for clearly reporting and stating the status of progress, achievements, challenges and issues to be solved, objective attainment levels (self-evaluation) and activities to be done during the next operational year. The reported Project progress and target attainment levels are summarized into the "Monitoring of activity and results" report so that all three implementing agents gain and hold the same information during the JCC meetings at the end of each operational year, and they are encourage to coordinate with one another at the same time. As the Project came to complete its cooperation term, the Project considered the achievements gained during four years of Project implementation and drew up the "Post-Project Work Plan" as a collective suggestion for the activities that the Project believes should continue for fulfilling the Projects objectives even more. This plan was shared by related organizations and earned unanimous approval at the JCC-9.

5.1.2 Reinforcement of the core agencies' function

The roles of the Project implementation agencies are given specifically to each agency: the development of rice cultivation techniques to EAC, the maintenance and management of the irrigation facilities to HICEP and the technical extension to SDAE. Although most of the rice farmers in the Chokwe Irrigation Scheme under the current situation are cultivating a variety called ITA312, the seed has been mixed with

other grains and its quality has been deteriorating. The renewal of the paddy seed or reassurance of its quality is necessary. The local research stations are meant to develop techniques based on the farmers actual needs and solve any problems related to rice cultivation; however, the feedback mechanism for those local stations to report their current situations to EAC has not been well established, mainly due to its organizational fragility. The Project has attempted to verify five rice varieties at the FSG fields since 2012: Macassane and Vembe that EAC recommends as well as? IRGA409, Farox and Alvorada that are recommended by MIA. Through this verification process, farmers have become highly interested in Macassane so that this variety may be in high demand in near future. MIA withdrew from Chokwe after the flood of 2013, so the production of seed has been limited only to native varieties. This current situation may increase the need for EAC seeds.

The maintenance and management of the main water canals in the Scheme are divided between HICEP and farmers: HICEP manages the secondary drainage canals and farmers manage the tertiary drainage canals. Yet the maintenance and management have not been dealt with well, with a shortage of water frequently being seen in many fields, causing salt concentrations and difficulties in controlling the water level when direct sowing fields need enough water to leave the seedlings soaked but protruding out of the water, etc. A number of OJT to show how to lay drainage pipes to get water across the farming road and to learn how to measure the water level simply as well as how to maintain and manage the drainage canals were held for farmers. The simple water level management technique is also taught to HICEP cantoneiro as well as techniques to check the gradient of drainage canals and how to improve them.

In regard to SDAE, the Project had supervised extension agents in the improved rice cultivation techniques through OJT on demonstration fields, Field days in the verification block, and other opportunities to see the achievements of the demonstration fields and exchange technical information among FSG farmers, etc. The SDAE extension agents do not have specific expertise, so their time is largely taken up with doing end tasks of agriculture related administration instead of offering technical guidance to farmers. Nevertheless, their presence is absolutely necessary to extend the improved rice cultivation techniques in the Chokwe Irrigation Scheme and SDAE has been expected to promote their roles to deal with the needs on site smoothly and efficiently.

The achievement of the overall goals of the Project after the cooperation term ends requires the physical expansion of the paddy fields within the scheme, and in order to realize that, FSG need to continue rice cultivation and extend technical knowledge to other farmers. The Project has coached FSG farmers in the improved rice cultivation techniques through the assistance for the farming revolving fund and OJT at demonstration fields. The number of FSG farmers was originally twenty in 2012 at the start, which steadily increased to one-hundred and seven in 2014. The number of FSG increased also from two to six. Evidently, farmers have been highly interested in the improved rice cultivation techniques that are promoted by the Project. From now on, six FSGs and one-hundred and seven farmers should take a strong initiative to promote the extension to non-member farmers. The key is the coordination with implementing agencies. There are some detailed suggestions: the seed production by EAC, the assistance to set up demonstration fields for SDAE to develop the improved rice cultivation techniques of direct sowing, the improvement of the manual row seeder (pulled by animals), the coaching for farmers on maintenance and management of the tertiary irrigation canal by HICEP, and so on. Other suggestions are for SDAE to take the initiative to

consider the current challenges and needs that farmers face and have feed back to EAC as well as HICEP and to coach EAC as well as HICEP to take measures to show some resolution to these issues.

5.2 Communication within the Project team

The Project requires smooth and transparent communication among Project experts, between Project experts and the counterparts of Mozambique and among the counterpart organizations. Therefore, the Project experts held weekly meetings to acknowledge everyone and present them with the activity plan, the progress status, the implementing of problems as well as any announcements. Any discussions and meetings carried out between the Project team members and other involved organization as well as visitors, that should concern the Project operation, were recorded in the "ledger for meetings (in Japanese)" so that the information was to be shared thoroughly among these experts. In regard to communication between the Project team and the Mozambique side, the Steering Committee meetings played an important role. Being held a few times every operational year, the meetings presented reports on the progress of the Project activities, the status of achievements monitored and the information obtained by each of the implementing agencies shared among all three of them, SDAE, EAC and HICEP.

5.3 Other efforts that are not specified on PDM

Under circumstances where things and conditions constantly change, it is necessary to have a degree of flexibility for achieving the overall goals and objectives of the Project, by considering and dealing with other matters even if they are not written in the PDM. The Project proactively dealt with some issues that were not specified in PDM, such as the consideration given to profitability, the improvement of agricultural machinery and equipment, the survey on marketing, the rice milling trial business, etc.

6. Attainment level of Project purpose

6.1 Attainment level of Project purpose

Purpose of the Project	Indicator
Rice productivity in the target area of the Chokwe Irrigation Scheme is increased.	The average rice yield in the target area is increased by 1.1 t/ha.

The Project has aimed to improve the rice productivity and expand the paddy field area in the Project target area through the Farmer to Farmer extension system. First, the Farmers Support Group (FSG) was organized, consisting of farmers with rice cultivation experiences and/or positive attitudes with a high degree of interests towards adopting the improved techniques. FSG members were assisted in managing the farming revolving fund and were also offered OJT opportunities on the improved rice cultivation techniques at the demonstration fields. These FSG farmers are expected to extend their knowledge and experiences to non-member farmers. This is what the Project means by the "Farmer to Farmer" extension system. From its inauguration in 2011, the Project experienced three cropping seasons, until 2014, for both transplanting and direct sowing seeding methods. Unfortunately, a disastrous flood occurred in 2013 and damaged the demonstration fields in the transplanting blocks of D5 and D6 quite severely. There was no harvest for those fields that year. Although the fields were not completely inundated in the direct sowing blocks in D11 and D12, the main water canals partly burst and could not provide irrigation water. Some fields had a shortage of water for around one whole month. Although the coaching on the transplanting cultivation method started in 2012, FSG farmers in D5 shifted their practice from transplanting to direct sowing for 2014 season and farmers in D6 decided not to cultivate rice. Consequently, the Project had only two cropping seasons for transplanting cultivation. The direct sowing cultivation was also only realized for two cropping seasons, starting in 2013 and ending in 2014. Some fields for direct sowing did not have an adequate harvest because of the flood.

The achievement of the Project purpose was determined through the comparison between the average yield of non-member farmers recorded at the time of the Baseline Survey of 2011 and the average yield of FSG demonstration fields of 2014.

Table 6.1.1 Yield Comparison between 2011 and 2014

Areas	Baseline survey: 2009/10		FSG: 2013/14		Difference of yield (ton/ha)
	Yield (ton/ha)	Cultivation method	Yield (ton/ha)	Cultivation method	
D5 (Chokwe)	3.73	Transplanting	3.51	Direct sowing	-0.22
D6 (Lionde)	2.57	Transplanting	-	-	n.a.
D11 (Massavasse)	2.96	Direct sowing	4.10	Direct sowing	1.14
D12 (Conhane)	2.58	Direct sowing	4.00	Direct sowing	1.42

The average yield at the Baseline Survey and the average yield of FSG demonstration fields in 2014 were increased by 1.1t/ha in D11 and D12, although the same increase could not be achieved in D5. Since the

purpose the Project is to raise the average yield of non-member farmers by 1.1t/ha through technical extension from FSG to non-member farmers, it is identifiable that this kind of extension has not yet been realized at the time of the completed evaluation in 2014.

On the other hand, the transition in the number of demonstration fields in FSG farms shows a constant increase from twenty in the original transplanting blocks in D5 and D6 in 2012, to sixty-four in 2013 and one-hundred and seven in 2014. Meanwhile, the field area increased also from 10ha in 2012 to 82ha in 2014. Non-member farmers must have seen the demonstration fields of the twenty original member farmers and became interested in the improved rice cultivation enough to join the FSG. Therefore, it is possible to understand the increased numbers as being a result of the original twenty FSG extending the improved rice cultivation to forty-four non-member farmers during the 2012/2013 season, and to an additional eighty-seven (the difference in number between 2012 and 2014) in the forthcoming seasons. Although the total number of registered farmers in all Project target areas, D5, D6, D11, D12, R1 and F3, is one-thousand seven-hundred and twenty-three, the improved rice cultivation techniques developed by the Project has extended to the 8.9% of one-thousand two-hundred and four farmers in D5, D6, D11 and D12, except R1 and R3, where the guidance through demonstrations was not intended originally due to the inconvenient road access during the rainy season.

Table 6.1.2 Transition of the number of FSG Farmers and Ratio of the Number of Registered Farmers

Traget area	2012	2013	2014	Num. of registered farmers	FSG farmer (%)
D5	10	26	50	324	15.4
D6	10	16	16	156	10.3
D11	0	12	24	301	8.0
D12	0	10	17	423	4.0
R1	-	-	-	350	-
R3	-	-	-	169	-
Total	20	64	107	1,723	8.9

6.2 Attainment level of expected outputs

(1) Output 1. Improved rice cultivation techniques of transplanting are disseminated to the target farmers.

Indicator	Attainment level
1. Three (3) important techniques of 8 technical components of transplanting rice cultivation are adopted by 15% of farmers in the target area for transplanting	During the fourth year, the demonstration fields in D5 were set up for the direct sowing, as the expenses for transplanting could not be calculated, due to the flood. In D6, demonstration fields for transplanting were not set up as rice cultivation did not happen at all due to the breakage of the key drainage canal-2. Because of the above reasons, training courses on studying the attributes of different varieties,

	productivity, etc. were held using the variety test block of EAC. 2nd Operation Year : 205 farmers 3rd Operation year : 90 farmers 4th Operation year: 104 farmers (overlaps with direct sowing) Total : 399 farmers Total number of farmers in target area : 480 farmers Ratio of farmers who participated in training courses : 83.1%

Indicator	Attainment level
2. More than 50% of the farmers in the target areas where transplanting method is widely practiced are trained on appropriated techniques for irrigation facility maintenance and water use.	Number of participated farmers 2nd Operation Year : 132 farmers (D5D6D11) 3rd Operation Year : 209 farmers (D11D12) 4th Operation Year: 766 farmers (D5D6D11D12R1R3) Total : 1,017 farmers Total number of farmers in target area:1,723 Ratio of farmers who participated in training courses : 64.2%

Output 2. Improved rice cultivation techniques of direct sowing are developed.

Indicator	Attainment level
1 The yield in trial verification plots is increased by 60% compared to the farmers' plots at the beginning of the Project.	The yield of a standard field is 2.9t/ha which was also the result of the yield survey of D11 and D12 carried out during the second year. The average yield of the direct sowing blocks in D5, D11 and D12 was 5.04t/ha during the fourth year. Yield at beginning : 2.9 t/ha Average yield of verification block in 2014 : 5.04 t/ha Increase rate : 73.8%
2 Six (6) kinds of techniques are developed.	The important technical factors of the rice cultivation of direct sowing were sorted into six and were all improved, so the indicated aims were achieved.
3 Direct sowing manuals are prepared.	The manual scripts for the rice cultivation techniques of direct sowing were made by the Project and printed in Mozambique after discussions on editing. Portuguese : 100 copies English : 50 copies Posters on direct sowing rice cultivation were made for farmers, along with the manual

	Portuguese : 2,100 copies

Output 3. Improved rice cultivation techniques of direct sowing are disseminated to the target area

Indicator	Attainment level
1 More than 25% of the farmers in the target areas are trained on six (6) technical components of direct sowing rice cultivation.	Number of participated farmers within the target areas 3rd Operation Year : 196 farmers 4th Operation Year : 276 farmers Total : 472 farmers Total number of farmers in target area : 1,243 (D11D12R1R3) Ratio of farmers who participated in training courses : 38.0%

Output 4. Activities of farmers groups are strengthened in the areas of the demonstration farms.

Indicator	Attainment level
1. The number of farmer's group members increases by 60%.	2nd Operation Year (42 farmers) D5:10, D6:10, D11:12, D12: 10 4th Operation year (107 farmers) D5:50、D6:16、D11 : 24、D12 : 17 Rate of increase : 155%
2 Account records on the operations of the rice milling machines are properly maintained and annually reported to the WUA members.	The book keeping skills improved through follow-up trainings and OJT on book keeping. Based on the book, an annual report was presented to WUA.
3 Records of the revolving fund program are properly maintained and annually reported to the FSG members	The book keeping skills are improved through the follow-up trainings and OJT regarding book keeping. The progress of the debt collection of the fund was confirmed and reported to FSG at the meeting so that FSG shared the information.

Output 5. The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.

Indicator	Attainment level of target
1. The progress review meetings are held at least twice a year.	A series of Steering Committee (SC) was held prior to the Coordination Committee (JCC) with both of implementing and coordination agency, where the progress report was given and

	confirmed. 1st Operational year : Two JCC (49 attendees): Three SC: 22 attendees 2nd Operational year : Two JCC (48 attendees): Four SC (40 attendees) 3rd Operational Year : Two JCC (51 attendees) :Four SC (35 attendees) 4th Operational Year : Three JCC (63 attendees): Seven SC (58 attendees)
Indicator	Attainment level
2. Joint monitoring sheets on the progress are prepared.	Four monitoring worksheets are made to monitor the work progress and the attainment level of targets of each operational year. Those four worksheets are the Activity Log Sheet, the Activity Result Report, the Monitoring of activity and results) and the Activity implementation Program.

6.3 Five Evaluation Criteria

At the time of the Project completion, the Project was evaluated under five criteria: relevance, effectiveness, efficiency, impact and sustainability. As table 6.3.1 shows, the relevance was evaluated as "high" but effectiveness, efficiency, impact and sustainability were all around medium.

Table 6.3.1 Five Evaluation Criteria

Relevance: High	Effectiveness: Moderate	Efficiency: Moderate	Impact: Moderate	Sustainability: Moderate
Policy: High JPN ODA: High Needs: High Approach: Moderate	Causality: High Project Purpose: Moderate	Inputs: High Outputs: Moderate	Overall Goal: Moderate Spillovers: High	Policy: High Organization: Moderate Finance: Moderate Technical: High

(1) Relevance

The "Plano Estrategico de Desenvolvimento do Sector Agrario (PEDSA) 2010-2019" (Strategic Plan for the Development of the Agriculture Sector) aims to foster food safety conscious and competitive farmers, where "Food Production Action Plan (PAPA)" seeks the way to improve self-sufficiency so that the country

no longer depends on imported food. The government of Mozambique has addressed the improvement of food productivity and the provision of assistance to the development of small-scale farmers as important issues to tackle under the national strategic policy. Based on the framework of the "Coalition for African Rice Development (CARD)," the "National Rice Development Strategy (NRDS)" has proposed the plan to increase rice production approximately five times more from 2008 to 2018. On the other hand, the government of Japan has promoted the reinforcement of the assistance for the sector of poverty eradication, based on MDGs and discussions with the government of Mozambique at TICAD-V. As the majority of farmers in the Chokwe Irrigation Scheme, one of the main rice production communities in the country, are small-scale farmers, the Project has been recognized for its consistency from the perspectives of the national policy of Mozambique and Japanese national assistance polity toward Mozambique for aiming to develop and extend the improved rice cultivation techniques targeting small-scale farmers.

(2) Effectiveness

The activities in the R1 and R3 irrigation areas were rather limited, due to the difficulty of access to these areas. Therefore, the effectiveness of this Project towards these areas was low. However, the Project contributed towards tackling a number of issues there also, such as the improvement of the cost structure and the development of skills to repair drainage canals, etc. Although the plan is to assign SDAE extension agents widely in the Chokwe Irrigation Scheme to provide technical assistance to farmers, the current situation doesn't promise such assistance, because of the unfavorable transportation conditions and insufficient agriculture techniques. Even though the effectiveness of the revolving fund is high, its sustainability would not be possible without additional financial resources. Therefore, it is evaluated as medium for its effectiveness.

(3) Efficiency

There was a case where the activity was found to be difficult to continue, when the assigned expert was absent for a period during an important time for rice cultivation, due to a visa problem. The flood that occurred in January 2013 also damaged the rice cultivation by FSG severely; moreover, the rice milling machines were completely soaked in the water and this stagnated the activities of the Farmers' Management Group of Rice Milling Machine as well. As for the farming revolving fund, which is designed to support the establishment of demonstration fields, a consideration was given to the minimization of necessary costs, limiting the cost of spending for plowing, seeding and fertilizer application for the transplanting techniques and plowing, seeding, fertilizer and herbicide application for the direct sowing.

(4) Impact

In order to achieve the overall goals of the Project in the future, it is necessary to expand the range of the "Farmer to Farmer (FTF)" extension system. The interest of the DPA Gaza and the DNEA has been shown towards the technical extension of the rice cultivation of direct sowing to other communities outside of the Project target area. Women are core farmers in the transplanting blocks in D5 and D12. The labor and cost are mostly spent for the task of transplanting, which is a concern for many of them. It would be possible for the rice cultivation of direct sowing to be adopted by the farmers who are currently practicing the

transplanting techniques, if farmers understand the merits of the direct sowing techniques, which are lower cost and less labor. A high level of economic impact can be well expected, if the improved rice cultivation of direct sowing (row seeding in well-drained fields) succeeds with as high a productivity rate as the transplanting techniques, by reducing the production costs of direct sowing considerably.

(5) Sustainability

Based on the CARD framework, the expansion of rice production has been put forward. The sustainability of implementing this policy of food production improvement and rice cultivation promotion is expected to remain high. There is also an institutional structure already established, where the chain of command is very clear: from the SDAE director to the head of the extension section and on to extension agents. As an institutional body to promote technical extension, SDAE is rather limited within its role to maintain and manage the involved facilities and assignment of extension agents, due to the constraints of its budget. It is expected to be difficult to extend the system of the farming revolving fund to other communities without a sufficient budget, as the fund requires original financial resources to start with.

6.4 Conclusion of the evaluation at completion and recommendations

6.4.1 Conclusion

The achievement of the Project's purpose seems quite difficult, looking at the indicators, mainly due to the damages caused by the flood. Yet if the underlying purpose of the Project is closely examined, the Project has had significant progress. It focused, in particular, on the high costs structured into small-scale rice farming and made efforts to improve the techniques to tackle related problems. Although the Project only had three cropping seasons during the agreed term of cooperation, the Project identified and categorized a number of issues and challenges and tackled with them with some recognizable achievements. The outcomes obtained by the Project would continue to improve with effort paid by the Mozambique side. The overall goals that the Project aimed would be realized with such an ongoing efforts. So it was determined that the Project should end as originally planned.

6.4.2 Recommendations

(1) Documentation of the Project achievements

The Project implemented a number of activities, such as studies on cultivation costs, variety comparison tests, trial sales business, etc. Not only the manual for cultivation techniques, but also the record of these activities and their outcomes should be documented and shared with other involved institutions including other donors so that it will be more effective through the proliferation of all of the achievements and the reinforcement of coordination among related institutions and organizations.

(2) FTF extension of cultivation techniques

For expanding the FTF extension system, the manual for the rice cultivation techniques of direct sowing as well as transplanting should be effectively and efficiently utilized by counterparts and farmers and the efforts to support FSG and the training programs for extension agents should be continued.

(3) Project design

The Project was unable to set up either FSG or demonstration fields in the R1 and R3 areas. Regardless of this fact, there were a large number of farmers wishing for them to take place, however this was not practical because of the poor road condition. The condition of the road should have been addressed with the help of much more information, at the time of designing the Project. Also, there was a point where an expert was absent for a crucial period of time, due to a visa problem. These experiences are to be shared with other involved personnel to design future projects for the better.

(4) Coordination reinforcement among involved organizations (farmers, SDAE, HICEP and EAC)

It is necessary to strengthen the coordination among farmers and the research and extension institutions, in order to earn a thorough understanding of problems and the needs that farmers face, along with extending cultivation techniques and skills of maintenance and management of irrigation facilities. In particular, the institutions and organizations within the field of rice cultivation agriculture are highly recommended to recognize the roles being played by each of them and consider providing effective assistance programs that can be offered by each of the research and extension sectors.

(5) Continued use of the revolving fund

The ledger of the currently revolving farming fund should continue to be closely kept. More cooperation from DNEA is necessary to secure financial resources for prospective FSG members.

(6) Production and revenue

An increase in costs remains a possible factor that would reduce the revenue, even if the productivity of 1ha of production area is improved. The "break even" point should be studied thoroughly in regard to the production area and its yield.

The evaluation result and recommendations were presented and approved at JCC-8 held on June 12. The evaluation result and recommendations were also confirmed by the minutes of the meeting.

7. Recommendations toward achieving the overall goals

7.1 Guideline of achieving overall goals

The Project set two goals: 1) Farmers' annual yield from rice production in the target area of the Chokwe Irrigation Scheme is increased and 2) Rice production in the entire Chokwe Irrigation Scheme is increased. The indicators are set to show that the improvement in farmers' income would increase by 45%, meaning an increase for one-thousand seven –hundred and twenty-three farmers in the Project target blocks, D5, D6, D11, D12, R1 and R3 by year 2017, and the entire rice production in the Chokwe Irrigation Scheme increases by 80% by year 2017. The following is the guideline to achieve such goals.

Overall goal	Indicator	Countermeasure
1. Farmer's annual income from rice production in the target area is improved.	1. Small scale farmer's annual income increases 45% in the target area by year of 2017	1. Increase in paddy yield 2. Reduction of operation costs 3. Improvement of income through selling milled rice
2. Rice production in the Chokwe Irrigation Scheme is increased.	2. Rice production increases by 80 % in the Chokwe Irrigation Scheme by year of 2017.	1. Improvement of irrigation facilities 2. Increase of acreage 3. Determination of focused area and target techniques (direct sowing) for extension 4. Extension of the improved rice cultivation techniques and assistance of managing the farming revolving fund 5. Increase in number of FSG farmers

7.1.1 Increase of annual revenue from rice farming for the farmers in target areas of the Chokwe Irrigation Scheme

According to the result of the Baseline Survey in 2011, the annual income of farmers in target areas was 14,277Mt and approximately 61% of the total was the farming revenue from rice and upland crop farming as well as animal husbandry. The rice revenue is 55.1% of farming income and 33.5% of the net income, indicating the importance of rice for farmers in target areas.

Table 7.1.1 Annual Income of Farmers in the Project Target Area (Baseline Survey, second OY)

Source of Income	Planting Method		
	All* (n=228)	Direct Sowing (n=69)	Transplanting (n=116)
Farming Income	15,744	23,100	14,828
Cropping (Rice)	8,681	10,688	8,556
Cropping (Other Crops)	5,543	9,879	5,031
Livestock's	1,520	2,533	1,241
Non-farming Income	10,152	14,981	9,685
Total Family Income	25,896	38,081	24,513

* Including the respondents with no answer about their planting method.

(1) Increase in paddy yield

There are three possible ways to increase the farmers' rice revenue: an increase in paddy yield, an improvement in techniques that are economically and productively effective and a revenue increase by selling milled rice instead of paddy. In regard to the increase in paddy yield, the average yield was 2.75t/ha confirmed by a survey in 2010, and the yield of 3.98t/ha is the lowest figure necessary to realize a 45% increase in rice revenue. The gross income in 2010 was 8,681.40Mt, so it should become 12,588.03Mt to realize the 45% increase in gross income. This gross income is calculated at 3.16Mt/kg, the average paddy purchase price in 2010, and converted into the yield to arrive at the 3.98t/ha figure. The rice revenue cannot be discussed through gross income completely, but it provides a guide at least. Approximately a 4t/ha yield would make it possible to realize the 45% increase in rice revenue.

(2) Reduction of operational costs

The balance of payments of small-scale farmers in the Chokwe Irrigation Scheme shows that the farming costs (materials, labor, etc.) are approximately 40% of the gross income, 45% of which is the material costs and 55% the labor cost. It is necessary to introduce economic and productive techniques, in order to increase the rice revenue of farmers. As the profitability of rice cultivation has been given some consideration previously, the rice cultivation techniques of transplanting had the advantages of having a stable productivity and a reduction of risk at the early stage of plant growth, compared to that of direct sowing. Nevertheless, it has a higher cost for transplanting, weeding and harvesting. On the other hand, the rice cultivation of direct sowing makes it possible to reduce the cost of seeding, weeding by applying herbicide and mechanical harvesting, but the field management at the early stage of plant growth from seeding to the plant establishment stage, about for one month, is a crucial task. The Project came to understand the condition of the infrastructure and paddy fields of the Chokwe Irrigation Scheme through the experiences of verifying and demonstrating the rice cultivation techniques of both transplanting and direct sowing throughout the Project cooperation term from 2012 to 2014. Based on that, the Project believes that under the current conditions, the improved rice cultivation techniques of direct sowing (broadcast seeding of 150kg/ha, Propanil and MCPA as applicable herbicide, 100kg/ha of urea applied three separate times, mechanical harvesting) is the practical method to realize an acceptable profitability. According to the results of the yield survey in 2014, targeting one-hundred and nine FSG farmers, approximately 66% of these fields had a yield in the range of between 4t/ha and 5t/ha, so it is plausible to

expect 4t/ha of yield. The improved rice cultivation techniques to produce 4t/ha paddy yield was developed and verified during the Project term, this method should be extended to other small-scale farmers outside of the target areas through the Farmer to Farmer extension system.

Table 7.1.2 Current Status of Rice Cultivation (Baseline Survey, second OY)

Area	Planting Method	Rice Field Area (ha)	Yield of Paddy (kg/ha)	Cash Income* from Rice (Mt)
All Target Areas	All	1.18	2,744	8,681.40
	Direct Sowing	1.32	2,721	10,687.70
	Transplanting	1.13	2,802	8,555.80
D5 (Chokwe)	All	0.78	3,726	6,936.90
D6 (Lionde)	All	0.97	2,570	3,308.50
D11 (Massavasse)	All	2.03	2,958	19,261.30
D12 (Co-hane)	All	1.35	2,583	8,249.00
R1-R3 (Muianga)	All	1.04	2,320	7,903.20

Cropping Season: 2009-2010 (Summer)

*Gross income

(3) Income increase through milled rice sales

The trial sales business of milled rice in 2014 acknowledged the farmers various problems made possible during the milling, sorting and packaging the rice. The farmers need to find solutions for these problems when this sales business of milled rice is launched as their new business as a mean to raise their income.

At the first processing stage, from collecting to milling the paddy, it took a long time to collect paddy. If paddy is not collected on time, it is difficult to step forward to the next stage, the milling. It is obvious to state that the production of milled rice must be constant for the sales business.

As for the milling stage, the quality control as well as the required cost was a considerable issue. The yield percentage after removing broken rice was low, 50.8% (25.4kg of milled rice out of 50kg paddy), but the broken rice percentage was high, 30.0%. At this time, FSG farmers used sieves to remove the broken rice, so labor increased its cost. The moisture content of rice at this time was 14%, so the performance of the milling machine was questionable for the high percentage of the broken rice. In order to adjust the percentage of broken rice (25%) to be about the same level with the imported rice of relatively low quality, it is recommended to use a sorting machine to remove the broken rice. The performance of the milling machine at the middle-scale mill with a sorting machine may be about the same with that of the milling machine in Masavasse. Whether or not the broken rice can be sold as a byproduct is another important issue. At the same time, it is also an option to sell their rice together with the broken rice as a low quality milled rice, sold at a lower price. The quality of rice that they produce should be determined after a thorough consideration given to the demands, what quality of rice is sellable and where.

Since the farmers sold rice face to face, the labor costs were increased. These rice sales were made possible through three retail shops in Chokwe, two shops sold it well and showed their interests in continuing. It is another option to use such retail shops. The reason why the sales did not go well at one of three was due to the packaging. The packaging was transparent without any production related information (production location, variety, production year, etc.), and this influenced the purchase trend. In reality, it is

difficult for FSG farmers to handle the preparation of the bags with logos and other information printed as well as the packaging. Especially, packaging related tasks can be done only in Maputo. It is very time consuming as well. Therefore, the packaging should be given thorough consideration.

The price was set to 30Mt/kg, which is moderately higher than the low quality imported rice available at shops (21Mt/kg). This was because of a better taste instead of the quality (high broken rice percentage). In the future, the price should also be decided through consideration of quality, volume, sales contact, sales method, etc.

The trial milled rice sales business is a project to improve farmers income and lift up their motivation toward rice cultivation; furthermore, it shall also contribute to create a system of milling rice sales business through identifying issues to be solved in order for the business to grow with a wider range of sales contacts. The Project carried out a market survey in regard to several matters of the milled rise sales: the consumer tendency, the distribution route for imported rice and for the rice produced in the Chokwe Irrigation Scheme. The Appendix 9 (9-3) shows the result in detail.

To confirm the validity of the milled rice sales as a means of increasing the income, the operation costs, including costs for milling, buying packages, removing broken rice or other paddy varieties, transportation fees and labor, was calculated for and compared between two cases: when farmers mill their rice and when the milling was done by a milling company. The milled rice was sold in a 5kg bag at a price of 30Mt/kg for four days in a town of Chokwe. The comparison was made between the selling price to the milling companies and the selling profit. The purchasing price of Inacio de Sousa (a milling company in Palmeira), 8.24Mt/ha, was adopted to this trial sales. The various costs required in order to sell milled rice, after being sorted and packaged, using 1kg of paddy (0.5kg of milled rice at 50% of the broken rice percentage), were 3.0Mt/kg for milling, 0.50Mt/kg for transporting, 0.70Mt/kg for packages and packaging, 1.25Mt/kg for sorting and removing impurities and 1.50Mt/kg for labor. The profit for selling paddy by hiring someone else to do the above processes would be approximately 8% less than that of when the paddy is directly sold to mill companies. If farmers share the labor of sorting and selling, their profit would increase by 24%. Based on this study, farmers can get a higher profit when they share the process of sorting and selling. According to the Baseline Survey of 2011, approximately 62% of farmers were selling their paddy to milling companies. Since it is now understood that a 24% profit can be made by processing and selling their paddy themselves without having the same thing done through milling companies, the business should improve in its dealings and should be able to expanded its scale, in order to continue to bring forth a higher revenue from rice farming.

7.1.2 Increase in rice production in the entire Chokwe Irrigation Scheme

The transition of the rice cultivation area in target areas and the change in yield are two important factors, when considering the increase of rice production in entire Scheme. The average rice cultivation area of the past five years has been approximately 5,000ha. Although there is a slight fluctuation from one year to next, the trend is a gradual decrease in size. The rice cultivation area is said to be 19% of the total land area of 26,000ha. The flood in January 2013 caused severe damage to the main irrigation canal, the secondary drainage canal, the agricultural road, etc. As of April 2014, the completion percentage of repairs to each was 77.3% for the main irrigation canal, 53.0% for the drainage canal, 45.4% for the agricultural road, 62.1%

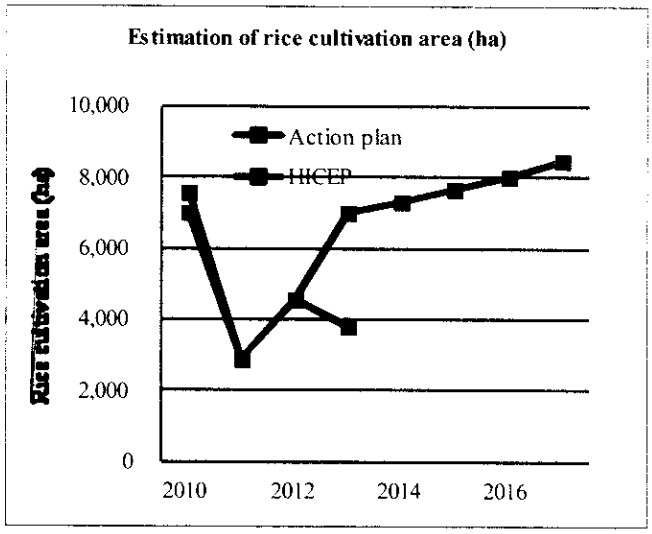
for the part of the primary irrigation canal that had burst and 60.7% for the part of the secondary irrigation canal that had also burst. According to HICEP 2013/2014 report (RELATÓRIO DE BALANÇO DA 1ª ÉPOCA DA CAMPANHA AGRÍCOLA 2013/14), the rice cultivation area for the 2013 season was originally 2,500ha, but only 301ha of that remained alright for the harvest, and therefore the average yield was also limited to 2.27t/ha.

Table 7.1.3 Cultivation Status in the Chokwe Irrigation Scheme (HICEP)

Season	Crop						Average
		2009	2010	2011	2012	2013	
Hot season	Rice	6,200	7,567	2,877	4,567.3	3,798.0	5,002
	Others	1,659	1,579	777	5,837.5	n.a.	2,463
Cool season	Horticulture	3,271	2,349	2,358	2,090.5	898.0	2,193
Total area (ha)		11,130	11,495	6,012	12,495.3	4,696.0	9,166
Land utilization (%)		42.8	44.2	23.1	48.0	18.0	35.2

Total araea of Chokwe Irrigation Scheme: 26,030 ha

As one of the overall goals , namely ,the increase of rice production in the Scheme by 80%, the question is: what should be the original figure of production. According to the Action Plan that was approved in February 2010, the cultivation area for the 2009/2010 season was 7,023ha with the yield of 3.10t/ha and the total production of 21,497t. On the other hand, the above mentioned HICEP report "RELATÓRIO DE BALANÇO DA 1ª ÉPOCA DA CAMPANHA AGRÍCOLA 2013/14" states the total cultivation area was 6,200ha and there is no data about the yield. If we say that the average yield was 3.10t/ha, the rice production of 2010 was 19,220t. Having 21,497t of rice produced in the 2009/2010 season, a production of 38,700t of rice would be required by the year 2017 in order to achieve the overall goal. When the yield of FSG demonstration fields in 2014 is estimate d at 4.0t/ha, a total of 9,675ha of field would have to produce rice. When the estimated yield is 4.63t/ha in 2017, according to the Action Plan, a total of 9,675ha of land must be used for rice cultivation. Since the average area for rice cultivation in the Scheme was approximately 5,000ha in the last five years, 3,359ha of more land should become paddy field by the year 2017.



Note: Date of the Action Plan of 2012 was not available therefore the HICEP date was taken in consideration

Figure 7.1.1 Field Plan for Rice Cultivation in Action Plan and Record (HICEP)

(1) Upgrading irrigation facility

Upgrading of the irrigation facility is absolutely necessary to increase the cultivation area by an additional 3,359ha. Nevertheless, the construction repairs to the main irrigation canal, drainage canals and the mending of burst holes are still being undertaken by HICEP, after the flood of January 2013. The upgrading work by BID to deal with 7,000ha is also only 47.5% complete as of 2012/2013, so it is the farmers' motivation that would be the key to expansion of the rice cultivation area.

(2) Expansion of the cultivation area

The expansion of the rice cultivation area requires a well-equipped irrigation facility and highly motivated farmers. In reality, it would be difficult without either one. As it is written also for the 4.1.1 (7) "Farmers' consciousness toward rice cultivation," 1) the majority of farmers don't have the motivation to expand their cultivation area for several reasons: rice cultivation being unprofitable, a shortage of finances and a wish to maintain the current condition, 2) approximately 70% of farmers are interested in the direct sowing rice cultivation method because its costs are relatively less than that of the transplanting method and 3) many farmers are reluctant to cultivate rice because of: the low selling price, the drainage facility of the paddy fields and high operation costs. One of the keys for the possible expansion of the rice cultivation in the Scheme is the economical techniques to realize a higher yield (or the reduction of operation costs), the plowing fees as initial investment, the ability to securely obtain seed, fertilizer and herbicide, etc. and an increase in income through the sale of milled rice for the improvement of the profitability.

(3) Establishment of key regions and target techniques (direct sowing) for extension

It is important to narrow down the key regions and the techniques of extension, in order to consider strategies for expansion of rice cultivation in the entire Chokwe Irrigation Scheme. According to HICEP "Campanha agrícola 2011/2012" and "Época Quente Relatorio ate 06/06/12," the Chokwe Irrigation

Scheme consists of three sectors (Montante: up-stream, Sul: mid-stream and Do Rio: down-stream), and approximately 60% of the fields for rice cultivation are located in Sul. When the cultivation method used in the entire Scheme is closely looked at, 70% of the farmers practice direct sowing and 30% transplanting. Therefore, Sul could be the key region and the direct sowing method should be adopted for achieving the overall goals. The direct sowing cultivation is generally viewed as unstable and disadvantageous for yield performance compared to the transplanting cultivation method. However the demonstration fields for the direct sowing method established in the Project target area in 2014 had a yield that was equivalent to that of the transplanting method practiced by non-member farmers. The direct sowing method, which has a low operation cost, is more advantageous for the expansion of cultivation area.

Table 7.1.4 Rice Cultivation in the Chokwe Irrigation Scheme (2012)

Sector	Total area (ha)	Direct sowing (ha)	Transplanting (ha)
Montante	950	286	664
Do Rio	796	605	190
Sul	2,822	2,329	493
Total	4,567	3,220	1,348

(4) Extension of the improved rice cultivation techniques and assistance for the farming revolving fund

The basic policy, of expansion of the rice cultivation area during the Project cooperation term, was to foster practical farmers and to extend the improved techniques to other farmers through the knowledge and experience gained by these practical farmers. Farmers with rice cultivating experiences and a keen interests towards the improved techniques were selected and FSG were organized. The Project has offered the FSG farmers a series of coaching sessions and a specifically designed extension system for improved techniques in the target area through the management of a farming revolving fund. This work should be continued so that the extension of the improved techniques would be the guideline to achieve the overall goals throughout the Chokwe Irrigation Scheme.

(5) Increasing the number of FSG farmers

During the Project cooperation term, the demonstration fields for the rice cultivation techniques of direct sowing and transplanting were set up at FSG farmers' fields in target areas, D5, D6, D11 and D12 (2,119ha). The total number of demonstration fields over three years was one-hundred and seventy-five, the area of 145ha. The number of FSG farmers who participated in OJT on the improved techniques at demonstration fields was one-hundred and seven. Due to the poor access road during the rainy season, no demonstration field was set up in R1 and R3, so the total target area remained as 2,119ha.

Table 7.1.5 Record of Establishment of Demonstration Fields During the Project Cooperation Term

Cultivation method	2012		2013		2014		Total	
	Area (ha)	Number of filed	Area (ha)	Number of filed	Area (ha)	Number of filed	Area (ha)	Number of filed
Transplanting	10	20	21	42	0	0	31	62
Direct sowing	0	0	32	22	82	91	114	113
Total	10	20	53	64	82	91	145	175

The number of FSG farmers increased from original twenty to one-hundred and seven in the three years after the inauguration, and during this time the technical extension started from FSG farmers to non-FSG farmers. For the target area of 2,119ha, one-hundred and seven FSG farmers got together as group members to implement the Farmer to Farmer extension. So it is estimated that about twice as many of the number of FSG farmers are necessary to be organized to expand the rice cultivation field to 3,359ha, through a combined system of setting up the demonstration fields and the management of the fund.

7.2 Methodology of implementing detailed activities

The Project had a series of discussions with the government of Mozambique to draw up the "Post-Project Work Plan," which states the necessary activities to be implemented from 2015 to 2017 based on the guidelines for achieving the overall goals. The plan was approved at JCC-9. Based on the work progress and the attainment level of targets for the fourth operational year, some of the already implemented activities are to be continued along with new ones.

7.2.1 Activities to be continued

(1) Establishment of demonstration fields for the rice cultivation techniques of transplanting

Promising rice varieties other than ITA312 should be verified for their productivity at FSG farms in cooperation with EAC. The key issues should be the verification and attribution of the productivity of promising varieties, instead of the extension of the transplanting block. When FSG farmers in the transplanting blocks in D5 and D6 wished to convert to the direct sowing method, they set up the demonstration fields on EAC property in order to extend the improved rice cultivation techniques of transplanting. Extension was done by holding relative events such as Field Days to demonstrate and show noon-FSG farmers the difference in yield between the two seeding methods of the regular row seeding and random seeding.

(2) Establishment of demonstration fields for the rice cultivation techniques of direct sowing

The demonstration fields for ITA312 should be set up in FSG fields (broadcasting urea 100kg/ha, three applications, weeding by herbicide sprayed), in order to extend the improved rice cultivation techniques of direct sowing, through Field Days or similar occasions for non-FSG farmers to participate in. Two rice varieties other than ITA312, Macassane and Alvorada, tended to have an increased yield when broadcast. Therefore, demonstration fields (the same crop standard with demonstration fields for ITA312) for three

varieties broadcast ITA 312, Macassane and Alvorada, should be set up in at least one field to see the comparison between Macassane and ITA312 as well as Alvorada and ITA312 in D5, D6, D11 and D12. In addition, the introduction of new varieties may be encouraged through events such as Field Days.

(3) OJT on the maintenance and management of the irrigation facility and water management

The direct sowing method requires an appropriate level of water management after seeding and especially proper drainage, so much so that the importance of these necessary matters should be discussed with the FSG farmers of each block during the Project term. These discussions should include the maintenance and management of the irrigation facility and the basic construction of tertiary drainage canals, and they should be implemented in cooperation with HICEP.

(4) Operation and management of the farming revolving fund

The debt collection of the farming revolving fund operation in D5, D6, D11 and D12, dealt with during the Project cooperation term, should be monitored and used to secure the sustainability of rice cultivation the area that used the fund. At the same time, a periodical report should be made regarding the accounts book keeping and/or farming finance management among FSG farmers, to consider the proper management of these finances.

7.2.2 New activities

(1) Building a new seed production system

The variety ITA 312 has been mixed with other varieties as well as deteriorating in its quality as part of its characteristic, so it should be replenished once every five years. The seed production plan should include this aspect. New varieties like Macassane and Alvorada as well as new prospective seeds should each have a separate production system to meet with farmers' needs. This kind of system should be launched in cooperation with EAC.

(2) Remodeling the manual row seeder

There were many farmers that requested the remodeling the manual row seeder in order to be applicable to animals, so the adaption to allow two cattle to pull the seeder will take place. For the application of the manual row seeder, the clod crushing by a rotavator was considered absolutely necessary. So the manual row seeder was tested on the FSG field in D5 without clod crushing by a rotavator. There were no significant problems found, but the seed covering rate was remarkably low. The use of a rotavator is what adds more to the seeding cost by the manual row seeder, so it is necessary to find ways to cover the seeds, other than covering by chain, in cooperation with EAC engineers.

(3) Organizing new FSG

It is necessary to expand further the demonstration field establishment area for promoting extension efforts for the improved rice cultivation techniques of transplanting and direct sowing. For this reason, SDAE should establish new FSG.

(4) Securing financial resources of the farming revolving fund and assistance to the new FSG

The farming revolving fund is absolutely necessary to set up demonstration fields. The financial resources for the fund need to be secured through coordination with local microfinance lending institutions and/or application of counter fund. SDAE should organize training sessions as well as OJT on the appropriate usage of the farming revolving fund, in order to assist farmers to establish the demonstration fields and to manage the spending and collecting the fund.

(5) Business to sell milled rice

According to the trial sales of milled rice in the fourth operational year, it was recognized that there was the possibility of earning a higher profit from selling the milled rice than selling paddy. Therefore, this business should be considered as a fully fledged business opportunity by finding solutions for the already mentioned challenges regarding the trial sales of milled rice. The prospective milling section should consider introducing a sorting machine in addition to the milling machine in Masavasse or to establish a coordinating relationship with middle scale mill companies. For the prospective sales section, it should aim to sell milled rice on consignment basis to retail shops in Chokwe. Of course, these prospective efforts should be realized by SDAE in cooperation with FSG and the Farmers' Management Group for Rice Milling Machine.

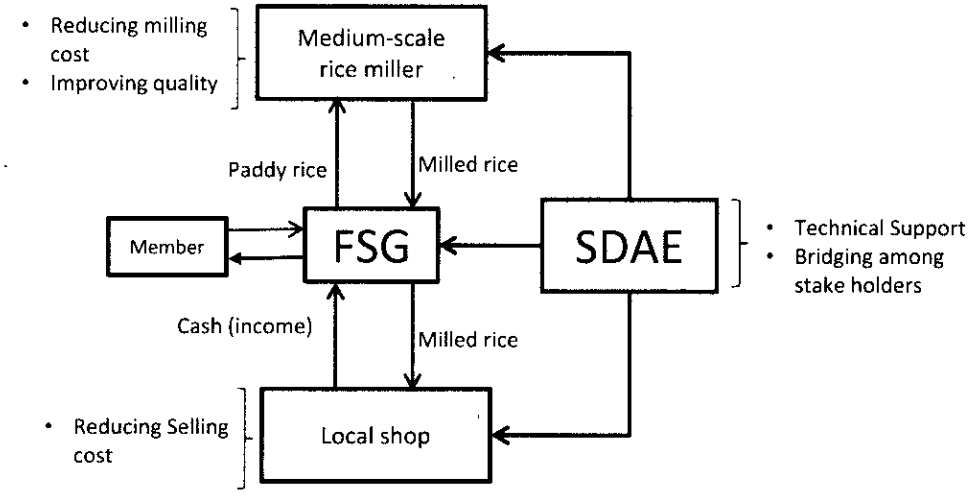


Figure 7.2.1 Sales of Milled Rice Having FSG as Core

Please refer to the Appendix 11 "Activity Design" for the above mentioned activities in detail. At the same time, the "Operation Plan" was drawn up with consideration given to the priority of each required activity during post-Project time, the term for the activity to be continued and the budget for implementation.

Work Completion Report

Appendices

- Appendix 1: Record of PDM
- Appendix 2: Detailed Work Plan
- Appendix 3: Record of Dispatching Japanese Experts and Receiving Counterparts
- Appendix 4: Joint Coordination Committee and Joint Evaluation Committee (Mid-term Review and Terminal Evaluation)
- Appendix 5: Record of Provided and Imported Machinery and Equipment
- Appendix 6: Reference to Output 1
- Appendix 7: Reference to Output 2
- Appendix 8: Reference to Output 3
- Appendix 9: Reference to Output 4
- Appendix 10: Reference to Output 5
- Appendix 11: Post-Project Work Plan

Appendix 1: Record of PDM

- 1-1 PDM-0
- 1-2 PDM-1
- 1-3 PDM-2
- 1-4 PDM-2 Main Changes

ANNEX II

Project Design Matrix (PDM-0)

Project Title: Project for Rice Productivity Improvement in Chokwe Irrigation Scheme.
Term of the cooperation : Three (3) years and ten (10) months
Target Group and Target Area: Small scale (less than 5 ha) rice farmers in the upper and midstream of the Chokwe Irrigation Scheme (mainly in D5, D6, D11, R1, R3, D12)
Responsible agency: National Directorate of Agricultural Extension (DNEA), Ministry of Agriculture (MINAG)
Coordinationg agency: Provincial Directorate of Agriculture (DPA), Gaza, MINAG
Ver.0:2010.09
Implementing agencies: District Services for Economic Activities(SDAE), Chokwe Agricultural Research Station(EAC) and Chokwe Hydraulic Public Corporation(HICEP)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTION
OVERALL GOAL			
1 Farmer's annual income from rice production in the target area is improved.	1 Small scale farmer's annual income increases XX % in the target area.	· Baseline Survey	
2 Rice production in the Chokwe Irrigation Scheme is increased.	2 Rice production increases by XX% in the Chokwe Irrigation Scheme.	· Statistics	
PROJECT PURPOSE	By the end of the Project,		
1 Rice productivity in the target area of the Chokwe Irrigation Scheme is increased.	1 Average yield of rice is increased XXt/ha in the target area.	· Project reports · Baseline survey	· No extreme fluctuation in price of products occurs. · Rehabilitation and maintenance of irrigation facilities in the Chokwe Irrigation scheme are implemented as planned.
OUTPUTS			
1 Improved rice cultivation techniques of transplanting are disseminated to the target farmers	1-1 XX improved techniques are adopted by XX % of farmers in the target areas for transplanting. 1-2 XX % of training participants understand appropriate techniques for Irrigation facility maintenance and water use.	· Project reports	· Lack of irrigation water due to severe drought does not occur. · Serious natural disaster does not affect the Chokwe irrigation scheme.
2 Improved rice cultivation techniques of direct sowing are developed.	2-1 XX% of yield is increased in trial and verification plots. 2-2 XX kinds of techniques are developed. 2-3 Direct sowing manuals areprepared.	· Project reports	
3 Improved rice cultivation techniques of direct sowing are disseminated to the target farmers.	3-1 XX kinds of techniques are disseminated to XX% of farmers in the target areas for direct sowing.	· Project reports	
4 Activities of farmers groups are strengthened in the areas of the demonstration farms.	4-1 The number of farmer's group members increases by XX %. 4-2 The amount of rice processed by the milling machines is increased at least XXt annually.	· Project reports and	
5 The implementation process of the Action Plan is promoted with the collaboration among stakeholders.	5-1 Progress reports of the Action Plan are submitted.	· CP Interview and project	

App.1-1

1-1 PDM-0

ACTIVITIES	INPUTS		IMPORTANT ASSUMPTION
	MOZAMBIQUE SIDE	JAPANESE SIDE	
1-1 To examine and develop effective extension methods. 1-2 To train extension leaders on improved rice cultivation techniques of transplanting 1-3 To set up demonstration farms for transplanting with initiative of extension leaders. 1-4 To train farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders. 1-5 To train farmers on irrigation facility maintenance and water use management. 2-1 To establish trial and verification plots 2-2 To develop and verify rice cultivation techniques of direct sowing. 3-1 To train extension leaders on improved rice cultivation techniques of direct sowing. 3-2 To set up demonstration farms for direct sowing with initiative of extension leaders. 3-3 To train farmers on improved rice cultivation techniques of direct sowing. 4-1 To organize a farming support group in each target 4-2 To train farming support groups. 4-3 To support farming support groups' activities. 5-1 To hold periodic meetings to mutually review activities of SDAE, EAC, HICEP and related organizations. 5-2 To monitor the progress of activities conducted by SDAE, EAC and HICEP based on the Action Plan.	【Counterpart】 SDAE:Project Manager SDAE: Extension HICEP: Irrigation water management EAC: Agronomy section 【Project Office】 SDAE	【JICA Experts】 - Chief Adviser / Rice Cultivation - Extension / Farmers Organization - Coordinator / Training 【Provision of Equipment】 【Local cost】 【Training in Japan and/or in other countries 】	• Agricultural policy does not change drastically. • Financial assistance for farmers is stable. • Small scale farmers produce rice continuously. • A large number of staff members of counterparts are not transferred. **Pre-Condition** • The condition of public safety is not deteriorated.

Project Design Matrix (PDM-1)

Project Title: Project for Rice Productivity Improvement in Chokwe Irrigation Scheme.
Term of the Cooperation: Three (3) years and ten (10) months
Target Group and Target Area: Small scale (less than 5 ha) rice farmers in the upper and midstream of the Chokwe Irrigation Scheme (mainly in D5, D6, D11, R1, R3, D12)
Responsible agency: National Directorate of Agricultural Extension (DNEA), Ministry of Agriculture (MINAG)
Coordinating agency: Provincial Directorate of Agriculture (DPA), Gaza, MINAG
Implementing agencies: District services for Economic Activities (SDAE), Chokwe Agricultural Research Station (EAC), Chokwe Hydraulic Public Cooperation (HICEP)

Ver.1. 2011.06

NARATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTION
OVERALL GOAL 1. Farmer's annual income from rice production in the target area is improved. 2. Rice production in the Chokwe Irrigation Scheme is increased.	1. Small scale farmer's annual income increases 60% in the target area by year of 2020. 2. Rice production increases by 130 % in the Chokwe Irrigation Scheme by year of 2020.	・Baseline Survey ・Statistics	
PROJECT PURPOSE 1. Rice productivity in the target area of Chokwe Irrigation Scheme is increased.	By the end of the Project, 1. Average yield of rice is increased 1.1 t/ha in the target area by the end of the Project.	・Project reports ・Baseline Survey	・The Plan Implementing Agencies will continue efforts to accomplish the Action Plan. ・No extreme fluctuation in price of products occurs. ・Rehabilitation and maintenance of irrigation facilities in the Chokwe Irrigation Scheme are implemented as planned.
OUTPUTS 1. Improved rice cultivation techniques of transplanting are disseminated to the target farmers. 2. Improved rice cultivation techniques of direct sowing are developed. 3. Improved rice cultivation techniques of direct sowing are disseminated to the target area. 4. Activities of farmers groups are strengthened in the areas of the demonstration farms. 5. The implementation process of the Action Plan is promoted with the collaboration among stakeholders.	1-1 Thirteen (13) improved techniques are adopted by 10 % of farmers in the target area for transplanting. 1-2 100 % of training participants understand appropriate techniques for irrigation facility maintenance and water use. 2-1 150-200 % of yield is increased in trial verification plots. 2-2 Six (6) kinds of techniques are developed. 2-3 Direct sowing manuals are prepared. 3-1 Six (6) kinds of techniques are disseminated to 7 % of farmers in the target areas for direct sowing. 4-1 4-1 The number of farmer's group members increases by XX%. 4-2 The amount of rice processed by the milling machines is increased at least XXt	・Project reports ・Project reports ・Project reports ・Project reports and farmers interview ・CP interview and project reports	・Lack of irrigation water due to severe drought does not occur. ・Serious natural disaster does not affect the Chokwe irrigation scheme.

	annually. 5-1 Progress reports of the Action Plan are submitted.		
ACTIVITIES	INPUTS		IMPORTANT ASSUMPTION
1-1 To examine and develop effective extension methods. 1-2 To train extension leaders on improved rice cultivation techniques of transplanting. 1-3 To set up demonstration farms for transplanting with initiative of extension leaders. 1-4 To train farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders. 1-5 To train farmers on irrigation facility maintenance and water use management. 2-1 To establish trial and verification plots. 2-2 To develop and verify rice cultivation techniques of direct sowing. 3-1 To train extension leaders on improved rice cultivation techniques of direct sowing. 3-2 To set up demonstration farms for direct sowing with initiative of extension leaders. 3-3 To train farmers on improved rice cultivation techniques of direct sowing. 4-1 To organize a farming support group in each target area. 4-2 To train farming support groups. 4-3 To support farming support groups' activities. 5-1 To hold periodic meetings to mutually review activities of SDAE, EAC, HICEP and related organizations. 5-2 To monitor the progress of activities conducted by SDAE, EAC and HICEP based on the Action Plan.	MOZAMBIQUE SIDE	JAPANESE SIDE	· Agricultural policy does not change drastically. · Financial assistance for farmers is stable. · Small scale farmers produce rice continuously. · A large number of staff members of counterparts are not transferred. · The condition of public safety is not deteriorated.

Project Design Matrix (PDM-2)

Project Title: Project for Rice Productivity Improvement in Chokwe Irrigation Scheme
Term of the Cooperation: Three (3) years and ten (10) months
Target Group and Target Area: Small scale (less than 5 ha) rice farmers in the upper and midstream of the Chokwe Irrigation Scheme (mainly in D5, D6, D11, R1, R3, D12)
Responsible agency: National Directorate of Agricultural Extension (DNEA), Ministry of Agriculture (MINAG)
Coordinating agency: Provincial Directorate of Agriculture (DPA), Gaza, MINAG
Implementing agencies: District services for Economic Activities (SDAE), Chokwe Agricultural Research Station (EAC), Chokwe Hydraulic Public Cooperation (HICEP)

July 26, 2013

NARATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTION
OVERALL GOAL			
1. Farmer's annual income from rice production in the target area is improved. 2. Rice production in the Chokwe Irrigation Scheme is increased.	1. Small scale farmer's annual income increases 45% in the target area by year of 2017. 2. Rice production increases by 80 % in the Chokwe Irrigation Scheme by year of 2017.	· Baseline Survey · Statistics	
PROJECT PURPOSE			· No extreme fluctuation in price of products occurs.
1. Rice productivity in the target area of Chokwe Irrigation Scheme is increased.	Average yield of rice is increased 1.1 t/ha in the target area by the end of the Project.	· Project reports · Baseline Survey	· Rehabilitation and maintenance of irrigation facilities in the Chokwe Irrigation Scheme are implemented as planned.
OUTPUTS			
1. Improved rice cultivation techniques of transplanting are disseminated to the target farmers.	1-1 Three (3) important techniques of 8 technical components of transplanting rice cultivation are adopted by 15% of farmers in the target area for transplanting.	· Project reports	· Lack of irrigation water due to severe drought does not occur.
	1-2 More than 50% of the farmers in the target areas where transplanting method is widely practiced are trained on appropriated techniques for irrigation facility maintenance and water use.	· Project reports	· Serious natural disaster does not affect the Chokwe irrigation scheme
2. Improved rice cultivation techniques of direct sowing are developed.	2-1 The yield in trial verification plots is increased by 60% compared to the farmers' plots at the beginning of the Project. 2-2 Six (6) kinds of techniques are developed. 2-3 Direct sowing manuals are prepared.	· Project reports	
3. Improved rice cultivation techniques of direct sowing are disseminated to the target area.	3-1 More than 25% of the farmers in the target areas are trained on six (6) technical components of direct sowing rice cultivation.	· Project reports and farmers interview	
4. Activities of farmers groups are strengthened in the areas of the demonstration farms.	4-1 The number of farmer's group members increases by 60%. 4-2 Account records on the operations of the rice milling machines are properly maintained and annually reported to the WUA members. 4-3 Records of the revolving fund program are properly maintained and annually reported to the FSG members.	· Project reports and farmers interview	
5. The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.	5-1 The progress review meetings are held at least twice a year. 5-2 Joint monitoring sheets on the progress are prepared.	· CP interview and project reports	

ACTIVITIES	INPUTS: MOZAMBIQUE SIDE	INPUTS: JAPANESE SIDE	IMPORTANT ASSUMPTION
1-1 To examine and develop effective extension methods. 1-2 To train extension leaders on improved rice cultivation techniques of transplanting. 1-3 To set up demonstration farms for transplanting with initiative of extension leaders. 1-4 To train farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders. 1-5 To train farmers on irrigation facility maintenance and water use management. 2-1 To establish trial and verification plots. 2-2 To develop and verify rice cultivation techniques of direct sowing. 3-1 To train extension leaders on improved rice cultivation techniques of direct sowing. 3-2 To set up demonstration farms for direct sowing with initiative of extension leaders. 3-3 To train farmers on improved rice cultivation techniques of direct sowing. 4-1 To organize a farming support group in each target area. 4-2 To train farming support groups. 4-3 To support farming support groups' activities. 5-1 To hold periodic meetings to mutually review activities of SDAE, EAC, HICEP and related organizations. 5-2 To monitor the progress of activities conducted by SDAE, EAC and HICEP based on <u>their plans and programs</u>.	【Counterpart】 SDAE:Project Manager SDAE: Extension HICEP: Irrigation water management EAC: Agronomy section 【Project Office】 SDAE	【JICA Experts】 - Chief Adviser / Rice Cultivation - Extension / Farmers Organization - Coordinator / Training 【Provision of Equipment】 【Local cost】 【Training in Japan and/or in other countries】	· Agricultural policy does not change drastically. · Financial assistance for farmers is stable. · Small scale farmers produce rice continuously. · A large number of staff members of counterparts are not transferred. PRE-CONDITIONS · The condition of public safety is not deteriorated.

Major Points of the Proposed Modification of the PDM

Part of the PDM	Description in the Original PDM	Proposed Revision	Explanation
OVI for Overall Goal	1.Small scale farmer's annual income increases 60% in the target area by year of 2020. 2.Rice production increases by 130 % in the Chokwe Irrigation Scheme by year of 2020.	1. Small scale farmer's annual income increases by 45% in the target area by year of 2017. 2. Rice production increases by 80 % in the Chokwe Irrigation Scheme by year of 2017	As the ex-post evaluation of JICA is scheduled three years after the completion of the Project, the indicators for the overall goals need to be revised to refer to the target by the year 2017 stated in the Action Plan (i.e. target yield of 4.63 ton against the baseline of 3.1 ton, and target production of 39,500 ton against the baseline of 21,500 ton).
Important Assumption from Project Purpose to Overall Goal	The Plan Implementing Agencies will continue efforts to accomplish the Action Plan	Delete	The Action Plan that was jointly formulated in 2010 is considered to be an ad-hoc document, while the most of the planned components have already been integrated in the respective plans and programs of the implementing agencies.
OVI for Output 1	1-1Thirteen (13) improved techniques are adopted by 10 % of farmers in the target area for transplanting. 1-2 100 % of training participants understand appropriate techniques for irrigation facility maintenance and water use.	1-1 Three (3) important techniques of 8 technical components of transplanting rice cultivation are adopted by 15% of farmers in the target area for transplanting 1-2 More than 50% of the farmers in the target areas where transplanting method is widely practiced have trained on appropriated techniques for irrigation facility maintenance and water use.	1-1 The thirteen (13) techniques referred in the transplanting rice cultivation manual developed by the Phase I project can be classified into 8 technical components, and adoption of three most important 3 techniques (i.e. nursery preparation, transplanting and fertilization) should be considered as the proof of the improved rice cultivation practices. As the rate of adoption has already reached to over 8 % by the time of Review, the target by the end of the Project should be set at the higher level. 1-2 Since it is difficult and controversial to verify the understanding of the farmers with objective basis of measurement, more concrete indicator on training is applied. The target coverage is set with general estimation based on the number of participants trained so far.
OVI for Output 2	2-1 150-200 % of yield is increased in trial verification plots. 2-2Six (6) kinds of techniques are developed. 2-3 Direct sowing manuals are prepared.	2-1 The yield in trial verification plots is increased by 60% compared to the farmers' plots at the beginning of the Project. (2-2, 2-3 Unchanged)	The target rate of increase should be rationalized based on the achievement in the experimental plots. It is also necessary to clarify the statement with indication of the subject of comparison.
OVI for Output 3	Six (6) kinds of techniques are disseminated to 7 % of farmers in the target areas for direct sowing	More than 25% of the farmers in the target areas are trained on six (6) technical components of direct sowing rice cultivation	The vague expression such as "techniques are disseminated" should be avoided. Target rate was revised in view of the activity plan for the coming years and in reference to the achievement so far made by the time of the Review.
OVI for Output 4	4-1The number of farmer's group members increases by XX%. 4-2The amount of rice processed by the milling machines is increased at least XXt annually.	4-1 The number of farmer's group members increases by 60%. 4-2 Account records on the operations of the rice milling machines are properly maintained and annually reported to the WUA members. 4-3 Records of the revolving fund program are properly maintained and annually reported to the FSG members.	4-1 As more than 50% of increase have so far observed, the target by the end of the Project is suggested to be 60%. 4-2 As the rice mill operation has just started, and the increment of performance may not be appropriate measurement of the capacity of farmer groups, a qualitative indicator on the activities of the group are introduced instead. 4-3 A qualitative indicator similar to 4-2 above is also added to evaluate the performance of FSGs.

Part of the PDM	Description in the Original PDM	Proposed Revision	Explanation
Output 5	The implementation process of the Action Plan is promoted with the collaboration among stakeholders.	The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.	The Action Plan that was jointly formulated in 2010 is considered to be ad-hoc documents, while the most of the planned components have already been integrated in the respective plans and programs of the implementing agencies. The statement thus needs to be rephrased.
OVI for Output 5	5-1 Progress reports of the Action Plan are submitted.	5-1 The progress review meetings are held at least twice a year. 5-2 Joint monitoring sheets on the progress are prepared.	As there has not been any legitimate form of progress report for the purpose of information sharing, the new indicators are added that reflect actual activities conducted by the Project.
Activity 5-2	To monitor the progress of activities conducted by SDAE, EAC and HICEP based on the Action Plan.	To monitor the progress of activities conducted by SDAE, EAC and HICEP based on their plans and programs.	The Action Plan that was jointly formulated in 2010 is considered to be ad-hoc documents, while the most of the planned components have already been integrated in the respective plans and programs of the implementing agencies. The statement thus needs to be rephrased.

Appendix 2: Detailed Work Plan

- 2-1 Detailed Work Plan

Activity implementation program 2011-2014

16 June 2012

Activities	Activity code	2010 J F M A M J J A S O N D	2011 J F M A M J J A S O N D	2012 J F M A M J J A S O N D	2013 J F M A M J J A S O N D	2014 J F M A M J J A S O N D	Observation
Activity implementation phase	-						Programed activity implementation phase
Recommended cropping season of rice cultivation	-						Recommended by HICEP
1. Extension							
1-1. Examination and development of effective extension method	1-1/11/14						Introduction of accessible extension method(s).
1-2. Training of extension leaders on improved rice cultivation techniques of transplanting	1-2/11/12						Introduction of basic and simple transplanting rice cultivation techniques
1-3. Establishment of demonstration farm for transplanting with initiative of extension leaders	1-3/11/14						Demonstration of improved transplanting rice cultivation techniques
1-4. Training of farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders	1-4/11/-14						Diffusion of improved transplanting rice cultivation techniques
1-5. Training of farmers on irrigation facility maintenance and water management.	1-5/11/14						Maintenance secondary and tertiary canals and water use management
2. Verification of technology generated							
2-1. Establishment of trial and verification plots	-						
(1) Establishment of direct sowing rice cultivation techniques	2-1/11/12						Establishment of direct sowing method
2-2. Development and verification of rice cultivation	-						
(1) Analysis of limiting factors of technical components of traditional direct sowing rice cultivation	2-2(1)/11/12						Field survey of traditional direct sowing in the project area
(2) Verification of the efficiency of mechanized rice cultivation	2-2(2)/12/13						Verification of mechanization
(3) Elaboration direct sowing rice cultivation manual	2-2(3)/12/14						Elaboration of manual
3.Training of extension leaders							
3-1. Training of extension leaders on rice cultivation techniques of direct sowing.	3-1/12/14						Introduction of direct sowing rice cultivation
3-2. Establishment of demonstration farm for direct sowing with initiative of extension leaders	3-2/12/14						Demonstration of improved direct sowing rice cultivation techniques
3-3. Training of farmers on improved rice cultivation techniques of direct sowing.	3-3/12/14						Diffusion of improved direct sowing rice cultivation techniques
4. Farmers organization							
4-1. Organization of farming support group in each target area	4-1/11/14						Reinforcement of FSG
4-2. Training of farming support group	4-2/11/14						Reinforcement of function of FSG
4-3. Support of the activities of Farming Support Group (FSG)	4-3/11/14						Reinforcement of function of FSG
(1) Support of the activities of Farming Support Group (FSG) of revolving fund management	4-3/11/14						Reinforcement of function of FSG of revolving fund management
(2) Support of the activities of Farming Support Group (FSG) of rice milling machine operation	4-3/11/14						Reinforcement of function of FSG of rice milling machine operation
5. Project management							
5-1. Project management through the periodic meetings to mutually review activities of SDAE, EAC, HICEP and	5-1/11/14						Advance and results of the project
5-2. Monitoring of the progress of activities conducted by SDAE, EAC, HICEP based on the Action Plan	5-2/11/14						Monitoring advance of the Action Plan

Appendix 3: Record of Dispatching Japanese Experts and Receiving Counterparts

- 3-1 Record of Dispatching Japanese Experts
- 3-2 Record of Receiving Counterparts
- 3-3 Training in Japan

Name	Field	Assignement Duration	Affiliation
Akio MAEDA	Chief adviser/rice cultivation	26/02/2011- 26/04/2011 09/06/2011- 08/07/2011 12/10/2011- 08/02/2012	RDI, Ltd.
Kiyoshi MASUBUCHI	Chief adviser/rice cultivation	31/03/2012 - 28/04/2012 09/06/2012 - 07/08/2012 12/10/2012 - 08/02/2013 05/05/2013 - 02/08/2013 19/10/2013 - 16/01/2014 12/04/2014 - 10/07/2014 02/08/2014 - 30/09/2014	RDI, Ltd.
Nobuharu MORITA	Extension / Farmers Organization	21/04/2011 - 19/06/2011 12/10/2011 - 08/02/2012 31/03/2012 - 28/07/2012	RDI, Ltd.
Masahiro OTAKE	Extension / Farmers Organization	12/10/2012 - 10/03/2013 05/04/2013 - 02/08/2013 19/10/2013 - 16/01/2014 12/04/2014 - 10/07/2014 02/08/2014 - 30/09/2014	RDI, Ltd.
Teruhisa NAMBA	Agronomy (rice)	21/04/2011 - 20/05/2011 15/10/2011 - 13/12/2012 31/03/2012 - 29/05/2012 12/10/2012 - 10/12/2012 12/10/2013 - 10/12/2013 05/04/2013 - 04/05/2013 19/10/2013 - 17/11/2013	RDI, Ltd.
Yorio IITSUKA	Agricultural Machinery and Equipment/Mechanization, Post-Harvest Processing	15/10/2011 - 13/12/2011 09/06/2012 - 08/07/2012 12/10/2012 - 25/11/2012	RDI, Ltd.
Toru HAMANAKA	Agricultural Machinery and Equipment	19/10/2013 - 17/12/2013 12/04/2014 - 16/06/2014	RDI, Ltd.
Takashi KURAUCHI	Irrigation Water Management	12/05/2012 - 10/07/2012 04/06/2013 - 02/08/2013 12/05/2014 - 10/07/2014	RDI, Ltd.
Kenji SUEMITSU	Socio-economic / Marketing	01/04/2011 - 30/05/2011	RDI, Ltd.
Naoyoshi KAWANO	Social Economic/marketing	12/04/2014 - 10/07/2014	RDI, Ltd.
Yumiko TAKEDA	Coordination / Training	26/02/2011 - 26/04/2011 09/06/2011 - 08/07/2011 12/10/2011 - 09/01/2012 09/06/2012 - 07/08/2012	CDC International, Co., Ltd.
Samuel TANAKA	Coordination / Training	12/10/2012 - 08/02/2013 06/03/2013 - 02/08/2013 19/10/2013 - 17/12/2012	RDI, Ltd.
Asako RIERA	Coordination / Training	19/12/2013 - 17/03/2014 12/04/2014 - 10/07/2014 02/08/2014 - 30/09/2014	RDI, Ltd.
Kenji SATO	Coordination support	31/03/2012 - 12/06/2012	RDI, Ltd.

Name and post	Specialty	Assignment period (project)	Japanese expert coworker	Remarks
Jose Antonio Gaspar (Mr.) Project director National Director of Agricultural Extension, Ministry of Agriculture	Extension	26/02/2011 - 10/02/2012	Akio Maeda	transferred
Albertina Alage (Ms.) Project director Deputy National Director of Agricultural Extension, Ministry of Agriculture	Extension	11/02/2012 - 31/07/2012	Akio Maaeda Kiyoshi Masubuchi	
Fernando Mavie (Mr.) Project director National Director of Agricultural Extension, Ministry of Agriculture	Extension	1/08/2012- Current	Kiyoshi Masubuchi	-
Joao Simao Nyaima (Mr.) Director of Department of International Cooperation MINAG	Internation cooperation	26/02/2011- 31/07/2012	Kiyoshi Masubuchi	transferred
Gerturdes S. Muchave (Ms.) Director of Department of International Cooperation MINAG	International cooperation	1/08/2012- Current	Kiyoshi Masubuchi	-
Ernest Paulino (Mr.) Project coordinator Provincial Director of Agriculture, Gaza	Extension/training	26/02/2011- Current	Kiyoshi Masubuchi	-
Gracinda Natalia Carlos(Ms.) Technicians in Division of Rural Extension, DPA Gaza	Extension/training	26/02/2011 - Current	Kiyoshi Masubuchi	-
Inacio Mateus Mugabe(Mr.) Project manager Director of District Services for Economic Activities, SDAE	Extension	26/02/2011 - Current	Kiyoshi Masubuchi	-
Salmao Mature(Mr.) Director of Chokwe Hydraulic Public Corporation, HICEP	Irrigation	26/02/2011 - 01/08/2011	Takashi Kurauchi	transferred
Soares Xerinda (Mr.) Director of Chokwe Hydraulic Public Corporation, HICEP	Irrigation	01/08/2011- Current	Takashi Kurauchi	-

Name and post	Specialty	Assignment period (project)	Japanese expert coworker	Remarks
Eduardo Cesar Muluana (Mr.) HICEP engineer	Irrigation	26/02/2011 - Current	Takashi Kurauchi	-
Olga Mario Chaguala (Ms.) Director of Estacao Agraria do Chokwe	Agronomy	26/02/2011 - Current	Teruhisa Namba	-
Jose Amandio Lopez (Mr.) SDAE Extension	Extension/farmers organization	26/02/2008 - 26/02/2011	Nobuharu Morita	transferred
Jorge Junior de Almerda (Mr.) SDAE Extension	Extension/farmers organization	26/02/2011 - Current	Nobuharu Morita Masahiro Ootake	-
Arsenio Francisco Lhamine (Mr.) SDAE engineer	Extension/farmers organization	26/02/2011 - Current	Nobuharu Morita Masahiro Ootake	-
Marcos Langa(Mr.) EAC researcher	Rice cultivation	26/02/2011 - Current	Nobuharu Morita	-
Tomas Antonio Massingue (Mr.) EAC researcher	Rice cultivation	26/02/2011 - Current	Teruhisa Namba Kiyoshi Masubuchi	-
Naftal Tristelio (Mr.) EAC researcher	Rice cultivation agricultural machinery	26/02/2011 - Current	Yorio Iitsuka	-
Ercilia Xavier Cau (Ms.) Extension agent	Extension	26/02/2011 - 31/12/2013	Nobuharu Morita Masahiro Ootake	D5
Cristeza Vasco Sitoe (Ms.) Extension agent	Extension	26/02/2011 - 31/12/2013	Nobuharu Morita Masahiro Ootake	D6
Jerinho Zacarias Cumbe (Mr.) Extension agent	Extension	26/02/2011 - Current	Nobuharu Morita Masahiro Ootake	D11, R1, R3
Baptista Acacio Macuacua (Mr.) Extension agent	Extension	26/02/2011 - Current	Nobuharu Morita Masahiro Ootake	D12
Vania Dulce Macula (Ms.) Extension agent	Extension	01/01/2014- Current	Masahiro Ootake	D5, D6

Name	Period of Participation	Field/Name of the Course	Content	Implementing Institution	Position
Naftal Tristelio (Mr.)	22/08/2012 - 22/09/2012	Rice cultivation/ agricultural machinery	Post harvest	JICA Tohoku (University of Yamagata)	EAC researcher
Eduardo Cesar Muluana(Mr.)	14/01/2013 12/03/2013	Region Focused Training Program on"Improvement of Agricultural Machinery and Equipment for the Growth in Agricultural Productivity for African Countries (B) "	Irrigation Agricultural Machinery	JICA Obihiro(Obihiro University of agriculture and veterinary medicine)	HICEP engineer
Arseino Fransisco Lhamine(Mr.)	02/07/2013 02/08/2013	Development of core agricultural researchers for rice promotion In sub Saharan Africa	Extension	JICA Chubu Niigata University	SDAE engineer

Appendix 4: Joint Coordination Committee and Joint Evaluation Committee (Mid-term Review and Terminal Evaluation)

- 4-1 JCC-1 MM
- 4-2 JCC-2 MM
- 4-3 JCC-3 MM
- 4-4 JCC-4 MM
- 4-5 JCC-5 MM
- 4-6 MM and Report of the Joint Evaluation Committee
- 4-7 JCC-6 MM
- 4-8 JCC-7 MM
- 4-9 JCC-8 MM and Report of Terminal Evaluation
- 4-10 JCC-9 MM

Minutes of Meeting
on
Work Plan (First Operation Year) Report
(Draft)
for
The Project for Rice Productivity Improvement
in
Chokwe Irrigation Scheme

Republic of Mozambique

Chokwe
Mach 18, 2011

Mr.José Antonio Gaspar
National Director of
Directorate of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr.Akio MAEDA
Chief Advisor/Rice Cultivation
JICA Project Team
Japan International Cooperation
Agency
Japan

The First Joint Coordinating Committee meeting (JCC1) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Akio MAEDA was held on 18th of March, 2011 at Chokwe District Office in Chokwe under chairmanship of the Project Director, Mr.Jose' Antonio Gaspar, National Director of Directorate of Agricultural Extension MINAG to discuss the contents of draft of Work Plan (First Operation Year) Report proposed for the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as the "Project") in the Republic of Mozambique. The progress of the Action Plan was also discussed. The list of participants is attached in Annex 1.

The presentation of the draft of the Work Plan (Frist Operation Year) Report was made by the JICA Team personnel and several comments were given by the members of MINAG. Also, presentation of the progress of the Action Plan by the plan implementing agencies was made by the Project Manager (SDAE director).

After full of discussions, the Work Plan for the Project was agreed between the Project Director, chairman of the Committee and the JICA Team. And the Work Plan was approved by the Coordinating Committee.

Also, the progress of Action Plan presented by the plan implementing agencies was understood by the Project Director on behalf of MINAG and the Project Team.

Minutes of Meeting
on
Setting of PDM-1 and Detailed Work Plan
for
The Project for Rice Productivity Improvement
in
Chokwe Irrigation Scheme

Republic of Mozambique

Chokwe
June 30, 2011

Mr.Jose Antonio Gaspar
Project Director
National Director of
Directorate of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr.Akio MAEDA
Chief Advisor/Rice Cultivation
JICA Project Team
Japan International Cooperation
Agency
Japan

Witnessed by

Mr. Masami SHUKUNOBE
Resident Representative
Japan International Cooperation
Agency (JICA) Mozambique Office

The Second Joint Coordinating Committee meeting (JCC2) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Akio MAEDA was held on 30th of June, 2011 at Chokwe District Office in Chokwe under chairmanship of the Project Director, Mr.José Antonio Gaspar, National Director of Directorate of Agricultural Extension MINAG to discuss setting of the Project Target of the PDM, the contents of draft of Detailed Work Report Plan (for whole operation year of the Project) proposed for the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as the "Project") in the Republic of Mozambique. The progress of the Action Plan was also discussed. The list of participants is attached in Annex 1.

The presentation of the progress of the Action Plan by the plan implementing agencies was made by the Project Manager (SDAE director). The presentation of the summary of the Baseline Survey was made by one of Counter Part Personnel. Presentation on setting of the proposed PDM-1 including the Project Target with some indicators for the overall goal, the Project purpose, and the expected outputs, and the draft of the Detailed Work Plan was made by the JICA Team personnel and several comments were given by the members of MINAG.

After full of discussions, the proposed PDM-1 and the draft of Detailed Work Plan for the Project was agreed between the Project Director, chairman of the Committee and the JICA Team. And the Detailed Work Plan was approved by the Coordinating Committee.

Also, the progress of Action Plan presented by the plan implementing agencies was understood by the Project Director on behalf of MINAG and the Project Team.

Republic of Mozambique
Ministry of Agriculture

The Project for Rice Productivity Improvement
in
Chokwe Irrigation Scheme
(PROMPAC)

Minutes of Meeting
on
The Third Joint Coordinating Committee
(JCC3)

Chokwe
October, 2011

Mr.Jose Antonio Gaspar
Project Director
National Director of
Directorate of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr.Akio MAEDA
Chief Advisor/Rice Cultivation
JICA Project Team
Japan International Cooperation
Agency
Japan

Witnessed by

Mr. Masami SHUKUNOBE
Resident Representative
Japan International Cooperation
Agency (JICA) Mozambique Office

The First Joint Coordinating Committee meeting (JCC1) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Akio MAEDA was held on 18th of March, 2011 at Chokwe District Office in Chokwe under chairmanship of the Project Director, Mr.Jose Antonio Gaspar, National Director of Directorate of Agricultural Extension MINAG to discuss the contents of draft of Work Plan (First Operation Year) Report proposed for the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as the "Project") in the Republic of Mozambique. The progress of the Action Plan was also discussed. The list of participants is attached in Annex 1.

The presentation of the draft of the Work Plan (Frist Operation Year) Report was made by the JICA Team personnel and several comments were given by the members of MINAG. Also, presentation of the progress of the Action Plan by the plan implementing agencies was made by the Project Manager (SDAE director).

After full of discussions, the Work Plan for the Project was agreed between the Project Director, chairman of the Committee and the JICA Team. And the Work Plan was approved by the Coordinating Committee.

Also, the progress of Action Plan presented by the plan implementing agencies was understood by the Project Director on behalf of MINAG and the Project Team.

MINUTES OF MEETINGS
BETWEEN
MINISTRY OF AGRICULTURE, THE REPBLIC OF MOZAMBIQUE
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY
FOR THE FORTH JOINT COORDINATING COMMITTEE (JCC4)
IN THE PROJECT FPR RICE PRODUCTIVITY IMPROVEMENT
IN CHOKWE IRRIGATION SCHEME (PROMPAC)

The Forth Joint Coordinating Committee meeting (JCC4) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Kiyoshi MASUBUCHI was held on 3rd of August, 2012 at the District Office in Chokwe. JCC meeting was conducted under chairmanship of the Project Director, National Director of Agricultural Extension MINAG to discuss the Progress of the Second Operational Year and the Introduction of the Third Operational Year proposed by the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as "the Project") in the Republic of Mozambique.
As a result of discussion, both sides agreed to the matters in the documents attached hereto.

Chokwe, 3, August, 2012

For Project Director
Dra. Albertina Alage
Vice-National Director of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr. Kiyoshi MASUBUCHI
Chief Advisor/Rice Cultivation
JICA Project Team (PROMPAC)
Japan International Cooperation Agency
Japan

Witnessed by

Mr. Ryuichi NASU
Resident Representative
Japan International Cooperation Agency
JICA Mozambique Office

Attached Document

Major Points Discussed

1. Progress Report of the Second Operational Year

The Project Team presented the progress report of the second operational year to the JCC-4, and the JCC approved the Report. The summary was presented respectively by the Project Team of PROMPAC; SDAE, HICEP and EAC. The JCC appreciated the achievements and efforts made by the Project stakeholders through the Project implementation.

2. Draft Plan of the Third Operational Year

The Project Team submitted the draft plan of the third operational year to JCC. The schedule of the third operational year will be assumed starting from October, 2012. The JCC welcomed the continuous efforts and expected the acceleration of the progress through the collaboration of SDAE, HICEP and EAC.

3. Revision of Project Design Matrix (PDM)

With special reference to the mid-term review for the Project, the Project Team presented the idea of modifying PDM-1. The Project Team expressed the need of internal discussion to review the realistic achievement in terms of confirming the technology transfer and diffusion. By the time of the mid-term review, assuming in the third operational year, the Project gets fixated on the idea of the modifying PDM.

4. Scheme of Revolving Fund

The Project Team explained the introduction of a revolving fund for the farmers' associations in D5, D6, D11 and D12. As refers to the trial of revolving fund in D4 and D7, the new scheme for the revolving fund was introduced respectively in 1) revolving fund management by land preparation in group, and 2) operation of the rice mill in group as an independent activity under the aim of sustainability. The JCC approved the idea of the Project Team and the new scheme of the revolving fund.

ANNEX I: Agenda of JCC-4
ANNEXII: Participants List

Republic of Mozambique
Ministry of Agriculture

The Project for Rice Productivity Improvement
in
Chokwe Irrigation Scheme
(PROMPAC)

Minutes of Meeting
on
The Fifth Joint Coordinating Committee
(JCC5)

Chokwe
November, 2012

Mr. Fernando Mavie
Project Director
National Director of
Directorate of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr. Kiyoshi Masubuchi
Chief Advisor/Rice Cultivation
JICA Project Team
Japan International Cooperation
Agency
Japan

Witnessed by

Mr. Naoki Yanase
Deputy Resident Representative
Japan International Cooperation
Agency (JICA) Mozambique Office

The Fifth Joint Coordinating Committee meeting (JCC5) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Kiyoshi MASUBUCHI was held on 22th of November, 2012 at Hotel Limpopo in Chokwe under chairmanship of the Project Director, Mr. Fernando Mavie, National Director of Directorate of Agricultural Extension MINAG to discuss the "Work Plan for Third Operation Year" proposed for the "Project for Rice Productivity Improvement in Chokwe Irrigation Scheme" (hereinafter referred to as "the Project") in the Republic of Mozambique. The list of participants to the committee meeting is attached in Annex 1.

The presentation of the Work Plan for Third Operation Year was made by the Project Manager (SDAE director) and several comments were given by the members of MINAG.

After full of discussions, the proposed Work Plan for Third Operation Year was agreed between the Project Director, chairman of the Committee and the JICA Team.

MINUTES OF MEETING
BETWEEN
JAPANESE MID-TERM REVIEW TEAM
AND
AUTHORITIES CONCERNED OF THE GOVERNMENT OF
REPUBLIC OF MOZAMBIQUE
ON
JAPANESE TECHNICAL COOPERATION
ON
THE PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT
IN CHOKWE IRRIGATION SCHEME

Japan International Cooperation Agency (hereinafter referred to as "JICA") and National Directorate of Agricultural Extension, Ministry of Agriculture, Republic of Mozambique jointly organized the Mid-term Review Team from 20th to 31st January, 2013 in order to review the progress of the Technical Cooperation on the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme, (hereinafter referred to as "the Project").

After the intensive study and analysis of the activities and achievements of the Project, the Team prepared the Joint Mid-Term Review Report (hereinafter referred to as "the Report") and presented it to the Mid-term Review Meeting held on 31st January, 2013.

The major issues of the Project stated in the Report were discussed in the Meeting and agreed to take necessary measures for the better implementation of the Project.

Maputo, 31st January, 2013

Mr. Yutaka IWATANI
Deputy Director General
Rural Development Department
Japan International Cooperation
Agency (JICA)

Mr. Fernando MAVIE
Director
National Directorate of Agricultural
Extension
Ministry of Agriculture
Republic of Mozambique

ATTACHMENT

Main points of discussion on the Mid-term Review Meeting are as follows.

1. **Countermeasures in response to the flood incidence**

   At first, deep condolence was expressed by all the participants for those who were affected by the extraordinary flood in Chokwe. As the flood has caused considerable damages to the areas in and around Chokwe Irrigation Scheme, it may affect the Project implementation which possibly makes the Project modify its original plan of operations. It was thus confirmed that the Project in close collaboration with concerned stakeholders would take the following measures immediately after the situation calms down:

   - Assess the degree of damages
   - Revision of plan of operations if necessary
   - Approval by JCC

2. **Joint Mid-term Review Report**

   The summary of the Mid-Term Review Report including the proposed revision of PDM was presented at the Review meeting and agreed to take necessary actions for each recommendation. However, as stated above, the proposed revision of PDM might need further modification based on the result of the assessment of the flood damages.

Annex: Mid-term Review Report

Joint Mid-Term Review Report

on

the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme

By

Joint Mid-term Review Team

Maputo,
January 31, 2013

Mr. Yutaka IWATANI
Team Leader
Japanese Mid-Term Review Team
Japan International Cooperation Agency (JICA)

Mr. Inácio Tiago NHANCALE
Team Leader
Mozambican Mid-Term Review Team
National Directorate for Agricultural Extension
Ministry of Agriculture

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Abbreviations

AGRA	Alliance for a Green Revolution in Africa
CARD	Coalition for African Rice Development
DAC	Development Assistance Committee
DNEA	National Directorate for Agricultural Extension
DPA	Provincial Directorates for Agriculture
EAC	Chokwe Agricultural Research Station
FSG	Farming Support Group
GoJ	Government of Japan
GoM	Government of Mozambique
HICEP	Chokwe Hydraulic Public Cooperation
JICA	Japan International Cooperation Agency
MIA	*Moçfer Industrias Alimentares*
MINAG	Ministry of Agriculture
MT	*Metical* (plural: *Meticais*)
NGO	Non-governmental Organization
NRDS	National Rice Development Strategy
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OJT	On-the-Job Training
OVI	Objectively Verifiable Indicator
PEDSA	Strategic Plan for Agricultural Sector Development
PDM	Project Design Matrix
PITTA	Integrated Agrarian Program for Technology Transfer
PO	Plan of Operations
PROIRRI	Sustainable Irrigation Development Project
PSP	National Program for Agricultural Extension (PRONEA) Support Project
SDAE	District Service of Economic Activities
TICAD	Tokyo International Conference on African Development

1. Outline of the Mid-Term Review

1-1 Background

Mozambique has the land area of 799,380 km^2 (180,000 km^2 farming land) with a population of 20,854 thousand (National Institute of Statistics, 2008), and about 80% of the working population is employed in agriculture. In the country, the consumption of rice is on the increase each year, estimated at 500,000 tons per annum (milled rice). Rice therefore is considered a priority cash crop with increasing demand, but its domestic production as paddy remains at 260,000 tons with the total cultivation area of 204,000 ha (thus an average yield is stagnating at 1.27 ton/ha) in 2009. Mozambique is importing more than 300,000 tons of rice annually to complement the limited domestic supply. As such, increasing rice cultivation productivity and raising food self-sufficiency ratio is an urgent issue in the country for ensuring food security.

In this regard, JICA with request from the Government of Mozambique implemented a project called "The Integrated Agricultural Development for Small Scale Farmers in Chokwe Irrigation Scheme" from March 2007 to March 2010 in Chokwe, Gaza Province, the largest irrigation scheme in Mozambique. According to the terminal evaluation conducted in December 2009, it was confirmed that the project was managed successfully to increase average yield of rice as well as to improve collection ratio of water fee. However, there are still several issues remained to be improved such as dissemination of improved rice cultivation techniques and the weak farming support system.

To this end, "Project for Rice Productivity Improvement in Chokwe Irrigation Scheme" (hereafter referred as "the Project") has been implemented for three years and ten months from February 2011 to November 2014. So far, the Japanese experts in the relevant fields (Chief Advisor / Rice Cultivation, Extension / Farmer's Organization, Agronomy, Water Management, Agricultural Machinery and Equipment / Mechanization, Coordinator/Training) have been dispatched.

1-2 Objectives of the Mid-term Review Study

The objectives of the Mid-term Review (hereinafter referred to as "the Review") are to:

1) conduct a joint review by the team consisting of Japanese and Mozambican reviewers;
2) confirm actual inputs, activities and the degree of achievements of the outputs, and the prospect of achieving the Project purpose;
3) assess the Project based on five evaluation criteria of the Development Assistance Committee (DAC) - Relevance, Effectiveness, Efficiency, Impacts and Sustainability -- together with the Project team and those concerned of Mozambican authorities;
4) make recommendations on the measures to be taken during the remaining period and beyond in consultation with agencies concerned; and
5) confirm the results of the review above with Mozambican authorities and agree on the minutes of meetings.

1-3 Outline of the Project

The Project Design Matrix (PDM) version 1 in June 2011 dictates the outline of the Project as follows. (See Annex 1).

1) Project Period

Three years and ten months from February 2011 to November 2014.

2) Counterpart Organizations

Responsible agency: National Directorate of Agricultural Extension (DNEA), Ministry of Agriculture (MINAG)

Coordinating agency: Provincial Directorate of Agriculture (DPA), Gaza, MINAG

Implementing agencies: District Services for Economic Activities (SDAE), Chokwe Agricultural Research Station (EAC), Chokwe Hydraulic Public Cooperation (HICEP)

3) Target Area and Beneficiaries

Small scale (less than 5 ha) rice farmers (about 2,000 households) in the upper and midstream of the Chokwe Irrigation Scheme (about 2,000 ha) mainly in D5, D6, D11, D12, R1, R3), and extension staff of SDAE.

4) Overall Goal

1. Farmer's annual income from rice production in the target area is improved
2. Rice production in the Chokwe Irrigation Scheme is increased.

5) Project Purpose

Rice productivity in the target area of Chokwe Irrigation Scheme is increased.

6) Outputs

1. Improved rice cultivation techniques of transplanting are disseminated to the target farmers.
2. Improved rice cultivation techniques of direct sowing are developed.
3. Improved rice cultivation techniques of direct sowing are disseminated to the target area.
4. Activities of farmers groups are strengthened in the areas of the demonstration farms.
5. The implementation process of the Action Plan is promoted with the collaboration among stakeholders.

1-4 Members of the Mie-term Review Team

The Review was conducted by the Joint Mid-term Review Team (hereinafter referred to as "the Team") composed by the following members:

(Japanese Team)

Name	Position	Title
Mr. Yutaka IWATANI	Leader	Deputy Director General, Rural Development Department, JICA
Mr. Motonori TOMITAKA	Technical Advisor	Senior Advisor (Agricultural Development), JICA
Ms. Keiko ITAGAKI	Evaluation and Analysis	Global Link Management, Inc.
Mr. Hiroki WATANABE	Survey Planning	Project Formulation Advisor (Agriculture and Rural Development), Rural Development Department, JICA

(Mozambican Team)

Name	Position	Title
Mr. Inácio Tiago NHANCALE	Leader	Head of Technical Department, DNEA, MINAG
Mr. Eugénio COMÉ	Project Evaluation	DNEA, MINAG
Mr. Susartino PALEGE	Project Evaluation	National Irrigation Institute, MINAG

1-5 Schedule of the Activities

The schedule of the activities of the Review is attached as Annex 2.

1-6 Methodology of the Mid-term Review

The Review was carried out in accordance with "the JICA New Guideline for Project Evaluation, Ver. 1 (June 2010)", which mainly follows "the Principles for Evaluation of Development Assistance, 1991" issued by Organization for Economic Co-operation and Development (OECD) –DAC. The PDM with the statement of the Project purpose, outputs and activities is used as the basic reference point for the Review.

As a framework to collect and sort out relevant data and information as prescribed in the JICA Guideline, an evaluation grid was prepared in reference to reports and documents on the Project. To collect information for the evaluation grid, questionnaires were prepared and forwarded in advance to the counterpart organizations. During the Review, the Team conducted interviews with counterpart personnel based on the questionnaire, hearings with related organizations, and visited target areas.

Findings and information from reports, interviews, questionnaire survey and site visits were collected and analyzed in the grids. The Team confirmed the achievements, assessed the Project based on the five criteria, and made recommendations.

The criteria used for the evaluation are the following five criteria: relevance, effectiveness, efficiency, impacts and sustainability.

Relevance	Relevance is reviewed by the validity of the Project purpose in light of Mozambique's development policies and needs and Japanese cooperation policies.
Effectiveness	Effectiveness is assessed to what extent the Project is achieving the Project purpose, clarifying the relationship between the Project purpose and outputs.
Efficiency	Efficiency is analyzed with emphasis on the relationship between outputs and inputs in terms of timing, quality, and quantity.
Impacts	Impacts are assessed in terms of positive/negative and expected/unexpected influences caused by the Project.
Sustainability	Sustainability is assessed in terms of institutional, financial, and technical aspects by examining the extent to which the achievements of the Project will be sustained after the Project is completed.

1-7 Limitations and Special Remarks on the Review Study

A flood of extraordinary magnitude hit the areas in and around of the district of Chokwe on January 23, 2013, which devastated the farms and living infrastructures in the target areas of the Project. This unprecedented incidence also negatively altered most of the scheduled activities of the Review, especially at the field level, resulted in causing some limitations of the Study. The Team could not interview some counterpart personnel and beneficiary farmers, nor could directly observe the activities and performance of the Project in the field such as verification and demonstration plots[1].

It should thus be noted that the findings presented in this report are mainly based on documents and data prepared by the Project, augmented by only a limited number of field interviews. Moreover, the assessment derived from the Review exercise are those reflected the situation at the time prior to the flood incidence, thus the prospects for the later course of Project implementation should be re-accessed after the

[1] In the Project, the term "verification plot" is used to mean the farmers field where on farm trials are conducted, and "experimental plots" is used to mean the field in the research stations for any on-station trials.

degree of influence of the flood over the activities of the Project would precisely be grasped.

2. Achievements and Implementation Processes

During the Review, the performance of the Project including inputs, activities and outputs, as well as the implementation processes, were reviewed to assess the degree of achievements. The findings of the Review are presented in the following:

2-1. Achievements of the Project

2-1-1 Inputs

The Team has confirmed that the Project has availed the following inputs along with the plan.

[Japanese side]

1) Dispatch of experts to Mozambique

A cumulative total of ten (10) Japanese experts have so far been dispatched to the Project, who covered the thirteen (13) fields of expertise, i.e. Chief Advisor/Rice Cultivation, Extension/Farmers Organization, Agronomy (rice), Agricultural Machinery and Equipment/Mechanization, Post-harvest Processing, Irrigation Water Management, Socio-economic Survey/Marketing, and Coordination/Training. The total period of assignments of these experts for technology transfer have so far been 55.5 man/months. The details of assignment of these experts are found in Annex 3.

2) Provision of equipment and machineries

Equipment and machineries of the total value equivalent to 6,509,162.99 *Meticais* (MT) were provided for the Project activities. The details of the equipment and machineries provided by JICA are found in Annex 4.

3) Training of counterpart personnel in Japan

So far, one (1) counterpart personnel from EAC was dispatched to Japan for short-term training on the subject related to post harvest and agricultural mechanization. Another counterpart officer from HICEP has been attending similar training in Japan at the time of the Review. The details of the counterpart personnel attended the training in Japan are found in Annex 5.

4) Bearing of local costs

A total sum of 36,615,000 Japanese Yen (approximately equivalent to 16,868,000 Mt[2]) has been provided to supplement a portion of operational expenses for the Project activities, as indicated in the following Table 2-1.

Table 2-1: Local Expenses borne by the Japanese side (Japanese Yen)

Fiscal Year (*1)	2010	2011	2012 (*2)	Total
Local Expenses	8,034,000	15,800,000	12,781,000	36,615,000

(*1) Figures are based on the Japanese Fiscal Year (April – March).
(*2) Figures are the amount approved in the annual plan for JFY 2012.
Source: Documents prepared by the Project

[2] The figure is based on the exchange rate at the time of the Review (1.00 MT = JY¥2.909). It should be noted that the actual amount disbursed may differ due to the exchange rate applied in the course of Project implementation in the past years.

[Mozambican side]

1) Appointment of Project personnel

The Project Director from DNEA, the Project Coordinator from DPA Gaza, and the Project Manager from SDAE have duly been appointed. Aside from these managerial personnel, a cumulative total of seventeen (17) counterpart personnel of relevant fields of the Project have been assigned to the Project from the DNEA, DPA Gaza, HICEP, SDAE and EAC. The details of the counterpart personnel are found in Annex 6.

2) Allocation of the operational costs

Mozambican side has allocated a total amount of 1,374,875.00 MT for the period from February 2011 to December 2012, the details of which are indicated in the Table 2-2 below:

Table 2-2: Operational costs borne by the Mozambican side (MT)

Fiscal Year(*1)	2010	2011	2012	Total
SDAE	193,660	203,343	212,951	609,954
EAC	31,200	40,320	34,320	105,840
HICEP	209,233	219,693	230,155	659,081
Total	434,093	463,356	477,426	1,374,875

(*1) Figures are based on the Mozambican Fiscal Year (January – December).
Source: Documents prepared by the Project

3) Provision of facilities

The necessary office spaces with office equipment, water and electricity have been provided for the Project offices at SDAE and HICEP. Other facilities and equipment of the implementing agencies, such as conference rooms, storage, parking lots, and laboratory have also been utilized for the activities of the Project.

2-1-2 Achievements of the Outputs

The Project has implemented its activities as per the plan stipulated in the PDM and the Plan of Operations (PO, attached as Annex 7) with slight modifications, which are considered appropriate. It was confirmed that the Project has implemented its activities without notable delays and could manage to cope up with any unprecedented difficulties encountered in the process. It was generally assumed that the Project would come up with all of its expected outputs by the end of the cooperation period, which has become uncertain due to the flood incidence. The Team examined the activities and achievement of the outputs so far as follows:

Output 1: Improved rice cultivation techniques of transplanting are disseminated to the target farmers.	
Indicators:	**Degree of achievement:**
1-1. Thirteen (13) improved techniques are adopted by 10 % of farmers in the target area for transplanting.	1-1 80% of the target
1-2. 100 % of training participants understand appropriate techniques for irrigation facility maintenance and water use.	1-2 No data yet

Activities and Achievements:

The Project has so far conducted nine (9) training courses for extension agents and leaders of Farming Support Groups (FSGs), which were attended by a total of 186 participants. Twenty (20) demonstration plots were set up, i.e. 10 plots each in D5 and D6, where improved rice cultivation techniques of

transplanting have been demonstrated.

The Project has also conducted one (1) training course on water management and facility maintenance, which was followed by three (3) on-the-job training (OJT) at the occasions of actual physical work on cleaning of tertiary canals, installation of polyvinyl chloride (PVC) pipes for drainage, and gate box construction in D5, D6 and D11. These training were attended by a cumulative total of 595 participants from respective areas.

The Team found that the target indicator on the adoption of the improved transplanting techniques has nearly been achieved, as it was reported that the members of FSGs in D5 and D6 have initiated application of those techniques of transplanting rice cultivation demonstrated in their respective areas as shown in the Table 2-3 below. As for the indicator on the farmers' understanding on the appropriate techniques for irrigation facility maintenance and water use, however, the Team could not obtain basis of judgment as there has not yet been objective assessment[3].

Table 2-3: Rate of farmers who adopt the improved techniques of transplanting

Target area	No. of registered farmers	No. of the FSG members	% of the FSG farmers
D5	324	26	8.03
D6	146	16	10.96
Total	480	42	8.75

Source: Documents prepared by the Project

Output 2: Improved rice cultivation techniques of direct sowing are developed.	
Indicators:	**Degree of achievement:**
2-1 150-200 % of yield is increased in trial verification plots.	2-1 Less than 50% of the target
2-2 Six (6) kinds of techniques are developed.	2-2 In process
2-3 Direct sowing manuals are prepared	2-3 Not yet

Activities and Achievements:

The Project has conducted trials in the experimental plots at EAC on direct sowing method. A manual seeder was also developed which can be fabricated with locally available materials. Verifications such as comparison of broadcasting and line sowing methods, wet field and dry field direct sowing and so forth have been conducted at the EAC, and the field verification have currently been in process, out of which the rice cultivation techniques of direct sowing to be disseminated would be identified, and their manuals are to be prepared.

As for the indicator on the yield increase, it was reported that the yield at the experimental field was 4.66 t/ha, while the yield at farmers' field was 2.88 t/ha, i.e. 62% increase in the experimental field. The Project personnel pointed out that the target percentage may need to be reviewed and revised, and the Team also found the necessity of clarifying the meaning of original indicator. Discussions on these points were reflected in the proposed modification of the PDM, i.e. attached as Annex 9.

Output 3: Improved rice cultivation techniques of direct sowing are disseminated to the target area.	
Indicators:	**Degree of achievement:**
3-1. Six (6) kinds of techniques are disseminated to 7% of farmers in the target areas for direct sowing	3-1 About 65% of target

[3] There were discussions on the appropriateness of the indicator, as the farmers' understanding should be measured with some objective and concrete basis. This point was also reflected in the proposed modification of PDM, i.e. attached as Annex 9.

Activities and Achievements:

The Project has set up four (4) verification plots at farmers' field, one each in D5, D6, D11 and D12 where comparison between broadcasting and line sowing has been tested. In D11 and D12, twenty-two (22) demonstration plots with a total of 32 ha were also installed to disseminate the techniques of direct sowing to the farmers. Due to the problems of physical access, the Project has not been able to establish verification and demonstration plots in R1 and R3, though farmers are to be invited to the training. The Project also conducted the OJT on direct sowing for three times, which were attended by sixty-six (66) participants, including sixteen (16) farmers who are not the members of FSG, as well as four (4) extension agents.

Degree of dissemination of rice cultivation techniques of direct sowing is summarized in the Table 2-4 below, indicating that the about 65% of the target indicator has been achieved.

Table 2-4: Farmers who are trained on the improved techniques of direct sowing

Target area	No. of registered farmers	No. of FSG members	Participants of the OJT		No. of farmers trained on the techniques	% of farmers trained on the techniques
			FSG members	Non-FSG farmers		
D5	324	26	26	0	26	8.0
D6	146	16	2	5	21	14.4
D11	301	12	12	3(*1)	15	5.0
D12	423	10	6	8(*2)	18	4.3
R1	350	-	-	-	-	0
R3	169	-	-	-	-	0
Total	1,723	64	46	16	80	4.6

* Note 1: One (1) extension agent also attended the OJT. *Note 2: Three (3) extension agents also attended the OJT
Source: Documents prepared by the Project

Output 4: Activities of farmers groups are strengthened in the areas of the demonstration farms.	
Indicators:	**Degree of achievement[4]:**
4-1 The number of farmer's group members increases by XX%.	4-1 Over 50%
4-2 The amount of rice processed by the milling machines is increased at least XXt annually.	4-2 No annual increase has been confirmed

Activities and Achievements:

The Project has organized the FSGs in D5, D6, D11 and D12, the details of which are indicated in the Table 2-5 below. The Project has conducted training for the members of the FSGs together with the extension agents not only on rice production techniques that were mentioned in the previous sections but also on the management of credit program, including the bookkeeping. A farm credit program has been operated in the FSGs in D5 and D6, which has been run successfully with high repayment rate in 2011, i.e. 100% in D5 and 80% in D6, respectively. As a result of their fair performances in rice cultivation and credit program, the membership has increased.

[4] For this output, the target figures of indicators were not decided by the time of the Review, thus the actual percentage, not the percentage of achievement against the target figure, is mentioned. The Team also recommends target figures in the proposed modification of the PDM attached as Annex 9.

Table 2-5: Details of the FSG membership

Target area	No. of the members at initial establishment	No. of the members of at the time of the Review	Increase in membership	
			No. of members	%
D5	10	26	16	160.0
D6	10	16	6	60.0
D11	12	12	0	0
D12	10	10	0	0
Total	42	64	22	52.4

Source: Documents prepared by the Project

The Project has also provided rice mill machines to the Water Users Associations (WUAs) in Massavasse village (D11) and Muianga village (R1 and R3), with establishment of the management group within the WUAs. The data on the amount of rice processed by the milling machine were obtained only from Massavasse, as the machine has recently been provided to Muianga in November 2012. It was reported that 48.9 ton of rice was milled by the machine provided to Massavasse during four (4) months from August to November 2012.

Output 5: The implementation process of the Action Plan is promoted with the collaboration among stakeholders.	
Indicators: 5-1. Progress reports of the Action Plan are submitted	**Achievement:** 5-1 One set of monitoring reports was prepared.

Activities and Achievements:

The Project has so far facilitated the monitoring on the progress of the Action Plan implementation at the occasions of Joint Coordinating Committee (JCC) and Steering Committee (SC) meetings of the Project, and an overall monitoring on the implementation was conducted once in July 2012, the results of which were summarized in the form of reports. Through these meetings, some of the planned components and target indicators were revised by the agencies which are responsible for the respective activities. The Project will continue facilitation on the monitoring of the Action Plan in collaboration with managing authorities of the implementing agencies.

2-1-3 Prospects to Achieve the Project Purpose

Project Purpose: Rice productivity in the target area of Chokwe Irrigation Scheme is increased.
Indicator: Average yield of rice is increased 1.1 t/ha in the target area by the end of the Project.

According to the Baseline Survey Report of the Project in August 2011, the average yield of rice for the year 2009/2010 in the target areas was 2.74 ton/ha. The yield of the model plots of the Project with transplanting method has achieved 5.99 ton/ha, and the yield at the experimental plots with direct sowing has marked 4.66 ton/ha in the harvest season of 2012. With these results of verification, the Team assumed that the prospect of achieving the Project purpose is high, given that improved techniques are properly disseminated to and adopted by the farmers in the target areas.

2-2. Implementation Processes of the Project

(1) Decision making mechanism

The JCC is the decision-making body of the Project, which is to confirm the progress of Project activities, to approve the activity plans for the upcoming period, and to discuss other issues related to the Project implementation. The JCC meetings have so far been held five (5) times. In addition to the JCC, there is the SC which serves as a coordination and monitoring mechanism of the Project. The SC meetings were held eight (8) times to conduct periodic review of the performances of the Project, where practical issues and concerns relevant to the progress of the Project activities have been discussed, mainly among the Project stakeholders at the field level. The details of these JCC and SC meetings are given in Annex 8.

(2) Coordination and communication among the Project personnel

As for the issues related to day-to-day operations, the Project has held weekly meetings among the Japanese experts and counterpart personnel for consultations and discussions. Aside from these regular meetings, special meetings have been held prior to the beginning of crop seasons, where all relevant stakeholders are invited to confirm the activity plans and demarcation of roles to play. All of the interviewed Project personnel unanimously shared to the Team that there has no problem or difficulty in terms of communication and information sharing among the Project personnel despite that the Project has been implemented in a joint collaboration among several implementing agencies.

3. Results of the Review

3-1. Results of the Review based on the Five Criteria

Through the Review, the relevance, effectiveness, efficiency, impacts and sustainability of the Project are assessed, the major findings of which are described below.

3-1-1 Relevance

The relevance of the Project is evaluated as high based on the following confirmation:

(1) Relevance to the development policies and sector programs of GoM

The current Government Five-Year Program of GoM, *Programa Quinquenal do Governo* (PQG) 2010-2014, aims to fight against the poverty, and the agriculture sector is regarded as one of the prime economic sectors to that end. The latest agricultural sectors strategy, i.e. Strategic Plan for Agricultural Development (PEDSA: 2011-2020) aims to "contribute towards the food security and income of agricultural producers in a competitive and sustainable way, guaranteeing social and gender equality," and stresses on the development of small and medium commercial farmers, making them more productive and competitive. In the plan, the Limpopo Corridor was designated as one of the priority areas for rice production, and the Chokwe Irrigation Scheme is regarded as the most potential area within the corridor. With special reference to the rice production, the GoM has planned to increase the rice procduction for about five times over a decade, as stipulated in the National Rice Development Strategy (NRDS: 2008-2018). Referring to these policy directives, the Project is considered to be consistent with the development plans and agricultural programs of GoM.

(2) Consistency with the ODA policies of GoJ

Japan's ODA policy for Mozambique emphasizes the supports to activation of regional economy, protection of environment and adaptation to climate change, as well as to administrative and institutional capacity development. Agricultural development is considered as one of the priority components for the activation of regional economy, with concrete focus on improving productivity of smallholder farmers and commercialization of agriculture which would contribute to the reduction of poverty. Also, GoJ has continued its commitment to support the initiatives to increase rice production in Africa within the framework of the Coalition for African Rice Development (CARD), which was launched in partnership with the Alliance for a Green Revolution in Africa (AGRA). The Project is regarded as one of the centerpieces of the agricultural technology support program in the ODA Rolling Plan as well. From these viewpoints, the Project is assessed to be quite well in line with the Japanese aid policies.

(3) Appropriateness of the Project design

The Project had been designed to address three technical aspects and two facilitating factors that contribute to the increase of rice productivity: With output 1, the improved rice cultivation techniques of transplanting are to be disseminated, while direct sowing techniques are developed through activities for output 2, which are to be disseminated through activities for output 3. To further facilitate the rice production by the farmers in the target area, the Project tries to strengthen the farmers' groups, i.e. output 4. The Project also promotes the implementation of action plans of the implementing agencies so as to improve the overall production environment in the target area through the activities for output 5. This comprehensive approach, combining the technical improvement and creation of facilitating environment, was assessed as an appropriate one to achieve the Project purpose.

3-1-2 Effectiveness

The overall effectiveness of the Project was considered to be high at the time prior to the flood incidence in January 2013, based on the following analysis:

(1) Prospects to achieve the Project purpose

The Project purpose is to increase the rice productivity in the target area of the Project. As discussed in previous section, the Team assumed that the target increase would be achieved if improved techniques would properly be disseminated to and adopted by the farmers in the later course of the Project implementation. It should thus be important for the Project to explore possible measures and effective means to enhance the dissemination of techniques, including the mechanism of farmer-to-farmer diffusion.

(2) Contribution of outputs to the achievement of the Project purpose

The output 1 is aiming to improve rice cultivation techniques of transplanting, while output 2 and 3 are to develop and disseminate more cost and labor effective rice cultivation techniques with direct sowing. Both of the techniques would properly contribute to the improvement of rice cultivation practices in the target areas in Chokwe Irrigation Scheme. The output 4 is to strengthen the farmers' organizations so as to provide enabling conditions for their production, and the output 5, i.e. promotion of implementation of the action plans of the implementing agencies, is to further facilitate the support from relevant government agencies to the farmers in the target area. The Team found that all of the outputs of the Project are to adequately contribute to the achievement of the Project purpose and that the logical sequence between the outputs and Project purpose is appropriate.

(3) Analysis of factors

1) Promoting factors

The efforts by the Project for dissemination of techniques would further be supported by the government initiatives such as the Integrated Agrarian Program for Technology Transfer (*Programa Integrado de Transferencia de technologias Agrarias*: PITTA), with which regular district- / province-wise gatherings among relevant stakeholders including extension agents are organized to disseminate new techniques and knowledge with provision of initial inputs for demonstration activities.

In the target areas, there are also private traders and non-governmental organizations (NGO) render services to the small-scale farmers. The Project has tried to build cooperative relationship with these private entities in search of possible future support to the farmers' organizations, in order to augment the government extension services. Collaboration with private partners such as a local branch of *Mocfer Industrial Alimentares* (a milling company: MIA), for example, in terms of introduction of new varieties that bring better milling performance, may be appreciated as a factor to promote Project's performances.

2) Hampering factors

The small scale farmers are chronically suffering from constraints of production capital, which has repeatedly been pointed as one of the obstacles for application of improved production techniques. Though the farmers understand the benefit of improved farming practices, some of them may not afford the costs incurred for their application. Although the Project has introduced revolving fund program to address the constraints, this may still remain as one of the hampering factors for the achievement of the Project purpose.

(4) Important assumptions

In January 2012, the target areas were affected by the flood which damaged some irrigation and drainage canals, resulted in the interruption of water distribution to some farm plots in the target areas, although it did not create drastic problem in the overall Project implementation. However, the flood in January 2013 has affected to the target areas to a devastating degree, which may create ample damages over the Project activities as well as over the production of the farmers. The Team observed the situation during the Review, yet could not assess the degree of the influence at the time. This incidence is considered as a drastic change of the important assumption, which should be taken into consideration when any discussions are to be held in terms of the future course of the Project implementation.

3-1-3 Efficiency

The efficiency of the Project is assessed as fair, based on the results of the examination on the following aspects:

(1) Japanese experts

As described in the previous sections, a total of ten (10) Japanese experts in the relevant fields of expertise have so far been dispatched to the Project. These experts have properly played their expected roles in the course of the implementation of the Project activities, which have been appreciated by the counterpart personnel as well as by the beneficiary farmers. Nonetheless, it was pointed out during the interviews that the periods of assignments of a few experts were not adequately matched with the timing in the cropping season. Some counterpart personnel regret that some experts had to leave when their expertise were needed in the field, which has caused some difficulties in the field activities. There are

also some comments from the counterpart personnel that the experts could work more closely if they were stationed in the implementing agencies responsible to the activities relevant to their field of expertise.

(2) Equipment and machineries

The equipment and machineries required for the Project activities and technical transfer have duly been provided in time. They have fully been utilized in training and field verification, FSG activities, regular monitoring and management of the Project, and counterpart personnel and beneficiary farmers have become capable of handling them by themselves. Most of the equipment and machineries have properly been kept in good conditions, except for a few items that are currently under repair.

(3) Training of the counterpart personnel in Japan

The counterpart officer who attended the training in Japan assesses that the subject of the training was relevant to his assignment in the Project, and that the skills and knowledge acquired through the training have been utilized in the Project activities. It has been pointed out, however, that it could have been more helpful if the training would have also included other subjects directly related to the routine duties of the training participant in the institution he belongs to.

(4) Inputs from the Mozambican side

The counterpart personnel assigned from implementing agencies have actively taken part in the Project activities, though it has been pointed out that many of them could not serve on the full time basis, due to the other routine duties and responsibilities. The provision of the office spaces with basic equipment for the Project office at SDAE and HICEP as well as research related facilities at EAC have contributed to the smooth implementation of the Project activities.

(5) Utilization of the outcomes and experiences of foregoing JICA technical cooperation project

Prior to the Project, there was another technical cooperation project assisted by JICA, i.e. "The Integrated Agricultural Development for Small Scale Farmers in Chokwe Irrigation Scheme" (hereinafter referred to as the "Phase I Project"), where improved rice cultivation techniques on transplanting have already been developed. The counterpart personnel who had participated in the precedent Phase I Project had acquired knowledge on and practical experiences in improved rice cultivation with transplanting method. The Project could start its activities on the basis of the technical knowledge and first-hand experiences accumulated through the Phase I Project. Utilization of these outcomes and experiences has contributed to the efficiency of the Project.

3-1-4 Impacts

Relatively high and positive impacts are expected from the implementation of the Project, as described in the following:

(1) Impacts on the Overall Goal

The overall goal of the Project is the increase of rice production and thus the improvement of farmers' income from rice production in the Chokwe Irrigation Scheme. To attain this overall goal, there should be systematic dissemination of improved techniques as well as other supportive measures to encourage application of improved techniques to be provided to the farmers in the areas within the scheme other than the target area of the Project. The Team found some positive impacts in terms of dissemination of the techniques. Spontaneous diffusion of improved rice cultivation techniques to the farmers in the adjacent areas has been reported in some parts of the target areas, which would further be

accelerated through the government initiatives such as PITTA.

(2) Positive impacts

Some farmers who have applied the improved transplanting techniques reported that the yield has increased, and that they can now secure funds for next cropping season out of the increased income. In the areas where the improved techniques of direct sowing are being verified, high technical impacts are expected with introduction of manual seeder developed by the Project which can be fabricated with locally available materials. It should also be noted that the large scale farmers in the target area are also interested in direct sowing method being developed and verified by the Project, thus that the adoption of these techniques by non-target group is also expected.

(3) Negative impacts

There has not been any negative impact observed or reported by the time of the Review.

3-1-5 Sustainability

At the time of the Review, the sustainability of the Project is assessed as fair in some of the aspects, but there are also some other aspects that need continuous monitoring and further reinforcement as described in the following:

(1) Policy and institutional sustainability

In the current government policies, importance of agricultural sector is well recognized and the improvement of production technologies is highlighted as one of the aspects to further be strengthened. Chokwe Irrigation Scheme has been designated as one of the priority areas for rice production in the agricultural plans and programs of the district, province and the central governments, as well as in the NRDS. It is thus generally assumed that the policy supports would continuously be secured for the coming years. As the activities of the Project have been carried out in line with the existing organizational structures of the SDAE, EAC and HICEP who are mandated to provide support to the farmers in Chokwe Scheme, thus the institutional sustainability is also assessed as high.

(2) Organizational and financial sustainability

As to the organizational and financial sustainability at the levels of implementing agencies, there seem to be various constraints. There have been delays in the planned rehabilitation and maintenance of irrigation facilities in the Chokwe Irrigation Scheme due to the financial and other constraints for the part of HICEP, while SDAE has been suffering from the limited number of experienced extension agents in rice cultivation, wide range of subjects of extension other than rice cultivation, difficulty to secure the means of transportation for the extension agents, and so forth. These conditions would cast some questions in the organizational and financial sustainability for the part of the implementing agencies.

For the part of the farmers' organizations, there are also many challenges: the small scale farmers are generally suffering from the insufficiency of production capital. The FSGs are newly organized under the WUAs through the intervention of the Project to address the constraints, but they are still in the embryo stage while current government extension programs do not support their own group activities such as revolving fund programs. Similarly, there has not yet been any formal mechanism to render continuous support and supervision to the management groups of the rice milling machines under the WUAs. Without proper organizational management, their financial basis may not either be sustainable. It is thus considered that the organizational and financial sustainability for the part of the farmers may largely depend on the possible future supports to these farmer groups either from the

government extension, through WUA structures, or through partnership with any private partners in the area.

(3) Technical sustainability

The improved rice cultivation techniques with transplanting and direct sowing have currently been verified and demonstrated in the target areas. As for the rice cultivation techniques, degree of adoption may depend on their effects in terms of yield performances and economic benefits, which are yet to be studied and confirmed through the Project activities for the rest of the cooperation period. To ensure the technical sustainability, it should thus be essential for the Project to conduct economic analysis and to carefully examine the applicability to and affordability for farmers in selecting the rice cultivation techniques to be disseminated.

3-2. Conclusion

The Team has confirmed that the Project had been implemented without any critical problem or notable delay, and that the prospect of achieving its outputs by the end of the Project was assumed as high at the time prior to the flood incidence in January 2013. The Project, with continuous efforts, could achieve its Purpose within the cooperation period; only if the effects of the flood would be manageable thus not affect to a considerable degree the performances of the Project as well as the farming activities of the target beneficiaries. It has not yet been able to assess the degree of damage in the target areas at the time of the Review, thus the Team concluded that the prospects of achievement of the Project purpose should be re-examined, based on the accurate assessment of the influences of the flood incidence over the implementation of the Project and production activities of the farmers.

4. Technical Aspects

(1) Direct sowing method of rice cultivation

The Project has been trying to establish a direct sowing method of rice cultivation fitting to the local environment especially soil conditions. Among steps from land preparation to crop establishment, how to manage the first irrigation water after sowing rice seeds is critical for obtaining the good germination rate. Based on trials at EAC, the Project started demonstration of the improved direct sowing method of rice cultivation in 2012/13 season and observed good establishment of the seedlings. It is expected that simple but informative manual of direct sowing rice cultivation will be available in the near future.

(2) Agricultural mechanization

For establishing a proper spacing of rice plants in the field, the Project has developed a manual type seeder which sows rice seeds on straight rows (4 rows at the same time). Workability of the seeder has been confirmed in demonstration plots. Extension agents and farmers are becoming interested in the seeder. It is expected that the manual type seeder will be multiplied in the near future for making it available to the extension agents and farmers in the Project area. The Project has confirmed that puddling of the paddy field by rotary of power tiller reduced the percolation of water and increased the paddy yield. Although introduction of agricultural machinery depends on workability, productivity and profitability, demonstration of the power tiller (for puddling) in paddy plots of farmers is worth to be conducted.

(3) Establishment and training of FSGs

Since 2011/12 cropping season, the Project has been supporting some farmers for dissemination of improved transplanting method of rice cultivation through establishing FSGs in D5 and D6. About 10 farmers per group cooperate with extension agent and their rice fields become demonstration farms for other farmers surrounding. The Project shoulders costs of land preparation, paddy seeds and fertilizer for one cropping season. Members of each FSG make rules including how to manage the revolving fund. In 2012/13 cropping season, the Project initiated similar FSGs in D11 and D12 for demonstration of improved direct sowing method of rice cultivation (including the cost for herbicide). Extension agents monitor the activities of and provide suggestions to respective FSGs. It is expected that such famer to farmer extension approach will facilitate dissemination of improved rice cultivation techniques in the Project covering areas.

5. Recommendations

(1) Assessment of the effects of the flood and examination of the necessary countermeasures

As the flood has caused considerable damages to the areas in and around Chokwe Irrigation Scheme, the Team is afraid that it may affect the Project implementation; it may require the Project to modify its original plans and schedule of activities. It is thus requested to relevant stakeholders of the Project to conduct thorough field investigation to grasp the degree of effects of the flood over the Project activities as well as the production activities of the farmers in the target areas, probably by the end of February 2013. The results of field investigation should be presented in the respective authorities, based on which discussions should be held on the possible and necessary countermeasures to be taken, together with the assessment of the prospect of achievement of the Project purpose within the original period of cooperation.

(2) Revision of the PDM

In the process of the Review, discussion was held in terms of some target figures of the objectively verifiable indicators (OVI) in the PDM, based on the achievements so far made through the Project activities. Questions were also raised on the interpretation of several indicators in the current version of PDM, and it was noted that some modifications might be necessary to clarify the directions of the Project for the remaining period of cooperation. Accordingly, the Team proposes some modifications of PDM as attached as Annex 9. Major points to be modified include; 1) the target figures as well as the expressions of some of the OVI for the outputs, Project purpose and overall goal, 2) description of Output 5 and activities for the output, and 3) statement of important assumptions as external factors to continuously be monitored in the course of Project implementation. The detailed explanations on the major points of the proposed modification are attached as Annex 10. It is thus recommended for the Project to further discuss among the stakeholders and accordingly revise the PDM with formal endorsement by JCC.

(3) Strengthening of extension system

In the later course of Project implementation, dissemination of improved rice cultivation techniques would further be accelerated. It is planned for the rest of the cooperation period to continuously set up and manage the verification and demonstration plots in the target areas, where OJT on rice cultivation techniques will be conducted, together with other training courses. The role of extension agents would also be more vital in the later stage of Project activities, thus, it is requested to the relevant institutions, namely to SDAE, to strengthen the extension system and to ensure the active participation

of the extension agents to these activities of the Project. It is also anticipated to the Japanese experts to make their further efforts to transfer technical knowledge to the extension agents so as to enhance their capacities.

(4) Efforts to widely disseminate the improved rice cultivation techniques developed by the Project

The Project has been engaged in development and verification of improved rice cultivation techniques, taking into the economic implications of the techniques as well. In the framework of the Project, these developed techniques are primarily to be disseminated to the target areas and then to the entire areas under Chokwe Irrigation Scheme. Some of the improved techniques, however, may potentially be applicable to other rice producing areas, which would be extended through the future initiatives of the relevant institution, such as DPA Gaza and DNEA. In view of maximizing the impacts of the Project, it is therefore requested to the Project and its implementing agencies to consciously disseminate the technologies and their impacts together with other accomplishment of the Project activities in any attractive manner to the wide range of relevant audiences through various measures i.e. publications, Field Days[5], seminars, projects and programs of implementing agencies such as Sustainable Irrigation Development Program (PROIRRI), National Program for Agricultural Extension (PRONEA) Support Project (PSP) , PITTA, and so forth.

[5] Field Days is one of the extension methodologies with which the farmers and other relevant stakeholder are gathered to directly observe and learn innovative practices.

MINUTES OF MEETINGS
BETWEEN
MINISTRY OF AGRICULTURE, THE REPUBLIC OF MOZAMBIQUE
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY
FOR THE SIXTH JOINT COORDINATING COMMITTEE (JCC6)
IN THE PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT
IN CHOKWE IRRIGATION SCHEME (PROMPAC)

The Sixth Joint Coordinating Committee meeting (JCC6) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Kiyoshi MASUBUCHI was held on 26th of July, 2013 at the District Office in Chokwe. JCC meeting was conducted under chairmanship of the Project Director, National Director of Agricultural Extension MINAG to discuss the Progress of the Third Operational Year, Result of the mid-term review and Introduction of the Forth Operational Year proposed by the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as "the Project") in the Republic of Mozambique.

As a result of discussion, both sides agreed to the matters in the documents attached hereto.

Chokwe, 26 ,July, 2013

Mr. Fernando Mavie
Project Director
National Director of Directorate of agriculture Extension
Ministry of agriculture
The Republic of Mozambique

Mr. Kiyoshi MASUBUCHI
Chief Advisor/Rice Cultivation
JICA Project Team (PROMPAC)
Japan International Cooperation Agency
Japan

Witnessed by

Mr. Ryuichi NASU
Resident Representative
Japan International Cooperation Agency
JICA Mozambique Office

Attached Document

Major Points Discussed

1. Progress Report of the Third Operational Year

The Project Team presented the progress report of the third operational year to the JCC6 , and the JCC approved the Report. The summary was respectively presented by the Project Team of PROMPAC; SDAE, HICEP and EAC. The JCC appreciated the achievements and efforts made by the Project stakeholders through the Project implementation.

2. Draft Plan of the Forth Operational Year

The Project Team submitted the draft plan of the forth operational year to JCC. The schedule of the Forth operational year will be assumed starting from October, 2013. The JCC welcomed the continuous efforts and expected the acceleration of the progress through the collaboration of SDAE, HICEP and EAC.

3. Revision of Project Design Matrix (PDM)

As recommended in the Joint Mid-Term Review Report, JCC discussed the modification of the PDM in order to clarify the direction of the project for the remaining period of cooperation.

As a result of discussion JCC approved the modification of the PDM as attached at Annex- III.

ANNEX I: Agenda of JCC6
ANNEXII: Participants List
ANNEXIII: PDM-2

Republic of Mozambique
Ministry of Agriculture

The Project for Rice Productivity Improvement
in
Chokwe Irrigation Scheme
(PROMPAC)

Minutes of Meeting
on
The Seventh Joint Coordinating Committee
(JCC7)

Chokwe
November, 2013

Mr. Fernando Mavie
Project Director
National Director of
Directorate of Agricultural Extension
Ministry of Agriculture
The Republic of Mozambique

Mr. Kiyoshi Masubuchi
Chief Advisor/Rice Cultivation
JICA Project Team
Japan International Cooperation
Agency
Japan

Witnessed by

Ms. Chiharu Morita
Deputy Resident Representative
Japan International Cooperation
Agency (JICA) Mozambique Office

The Seventh Joint Coordinating Committee meeting (JCC7) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Kiyoshi MASUBUCHI was held on 25th of November, 2013 at the District Office in Chokwe under chairmanship of the Project Director, Mrs. Albertina Alage on behalf of National Director of Directorate of Agricultural Extension MINAG to discuss the "Work Plan for Fourth Operation Year" proposed for the "Project for Rice Productivity Improvement in Chokwe Irrigation Scheme" (hereinafter referred to as "the Project") in the Republic of Mozambique. The list of participants to the committee meeting is attached in Annex 1.

The presentation of the Work Plan for Fourth Operation Year was made by the Project Manager (SDAE director) and several comments were given by the members of MINAG.

After full of discussions, the proposed Work Plan for Fourth Operation Year was agreed between the Project Director, chairman of the Committee and the JICA Team.

MINUTES OF MEETING
BETWEEN
JAPANESE TERMINAL EVALUATION TEAM
AND
AUTHORITIES CONCERNED OF THE GOVERNMENT OF
REPUBLIC OF MOZAMBIQUE
ON
JAPANESE TECHNICAL COOPERATION
ON
THE PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT
IN CHOKWE IRRIGATION SCHEME

Japan International Cooperation Agency (hereinafter referred to as "JICA") and National Directorate of Agricultural Extension, Ministry of Agriculture, Republic of Mozambique jointly organized the Terminal Evaluation Team from 4th June to 12th June, 2014 in order to evaluate the progress and achievements of the Technical Cooperation on the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as "the Project").

After the intensive study and analysis of the progress and achievements of the Project, the Team prepared the Joint Terminal Evaluation Report (hereinafter referred to as "the Report") and presented it to the Joint Coordinating Committee (hereinafter referred to as "JCC") held on 12th June, 2014.

Maputo, 12th June, 2014

Mr. Naoki YANASE
Deputy Resident Representative
Japan International Cooperation Agency (JICA)
Mozambique Office

Mr. Fernando Lissete MAVIE
National Director
National Directorate of Agricultural Extension
Ministry of Agriculture, Republic of Mozambique

ATTACHMENT

Main points of discussions based on the Report at JCC are as follows.

1. Approval of the Report

After the intensive discussion, JCC approved the Report and agreed to take necessary actions to each recommendation.

2. Others

The following issues were discussed at JCC. It is expected that necessary actions to be taken for better outcomes of the Project in the remaining project period and ensure effective utilization of the outcomes of the Project after the completion of project period.

1) Documentation of the useful experiences of the Project

The Project has made many trial activities that include cost survey, variety comparison, social survey, marketing trials and others. These experiences will be useful if documented and shared with other local and international organizations concerned.

2) Extension by FTF

For further development of "farmer to farmer" (FTF) extension, continuation of support for Farming Support Group (FSG) and cultivation of extension officers will be required to continue. The manual for the rice farming technologies improved by the Project will be useful if shared with other donors and NGOs concerned.

Using of farming Field school (FFS) approach to disseminate the rice farming technologies through other areas with potential to produce rice.

3) Project design

The road access to R1 and R3 should have been reviewed at time of the project design. Likewise, alignment of the experts that meets to the cropping season should have been planned carefully. These lessons should be noted by the project officers involved.

4) Collaboration among stakeholders (farmers, SDAE, HICEP and EAC)

For the sake of understanding issues farmers face and their needs as well as promoting dissemination of the developed techniques such as rice cultivation, irrigation facilities maintenance and water use, it is essential to strengthen linkage between farmers and research and extension fields, in other words, specifically EAC and SDAE. It is requested to EAC to invite extension officers of SDAE for more trainings or workshops to improve their farming skills and knowledge. In addition, through DPA's cooperation, workshops or seminars in terms of enhancement of farmers' organizational strength are requested to be hold. The stakeholders are needed to recognize their roles in rice farming activities including postharvest.

5) To Extend the Revolving fund

The revolving fund was found useful for developing FSG. To extend deployment of FSG furthermore, Ministry of Agriculture will need to take necessary measures for funding production and marketing activities.

6) Production and Profit

The production area and yield level should take into consideration break-even point.

In the future, thinking about increase production and productivity the introduction of machinery in similar projects should be taken into account, because of the workforce reduction that has accrued to the Agricultural sector. This fact also connects to the suggestion made for direct sowing machines modification in order to use animal traction instead of farmers force.

Annex: Joint Terminal Evaluation Report

THE JOINT TERMINAL EVALUATION REPORT

ON

PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT

IN CHOKWE IRRIGATION SCHEME

Maputo, June 12, 2014

Mr. Masahiro TAWA
Team Leader
Japanese Terminal Evaluation Team
Deputy Director General,
Rural Development Department,
Japan International Cooperation Agency

Mr. Inácio Tiago NHANCALE
Team Leader
Mozambican Terminal Evaluation Team
Head of Technical Department,
National Directorate of Agricultural Extension,
Ministry of Agriculture, Republic of Mozambique

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Abbreviations and Acronyms

	Portuguese (English)
CARD	Coalition for African Rice Development
CIS	Chokwe Irrigation Scheme
C/P	Counterpart
DAC	Development Assistance Committee
DNEA	Direcção Nacional de Extensão Agrária (National Directorate of Agricultural Extension)
DNSA	Direcção Nacional dos Serviços Agrários (National Directorate of Agrarian Services)
DPA	Direcção Provincial de Agricultura (Provincial Directorate of Agriculture)
EAC	Chokwe Agricultural Research Station
FFS	Farmer Field School
FSG	Farming Support Group
FTF	Farmer to Farmer
HICEP	Chokwe Hydraulic Public Corporation
IIAM	Instituto de Investigação Agrária de Moçambique (Institute of Agricultural Research in Mozambique, MINAG)
INIR	Instituto Nacional de Irrigação (National Institute of Irrigation)
IRRI	International Rice Research Institute
JCC	Joint Coordinating Committee
MINAG	Ministério da Agricultura (Ministry of Agriculture)
MM	Man Month
M/M	Minutes of Meeting
NRDS	National Rice Development Strategy
OJT	On-the-Job Training
PAPA	Plano de Acção para a Produção de Alimentos (Food Production Action Plan)
PARP	Plano de Acção Para a Redução da Pobreza (Action Plan for the Reduction of Poverty)
PDM	Project Design Matrix
PEDSA	Plano Estrategico de Desenvolvimento do Sector Agrario (National Strategic Plan for the Development of Agricultural Sector)
PITTA	Programa Integrado de Transferencia de Technologias Agrarias (Integrated Agrarian Program for Technology Transfer)
PNISA	Plano Nacional de Investimento do Sector Agrario (National Investment Plan of Agcitultural Sector)
PO	Plan of Operations
PROAGRI	Agricultural Sector Public Expenditure Program
PROIRRI	Sustainable Irrigation Development Project
PRONEA	Programa Nacional de Extensão Agrária (National Program for Agricultural Extension)
PSP	PRONEA Support Project
R/D	Record of Discussions
SDAE	Serviços Distritais das Actividades Económicas (District Services of Economic Activities)
WUA	Water Users Association

1. Introduction

1-1 Objectives of the Terminal Evaluation

(1) To review the progress of the Project and evaluate the achievement in accordance with the five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability);
(2) To identify the promoting factors and inhibitory factors of achievements of the Project;
(3) To discuss the plan for the Project for the rest of the project period together with Mozambique side based on the reviews and analysis results above; and
(4) To summarize the results of the study in Joint Terminal Evaluation Report.

1-2 Member of the Terminal Evaluation Team

The evaluation was jointly conducted by Mozambican and Japanese members. The members of the Joint Evaluation Team (hereinafter referred to as "the Team") were listed below.

1-2-1 Japanese Terminal Evaluation Team

No.	Field	Name	Present Occupation
1	Team Leader	Mr. Masahiro TAWA	Deputy Director General, Rural Development Department, JICA
2	Plan Management	Mr. Hiroyuki HANADA	Program officer, Arid and Semi-Arid Farming Area Division 1, Rural Development Department, JICA
3	Evaluation and Analysis	Mr. Toyomitsu TERAO	Consultant, Fisheries Engineering Co., Ltd.

1-2-2 Mozambican Terminal Evaluation Team

No.	Field	Name	Present Occupation
1	Team Leader	Mr. Inácio Tiago NHANCALE	Head of Technical Department, National Directorate of Agricultural Extension, Ministry of Agriculture
2	Member	Mr. Joel Juliao NHASSENGO	Official of Communication, National Directorate of Agricultural Extension, Ministry of Agriculture

1-3 Schedule of the Terminal Evaluation

The schedule is attached as Annex 1.

1-4 Methodology of the Terminal Evaluation

1-4-1 Method of Evaluation

The Project was evaluated jointly by the Mozambican and Japanese Terminal Evaluation Team, based on the project documents that include PDM, PO and the Record of Discussion (R/D). The evaluation covered review on reports and results of field surveys, as well as interviews with staff of the Ministry of Agriculture, HICEP and in the project target areas of Chokwe Irrigation Scheme (CIS), JICA experts, farmers participated in the Farmer Support Group (FSG) and other concerned personnel in the Project and related organizations. This Terminal Evaluation was conducted based on the following Five Evaluation Criteria.

1-4-2 Evaluation Criteria (Five Evaluation Criteria)

(1) Relevance

Relevance refers to the validity of the Project Purpose and the Overall Goal in connection with the development policy of the authorities concerned of Mozambique as well as the needs of beneficiaries and assistance policy of Japan.

(2) Effectiveness

Effectiveness refers to the extent to which the expected benefits of the Project have been achieved as planned. It also examines whether these benefits have been brought about as a result of the Project.

(3) Efficiency

Efficiency refers to the productivity of the implementation process. It examines whether the inputs of the Project have been efficiently converted into outputs.

(4) Impact

Impact refers to direct and indirect, positive and negative impacts caused by the implementation of the Project, including the extent to which the overall goal has been attained.

(5) Sustainability

Sustainability refers to the extent to which the Project can be further developed by the authorities concerned of Mozambique and the extent to which the benefits generated by the Project can be sustained under national policies, technology, systems and financial state.

2. Outline of the Project

2-1 Background of the Project

Mozambique has the land area of 799,380km^2 (180,000km^2 farming land) with a population of 23,929,708 (National Institute of Statistics, 2011), and about 80% of the working population is employed in agriculture. In the country, the consumption of rice is on the increase each year, estimated at 500,000 tons per annum (milled rice). Rice therefore is considered a priority cash crop with increasing demand, but its domestic production as paddy remains at 260,000 tons with the total cultivation area of 204,000 ha (thus an average yield is stagnating at 1.27 ton/ha) in 2009. Mozambique is importing more than 300,000 tons of rice annually to complement the limited domestic supply. As such, increasing rice cultivation productivity and raising food self-sufficiency ratio is an urgent issue in the country for ensuring food security.

In this regard, JICA with request from the Government of Mozambique implemented a project called "The Integrated Agricultural Development for Small Scale Farmers in Chokwe Irrigation Scheme" from March 2007 to March 2010 in Chokwe, Gaza Province, the largest irrigation scheme in Mozambique. According to the terminal evaluation conducted in December 2009, it was confirmed that the project was managed successfully to increase average yield of rice as well as to improve collection ratio of water fee. However, there are still several issues remained to be improved such as dissemination of improved rice cultivation techniques and the weak farming support system.

To this end, "Project for Rice Productivity Improvement in Chokwe Irrigation Scheme" (hereafter referred as "the Project") has been implemented for three years and ten months from February 2011 to November 2014. So far, the Japanese experts in the relevant fields (Chief Adviser / Rice Cultivation, Extension / Farmer's Organization, Agronomy, Irrigation/Water Management, Agricultural Machinery and Equipment / Mechanization, Coordinator / Training) have been dispatched.

2-2 Summary of the Project

The master plan of the project was provided in the R/D signed on October 5, 2010. The PDM for the Project had been modified two times so far. The version 1 was reviewed and agreed in the second JCC in June 2011, and the current version 2 was agreed in the sixth JCC in July 2013. The project narrative

summary described in the PDM version 2 is as follows (For more details, see Annex 2);

(1) Overall Goal

1. Farmer's annual income from rice production in the target area is improved.
2. Rice production in the Chokwe Irrigation Scheme is increased.

(2) Project Purpose

Rice productivity in the target area of Chokwe Irrigation Scheme is increased.

(3) Outputs

Output 1: Improved rice cultivation techniques of transplanting are disseminated to the target farmers.
Output 2: Improved rice cultivation techniques of direct sowing are developed.
Output 3: Improved rice cultivation techniques of direct sowing are disseminated to the target area.
Output 4: Activities of farmers groups are strengthened in the areas of the demonstration farms.
Output 5: The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.

3. Achievement and Implementation Process of the Project

3-1 Inputs

3-1-1 Japanese Side

(1) Dispatch of Experts

The experts were dispatched to the Project in the following fields: 1) Chief Advisor and Rice Farming, 2) Extension and Farmers Organization, 3) Agronomy, 4) Agriculture Machinery and Postharvest, 5) Irrigation/Water Management, 6) Socio Economy and Marketing, and 7) Coordinator and Training. For details, see Annex 3.

(2) Trainings in Mozambique and Japan

Until April 2014, three (3) persons from EAC, HICEP and SDAE have participated in different training courses in Japan. They received training mainly of postharvest processing, agriculture machinery and extension services, respectively. For details, see Annex 4.

(3) Provision of Equipment

Vehicles, motor bike, office equipment such as computers, printers, projectors and office furniture etc., and agricultural equipment such as pumps, rice milling machine, tiller, tractor with plowing attachment and trailer, and others, have been procured for the project activities. Cost for procurement of equipment is around 147 thousand US$ as of April 2014. For details, see Annex 5.

(4) Local Cost Allocated by Japanese Side

Local cost allocated by JICA for the implementation of the project activities is 52.8 million JPY (around 530 thousand US$) in total for the whole project term that include budget until October 2014. For details, see Annex 6.

3-1-2 Mozambican Side

(1) Assignment of Counterpart Personnel

At present 15 counterpart personnel in total are assigned, i.e. 2 persons from Ministry of Agriculture as

project director and counterpart personnel, one person from DPA Gaza as project coordinator, 6 persons of SDAE as project manager and counterpart personnel, 2 persons from HICEP, and 4 persons from EAC. For details, see Annex 7.

(2) Project Operation Cost Allocated by Mozambican Side

Project operation cost allocated by SDAE, HICEP and EAC for the implementation of the project activities is 1.9 million MT (around 63 thousand US$) in total for the whole project term that include budget until October 2014. For details, see Annex 8.

(3) Provision of Facilities

Office spaces for Japanese experts are provided at Chokwe by SDAE and HICEP. Experimental farming plot of 0.1ha is provided at the project target area by EAC.

3-2 Outputs

Output 1: Improved rice cultivation techniques of transplanting are disseminated to the target farmers.

Transplanting techniques was ensured in 2012/2013 and satisfactory results were achieved (For an example, 5.99 ton/ha was achieved as shown in the mid-term review study). However, the Output 1 will be difficult to achieve by the end of the Project, affected by facts that D6 suspended rice farming and FSG of D5 changed planting method to direct sowing in 2013/14 because of the damage from the flood in January 2013. Under the situation, all the demonstration plots for transplanting were closed. Rice cultivation in D6 will be resumed in 2014/2015 but FSG at D6 will adopt direct sowing method due to some reasons such as lower cost for transplanting than one for transplanting method.

The Project was begun with two technical approaches – transplanting and direct sowing. The Project will be finishing with demonstration plots of only direct sowing planting method, which is in the process of dissemination and modification to animal traction. The method of transplanting by the Project has left a record of 5.99 ton /ha, as reported by the Mid-term Review Study in 2013. Such project asset for transplanting is expected to be disseminated to farmers in, and even outside of, the CIS through the extension services under MINAG.

Indicator 1-1: Three (3) important techniques of 8 technical components of transplanting rice cultivation are adopted by 15% of farmers in the target area for transplanting

The indicator 1-1 will be difficult to achieve. In 2012/13, the farmers as many as 42 persons (around 9% of total 480 registered farmers) at D5 and D6 had demonstrated improved transplanting plots. However, in 2013/14, after the flood in January 2013, FSG at D5 selected direct sowing due to shortage of funding for transplanting, and the whole area at D6 suspended rice farming because of the damage of the main drainage canal No-2. Thus, all the demonstration plots for transplanting could not be opened in 2013/14, the final full cropping season during the project term.

Indicator 1-2: More than 50% of the farmers in the target areas where transplanting method is widely practiced are trained on appropriated techniques for irrigation facility maintenance and water use.

The indicator 1-2 will be mostly achieved as shown in the following table.

Tabel1: Farmer Training for Irrigation Facilities Maintenance and Water Use (Unit: person)

Areas	Registered Farmers	2nd Year 2011/12	3rd Year 2012/13	4th Year 2013/14	Total	(%)

D5	324	62	-	150	212	65
D6	156	38	-	50	88	56
D11	301	32	105	30	167	55
D12	423	-	104	50	154	36
R1	350	-	-	70	70	20
R3	169	-	-	70	70	41
Total	1,723	132	209	420	761	44

Source: Project, June 2014
Remarks: Numbers in the 4th Year are targeted numbers.

Output 2: Improved rice cultivation techniques of direct sowing are developed.
The Output 2 is achieved as shown in the following indicators.

Indicator 2-1: The yield in trial verification plots is increased by 60% compared to the farmers' plots at the beginning of the Project.

The base data in the beginning of the Project is given from the baseline survey. It gives 2.9 to/ha as an average of D11 and D12. Except for D12 in the 4th Year, all others exceed 4.6 ton/ha (160% of 2.9 ton/ha). Thus, the indicator 2-1 is achieved.
In the 4th year, various varieties production were in a priority position. By this reason, higher yields were not necessarily targeted. This may result in a lower yield at D12 in the 4th Year.

Table2: Yield Data in the 3rd and 4th Year

Year	D11	D12	Remarks
3rd Year	4.76 ton/ha	5.61 ton/ha	70% of the theoretical estimates
4th Year	5.57 ton/ha	4.21 ton/ha	Results of yield survey

Source: Project, June 2014

Indicator 2-2: Six (6) kinds of techniques are developed.

All six (6) kinds of techniques that comprise of plowing, sowing, water management, fertilization, weeding and harvesting were improved. Outcomes of the improvement are incorporated in the technical manual.

Indicator 2-3: Direct sowing manuals are prepared.

Indicator 2-3 will be achieved, as the technical manual is completed by the end of the Project.

Output 3: Improved rice cultivation techniques of direct sowing are disseminated to the target area.
So far as seen in the indicator, the Output 3 is achieved. It should be noted however that effects of training or extension to other farmers out of FSG are not clearly observed in the target areas. More reliable assessment of Output 3 would be made possible if follow-up study is done to know whether the farmers who participated in the training implement direct sowing as being trained and to record yield.

Indicator 3-1: More than 25% of the farmers in the target areas are trained on six (6) technical components of direct sowing rice cultivation.

The farmers who received training on six (6) technical components of direct sowing total 618 persons as of June 2014. The number corresponds to 36% of the total number of farmers in the CIS. The indicator 3-1 is achieved.

Output 4: Activities of farmers groups are strengthened in the areas of the demonstration farms.
Because of a bad road access during rainy season, FSGs were not organized at R1 and R3 and demonstration plots were not prepared, either. Except R1 and R3, Output 4 is achieved.

Indicator 4-1: The number of farmer's group members increases by 60%.

As of June 2014, total number of the members of FSG reaches at 107 persons which correspond to 2.6 times of 42 persons at time of establishment of FSG in the second year in 2011/12. The indicator 4-1 is achieved.

Indicator 4-2: Account records on the operations of the rice milling machines are properly maintained and annually reported to the WUA members.

Before the malfunction of the milling machine caused by the flood, the account had been well recorded by the group at Massavasse, but the one of the group at Muianga was needed to improve. Follow-up training was conducted for improving account capacity. The group account regulation is planned to be prepared by the end of the Project. The indicator 4-2 will be achieved by the end of the Project.

Indicator 4-3: Records of the revolving fund program are properly maintained and annually reported to the FSG members.

Training on account record for revolving fund was done for FSG. Follow-up training was also conducted for covering insufficient understanding. The account record was checked occasionally. Reporting of the record to the member farmers will be done after repayment from harvest in 2013/14. The indicator 4-3 will be achieved by the end of the Project.

Output 5: The implementation process of the plans and programs to support the farmers in Chokwe Irrigation Scheme by the implementing agencies is promoted through joint monitoring among the stakeholders.

The Output 5 is achieved as shown in the following indicators.

Indicator 5-1: The progress review meetings are held at least twice a year.

The JCC has been held twice a year and reviewed progress of the project activities. Before holding of JCC, the steering committee is held a few times and the implementation and coordination organizations checked progress of the annual operation plan. Accordingly, the indicator 5-1 is achieved.

Indicator 5-2: Joint monitoring sheets on the progress are prepared.

For monitoring of the Action Plan, four tools of Activity Log Sheet, Activity Result Report, Monitoring of activity and results and Activity implementation Program have been prepared and used. All these are applied to check for progress and achievement of outputs in the subject year. Accordingly, the indicator 5-2 is achieved.

3-3 Project Purpose
Project Purpose: Rice productivity in the target area of Chokwe Irrigation Scheme is increased.

The achievement indicator (average yield) for the project purpose is measured with comparison between

results of the baseline survey and results of the recent yield survey at demonstration plots of FSG for crop of 2013/14. Such comparison is possible at the water channel of D5, D11 and D12. Among these 3 water channel, the indicator has been achieved only at D11 and D12. Thus, the achievement shown in the indicator is rather limited. To see the achievement of the project purpose, however, other points of view need to be discussed. Some of such points are covered as below. Others are also reviewed in the implementation process (Section 3-4). Based on further consideration on these additional points of view, it is judged that the project purpose is achieved, except the activities that the Project could not control.

Transplanting has been practiced by many farmers at D5 for a long time. However, the members of FSG at D5 adopted direct sowing for cropping in 2013/14. Generally yield by direct sowing is lower than yield by transplanting. Despite of such disadvantage in yield, the FSG at D5 selected direct sowing because of its lower production costs and hence of possible higher total profits.

In cropping season of 2013/14, the whole area at D6 suspended rice farming because of damage at the main drainage canal. Thus, demonstration plots for transplanting at D5 and D6 could not be opened in 2013/14 and the newest yield data was thus not available at D6.

Less contribution was made to R1 and R3 by the Project due to a bad road access to the sites during rainy season. As a result, FSG was not organized and demonstration plots were not opened, while installation of the milling machine and provision of training were done.

As of June 2014, there are 6 FSGs and 107 member farmers at D5, D6, D11 and D12. The number of their total registered farmers is 1,204. Around 9% was thus organized to FSG. The members of FSG are core farmers of "farmer to farmer" extension approach. The ratio of 1 to 10 farmers is an ideal number for technology transfer from the FSG to the other farmers.

Implementation of "farmer to farmer" extension approach is not visible yet. Methods of FTF extension need to be more developed and the member farmers of FSG need to be more trained so that they can disseminate technical information to general farmers in a visible form. The activities for materializing such technical development were, however, not included clearly in the Project. It is expected on the contract that FSG conducts FTF extension as one of FSG activities.

Indicator: Average yield of rice is increased 1.1 t/ha in the target area by the end of the Project.

As shown in the following table, at D11 and D12, average yield was increased 1.1 ton/ha or more. However, at D5, average yield was decreased around 0.2 ton/ha. This is considered as a result in change of planting method at D5 as mentioned above. Direct sowing is practiced by 1.0% at D5, 4.3% at D6, 92% at D11 and 52.6% at D12 (Source: "Campanha Agricola 2011/12, Epoca Quente, Relatorio ate 06/06/12, HICEP).

Table3: Average Yield of Rice of Baseline Survey (2009/10) and FSG Yield Survey (2013/14)

Areas	Baseline: 2009/10		FSG: 2013/14	
	ton/ha	Method	ton/ha	method
D5 (Chokwe)	3.73	All	3.51	Direct sowing
D6 (Lionde)	2.57	All	-	-
D11 (Massavasse)	2.96	All	4.10	Direct sowing

D12 (Conhane)	2.58	All	4.00	Direct sowing

Source

1) FSG Yield Survey: Project, 2014

Number of surveyed FSG demonstration plots: 49 plots (D5), 23 (D11), 15 (D12)

2) Baseline Survey: Project, 2011

Number of surveyed farmers: 240 farmers

3-4 Implementation Process of the Project

3-4-1 Overall implementation process

In the first year (February 2011 to August 2011), the baseline study was conducted in April to May 2011. Based on the results of the baseline study, PDM-1 was finalized and the Detailed Work Plan was formulated.

In the second year (October 2011 to August 2012), a series of training for transplanting and maintenance of the water management facilities was conducted. Direct sowing (both for wet and dry land) was studied. Farmer support groups were organized and revolving funds were financed to their member farmers. Demonstration transplanting plots were set out as well.

In the third year (October 2012 to August 2013), in addition to the activities done in the second year, verification and demonstration plots for direct sowing were set out. In January 2013, CIS was widely inundated with high water overflow from the Limpopo River. The target areas of the Project were severely damaged. Rice crops were lost almost totally at D5 and D6, and at D11 and D12, rice could be harvested but yields were much less than usual.

In the fourth year (October 2013 to October 2014), FSG at D5 selected direct sowing for the season of 2013/14, and the whole area at D6 suspended rice farming in this season. Thus, demonstration plots for transplanting planned by the Project could not be opened this year, while demonstration and verification plots for direct sowing could be as planned.

3-4-2 Strategy of the Project

Strengthening of the extension service by SDAE at the project target areas would be necessary but it will take a long time, as the shortage of human resources and operation budget poses a main cause of the service's difficult operation.

The purpose of the extension done by the Project is to transfer, towards farmers, the techniques of direct sowing that are improved by the Project, as well as the techniques of transplanting that were presented by the previous project (2007 to 2010), "The Integrated Agricultural Development Project for Small Scale Farmers in CIS". In the previous project, through organization of the farming support groups, the "farmer to farmer" extension approach with provision of revolving fund and demonstration plots has made a remarkable achievement. Based on such experiences, the Project also fully adopted a "farmer to farmer" extension that is to be undertaken by farming support group (FSG).

3-4-3 Transition of PDMs and its background

The PDM-0 that was agreed at the time of conclusion of the R/D did not have numerical achievement indicators. Based on results of the baseline survey, the PDM-1 came to have numerical figures in some of, but not all of, the indicators and was approved by the second JCC in June 2011. Afterwards, for reflecting

development of the situations surrounding the Project that include effect of the flood in January 2013 and also for giving numeric to all the indicators, the Mid-term Review Team recommended to review the PDM and proposed a revised version in January 2013. The recommendation was later discussed and the revised version was approved by the 6th JCC in July 2013, which gave the PDM-2 (the current version).

3-4-4 Flood in the 3rd year

The inundation in Chokwe was first observed around at 09:00 am on 23 January 2013. The water level was rapidly increased afterwards and had reached at around 1.5m depth on the streets in Chokwe by evening of the same day. It was decreased to around 0.8m in the following morning, however, all the plots at D5 and D6 were totally inundated. An access road to Massavase Village (D11) was flooded, while another road to Conhane Village (D12) was not. Almost 100% of rice farming at D5 and D6 was damaged as plots were covered with mud of flood. It is estimated from a photo taken on 24 January 2013 that the water level at D5 and D6 reached around at 0.7m to 1 m. It is also estimated that D5 and D6 were inundated around for a week, though an exact water-covered period is unknown.

At D11 and D12, direct damage by the flood was not observed, though a shortage of irrigated water was caused later as some portions of irrigation channels were broken by the flood. The farmers at D5 and D6, where rice farming was severely damaged, had begun cultivation of maze and kidney bean from March or April 2013. Usually maze or vegetables are begun to be cultivated at the same plot after rice is harvested in April or May.

4. Results of Five Criteria Evaluation

4-1 Relevance

The relevance of the Project is high.

4-1-1 Consistency with the Government's policy and strategy

PEDSA "Strategic Plan for Agricultural Development (2011-2020)" was formulated in accordance with the direction given by PARP "Action Plan for the Reduction of Poverty (2011-2014)". The PEDSA is aimed to establish food security and to sustainably develop competitive farmers as one of the main objectives.

PROAGRI II (2007 to 2011) "Agricultural Sector Public Expenditure Program" that had been implemented with assistance from donors was aimed at improvement of agriculture productivity and income of farmer households with focus on support for small scale farmers, promotion of commercializing domestic agriculture products and sustainable management and conservation of natural resources.

PAPA "Plano de Acção para a Produção de Alimentos (Food Production Action Plan)" in 2008 was to develop agriculture production with objectives of improving food self-sufficiency and transcending imported food dependency. That is to say, increased food production and support for small scale farmers are prioritized state policies for the rural and agriculture development in Mozambique.

Under the framework of CARD "Coalition for African Rice Development" that was proposed in TICAD-IV in 2008, NRDS (2009) "National Rice Development Strategy" gives a direction to increase domestic rice production almost by five times from 2008 to 2018 and thus to decrease dependency on imported rice.

4-1-2 Consistency with the Japanese ODA strategy toward Mozambique

The Japanese government has been increasing support for the economic growth and poverty alleviation in Mozambique through various opportunities that include MDGs, PARP and TICAD-V.

The Country Assistance Strategy and Programs for Mozambique that was formulated by the Japanese Ministry of Foreign Affairs in March 2013 has a priority for cooperation in 1) Activation of Regional Economy including Development of the Corridors, 2) Human Resource Development, and 3) Disaster Prevention and Measures for Climate Change. The Project forms a component in "Activation of Regional Economy".

Mozambique is included in the first group of the candidate countries for support under the framework of the CARD. Implementation of the CARD was confirmed to continue in TICAD-V in 2013.

4-1-3 Target areas and Target groups

A majority of the farmers registered in the Chokwe Irrigation Scheme (CIS) is small scale holders. Beneficiaries of the Project is the small scale farmers who are practicing rice farming at land of 5ha or less, and the Project is intended to improve their rice farming technologies and to extend the outcomes towards them. Thus, the Project meets the needs of regional society. The CIS is the biggest irrigation scheme (26,000ha) and one of the main rice production areas in Mozambique where rice production is targeted to increase as the state policies. The CIS is therefore an appropriate area for implementing the Project.

4-1-4 Project approach

The project is aimed at improvement of productivity of rice farming. The achievement indicator is specified as an extent of increase of the yield. However, an increase of the yield would not result always in an increase of productivity including economic aspect, especially if cost is not appropriately controlled. One of the features of small scale farmers in the CIS is an occasional dependency on outsourcing of labor and machinery. In a course to implement the Project in the last three years, it was found that it is important condition for meeting the needs of the farmers to materialize the yield increase through controlling necessary costs. The project relevancy is ensured only when the yield is increased within amount of costs that farmers can bear. That point was not enough emphasized in the project design.

4-2 Effectiveness

The effectiveness of the Project is moderate.

4-2-1 Causal relation

As a result of limited contribution of the Project to the water channel district of R1 and R3, the project effectiveness for these two districts is smaller than the other target areas. Technical extension for general farmers is expected at the second step of "farmer to farmers" extension. It is not clear whether the current PDM includes the activity to implement such second step of extension. As shown in the table of Section 3-3, the yield of FSG at DS is lower than the one at the baseline survey. It should be however noted that cost of farming was also reduced through changing of planting method from transplanting to direct sowing. It is highly possible that profit was increased, and therefore it is considered that decrease of yield does not mean decrease of the project effectiveness. As shown in Section 3-3, FSGs at D11 and D12 have shown remarkable increase of yield. There are many other contributions of the Project that includes improvement of cost management, maintenance capacity for drainage canal and others, some of which are not made well visible yet.

4-2-2 Important factors that prevented the project purpose and outputs from being achieved

The commercial rice miller and seed distributer in the CIS withdrew all of its business operation except a research unit of seed after the flood in January 2013. This resulted in limited market channel to sell rice in view of farmers in the CIS, which might trigger a concern that purchase price of rice by traders might become down. Availability of seed was also remarkably reduced, which caused decrease of planned cultivation area of rice in the CIS to 2,500 ha in 2013/14. However, direct unfavorable effect to the Project was not found.

Affected by the flood in January 2013, rice crops of 2012/13 were lost almost totally at the water channel district of D5 and D6. The damage limited largely the farming activities of FSG and the extension activities by the Project.

Many farmers understand that effective plowing and fertilization are essential conditions for increasing yield. Nevertheless, since there is not sufficient number of agriculture machines in the CIS, appropriate timing of plowing is often missed. There also exist many farmers who cannot get credit to fund their plowing, fertilization and weeding.

The extension officers of SDAE are expected to assist farmers in improvement of agriculture production in the CIS. However, there seems to be almost no contact with many of the farmers due to unavailability of transportation. The extension officers are also occupied with various duties other than rice farming. It is noted that there is a certain need to develop specialists such as rice cultivation, post-harvest, mechanization, livestock and so on in SDAE.

4-2-3 Important factors that accelerated achieving the project purpose and outputs

The experiences gained by the previous project at D4 and D7 were utilized, which include "farmer to farmer extension" and separated management of revolving fund and financial operation of rice milling machine. The revolving fund contributed to activation of FSG, though further expansion of FSG to other areas is subject to additional supply of fund.

The Project identified high cost structure as one of the main problems in the small scale rice farming in the CIS. The Project prepared revolving fund that reduces unnecessary costs and also presented manual seeder. All these were aimed at reduction of costs or increase of production efficiency. The farmers have come to show their concern on these activities of the Project. This means that needs of the beneficiaries were successfully identified.

4-3 Efficiency

The efficiency of the Project is moderate.

4-3-1 Adequacy of the inputs by Japanese side

The inputs for human resources, machinery/equipment, training in Japan and others were made as planned. It had occasionally happened that the expert in charge could not be present in Chokwe when critical point of time in rice farming arrived and thus his/her continued activities were made difficult. Rice farming starts in October and ends at time of harvesting in April to May in the next year. Monitoring of the field activities by Japanese experts was delayed, because of technical reasons, as a result, some field observations were not properly conducted.

4-3-2 Adequacy of inputs by Mozambican side

Despite of the limited budget and human resource, SDAE and other counterpart organizations have paid significant efforts for giving planned inputs to implementing the project activities.

4-3-3 Generation of the outputs

Because of the flood in January 2013, rice crops were lost almost totally at the water channel district of D5 and D6, while at D11 and D12, rice could be harvested but yields were much less than usual. The members of FSG at these water channel districts had received similar damage and the water-damaged milling machine left obstacles in activities of the milling machine group. The flood had resulted in delay of generation of the Output 1 to 4.

Among the improved farming technologies in both transplanting and direct sowing, only prioritized ones were tried to disseminate. In addition, the revolving fund for FSG was prepared for covering costs only for plowing, seed and fertilizer in case of transplanting. Cost for weeding was further added in case of direct sowing. Such limited coverage of funding was intended to reduce excess or unnecessary costs. Likewise, improvement of the technologies to cope with high cost of rice farming in the target areas was undertaken in a course of the project implementation.

4-4 Impact

The impact of the Project is expected to be moderate.

4-4-1 Prospect for Achieving the Overall Goal

Overall Goal:

1. Farmer's annual income from rice production in the target area is improved.
2. Rice production in the Chokwe Irrigation Scheme is increased.

Indicator 1: Small scale farmer's annual income increases 45% in the target area by year of 2017.

Rice farming income of small scale farmers will be increased through approaches of increase in profit per land and increase of farming land itself. The Project has tried to clarify effects of improved farming technologies that are given to farming income. The study outcomes will be presented to SDAE by the end of the Project. After the Project, extended deployment of the FTF extension in wider areas will be needed in order to achieve the overall goal.

Indicator 2: Rice production increases by 80 % in the Chokwe Irrigation Scheme by year of 2017.

It may be possible to expand rice farming land in the CIS through repeated extension services of the improved direct sowing technologies. It should be noted however that renovation of irrigation facilities damaged by flood and improvement of salinity problem of land will be needed.

4-4-2 Other Impacts or spillover effects

The large scale farmers with financial capacities in the CIS may introduce the improved technologies by means of direct sowing (planting in lines at dry land), as it was observed that some of them have paid deep interests on technical development shown in the demonstration plots. The DNEA and DPA of Ministry of Agriculture have also paid a high concern on the extension service of direct sowing (planting in lines at dry

land) towards outside of the project target areas. It is reported that an officer in charge of agriculture extension from DPA once presented technologies of the direct sowing (planting in lines at dry land) at National Meeting for Periodic Review of technologies.

FSGs at D5 and D12 were organized mainly with housewives. Transplanting method requires intensive labor and cost inputs when transplanting rice seedling, which may give sometimes burden beyond role of housewives. Under such circumstance, the FSG at D5 began to undertake direct sowing in 2013/14. Understanding of other farmers on a success of the FSG at D5 in reducing labor and cost will enable and accelerate extension of the direct sowing at areas like D5 and D6 where transplanting is popular.

Due to its higher cost, traditional transplanting may not be able to expand rapidly its farming land. Compared with this, the direct sowing (planting in line at dry land) may be able to do, as it can reduce a considerable part of cost. This will generate a high economic impact in the agriculture sector.

4-5 Sustainability

The sustainability of the Project is moderate.

4-5-1 Policy Aspect

With objectives of improving food self-sufficiency and transcending imported food dependency, increase of domestic agriculture production and support for small scale farmers are highly prioritized in the state policies for the rural and agriculture development in Mozambique. In addition, under the framework of CARD proposed in TICAD-IV in 2008, NRDS (2009) directs to increase domestic rice production almost by five times from 2008 to 2018. These policies give continued support to projects for food production and developing rice farming.

4-5-2 Institutional Aspects

The main implementation organization for the Project is SDAE. The SDAE has a well-developed organization structure from director to extension officers for its institutional objectives. However, a number of the extension officers that SDAE deploys in the CIS for agriculture extension service is limited. It also seems that despite of its strong project ownership, SDAE has had only limited capacity in the budget and human resources for implementing the project activities.

(3) Financial Aspect

The current budget of SDAE is limited only in ordinary expenses for maintenance of building and facilities, energy cost and mobilization system of extension officers. While HICEP has been able to undertake repairs for the irrigation facilities with financial support from the donors, SDAE seems not to have such development or capital budgets. The Project has developed "farmer to farmer" extension in the target areas that requires initial investment for revolving fund. It will be difficult to extend the "farmer to farmer" extension to other areas in case that the initial capital is not secured.

(4) Technical Aspect

Transplanting is based on technologies that have been developed at irrigated land, and hence it can be adopted only at land where similar conditions are observed. Direct sowing at dry land that is not depended on irrigation facilities to less extent has a wider range of applicability and may be extended to other areas more easily.

4-6 Conclusion of the Evaluation

Mainly due to effects from the floods in January 2013, the indicator of PDM shows limited performance. So far as observing the indicator, the project purpose would be difficult to attain by the end of the Project. However, when looking on the main point of the Project – that is to say, development of small scale rice farming, it is found that the Project has made a substantial progress in improvement of the technologies to cope with high cost structure of the small scale rice farming in Chokwe Irrigation Scheme. It is expected that Mozambican side's continued efforts will expand the outcomes from the Project and achieve the overall goals in the future. Therefore, the Joint Evaluation Team judged that the Project can be terminated in October 2014 as initially scheduled.

5. Recommendations

Based on the conclusion above, the evaluation team recommends the below items:

5-1 Documentation of the useful experiences of the Project

The Project has made many trial activities that include cost survey, variety comparison, social survey, marketing trials and others. These experiences will be useful if documented and shared with other local and international organizations concerned.

5-2 Extension by FTF

For further development of "farmer to farmer" (FTF) extension, continuation of support for Farming Support Group (FSG) and cultivation of extension officers will be required to continue. The manual for the rice farming technologies improved by the Project will be useful if shared with other donors and NGOs concerned.

5-3 Project design

The road access to R1 and R3 should have been reviewed at time of the project design. Likewise, alignment of the experts that meets to the cropping season should have been planned carefully. These lessons should be noted by the project officers involved.

5-4 Collaboration among stakeholders (farmers, SDAE, HICEP and EAC)

For the sake of understanding issues farmers face and their needs as well as promoting dissemination of the developed techniques such as rice cultivation, irrigation facilities maintenance and water use, it is essential to strengthen linkage between farmers and research and extension fields, in other words, specifically EAC and SDAE. It is requested to EAC to invite extension officers of SDAE for more trainings or workshops to improve their farming skills and knowledge. In addition, through DPA's cooperation, workshops or seminars in terms of enhancement of farmers' organizational strength are requested to be hold. The stakeholders are needed to recognize their roles in rice farming activities including postharvest.

5-5 To Extend the Revolving fund

The revolving fund was found useful for developing FSG. To extend deployment of FSG furthermore, Ministry of Agriculture will need to take necessary measures for funding production and marketing activities.

5-6 Production and Profit

The production area and yield level should take into consideration break even point

6. General Observations

6-1 Technical Aspects

- Possibility of usage of the rice husk and crop residue for cattle feeding (hey/silage production), compost and soil covering.
- The need to continue to teach the farmers in both methods of cultivation, namely transplant and direct sowing, for the fact of both methods are still of relevance in the practices of the local farmers.
- The need to adapt the direct sowing machine for animal traction, due to weight that has when pulled by the farmers especially women.
- The rice milling groups include other members of other associations in the processing of their production.
- The need to consider a problem that worries the farmers namely plagues (mice and birds). According to the farmers, mice create more damages than birds, not attacking only the rice but also the cucumber and green bean. There is a need to consider countermeasures to control them.
- The need of training for other FSG in association (DNEA) and leadership matters, before the end of the project, taking advantage of the Japanese experts presence.
- With the Japanese specialists' attendance, there is a need to introduce the Farmer Field School (FFS) methodology as an appropriate method to expand the extension based on the FTF approach to assist more farmers (DNEA).

6-2 Learning Outcome of the Project for Farmers and Extension Officers

The farmers and extension officers learned new cultivation techniques with the Japanese experts as follow:

- The preparation of soils using the "puddling" method
- The practice of transplanting and direct sowing planting methods
- Efficient water management and direct sowing without affecting seed germination (rottenness of the seed), as it happened before the project
- The fertilizer split application in rice production

As a result, reducing the production cost from 35.000,00 MT to 13.000,00 MT/ha.

6-3 Farming Challenges

- How to secure the maintenance and cleaning of the drainage canals
- How to secure the rice harvesting using combine harvester, under administration of HICEP
- How the rice farmers secure resilience from the negative effects of the 2013 flood and other possible disasters
- How to ensure rice seed availability locally involving local companies

REPUBLIC OF MOZAMBIQUE
MINISTRY OF AGRICULTURE

THE PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT IN CHOKWE IRRIGATION SCHEME (PROMPAC)

MINUTES OF MEETINGS ON THE NINTH JOINT COORDINATING COMMITTEE (JCC9)

The ninth Joint Coordinating Committee meeting (JCC9) between members of the Ministry of Agriculture (hereinafter referred to as "MINAG") and the Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Kiyoshi MASUBUCHI was held on 19th of September, 2014 at the District Office in Chokwe. JCC meeting was conducted under chairmanship of the Project Director, National Director of Agricultural Extension MINAG to discuss the achievement of the project and Introduction of Post-Project Work Plan proposed by the Project for Rice Productivity Improvement in Chokwe Irrigation Scheme (hereinafter referred to as "the Project") in the Republic of Mozambique.
As a result of discussion, both sides agreed to the matters in the documents attached hereto.

Chokwe, 19, September, 2014

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Japan International Cooperation Agency
Japan

Witnessed by

Mr. Katsuyoshi SUDO
Resident Representative
Japan International Cooperation
Agency (JICA) Mozambique Office

Attached Document

Major Points Discussed

1. The achievement of the Project

The Project Team presented the achievement of the project through four years in the JCC meeting and the Report was approved by JCC. The summary of project achievement through project term was presented by Mr. Mugabe, the PROMPAC Project Manager from SDAE. The JCC appreciated the achievements and efforts made by the Project stakeholders through the Project implementation although some activities were not able to be completed due to flood damage.

2. Proposed Post-Project Work Plan

The Project Team proposed a post-project work plan which includes the strategies and activities to achieve the project overall goal after three years and the work plan was discussed and approved by JCC. The continuous collaboration for the implementation and monitoring of the work plan by SDAE, HICEP and EAC during post-project were also discussed. JCC welcomed the continuous efforts toward achieving overall goal and expected the continuous progress through the collaboration of the project stakeholder. A detail of proposed post-project work plan is shown in Annex III.

ANNEX I: Agenda of JCC9

ANNEXII: Participants List

ANNEXIII: Post-Project Work Plan

Appendix 5: Record of Provided and Imported Machinery and Equipment

- 5-1 Record of Provided and Imported Machinery and Equipment

No.	Purpose of Use	Arrival Date	Name of Machinery	Product No.	Maker	Price	Installation Place	Current Condition
1	Transportation of expert	02/03/2011	Vehicle	Nissan Hardbody	Nissan	29,979USD	SDAE Parking	in service
2	Document preparation	05/03/2011	Printer	P2055d	Hp	18,000 MT	Project Office	in service
3	Extension service	11/03/2011	Motor cycle	XL125SDK XL125S	Honda	4,637USD	Extension agents	4 in service
4	Protection of PC, scanner and printer	12/03/2011	UPS stabilizer	UPS1250VA	Evolution PRO	4,395 MT	Project Office	in service
5	Document preparation	02/04/2011	PC Desktop	500B Desktop	Hp	29,700 MT	Project Office	in service
6	Document preparation	02/04/2011	PC soft	Microsoft Office 2010	Microsoft	10,000 MT	Project Office	in service
7	Document preparation	02/04/2011	Scanner	G2710	Hp	4,600 MT	Project Office	in service
8	JCC, seminar	23/04/2011	Projector	CE591B	Acer	25,000 MT	Project Office	in service
9	recording project activity	23/04/2011	Digital camera	Cyber-shot DSC-W530	Sony	6,999 MT	Project Office	in service
10	Document preparation	11/06/2011	Printer	P2055d	Hp	18,000 MT	Project Office	in service
11	Document preparation	11/06/2011	Laptop Pc	ROBOOK 4520s	Hp	30,000 MT	Project Office	in service
12	Document preparation	11/06/2011	Scanner	G2710	Hp	4,600 MT	Project Office	in service
13	JCC, seminar, training	11/06/2011	Projector	EX-100	Sony	26,000 MT	Project Office	in service
14	Document preparation	11/06/2011	Color printer	C1515N	Hp	15,600 MT	Project Office	in service
15	Document preparation	28/06/2011	Copy machine	ir2025i	Canon	116,048.50 MT	Project office	in service
16	Land preparation	04/07/2011	Rotary	MXK2000	Niplo Matsuyama	1,050,000 ¥	SDAE Parking	in service in specific period
17	Land preparation	04/07/2011	Chisel plow	MSC8PSL	Sugano Nouki	789,600 ¥	SDAE Parking	in service in specific period
18	Irrigation	05/07/2011	Irrigation pump	CWD100LE 4"	Changfa	33,600 MT	EAC	in service
19	Irrigation	05/07/2011	Irrigation pump	CWD80LE 3"	Changfa	27,500 MT	EAC	in service
20	Post harvest	02/11/2011	Rice milling machine	YMM20	Yanmar	587,436 MT	Massavasse Muianga	in service in specific period
21	Land preparation	09/11/2011	Power tiller	YZC-D	Yanmar	16,037.06 USD	SDAE Warehouse	in service in specific period
22	Land preparation	09/11/2011	Trailer for power tiller	MW300	Yanmar	2,138.26 USD	SDAE Parking	in service in specific period

No.	Purpose of Use	Arrival Date	Name of Machinery	Product No.	Maker	Price	Installation Place	Current Condition
23	Land preparation	10/11/2011	Tractor	JD-5503	John Deere	750,000 MT	SDAE Parking	in service in specific period
24	Land preparation	10/11/2011	Disc harrow (tractor)	SH16	Bain	124,159 MT	SDAE Parking	in service in specific period
25	Land preparation	10/11/2011	Disc plow (tractor)	SP 3/3	Bain	185,672 MT	SDAE Parking	in service in specific period
26	Land preparation	10/11/2011	Trailer for tractor	MS071	BON-ART	355,637 MT	SDAE Parking	in service in specific period

ENTREGA DE EQUIPAMENTO

PROJECTO: Projecto para melhoramento da Produtividade do Arroz no Sistema do Regadio do Chókwè (PROMPAC), JICA

Por meio deste documento certifica-se que a JICA "Agência Japonesa de Cooperação Internacional", entregou o equipamento do Projecto "PROMPAC" mencionado na lista abaixo à Direcção Nacional de Extensão Agrária, Ministério da Agricultura (DNEA, MINAG) na sua qualidade de beneficiário do Projecto.

Lista de Equipamentos(1)

Number	Description/Name of Equipment/Goods	Specification · Standard	Quantity
1	Project Vehicle	Nissan Hardbody AAY381MP/AAY363MP	2
2	Printer	HP Laserjet P2055d Duplex Printer	2
3	Printer	HP Laserjet C1515N Colour Printer	1
4	Project Motorbike	Honda XL125SDK/XL125S	5
5	Desktop Computer	HP 500B Desktop PC Intel Pentium E5400	2
6	Laptop Computer	HP-PROBOOK 4520s	1
7	Projector	Acer-CE591B	1
8	Projector	SONY EX-100	1
9	Copy Machine	Canon ir2025l	1
10	Rotavata	NIPLO ROTARY TILLER MXK2000	1
11	Chisel Plow	SUGANO MSC8PSL	1
12	Water Pump	CHANOFA CWD100LE 4"	1

Lista de Equipamentos(2)

Number	Description/Name of Equipment/Goods	Specification · Standard	Quantity
13	Water Pump	CHANGFA CDW80LE 3"	1
14	Rice Mill Machinery	Yanmar YMM 20	2
15	Power Tiller	Yanmar YZC-D 10.5hp 2400rpm	2
16	Trailers for the Power Tiller	Yanmar MW300	2
17	Tractor	John Deere JD-5503	1
18	Disc Harrow for the Tractor	3 Discs SH16	1
19	Disc Plow for the Tractor	16 Discs SP 3/3	1
20	Trailer for the Tractor	MS071 3 tons	1

Sr. Katsuyoshi SUDO

Representante residente de ecritório da JICA em Moçambique

Sr. Fernando MAVIE

Director Nacional de Extensão Agrária, Ministério da Agricultura

Maputo, 19 de Septembro, 2014

Appendix 6: Reference to Output 1

- 6-1 Result Report
- 6-2 Transplanting Demonstration field (2^{nd} year and 3^{rd} year)
- 6-3 Irrigation and Water management

Activity code:1-1/11/14

Title of activity

Examination and development of effective extension methods

Activity realized

a) Collection and analysis of documents of current extension methods.

b) Hearing of opinions of farmers

c) Propose of possible alternative methods (farmers to farmers' diffusion)

Responsible person: SDAE/DPA Gaza/JICA

Objectives

To introduce accessible extension method

Methodology applied

a) Hearing the current extension methods at SDAE and farmers.

b) Field survey and study the current rice farming of small scale farmers.

c) On the job training (OJT) of farmers through operation of model farms in farming support group.

Results obtained

a) Estimation of production cost of traditional/improved rice cultivation

Land preparation

Type of work	Field work performance (hr/ha)	Operation cost (Mt/ha)	Fuel consumption (lit/hr)	Remarks
Land preparation				
Plowing (animal traction)	7.6	2,377.78	-	Field work performance: 7.6 days/ha (all work of plowing, harrowing, plotting included), Field survey, Field survey D5, D11, D12, R1-3, 2014
Plowing (disk plow, tractor)	4.9	2,377.85	n.a.	Field work performance: 4.9 days/ha (all operation included), Field survey D5, D11, D12, R1-3, 2014
Plowing (manual work)	540.0	3,100.67	-	All work of plowing, harrowing, plotting included, Field survey D5, D11, D12, R1-3, 2014
Harrowing (animal traction)	n.a.	1,292.31	-	Field survey D5, D11, D12, R1-3, 2014
Harrowing (disk harrow, tractor)	n.a.	1,177.23	n.a.	Field survey 2014, Field survey D5, D11, D12, R1-3, 2014
Chisel plowing (tractor)	3.9	1,813.54	3.91	Tractor: JD5503 75HP, chisel plow: SGANO MSC8PSL, width 220cm, Field test 2013/2014
Rotary cultivation (tractor)	3.6	3,504.47	7.95	Tractor: JD5503 75HP, rotary cultivator: NIPLO MXK2000(width 2m), Field test 2013/2014
Plotting (animal traction)	n.a.	564.71	-	Field survey D5, D11, D12, R1-3, 2014
Plotting (tractor)	n.a.	778.34	n.a.	Field survey 2014, Field survey D5, D11, D12, R1-3, 2014
Puddling (power tiller)	17.5	2,503.72	0.76	Power tiller: Yanmar YZC-D10.5HP (leveling work included), Field test 2013/2014
Puddling (manual work)	n.a.	2,800.00	-	Wage: 70Mt/cantero、Field survey (D5), 2012

Note Number of cantero/ha (2014 farmers survey)

Transplanting: 100 cantero/ha, D5 FSG 152 cantero/ha

Direct sowing: 40 cantero/ha

Cultural practice

Type of work	Field work performance (Men*Hour/ha)	Wage	Total cost (Mt/ha)	Remarks
Sowing/transplanting				
Sowing (broadcasting)	1.2	220	220.00	Field survey D5, D11, D12, R1-3, 2014
Sowing (line sowing by manual seeder)	3.6	151.96	-	Manual seeder: 4 rows (width 1m), hill to hill: 15 cm, row to row: 25 cm, 2 persons/seeder, Field test 2013/2014
Transplanting (line planting)	173	100	2,162.50	20 cm x 25 cm, 3 seedlings/hill, Field test D5, D6, D11, and D12,
Nursery preparation				
Nursery preparation (flood nursery)	70	100.0	875.00	Field test, EAC field, 5person x 7 hours (leveling, irrigation canal making, nursery making), nursery for 0.5 ha of main field, 2013
Nursery preparation (traditional)	17.0	64.0	354.88	Field survey D5, D11, D12, R1-3, 2014
Seed selection	30	100	375.00	Field test, 6 persons x2.5 hours, nursery for 0.5 ha of main field, 2013
Sowing and seed covering (nursery)	32	100	400.00	Field test EAC field, 4 persons x4 hours, nursery for 0.5 ha of main field, 2013
Uprooting seedling	4	100	47.50	Field test D5, D6, D11, and D12, Variety verification plots, 2013
Bird scaring (nursery)	20	150	3,000.00	Field test, EAC field, 1 person x10 days (after seed sowing), nursery for 0.5 ha of main field, 2013
Bird scaring	1,293	2,000	6,318.55	Wage unit Mt/ha/person, average period: 56 days, Field survey D5, D11, D12, R1-3, 2014
Fertilizer application and weeding				
Fertilizer application	6.8	200	540	Wage: 200 Mt/day/person, Field survey D5, D11, D12, R1-3, 2014
Weeding (herbicide)	17	218	587	Wage: 218 Mt/day/person, Field survey D5, D11, D12, R1-3, 2014
Weeding (manual, direct sowing)	192	82	3,698	Wage: 82 Mt/cantero, Field survey D5, D11, D12, R1-3, 2014
Weeding (manual, transplanting)	383	43	3,347	Wage: 43 Mt/cantero, Field survey D5, D11, D12, R1-3, 2014
Harvesting (manual)				
Cutting	508	62	5,816.66	Wage: 62 Mt/cantero, Field survey D5, D11, D12, R1-3, 2014
Carrying paddy for threshing	201	100	1,199.49	Wage: 100 Mt/day, Field survey D5, D11, D12, R1-3, 2014
Packing (bag)	5.30	100	66.25	Yield: 3 ton/ha, Field test D11(verification plot), 2013
Threshing	154	123	3,647.29	Wage: 123 Mt/day, Field survey D5, D11, D12, R1-3, 2014
Harvesting (combine harvester)				
Combine harvester	2	n.a.	3,400.00	2 hour/ha, Field survey D5, D11, D12, R1-3, 2014

Material

Material	Quantity per ha		Unit price (Mt)	Total cost	Remarks
	Amount	Unit			
Seed					
Transplanting (random planting)	100	kg	34.00	3,400.00	Subsidized price (SDAE): 17 Mt/kg
Transplanting (line planting)	50	kg	34.00	1,700.00	Field test D5 and D6 (verification plot), density: 20cm x 25cm, 20 hills/m^2, germination: more than 80%
Broadcasting (direct sowing)	200	kg	34.00	6,800.00	Field survey D11and D12, 2013
Broadcasting (direct sowing)	150	kg	34.00	5,100.00	Field test, EAC field, 2013
Line sowing (direct sowing)	100	kg	34.00	3,400.00	Manual seeder: 4 rows (width 1m), hill to hill: 15 cm, row to row: 25 cm, 2 persons/seeder, Field test D11 and D12, 2013
Fertilizer					
Improved technique	2	bag (50 kg)	1,550	3,100	Urea 100 kg/ha, Field survey D5, D11, D12, R1-3, 2014
Traditional technique	0	-	1,550	0	No fertilizer application or 25 - 50 kg/ha
Herbicide					
Propanil (MT/20lit.)	8	lit	200	1,600	Price: 4,000Mt/20lit, Field survey D5, D11, D12, R1-3, 2014
MCPA (MT/20 lit)	4	lit	180	720	Price: 3,600Mt/20 lit, Field survey D5, D11, D12, R1-3, 2014
Ronster	2	lit	500	1,000	Price: 2,500 Mt/5 lit, Field survey D5, D11, D12, R1-3, 2014

b) Field performance and agricultural machinery

Puddling
Power tiller: Yanmar YZC-D

Sample number	Place	Date	Area m^2	Working hour (min)	Field work performance (ha/hour)	Working efficiency (hour/ha)	Gear ratio/revolut ions	Fuel consumption (lit/hour)	Working speed (km/hour)	Remarks
1	D11	10 Dec. 2012	1,200	68	0.11	9.44	-	n.a.	2.46	No leveling
2	D12	15 Dec. 2012	891	88	0.06	16.46	-	n.a.	n.a.	No leveling
3	D5	18 Jan. 2013	780	75	0.06	16.03	-	n.a.	n.a.	No leveling
4	D6	9 Jan. 2013	1,078	78	0.08	12.06	-	0.76	1.74	No leveling
5	D6	9 Jan. 2013	1,078	65	0.10	10.05	-	n.a.	n.a.	Leveling
6	EAC	20 Dec. 2012	500	88	0.03	29.33	-	n.a.	n.a.	puddling +leveling
7	EAC(Nerica)	20 Dec. 2012	460	86	0.03	31.16	-	0.76	n.a.	puddling +leveling
1	EAC (variety)	14 Dec. 2013	600	78	0.05	21.67	-	0.77	2.22	Puddling and leveling
2	EAC (Langa)	9 Jan. 2014	2,100	145	0.09	11.51	-	n.a.	-	Puddling and leveling
				Av.	0.07	17.52		0.76	2.14	
				Median	0.06	16.03		0.76	2.22	
				STDEV	0.03	8.16		0.01	0.37	
				Av.	0.06	10.80		0.38	1.40	No leveling
				Av.	0.05	23.42		0.76	2.22	Puddling and leveling

Rotary cultivation
Tractor: JD5503 75HP
Rotary cultivator: NIPLO MXK2000 (width 2m)

Sample number	Place	Date	Area m^2	Working hour (min)	Field work performance (ha/hour)	Field work efficiency (hour/ha)	Gear ratio revolutions	Fuel consumption (lit/hour)	Working speed (km/hour)	Remarks
1	D11	10 Nov. 2012	3,658	72.0	0.30	3.28	A1/1500rpm	n.a.	n.a.	-
2	D11	do	3,999	81.0	0.30	3.38	A1/1500rpm	n.a.	n.a.	-
3	D11	do	3,472	67.0	0.31	3.22	A1/1500rpm	n.a.	n.a.	-
4	D11	do	1,245	26.0	0.29	3.48	n.a.	n.a.	n.a.	Operated by Sitoe
5	D12	14 Nov. 2012	5,000	123.0	0.24	4.10	A1/2400rpm	8.68	n.a.	-
6	D6	29 Nov. 2012	4,224	69.5	0.36	2.74	A1/ 2000rpm	n.a.	1.92	-
7	D5	28 Nov. 2012	2,896	42.1	0.41	2.42	B1/1500rpm	n.a.	1.90	-
8	EAC	-	5,000	58.0	0.52	1.93	n.a.	9.31	4.68	By Izuka
9	D11	7 Nov. 2013	4,800	245.00	0.12	8.51	A1/2000rpm	6.05	1.88	2 rotary cultivation
10	D12	15 Nov. 2013	4,960	166.00	0.18	5.58	A1/2000rpm	7.01	2.83	2 rotary cultivation
11	D12	28 Nov. 2013	1,800	87.00	0.12	8.06	A1/2000rpm	-	2.69	2 rotary cultivation
12	D12	29 Nov. 2013	1,800	44.00	0.25	4.07	A1/2000rpm	4.09	2.68	1 rotary cultivation
13	D11	4 Dec. 2013	1,800	44.00	0.25	4.07	A1/2000rpm	8.86	2.71	2 rotary cultivation
14	D11	4 Dec. 2013	1,800	48.00	0.23	4.44	A1/2000rpm	8.13	2.69	2 rotary cultivation
15	D5	10 Dec. 2013	1,275	46.00	0.17	6.01	A1/2000rpm	6.65	2.72	2 rotary cultivation
16	D5	10 Dec. 2013	1,275	19.00	0.40	2.48	A1/2000rpm	11.68	2.75	1 rotary cultivation
17	D5	10 Dec. 2013	1,445	24.00	0.36	2.77	A1/2000rpm	8.25	2.83	1 rotary cultivation
18	D5	10 Dec. 2013	1,360	49.00	0.17	6.00	A1/2000rpm	8.69	2.79	2 rotary cultivation
				Av.	0.28	3.62		7.95	2.70	
				Median	0.27	3.78		8.25	2.71	
				STDEV	0.11	1.88		1.97	0.70	

Land preparation Chisel plowing
Tractor: JD5503 75HP
Chisel plow: SGANO MSC8PSL, width 220cm

Sample number	Place	Date	Area m^2	Working hour (min)	Field work performance (ha/hour)	Working efficiency (hour/ha)	Gear ratio revolutions	Fuel consumption (lit/hour)	Working speed (km/hour)	Remarks
1	D11	21 Nov. 2012	4,950	45.00	0.66	1.52	B2/n.a.	3.30	6.00	After disk plowing
2	D6	27 Nov. 2012	4,224	81.38	0.31	3.21	A3/1500rpm	n.a.	2.85	Twice (no plowed field)
3	D5	28 Nov. 2012	2,896	57.98	0.30	3.34	A3/1500rpm	4.33	3.10	Twice (no plowed field)
4	D11	4 Nov. 2013	4,800	222	0.13	7.71	A3, 1500rpm	4.11	1.62	Two plowing, no disk plowed field
				Av.	0.35	3.94		3.91	3.39	
				Median	0.31	3.27		4.11	2.98	
				STDEV	0.22	2.64		0.54	1.85	

Summary

Line sowing by manual seeder

Specification: 4 rows sowing, width 1.0m, row to row distance 15 cm, hill to hill distance 15 cm, seed rate 100 kg/ha

Field performance data

Sample number	Place	Date	Working hour (min)	Working area (m^2)	Working speed (km/hour)	Field work performance (ha/hour)	Field work efficiency (hour/ha)	Number of seeder	Seed covering (%)	Remarks
1	D11	10 Nov. 2012	103.0	3,829	2.76	0.22	4.49	2	94.8	one rotary
2	D12	23 Nov. 2012	33.8	888	2.23	0.22	5.59	2	95.5	one rotary
3	D5	30 Nov. 2012	4.3	181	2.53	0.25	4.00	2	97.2	one rotary
4	D6	1 Dec. 2012	2.1	96	2.94	0.29	3.68	2	97.8	one rotary
5	D11#1	8 Nov. 2013	26.0	975	3.31	0.23	4.44	2	91.9	one rotary
6	D12 #1	15 Nov. 2013	29.0	1,628	3.14	0.34	2.97	2	94.3	one rotary
7	D12 #2	28 Nov. 2013	27.0	1,560	4.56	0.35	2.88	1	-	two rotary, no coverage count (rain)
8	D12 #2*1	28 Nov. 2013	7.0	240	4.56	0.21	4.86	2	-	two rotary, no coverage count (rain)
9	D12 #3	29 Nov. 2013	24.0	1,800	4.01	0.45	2.22	2	97.0	Plot#3 two rotary
10	D11#2	4 Dec. 2013	29.0	1,800	3.56	0.37	2.69	2	96.6	Plot#2, one rotary
11	D11#3	4 Dec. 2013	25.0	1,800	4.03	0.43	2.31	2	96.8	Plot#3 one rotary
12	D5 #1	10 Dec. 2013	18.0	1,275	4.39	0.43	2.35	2	95.3	Plot#1 one rotary, Macassane
13	D5 #2	10 Dec. 2013	21.0	1,275	4.40	0.36	2.75	2	95.2	Plot#2 one rotary, IRGA409
14	D5#3	10 Dec. 2013	23.0	1,445	3.82	0.38	2.65	2	94.0	Plot#3 one rotary , Farox
15	D5 #4	10 Dec. 2013	21.0	1,360	4.12	0.39	2.57	2	95.9	Plot#4, one rotary, Alvorada
16	D11	10 Nov. 2012	103.0	3,829	2.76	0.22	4.49	2	94.8	one rotary
17	D12	23 Nov. 2012	33.8	888	2.23	0.22	5.59	2	95.5	one rotary
18	D5	30 Nov. 2012	4.3	181	2.53	0.25	4.00	2	97.2	one rotary
19	D6	1 Dec. 2012	2.1	96	2.94	0.29	3.68	2	97.8	one rotary
				Av.	3.41	0.31	3.59	2.00	95.7	
				Median	3.31	0.29	3.68		95.5	
				STDEV	0.81	0.08	1.10		1.55	

Note: *1:caluculated as 2 seeder work (1 seeder delayed initiation)

Rice milling machine YMM 20

Capacity: 500kg/hour

Sample number	Place	Date	Working hour (hour)	Processed paddy (kg)	Working performance (kg/h)	Working efficiency (hour/kg)	Fuel consumed (lit)	Fuel consumption (lit/hour)	Theatrical processing capacity (kg)	Processing efficiency (70%)	Actual processing efficiency (%)	Remarks
1	Massavasse	July 2012	73.92	12,882	174.27	0.0057	122.11	1.65	36,960	25,872	49.8	-
2	do	August 2012	46.67	11,715	251.02	0.0040	120.00	2.57	23,335	16,335	71.7	-
3	do	Sep. 2012	28.49	8,633	303.02	0.0033	80.00	2.81	14,245	9,972	86.6	-
4	do	Oct. 2012	32.53	5,438	167.17	0.0060	80.79	2.48	16,265	11,386	47.8	-
				Av.	223.87	0.0048	100.72	2.38	22,701	15,891	64.0	
				Median	212.64	0.0049	100.39	2.53	19,800	13,860	60.76	
				STDEV	65.00	0.0013	23.49	0.50	10,274	7,192	18.57	

c) Operation cost of machinery

Type of work	Rotary cultivation	Chisel plow cultivation	Puddling by power tiller	Manual seeder
Name of machinery	NIPLO MXK2000	SGANO MSC8PSL	Yanmar YZC-D	Chokwe made
Field work performance (ha/hour)	0.28	0.35	0.07	0.31
Field work efficiency (hour/ha)	3.62	3.94	17.52	3.59
Fuel consumption (lit/h)	7.95	3.91	0.76	0.00
Useful life (years)	5	5	5	5
Annual fixed cost ratio (%)	26.25	26.25	21.67	24.00
Price of machinery (Mt.)	399,543	300,457	218,120	5,515
Fixed cost (Mt/year)	251,130	218,360	47,266	1,324
Variable cost (Mt/ha)	2,151	886	1,122	144
Workable area (ha/year)	186	235	34	157
Workable hours/year	960	960	720	720
Operation cost (Mt/ha)	3,504	1,814	2,504	152

Note

(1) Useful life (years): tractor (JD5503 75HP) 8 years, unite price: 750, 000 Mt.

(2) Workable are of rotary and chisel plowing: 120 days (Oct. to Jan., 30 days/month, 8 hours/day)

(3) Workable area of puddling and manual seeder: 90 days (Oct. to Dec., 30 days/month, 8 hours/day)

c) Technical problems of field management of rice cultivation are identified. (seedling age and planting density in transplanting,

Effect of seedling age on yield

Treatment	Hill/m^2	Panicle/m^2	Spikelet/panicle	Spikelet/m^2	Filled spikelet (%)	1000 grain weight (g)	Yield (t/ha)
Improved (average)	36.3	273	107.6	29,004	74.7	26.4	5.68
	0.339ns	0.809**	0.456ns	0.810**	0.47ns	0.157ns	-
Traditional (average)	35.8	236	109.3	26,285	76.9	27.05	5.36
	0.062ns	0.800**	0.432ns	0.949**	-0.619ns	0.269ns	-

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

Effect of land preparation method on yield

Treatment	Hill/m^2	Panicle/m^2	Spikelet/panicle	Spikelet/m^2	Filled spikelet (%)	1000 grain weight (g)	Yield (t/ha)
Power tiller (average)	50.2	315	105	32,920	76.2	25.97	6.51
Manual (average)	36.0	221	112	24,692	79.2	27.13	5.26
	0.561*	0.795**	0.154ns	0.155ns	0.154ns	-0.377ns	-

Correlation coefficient: ** significant at 1 % level, * significant at 5% level, ns no significant

d) Introduction of promising variety

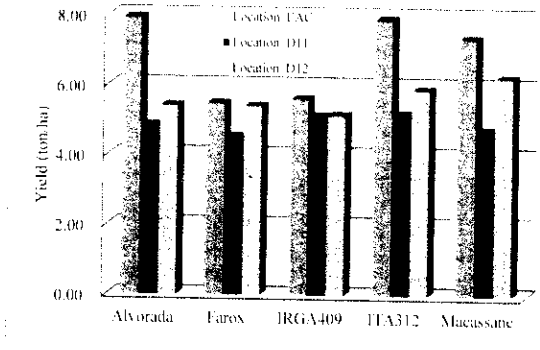
Results of productivity at 3 location across the year

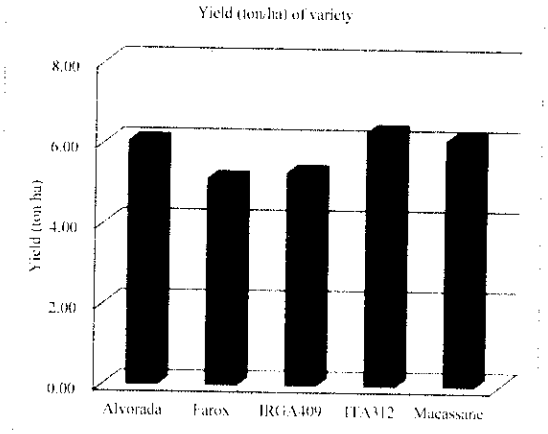
Variety	Location			Average yield (ton/ha)
	EAC	D11	D12	
Alvorada	7.92	4.83	5.41	6.05 abc
Farox	5.47	4.52	5.40	5.13 d
IRGA409	5.61	5.12	5.15	5.29 bcd
ITA312	7.90	5.17	5.89	6.32 a
Macassane	7.36	4.73	6.25	6.11 ab

Significant at 1% level, C.V. :14.5%

Location	Yield (ton/ha)
EAC	6.85 a
D11	4.87 ab
D12	5.62 b

Significant at 1% level, C.V. 9.3%



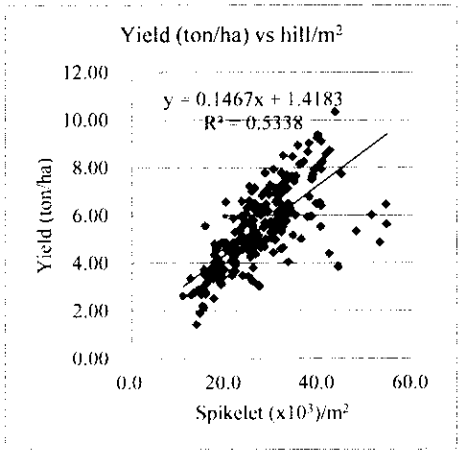


- No significant difference among Alvorada, ITA312 and Macassane
- Farox and IRGA409 lower than 3 varieties mentioned above
- Different response of yield production of 4 varieties observed
- Higher yield production of Alvorada,ITA312 and Macassane observed in EAC than other 2 location
- No significant yield difference of Farox and IRGA409 observed among 3 location

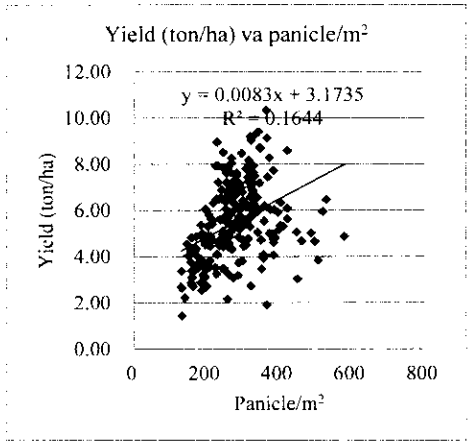
e) Yield and yield components

Results of correlation and multiple regressions between yield and yield components

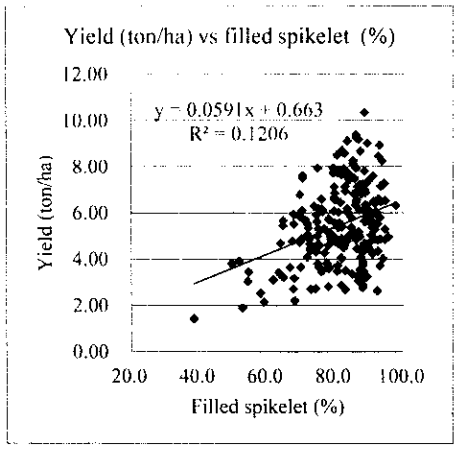
・Correlation analysis between yield and yield components



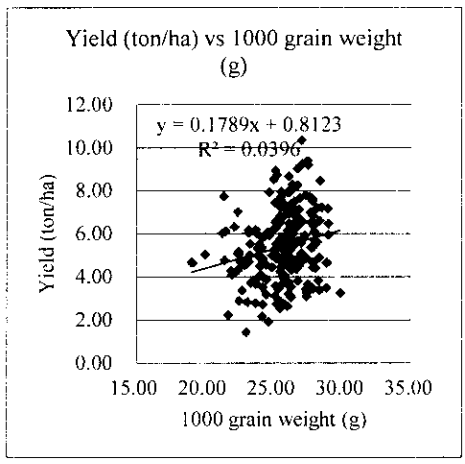
Regression statistics		
Multiple correlation R	0.7306	**
Multiple correlation R^2	0.5338	
Correction R^2	0.5320	
Standard error	1.1208	
Observation number	263	



Regression statistics		
Multiple correlation R	0.4054	**
Multiple correlation R^2	0.1644	
Correction R^2	0.1612	
Standard error	1.5006	
Observation number	263	



Regression statistics		
Multiple correlation R	0.3473	**
Multiple correlation R^2	0.1206	
Correction R^2	0.1173	
Standard error	1.5394	
Observation number	263	



Regression statistics		
Multiple correlation R	0.3473	**
Multiple correlation R^2	0.1206	
Correction R^2	0.1173	
Standard error	1.5394	
Observation number	263	

・Multiple regressions between yield and yield components

Multiple regression	
Panicle/m²	-5.0
Spikelet (x10³)/m²	66.3
Filled spikelet (%)	26.7
1000 grain weight (g)	12.0

d) Result of cost/benefit performance of rice cultivation techniques

Cost/benefit analysis data

Num.	Location	Variety	Cultivation method	Land preparation		Sowing and nursery preparation					Fertilizer application			Weeding									Harvest		Variable cost (x 10³ Mt/ha)	Yield (ton/ha)	Gross benefit (x 10³ Mt/ha) *Farm gate price of paddy, 8.5 Mt/kg
				Land preparation method	Land preparation cost (Mt/ha)	Seed rate kg/ha	Seed cost: 17Mt/kg	Cost of sowing (Mt/ha)	Cost of nursery preparation	Cost of transplanting (Mt/ha)	Urea kg/ha	Urea cost: 31 Mt/kg	Cost of application	Propanil (lit/ha)	Cost (Mt/ha) of Propanil (200 Mt/lit)	MCPA (lit/ha)	Cost (Mt/ha) of MCPA (180Mt/lit)	Ronstar (lit/ha)	Cost (Mt/ha) of Ronstar 500Mt/lit	Total cost of herbicide (Mt/ha)	Cost of herbicide application (Mt/ha)	Cost of manual weeding (Mt/ha)	Harvest method	Cost of Harvest (Mt/ha)			
EAC1	EAC	Alvorada	TP	Tractor	6,059	50	850	0	1,698	2,163	150	4,650	1,620	0	0	0	0	0	0	0	0	6,694	Manual	10,663	34.40	7.92	67.31
EAC2	EAC	Farox	TP	Tractor	6,059	50	850	0	1,698	2,163	150	4,650	1,620	0	0	0	0	0	0	0	0	6,694	Manual	10,663	34.40	5.47	46.52
EAC3	EAC	IRGA409	TP	Tractor	6,059	50	850	0	1,698	2,163	150	4,650	1,620	0	0	0	0	0	0	0	0	6,694	Manual	10,663	34.40	5.61	47.65
EAC4	EAC	ITA312	TP	Tractor	6,059	50	850	0	1,698	2,163	150	4,650	1,620	0	0	0	0	0	0	0	0	6,694	Manual	10,663	34.40	7.90	67.14
EAC5	EAC	Macassane	TP	Tractor	6,059	50	850	0	1,698	2,163	150	4,650	1,620	0	0	0	0	0	0	0	0	6,694	Manual	10,663	34.40	7.36	62.56
D557	D5	No FSG (ITA312)	TP	Animal	5,178	100	1,700	0	355	6,538	100	3,100	1,620	0	0	0	0	0	0	0	0	3,347	Manual	10,663	32.50	2.70	22.95
D564	D5	No FSG (ITA312)	TP	Manual	8,080	100	1,700	0	355	6,538	0	0	0	0	0	0	0	0	0	0	0	3,347	Manual	10,663	30.68	2.80	23.80
D565	D5	No FSG (ITA312)	TP	Manual	8,080	100	1,700	0	355	6,538	0	0	0	0	0	0	0	0	0	0	0	3,347	Manual	10,663	30.68	2.60	22.10
D559	D5	No FSG (ITA312)	TP	Tractor	5,511	100	1,700	0	355	6,538	0	0	0	0	0	0	0	0	0	0	0	3,347	Manual	10,663	28.11	2.50	21.25
D508	D5	FSG (ITA312)	BC	Tractor	5,511	150	2,550	220	0	0	100	3,100	1,620	12	2,400	3	540	0	0	2,940	150	0	Manual	10,663	26.75	4.30	36.55
D529	D5	FSG (ITA312)	BC	Tractor	5,511	150	2,550	220	0	0	100	3,100	1,620	12	2,400	3	540	0	0	2,940	150	0	Manual	10,663	26.75	3.30	28.05
D11-3	D11	IRGA409	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	2	1,000	3,540	150	0	Harvester	3,400	22.89	4.44	37.78
D11-5	D11	ITA312	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	2	1,000	3,540	150	0	Harvester	3,400	22.89	5.34	45.36
D5-1	D5	Macassane	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	6.45	54.85
D5-3	D5	IRGA409	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	3.83	32.59
D5-6	D5	Alvorada	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	4.87	41.40
D11-1	D11	Alvorada	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2540	150	0	Harvester	3,400	21.89	6.05	51.45
D12-1	D12	ITA312	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	4.89	41.58
D12-2	D12	Macassane	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	3.48	29.57
D12-3	D12	Farox	LS	Tractor	7,060	100	1,700	152	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	21.89	5.17	43.93
D5-2	D5	Macassane	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	5.94	50.49
D5-4	D5	IRGA409	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	4.60	39.11
D5-5	D5	Farox	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	6.09	51.75
D5-7	D5	Alvorada	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	5.02	42.64
D11-2	D11	Alvorada	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	6.19	52.58
D11-4	D11	IRGA409	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	4.56	38.73
D11-6	D11	ITA312	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	5.97	50.73
D12-4	D12	ITA312	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	5.63	47.82
D12-5	D12	Macassane	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	3.24	27.57
D12-6	D12	Farox	BC	Tractor	5,511	120	2,040	220	0	0	170	5,270	1,620	10	2,000	3	540	0	0	2,540	150	0	Harvester	3,400	20.75	4.06	34.51
D510	D5	FSG (ITA312)	BC	Tractor	5,511	150	2,550	220	0	0	100	3,100	1,620	12	2,400	3	540	0	0	2,940	150	0	Harvester	3,400	19.49	4.60	39.10
D501	D5	FSG (ITA312)	BC	Tractor	5,511	150	2,550	220	0	0	100	3,100	1,620	12	2,400	3	540	0	0	2,940	150	0	Harvester	3,400	19.49	3.50	29.75
D1225	D12	No FSG (ITA312)	BC	Tractor	5,511	200	3,400	220	0	0	50	1,550	1,620	15	3,000	3	540	0	0	3,540	150	0	Harvester	3,400	19.39	2.72	23.12
D1219	D12	No FSG (ITA312)	BC	Tractor	5,511	200	3,400	220	0	0	50	1,550	1,620	15	3,000	3	540	0	0	3,540	150	0	Harvester	3,400	19.39	2.56	21.76
D1220	D12	No FSG (ITA312)	BC	Tractor	5,511	200	3,400	220	0	0	0	0	0	15	3,000	3	540	0	0	3,540	150	0	Harvester	3,400	16.22	2.64	22.44
D1142	D11	No FSG (ITA312)	BC	Tractor	5,511	200	3,400	220	0	0	25	775	1,620	0	0	0	0	1.5	750	750	150	0	Harvester	3,400	15.83	2.60	22.10

Note: cultivation method; TP: transplanting, BC: Broadcasting, LS: Line sowing

Marginal Rate of return

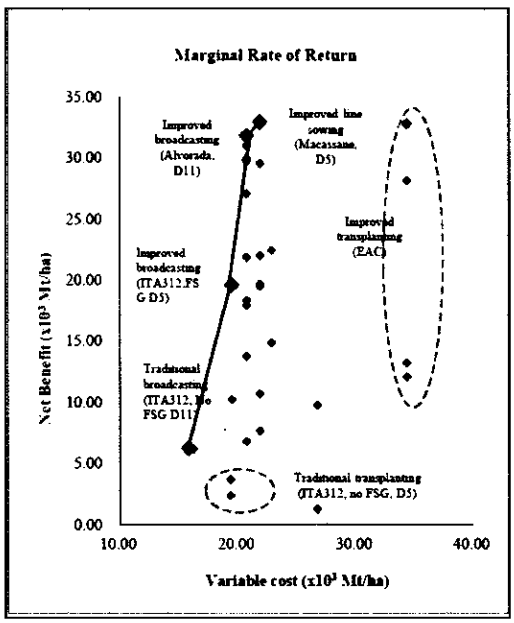
Num.	Cultivation method	Technology level	Variety	Variable cost (VC) (x 10^3 Mt/ha)	Yield (ton/ha)	Gross benefit (GB) (x 10^3 Mt/ha)	Net benefit (NB) (x 10^3 Mt/ha)	ΔVC	ΔNB	Marginal Rate of Return (MRR)
EAC1	TP	Improved	Alvorada	34.40	7.92	67.31	32.92	-	-	-
EAC2	TP	Improved	Farox	34.40	5.47	46.52	12.12	-	-	-
EAC3	TP	Improved	IRGA409	34.40	5.61	47.65	13.26	-	-	-
EAC4	TP	Improved	ITA312	34.40	7.90	67.14	32.74	-	-	-
EAC5	TP	Improved	Macassane	34.40	7.36	62.56	28.16	-	-	-
D557	TP	Traditional	No FSG (ITA312)	32.50	2.70	22.95	-9.55	-	-	-
D564	TP	Traditional	No FSG (ITA312)	30.68	2.80	23.80	-6.88	-	-	-
D565	TP	Traditional	No FSG (ITA312)	30.68	2.60	22.10	-8.58	-	-	-
D559	TP	Traditional	No FSG (ITA312)	28.11	2.50	21.25	-6.86	-	-	-
D508	BC	Improved	FSG (ITA312)	26.75	4.30	36.55	9.80	-	-	-
D529	BC	Improved	FSG (ITA312)	26.75	3.30	28.05	1.30	-	-	-
D11-3	LS	Improved	IRGA409	22.89	4.44	37.78	14.88	-	-	-
D11-5	LS	Improved	ITA312	22.89	5.34	45.36	22.47	-	-	-
D5-1	LS	Improved	Macassane	21.89	6.45	54.85	32.96	1.14	1.12	0.99
D5-3	LS	Improved	IRGA409	21.89	3.83	32.59	10.70	-	-	-
D5-6	LS	Improved	Alvorada	21.89	4.87	41.40	19.51	-	-	-
D11-1	LS	Improved	Alvorada	21.89	6.05	51.45	29.56	-	-	-
D12-1	LS	Improved	ITA312	21.89	4.89	41.58	19.69	-	-	-
D12-2	LS	Improved	Macassane	21.89	3.48	29.57	7.67	-	-	-
D12-3	LS	Improved	Farox	21.89	5.17	43.93	22.04	-	-	-
D5-2	BC	Improved	Macassane	20.75	5.94	50.49	29.74	-	-	-
D5-4	BC	Improved	IRGA409	20.75	4.60	39.11	18.36	-	-	-
D5-5	BC	Improved	Farox	20.75	6.09	51.75	31.00	-	-	-
D5-7	BC	Improved	Alvorada	20.75	5.02	42.64	21.89	-	-	-
D11-2	BC	Improved	Alvorada	20.75	6.19	52.58	31.83	1.26	12.22	9.70
D11-4	BC	Improved	IRGA409	20.75	4.56	38.73	17.98	-	-	-
D11-6	BC	Improved	ITA312	20.75	5.97	50.73	29.98	-	-	-
D12-4	BC	Improved	ITA312	20.75	5.63	47.82	27.07	-	-	-
D12-5	BC	Improved	Macassane	20.75	3.24	27.57	6.81	-	-	-
D12-6	BC	Improved	Farox	20.75	4.06	34.51	13.76	-	-	-
D510	BC	Improved	FSG (ITA312)	19.49	4.60	39.10	19.61	3.67	13.34	3.64
D501	BC	Improved	FSG (ITA312)	19.49	3.50	29.75	10.26	-	-	-
D1225	BC	Traditional	No FSG (ITA312)	19.39	2.72	23.12	3.73	-	-	-
D1219	BC	Traditional	No FSG (ITA312)	19.39	2.56	21.76	2.37	-	-	-
D1220	BC	Traditional	No FSG (ITA312)	16.22	2.64	22.44	6.22	-	-	-
D1142	BC	Traditional	No FSG (ITA312)	15.83	2.60	22.10	6.27	-	-	

Note: cultivation method; TP: transplanting, BC: Broadcasting, LS: Line sowing

Technical components of cultivation techniques

Technical component	Improved transplanting	Traditional transplanting	Improved direct sowing	Traditional direct sowing
Land preparation	Disk plow x 1 + disk harrow x 1 +puddling (power tiller)	Manual plowing and manual puddling	Disk plow x 1 + disk harrow x 1 + rotary cultivation + plotting	Disk plow x 1 + disk harrow x 2 + plotting
Sowing (nursery)	Flood nursery	Upland nursery	Line sowing (manual seeder)	Broadcasting
Transplanting	20cm x 25 cm, 3 seedings/hill, line planting	1 seedling/hill, random planting	-	-
Seed rate (kg/ha)	50	100	120	150
Fertilizer application	Urea 150 kg/ha, split application (3 times)	No fertilizer application	Urea 170 kg/ha, split application (3 times)	Urea 50 kg/ha, all at a time
Weeding	Manual	Manual	Herbicide application Propanil: 10 lit/ha MCPA 3 lit/ha)	Herbicide application Propanil: 15 lit/ha MCPA 3 lit/ha)
Harvest	Manual	Manual	Combine harvester	Combine harvester

Marginal Rate of Return and dominated techniques



8. Self-evaluation (accomplishment % as compared with the indicator of PDM): 78 %

9. Observations (problems observed if any)

Flood in 2013 forced the farmers to change cultivation method, from transplanting to direct sowing in D5 and D6 in 2013/2014.

10. Activity in continuation

a) Verification of production cost of rice cultivation

b) Verification of field work performance of agricultural machinery

Activity code: 1-2/11/14

Title of activity

Training of extension leaders on improved rice cultivation techniques of transplanting.

Activity realized

a) To train extension agents and extension leaders on improved rice cultivation techniques of transplanting.

b) To Introduce improved rice cultivation techniques of transplanting to extension agents and extension leaders through OJT conducted at demonstration farms of Farming Support Groups (FSG).

Responsible person: SDAE/DPA Gaza/JICA

Objectives

Important and basic rice cultivation techniques of transplanting are acquired by extension leaders and extension agents.

Methodology applied

To conduct OJT at the demonstration farms on improved rice cultivation techniques of transplanting for extension agents and extension leaders.

Results obtained

a) Verification plot (introduction of variety) installed

D5: 4 locations, 8 plots (1.13 has), 4 varieties, broadcasting/line sowing by manual seeder

D6: suspended rice cultivation

b) Demonstration field (ITA312) of FSG field

D5 : 50 filed (direct sowing, 25 ha)

D6 : 0 field suspended rice cultivation

Accomplishment: 76% (25 ha/(programed 25 Ha +8 ha)

c) Training of extension agents and FSG farmers

15 courses, 147 participants

Accomplishment: 100%

Self-evaluation (accomplishment % as compared with the indicator of PDM): 65 %

Observations (problems observed if any)

Flood of January 2013 caused severe damage and almost 100% of demonstration plot are destroyed at early growth stage of paddy plant. D5 FSG farmers shifted from transplanting to direct sowing and D6 FSG farmers suspended rice cultivation in 2013/2014.

Activity in continuation

a) Verification of productivity and characteristics of variety

b) Installation of verification plot and demonstration field

c) Organization of field day

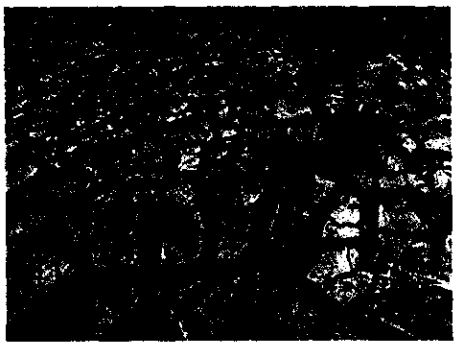
Reference data

a) Flood damage of demonstration plot in D5 and D6 in 2012

Block	Num. of demonstration plot	Estimated damage (%)	Cause of damage		Farmers' intention			Remarks
			Mud accumulation (%)	Washing out (%)	Abandon field	Tray again next season	Tray next season again (%)	
D5	26	90.8	100	0	0	25	96.2	Other crop in April
D6	16	100.0	100	0	0	16	100.0	Other crop in March/April
D11	13	25.4	0	0	0	13	100.0	-
D12	10	0.0	0	0	0	10	100.0	Shortage of water
	65	54.0	-	-	-	64	99.0	

b) Condition of damaged field on 15 Feb. 2013

D5: Farmer's Name: Maria S. Matusse



D6: Farmer's Name: Valente Mucavel

c) Training course conducted

Name of the Course	Date	No. of Participants	Target Participants	Remarks
Land preparation by power tiller (OJT power tiller)	18 Oct. 2011	4	Machinery operator of HICEP, SDAE and FDA、technician of EAC	Operation of power tiller and land preparation by power tiller
Land preparation by tractor (OJT tractor and attachiment)	15 Nov. 2011	8	Machinery operator of HICEP, SDAE and FDA、technician of EAC	Land preparation by tractor and attachment
Basic techniques of transplanting rice cultivation	25 Nov. 2011	19	Project C/P, extension agent, technicain of EAC and MIA	Basic knowledge of transplanting rice cultivation
Case study of small scale rice cultivation in Ghana	25 Nov. 2011	19	Extension agent, techician of EAC and MIA	Small scal rice cultivation
Mechanized land preparation (OJT land preparation)	29 Nov. 2011	33	Extension agent, EAC technician and FSG member farmer (20)	Plowing and rotary cultivation
Nursery preparation (OJT)	29 Nov. 3011	33	Extension agent, EAC technician, FSG member farmers (20)	Preparation of nursery and seed sowing
Mechanized rice cultivation	5 Dec. 2011	13	Extension agent and technician of EAC	Mechanized rice cultivation techniques and maintenance of machinery
Technique for high yielding of transplanting rice cultivation	15 Dec. 2011	12	project C/P, extension agent, technicain of EAC and MIA	Yield survey, yeild component, highyielding techniques
Landpreparation for transplanting rice cultivation (OJT puddling)	19 Dec. 2011	32	Extension agent, EAC technicain, FSG member farmers (20)	Puddling by power tiller, leveling of field
Transplanting of transplanting rice cultivation (OJT transplanting)	19 Dec. 2011	32	Extension agent, EAC technicain, FSG member farmers (20)	Line planting, plant density, quality of seedling
Field day of variety	22 March 2013	63	Extension agent, Farmers of D11, D12, D5 and D6	Variety characterisitics of promissing variety at D11 variety verification plot of transplaning
Variety characteristics of promissing variety for transplanting rice cultivation	10 July 2013	27	Extension agent, FSG farmers of D11, D12, D5 and D6	Results of variety trial and characterisitics of promissing variety
Improved rice cultivation techniques*(1)	7 Feb. 2014	18	Extensionagent, Lider farmers of FSG	Lecture of improved rice cultivation techniques of transplanting and direct sowing by C/P
Field day of transplantingrice cultivation	11 March 2014	39	FSG member farmer of D5 and D6	Variety characteristics of promissing variety at EAC field (variety trial plot)
Improved rice cultivation techniques*(2)	3 July 2014	65	FSG member farmers of D5, D6, D11, and D12	Variety characteristics and grain production of promissing variety of transplanting, result of verification of promissing variety of direct sowing, and yield of demonstration plot of direct sowing
		417		

Note: *(1) and (2) overlaped with direct sowing training

Activity code: 1-3(1)/11/14

Title of activity

Establishment of demonstration farms for transplanting with initiative of extension leaders

Activity realized

To demonstrate improved rice cultivation techniques of transplanting recommended by the project for the further dissemination.

Responsible person: SDAE/DPA Gaza/JICA

Objectives

To demonstrate farms improved rice cultivation techniques of transplanting at D5 and D6.

Methodology applied

Following activities are carried out for the establishment of demonstration farms for transplanting;

a) To review field condition of each FSG farmer of D5 and D6

b) To conduct follow-up activities of field management of FSG members

c) To demonstrate improved rice cultivation and promising variety.

Results obtained

a) Verification plot (introduction of variety) installed

D5: 4 locations, 8 plots (1.13 has), 4 varieties, broadcasting/line sowing by manual seeder

D6: suspended rice cultivation

b) Demonstration field (ITA312) of FSG field

D5 : 50 filed (direct sowing, 25 ha)

D6 : 0 field suspended rice cultivation

Accomplishment: 76% (25 ha/(programed 25 Ha +8 ha)

c) Training of extension agents and FSG farmers

15 courses, 147 participants

Accomplishment: 100%

Self-evaluation (accomplishment % as compared with the indicator of PDM): 77%

Observations (problems observed if any)

Flood of January 2013 caused severe damage and almost 100% of demonstration plot are destroyed at early growth stage of paddy plant. D5 FSG farmers shifted from transplanting to direct sowing and D6 FSG farmers suspended rice cultivation in 2013/2014.

Activity in continuation

a) Verification of productivity of demonstration field

b) Verification of productivity and characteristics of variety

c) Organization of field day

Reference data

a) Farmers' preference of newly introduced variety (2013)

Variety	Farmer's preference		Criteria (num. of farmer)						
	Num. of farmer *1	%	Maturity days	Price	High yielding	Palatability	Grain size	Panicle size	Other
Alovorada	5	23.8	1	2	5	2	3	1	1
Farox	3	14.3	0	2	2	0	2	0	0
IRGA 409	4	19.0	1	4	3	1	1	0	1
ITA 312	11	52.4	3	4	7	1	2	1	0
Macassane	13	61.9	0	3	8	0	2	3	1
			5	15	25	4	10	5	3

Note: *1: Total num. of farmer answered: n = 26

Activity code: 1-3(2)/13/14

Title of activity

Establishment of demonstration farms for transplanting with initiative of extension leaders. (variety trial for transplanting rice cultivation)

Activity realized

Installation of verification plot of variety for transplanting rice cultivation

Responsible person: SDAE/DPA Gaza/JICA

Objectives

To identify adequate variety for transplanting rice cultivation in the project area

Methodology applied

a) Experimental design: RCBD with 3 repetitions, 5m x 6m (30m2/plot) in EAC experimental field

b) Treatment: 6 varieties, Macassane, Vembe, IGRA409, Farx, Alvorada , ITA312

Results obtained

Variety experiment installed in EAC experimental field in 2013 an in 2014. Trial in 2103 was destroyed by flood but productivity and variety characteristics were analyzed...

Self-evaluation (accomplishment % as compared with the indicator of PDM): 100 %

Observations (problems observed if any)

Flood of January 2013

Activity in continuation

a) Verification of productivity of demonstration field

b) Verification of productivity and characteristics of variety

c) Organization of field day

Reference data

Result of variety trial (2014)

Variety	Panicle per hill	Spikelet per panicle	Spikelet 10^3/m2	Filled spikelet (%)	1000 grain weight (g)	Shattering (%)	Yield (ton/ha)	Number of days to 50% heading	Date 50% heading
Alvorada	12.5	135.9 ab	34.0	84.6 c	26.6 bcd	23.2 a	7.92 a	98	Feb. 12
Farox	12.9	157.9 a	40.6	90.9 b	28.0 ab	16.1 b	5.47 abc	125	March. 11
IRGA409	11.9	144.7 ab	34.3	94.9 a	25.5 d	16.3 b	5.61 abc	111	Feb. 25
ITA312	12.3	149.1 ab	36.6	92.6 a	25.8 d	17.4 b	7.90 a	111	Feb. 25
Macassane	13.8	119.7 b	33.3	92.6 ab	28.3 a	16.0 b	7.36 ab	104	Feb. 18
Vembe	12.9	98.6 c	25.5	87.3 c	27.5 abc	6.6 c	3.26 c	77	Jan. 22
Significance	ns	1%	ns	1%	1%	1%	1%	-	-
CV(%)	8.2	9.1	14.1	1.3	1.8	9.7	15.0	-	-

a) Low yield of Vembe is due to less number of spikelet/m2 and low percentage of ripening ratio and low thresh ability

b) There was no significant difference in yield among Alvorada, ITA312, Macassane, IRGA409 and Farox

c) Macassane and Farox are big grain type. ITA312 and IRGA409 are small grain type

d) High ripening ration was observed in IRGA409, ITA312 and Macassane.

e) High thresh ability was observed in Alvolada.

Reference data

Variety trial EAC (2014)

Field day EAC variety trial, March 2014

Activity code: 1-4(1)/11/14

Title of activity

Training of farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders.

Activity realized

Extension leaders disseminate improved rice cultivation techniques of transplanting to other farmers through demonstration farms of FSGs.

Responsible person: SDAE/DPA Gaza/JICA

Objectives

Extension leaders play important roles in disseminating improved rice cultivation techniques of transplanting.

Methodology applied

Following activities are carried out for the training of farmers on improved rice cultivation techniques of transplanting;

a) Extension leaders explain about the recommended techniques to other farmers at demonstration farms of FSGs.

b) To conduct OJT on the recommended techniques at demonstration farms of FSGs.

Results obtained

a) 2013: Demonstration filed, D5 26 plots (13 ha) and D6 16 plots (8ha), of 2013 have been destroyed by flood of Jan. 2013.

b) 2014

- Demonstration field (ITA312) of FSG field

  D5 : 50 filed (direct sowing 25 ha)

  D6 : 0 field suspended rice cultivation

  Accomplishment: 76% (25 ha/(programed 25 Ha +8 ha)

- Training of extension agents and FSG farmers

  (a) Field day of variety characteristics of promising variety at D11 variety verification plot of transplanting, , 22 March 2013, 63 participants(extension agent, farmers of D11, D12, D5 and D6) at D11 variety verification plot of transplanting

  (b) 15 courses, 147 participants

  Accomplishment: 100%

Self-evaluation (accomplishment % as compared with the indicator of PDM): 100%

Observations (problems observed if any)

Flood of January 2013

10. Activity in continuation

a) Verification of productivity of demonstration field

b) Organization of field day

Reference data

Field day organized for transplanting and direct sowing rice cultivation

Activity code: 1-4(2)/13/14

Title of activity

Training of farmers on improved rice cultivation techniques of transplanting with initiative of extension leaders. (Demonstration of variety for transplanting rice cultivation)

Activity realized

Installation of demonstration plot of 6 varieties for transplanting rice cultivation

Responsible person: SDAE/DPA Gaza/JICA

Objectives

To demonstrate alternative varieties to farmers in the project area

Methodology applied

a) Demonstration plots installed (2013);

D5: 13.0m x 8.0m (104m$^{2)}$/variety, total area 624m2

D6: 6.0m x 24.0m (144m^{2})/variety, total area 864m2

D11: 15.0m x 12.0m (180m^{2})/variety, total area 1,080m2

D12: 12.5m x 13.0m (162.5m^{2})/variety, total area 975m2

- Varieties: Macassane, Vembe, IGRA409, Farox, Alvorada , ITA312
- Planting distance: 20 cm x 25 cm (20 hills/m$^{2)}$, Fertilizer application: 100 kg Urea/ha

b) Demonstration plot installed (2014)

D5: 4 locations, 8 plots (direct sowing, 1.13 has), 4 varieties, broadcasting/line sowing by manual seeder

D6: suspended rice cultivation

Results obtained

4 demonstration plots were installed in D5, D6, D11 and D12. Demonstration plot of D5 and D6 were destroyed by flood but demonstration plot of D11 and D12 are survived. Productivity and characteristics of 6 varieties are verified. Productivity and characteristics of 6 varieties are verified. Detail of results is as shown below. Result obtained in 2014 is indicated in Activity Report of 3-1/12/14.

Self-evaluation (accomplishment % as compared with the indicator of PDM): 54%

Observations (problems observed if any)

Flood of January 2013

Activity in continuation

Reference data

a) Results of demonstration plot in D11

Variety	Grain yield (ton/ha)	Panicle per hill	Panicle length (cm)	Stem length (cm)	Spikelet per panicle	Spikelet 10^{3}/m2	Filled spikelets (%)	1000 grain weight (g)	Shattering (%)	Number of days to Heading	Maturity	Lodging (%)
Alvorada	4.83 a	19.5 a	23.2 bc	69.1 bc	72.9 c	28.44 ab	71.4 cd	25.5 abc	19.8 bc	108	139	0.0
Farox	4.52 a	15.2 ab	19.9 d	54.1 d	70.8 c	21.53 bc	92.3 a	26.0 ab	18.3 bc	91	124	10.0
IRGA 409	5.12 a	13.6 c	22.5 bc	66.2 c	95.3 a	25.81 ab	87.3 ab	22.7 c	25.5 ab	96	130	0.0
ITA 312	5.17 a	15.8 ab	23.3 b	75.5 a	89.4 ab	28.17 ab	87.9 ab	23.0 bc	14.0 c	103	136	0.0
Macassane	4.73 a	16.0 ab	25.4 a	73.9 ab	95.2 ab	30.31 a	86.4 abc	27.9 a	32.2 a	99	127	0.0
Vembe	2.41 b	17.9 ab	16.1 e	53.2 d	47.3 d	16.97 c	69.2 d	25.7 abc	5.4 d	73	102	10.0
CV(%)	12.0	10.2	2.0	3.2	9.5	14.5	7.3	4.7	15.2	-	-	-
Significance	**	**	**	**	**	**	**	**	**			

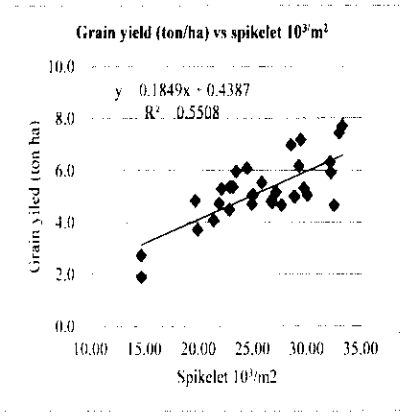
Note: Severe bird damage was observed in Vembe at maturity stage.

b) Results of demonstration plot in D12

Variety	Grain yield (ton/ha)	Panicle per hill	Panicle length (cm)	Stem length (cm)	Spikelet per panicle	Spikelet 10^3/m2	Filled spikelets (%)	1000 grain weight (g)	Shattering (%)	Number of days to Heading	Number of days to Maturity	Lodging (%)
Alovorada	5.41	19.4 ab	22.8 ab	62.6 abc	74.9 ab	29.04 ab	74.1 c	23.7 b	30.9 ab	108	140	0.0
Farox	5.40	15.8 bc	21.4 b	57.1 c	71.1 ab	22.42 c	81.6 abc	23.5 bc	24.4 ab	94	127	0.0
IRGA 409	5.15	18.4 b	21.6 b	57.7 c	74.7 ab	27.53 abc	90.6 a	22.6 bc	16.4 c	101	132	0.0
ITA 312	5.89	23.5 a	20.8 b	66.9 ab	63.8 b	29.96 a	82.8 ab	19.4 d	31.8 a	105	138	0.0
Macassane	6.25	14.7 c	24.5 a	68.2 a	80.4 a	23.48 c	88.3 ab	28.0 a	18.1 bc	101	128	0.0
CV(%)	15.0	8.3	3.7	3.6	7.0	9.4	4.6	2.1	24.8	-	-	-
Significance	ns	**	**	**	*	*	**	**	*			

Note: Vemeb was excluded for yield component analysis because of severe bird damage.

c) Spikelet/m2, filled spikelet (%) and 1000 grain weight (g) are important components for high yielding.



	Grain yield (ton/ha)	Panicle/hill	Spikelets per panicle	Spikelets 10^3/m^2	Filled spikelets (%)	1000 grain weight (g)
Grain yield	-	0.0263	0.7262	0.7422	0.5553	0.3548
Significance		ns	1%	1%	1%	5%

Activity code: 1-5/11/14

Title of activity

Training of farmers on irrigation facility maintenance and water management.

Activity realized

a) To maintain secondary and tertiary canals and drainages by users/farmers.

b) To instruct farmers on water management based on water requirement.

Responsible person: SDAE/DPA Gaza/JICA

Objectives

a) To make farmers understand how to maintain irrigation and drainage canals at the farm level.

b) To make farmers understand proper water management especially for direct sowing rice cultivation.

Methodology applied

a) To grasp the situation of irrigation and drainage canals at project site.

b) To conduct OJT on maintenance of irrigation and drainage canals at the farm level.

c) To conduct training on water management based on water requirement.

Results obtained

a) OJT on drainage canal maintenance

・OJT on canal maintenance for FSG farmers and simple leveling for FSG farmers and cantoneiro of

HICEP: 766 participants

D5: 141, D6: 45, D11: 142, D12: 138, R1: 177, R3: 123

- Elaboration of manual

b) Improvement of tertiary drainage of D5, D6, D11, D12

c) Study on field and OJT on simple leveling drainage level of D5, D6, D11, D12, R1 and R3

Self-evaluation (accomplishment % as compared with the indicator of PDM): 100%

Observations (problems observed if any)

None

Activity in continuation

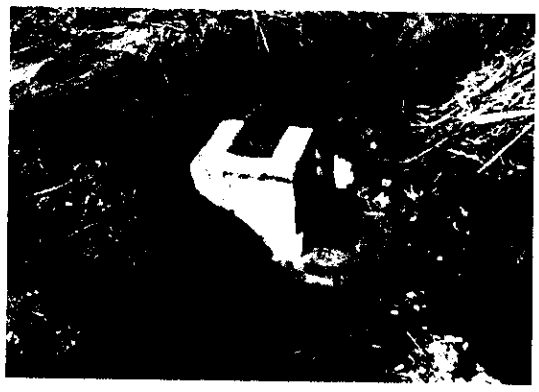
a) OJT of canal maintenance

b) Improvement of manual

Reference data

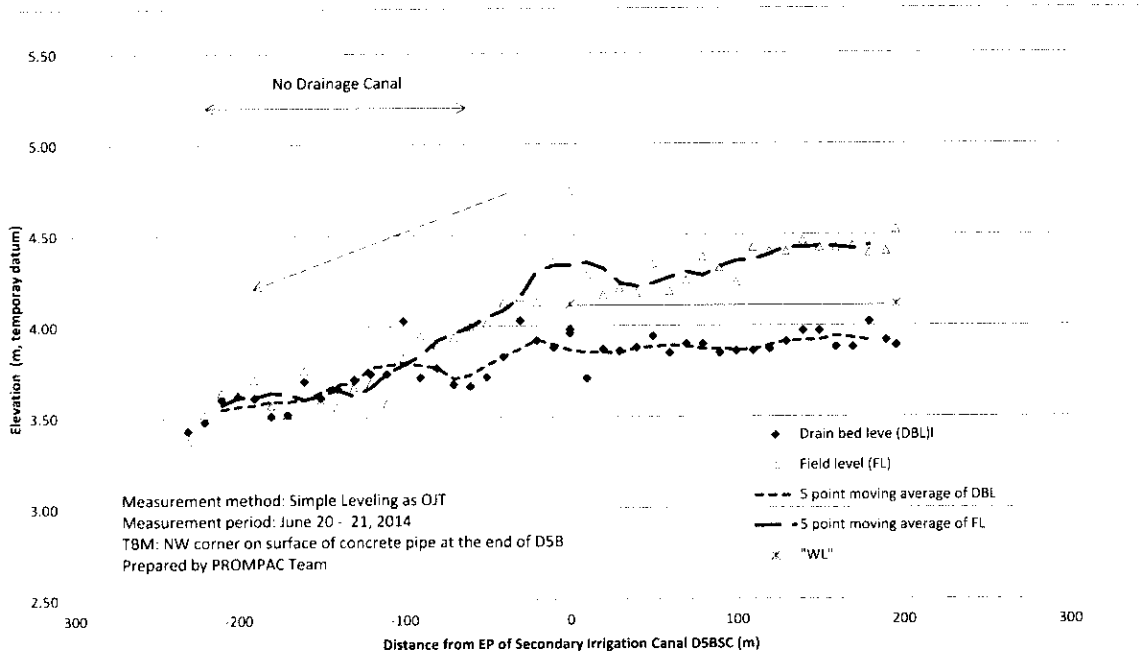
a) OJT on drainage canal maintenance

Improvement of tertiary drainage of D5 (July 2012)



Farm road crossing drainage of D11 (July 2013)

b) Result of simple leveling of D5



c) Result of simple leveling of D11

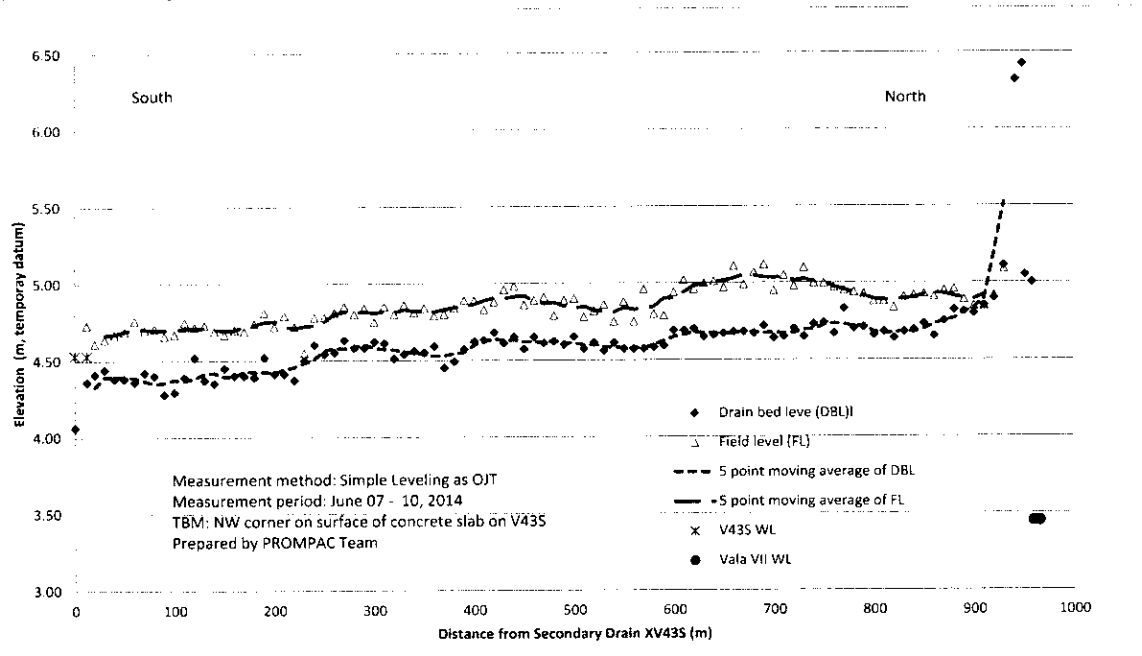
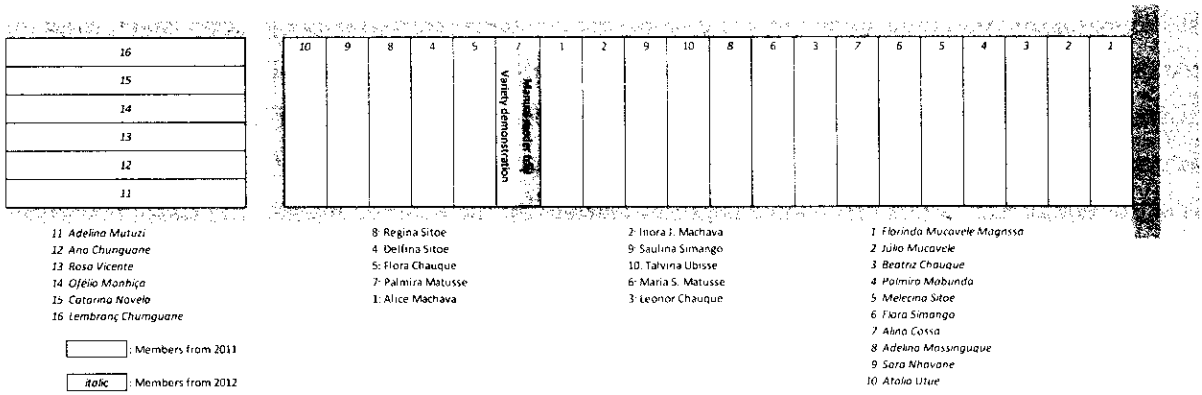
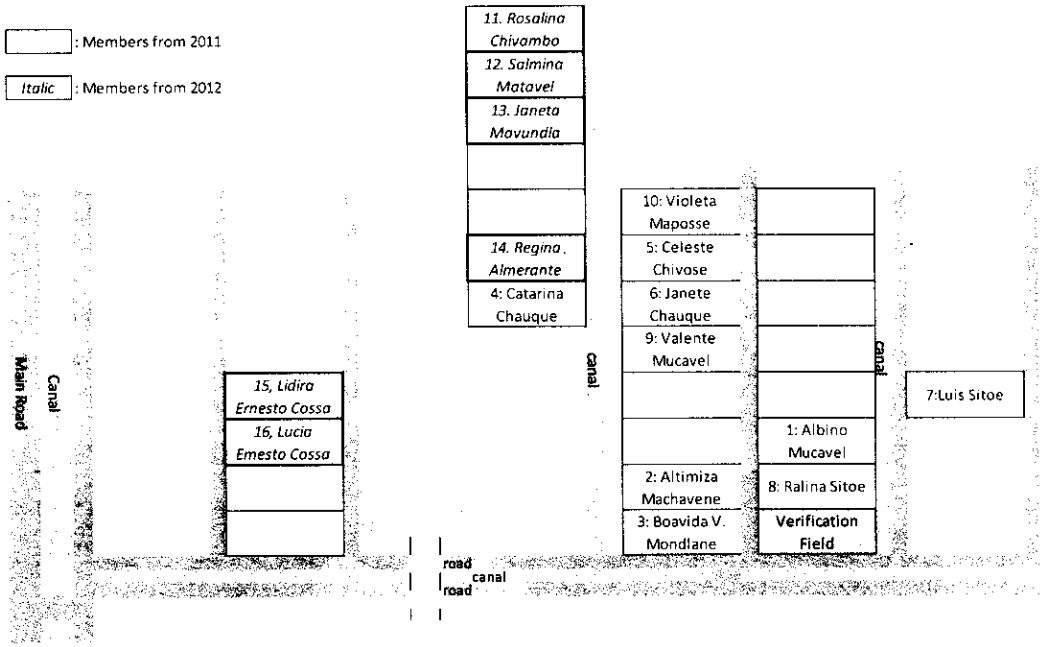


Figure Profile of Tertiary Drain between R16 & 18 in D11 area

D5


16
15
14
13
12
11
10 9 8 4 5 7
Variety demonstration
1 2 9 10 8 6 3 7 6 5 4 3 2 1
11 Adelina Mutuzi
12 Ana Chunguane
13 Rosa Vicente
14 Ofélia Manhiça
15 Catarina Novelo
16 Lembrança Chunguane
: Members from 2011
Italic : Members from 2012
8: Regina Sitoe
4: Delfina Sitoe
5: Flora Chauque
7: Palmira Matusse
1: Alice Machava
2: Inora J. Machava
9: Saulina Simango
10. Talvina Ubisse
6: Maria S. Matusse
3: Leonor Chauque
1 Florinda Mucavele Magaia
2 Júlia Mucavele
3 Beatriz Chauque
4 Palmira Mabunda
5 Melecina Sitoe
6 Flora Simango
7 Alina Cossa
8 Adelina Massinguaue
9 Sara Nhavane
10 Atalia Utue

D6


: Members from 2011
Italic : Members from 2012
11. Rosalina Chivambo
12. Salmina Matavel
13. Janeta Mavundla
14. Regina Almerante
4: Catarina Chauque
10: Violeta Maposse
5: Celeste Chivose
6: Janete Chauque
9: Valente Mucavel
2: Altimiza Machavene
3: Boavida V. Mondlane
1: Albino Mucavel
8: Ralina Sitoe
Verification Field
7:Luis Sitoe
15, Lidira Ernesto Cossa
16, Lucia Emesto Cossa
Main Road
Canal
canal
canal
road
road

Present Conditions of Irrigation/Drainage Facility and Water Use/Management

1) Chokwe Irrigation Scheme (CIS)

The Portuguese colonial government commenced construction of the Chokwe Irrigation Scheme (CIS) in 1950s (Figure 6-3-1 and Table 6-3-1). Of this scheme, water source is the Limpopo River, irrigation area was planned about 11,000 ha and design discharge of the General Canal was 21m^3/s. Later, the irrigation area was expanded to about 26,000 ha and the design discharge of the General Canal was increased to 43m^3/s. The General Canal was rehabilitated in 1977 after the independence and new intake structure was also constructed then. Flow capacity of the deteriorated General Canal declined to 19m^3/s in1995 and to 11 – 13m^3/s after the large flood of February 2000.

Figure 6-3-1 Chokwe Irrigation Scheme (CIS)

Table 6-3-1 Area, Users and Associations

Sector	Area (ha)			No. of Users	No. of Associations		
	Total	Usable	To be rehabilitated		Legalized	Not legalized	Total
Montante	6,164	4,866	2,770	2,490	9	1	10
Sul	18,946	11,891	4,230	4,646	9	2	11
Do Rio	8,738	7,091	1,500	5,177	9	3	12
TOTAL	**33,848**	**23,848**	**8,500**	**12,313**	**27**	**6**	**33**

(Source: HICEP)

The government of Mozambique commenced planning for rehabilitation of CIS in 1994 with assistance of French Development Agency (*Agence Française de Developpement*, AFD). A donor

meeting, consisting of Portugal, France, Japan, EU, AfDB, BID, OPEC and so on, was held after the flood of February 2000. As a result, Mozambique decided to rehabilitate the whole system through adjustment within the donor framework. It was suggested that rehabilitation of about 14 km of the General Canal was assigned to Japan. The Japanese government conducted basic design study through JICA from 2000 to 2001, based on which, a grant aid project was implemented and the rehabilitation works were completed in 2003. In pararell, the French government supported rehabilitation of D11 – D16 areas through AFD. Another rehabilitation of 7,000 ha in the Rio Sector is going on with financial support of about 10.5 million US$ from the Islamic Development Bank (IDB, IsDB or BID) for a period of 2 years from May 2012. The rehabilitation includes secondary and tertiary irrigation canals, main drains, secondary drains and their related structures (Tables 6-3-2 & 3 and Figure 6-3-2).

Table 6-3-2 Length of Irrigation Canal and Drain

Description	Unit	Length	Total
Principal Canal	km	98.7	1,584.70
Secondary Canal	km	268	
Tertiary Canal	km	1218	
Principal Drain	km	113	563.00
Secondary Drain	km	450	
TOTAL	**km**	**2,147.70**	**2,147.70**

(Source: HICEP)

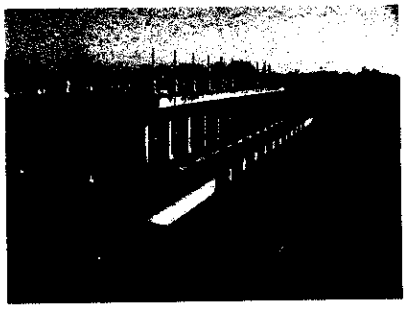
Table 6-3-3 Rehabilitation Project

Period	Finance source	Area to be rehabilitated (ha)
2002-2003	JICA	General Canal
2002-2003	AFD	1,000
2004-2005	Sector Privado Local	1,000
2004-2006	OPEC FUND	5,000
2012-2013	IDB	7,000
2014-2017	Exim Bank of China (*)	8,500
計		22,500

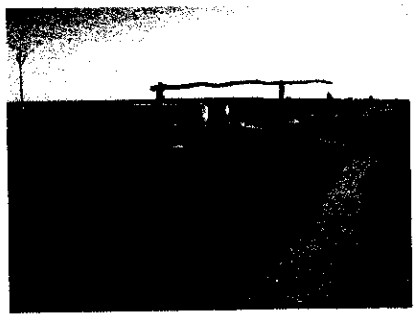
(*) Elaborado o estudo de viabilidade

(Source: HICEP)

Wanbao Grains and Oils Co., Ltd, a Chinese company (headquarter is in Hubei Province, China) started construction of drainage system as well as tertiary irrigation canal in D13 area in 2014.

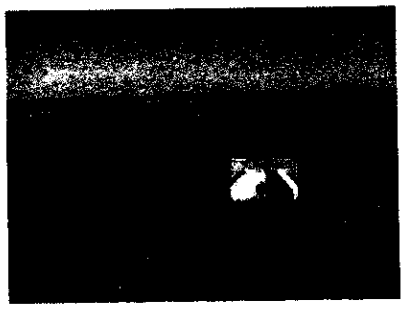


JICA



AFD

IsDB



Ex Im Bank

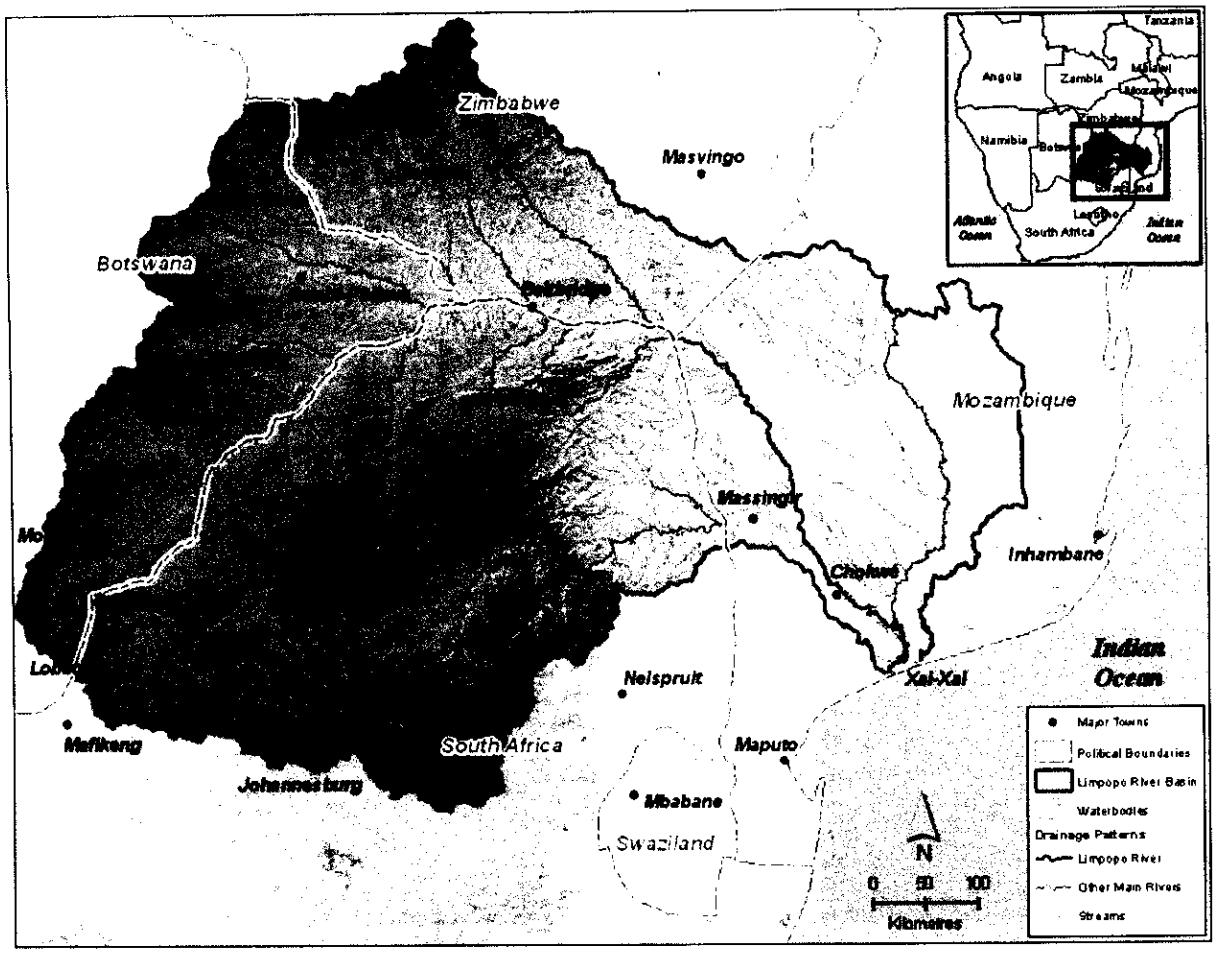
Figure 6-3-2 Rehabilatation of CIS

In order to assist in the rehabilitation of such parts of the General Canal that were damaged by

flood in January 2012, JICA dispatched a follow-up survey team to the site in July 2012. It was decided that the follow up works would include construction of inlet structure. However, CIS including the General Canal was damaged seriously by flood in January, 2013. For early recovery of damaged irrigation system, HICEP thought that procurement of heavy equipment should be more prioritized than provision of the inlet structure. HICEP proposed to change the once planned follow-up works to purchase of the equipment. JICA agreed the proposal and five items of equipment (total cost: about US$ 430 thousands) were granted to HICEP.

2) Limpopo River

Being water source of CIS, the Limpopo River flows in a great arc with total length of about 1,750 km and basin area of about 415,000 km^2 (Wikipedia). As seen in Figure 6-3-3, it originates near Pretoria, Republic of South Africa (RSA), flows toward north, turns north-eastward forming the border between RSA and Botswana, turns eastward forming the border of RSA and Zimbabwe, then flows into Mozambique toward south-east, and finally flows into the Indian Ocean near Xaixai. The annual mean discharge is approximately 170m^3/s at its river mouth (Wikipedia), which is only 13mm in runoff height probably because the basin is mostly covered by semi-arid and arid land.



(source: http://www.limpoporak.com/en/river.aspx "*Hatfield 2010*")

Figure 6-3-3 Limpopo River Basin

Lower Limpopo Irrigation (RBL: *Regadio do Baixo Limpopo*, total planned area = 12,000ha) area locates on the left bank of the Limpopo River near Xaixai town. Wanbao Grains and Oils Co., Ltd (Chinese company) has been performing farm land consolidation there for development of the area. In addition, the company started new development of agricultural land of 6,000 ha in Chicumbane area on the right bank of the river.

3) Massingir Dam

The Massingir Dam locates on the Elefantes River, a tributary of the Limpopo River (Figure 6-3-4). The purposes of the dam include water supply for irrigation of nearly 90,000ha, fishery, and control of flood and drought flows. Construction of the dam began in 1971 in the colonial era by Portuguese company. As one of the purposes of the dam, power generation was included at first. The construction works were suspended after independence, since many Portuguese left the country and civil war broke out. The Mozambique Government decided to heighten the dam top elevation, and completed the dam embankment and the gate facility in 2006 except for the power generation facility. Of the dam, type is earthfill, height is 46 m and crest level of the spillway is EL 115.00 masl.

According to *Manual de Operação e Manutenção*, 2003 by BRL Ingénierie (BRLI) (BRLI 2003 Manual), main dimensions of the Massingir Reservoir are as follows.

- Dam crest level : 130.00 m above sea level (masl)
- Design full storage level (FSL or NPA, Nível de pleno amazenamento): 125.00 masl
- Gross capacity : 2,836 million cubic meter (MCM)
- Capacity at water level (WL)=115.00 masl (surface water release): 1,463 MCM
- Capacity at WL=112.00 masl (management level before rehabilitation): 1,115 MCM
- Dead volume : 140 MCM (elevation (EL)=98.40 masl
- Active capacity : 2,696 MCM
- Maximum inundation area (NPA): 151 km2
- Surface water release (outflow over spillway)
  - Spillway crest level: 115.00 masl
  - 6 floodgates of width of 16.50 m
  - Design discharge at FSL: 7,320 m3/s
- Bottom water release (outflow through bottom outlet)
  - Sill level : 89.10 masl
  - 2 floodgates of the maximum opening of 7.0 m
  - Design discharge at FSL (with 7.0 m opening): 1,556 m3/s

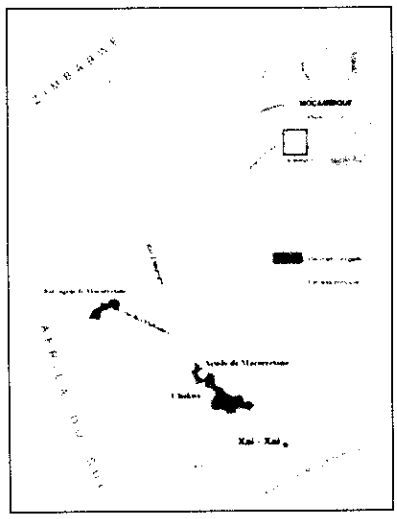


Figure 6-3-4 Massingir Dam

African Development Bank group (AfDB) has been supporting the dam rehabilitation through the following ongoing projects, of which main financial source is African Development Fund (AFD).

On May 22, 2008, an accident happened at the bottom outlets of the dam, and intake facility cannot be controlled since then. For the rehabilitation of the dam including the damaged bottom outlets, the second project mentioned below started with finance of 13.3 million UA (Unit Account, 1 UA=US$1.54 in May 2009, approx. 20.5 million US$). However, it was found clear that required cost

would be much higher than originally estimated one. So, the third project was formulated.

- Massingir Dam and Smallholder Agriculture Rehabilitation (Supplementary)
  Appraisal: 17/09/2006 Approval: 02/03/2007 Start: 30/11/2007
  Cost: 18.9 million UAC (ADF 17.0, Government 1.89, Delta 0.01)
- Massingir DAM Emergency Rehabilitation Project
  Appraisal: 28/10/2008 Approval: 15/07/2009 Start: 15/03/2010
  Cost: 21.44million UAC (ADF 13.3, Government 8.14)
- Massingir DAM Emergency Rehabilitation Project Supplementary LOAN
  Appraisal: 14/12/2012 Approval: 22/05/2013 Start: 26/12/2014
  Cost: 22.01million UAC (ADF 22.01)
  (source: AfDB)

4) Mapai Dam

In order to mitigate flood disaster, there is a conception of the Mapai Dam on the Limpopo River in northern part of Gaza Province. Implementation duration and cost were estimated as 5 years and 150 million US$, respectively, in "The Role of Water in the Mozambique, memorandum, May 2005, World Bank". The dam height is estimated at 65 m and reservoir capacity 11.2 billion m3, in FAO list. The Limpopo River Awareness Kit (RAK) expresses a concern on the dam project in the website.
The government of Mozambique is seeking funding source for the dam construction according to the media.

5) Flood

According to "The Role of Water in the Mozambique Economy, May 2005, World Bank", floods occurred in south part of the country in 1981, 1985, 1996 and 2000. Estimated frequency of flood occurrence is around once in 5 – 6 years. Recently large scale floods occurred in 1977, in 2000 and in 2013. The largest flood in recent years was that in Februrary 2000, when inundation water depth was around 2 m in Chokwe town including HICEP Office.

- Flood in 2000
- Flood hydrograph and hyetograph using ARA-Sul data

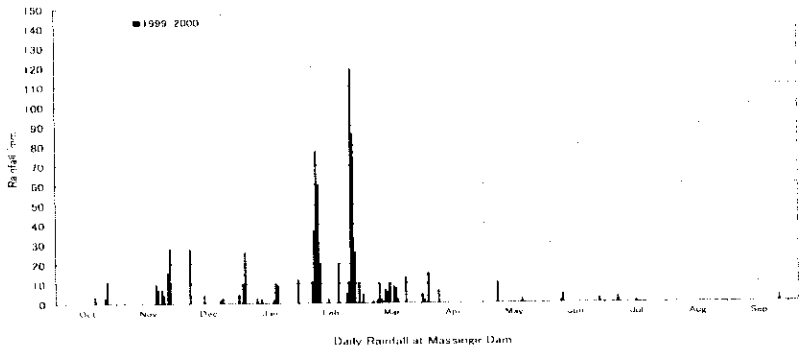


Figure 6-3-5 Daily Rainfall at Massingir Dam (1999/2000)

Hydrographs and hyetographs are useful to find careless mistakes in compiled data set, to know long term trend and characteristics, and to analyze data set. Figure 6-3-6 is an example of hyetograph. Figure 6-3-6 shows fluctuation of monthly water level of the Masingir Dam reservoir. After the accident on May 22, 2008, change in control of stored water is clearly seen in the figure.

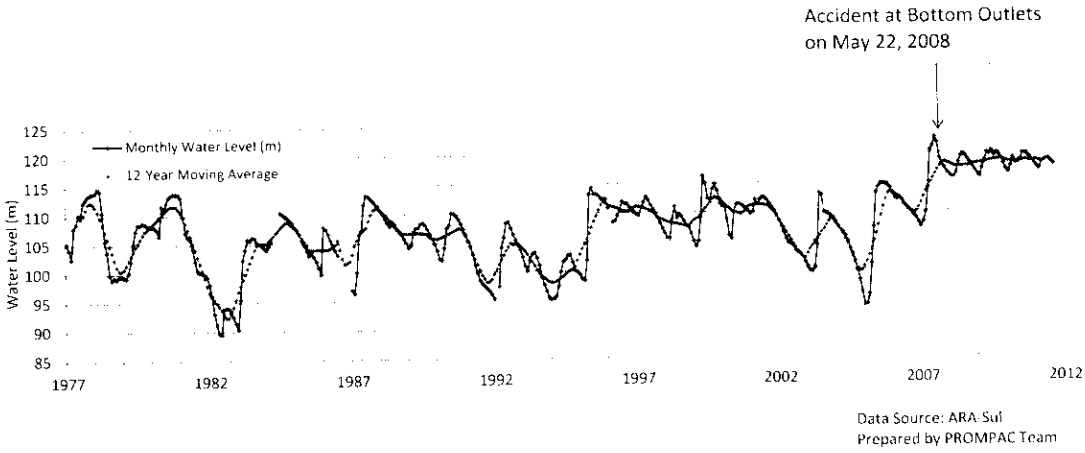


Figure 6-3-6 Monthly Water Level at Massingir Dam Reservoir

Time lag of flood peak is studied among the several stations on the Limpopo River for the year 2000 flood period. Figures 6-3-7 and 6-3-8 present observed water level hydrographs of the Limpopo River, where flood peak time lags can be seen.

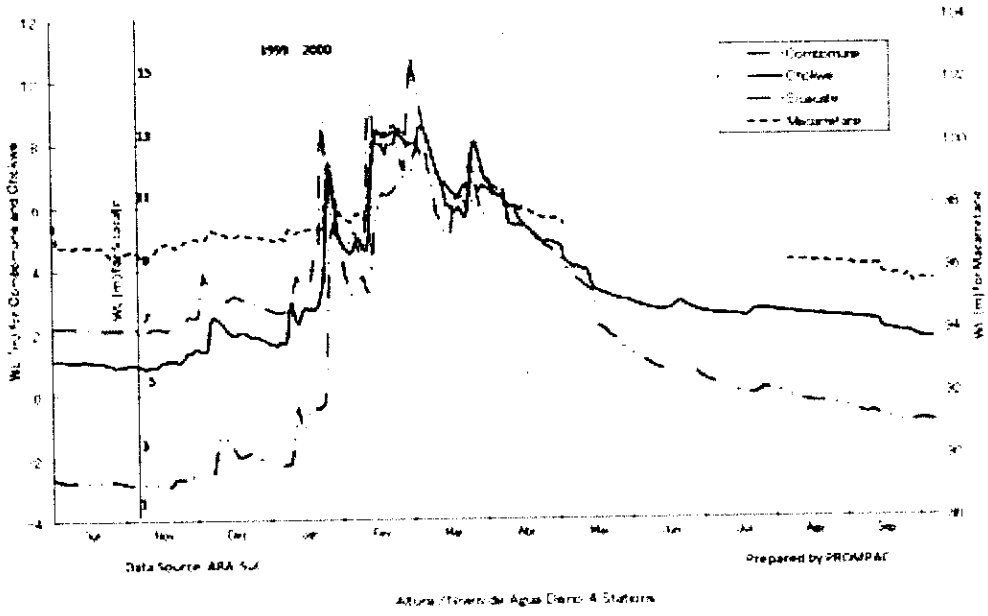


Figure 6-3-7 Flood Peak Time Lags in Hydrological Year 1999-2000

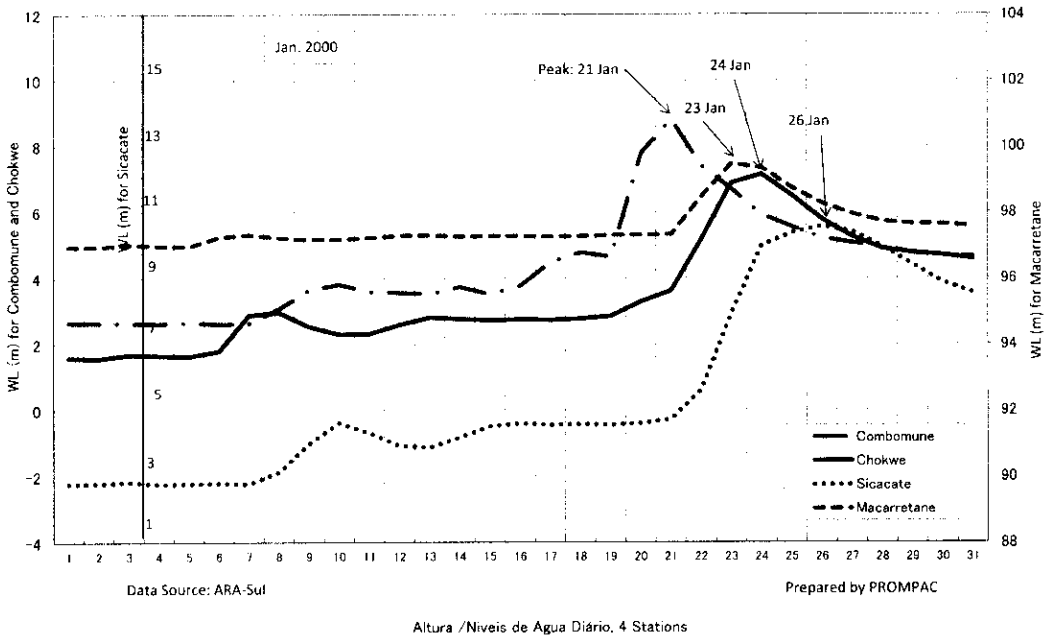


Figure 6-3-8 Flood Peak and Time Lag in January 2000

In this case, the time lag between Combomune and Chokwe was approximately 2-3 days.

- Impact to Chokwe Irrigation Scheme by flood in January 2012

At Macarretane, main part of the flood water came from northwestern side of CIS rather than the Limpopo River.

From Machiana (right bank of the Elefant River and 2 – 3 km upstream from the confluence with the Limpopo River), Xicimu (right bank of the Limpopo River, between the confluence and Macarretane) and some other points, overbank flood flow reached Macarretane. The flood crossed the Chokwe-Macarretane Dam road, damaging the structure. Of the General canal, gates of the Intake Structure and regulator were closed. The flood breached the right bank of the General Canal at around 0.35 km upstream from the culvert No.1. Then it broke the left bank of the General Canal at about 0.45 km downstream from the same culvert. Both banks of the General Canal were submerged there. The intake gates of the General canal were opened to release water in the canal to the river. Area surrounded by the General Canal and the Defense Dike (against the Limpopo River flood) was inundated. To save the General Canal and downstream area, HICEP cut a part of the Defense Dike by an excavator and released the inundated water to the river. This cut was reasonable on condition that the river water level was lower than the inundated water level in and along the General Canal. The main road surface was about 5 cm higher than the flood water level.

Of three Main Drainage Canals (Valas 1, 2 and 3), flap gates of the outlet culverts were damaged. Firstly, water level of the Limpopo River was higher than water levels of the main drainage canals 1, 2 and 3. So, to protect the area of main drainage canal 2 (Vala 2) from the river water intrusion, sand bags were placed by HICEP using its equipment. Later, the river water level lowered. Inundated water started to rush out to the river. Due to this flow, outlet structures were damaged.

- Impact to Chokwe Irrigation Scheme by flood in January 2013

- Flood damage to Chokwe irrigation system

Damages to General and Primary Canals by flood on January 23, 2013 were summarized by HICEP on February 21, 2013 as shown in Table 6-3-4, of which information was used in June 2013.

Table 6-3-4 Summary of damages in primary and secondary irrigation canals

Canal	Total length	Damaged canal including breach			Preliminary estimated
	(m)	No.	Length (m)	%	repair cost (US$)
General	14,337	22	5,530.00	39	1,166,536
Right	37,392	22	2,694.00	7	498,240
Nwachicoluane	7,078	5	960.00	14	3,820
Do Rio	39,903	24	1,117.80	3	1,335,853
Secondary canals (D7A, D8, D9, D10, D11, D12, R11 & D1R8)	36,543	25	7,575.97	21	1,035,732
Total	135,253	98	17,877.77	13	4,040,181

Source: HICEP

In order to avoid irrigation water shortage in next cropping season, HICEP has been repairing from General Canal and Direito (Right) Primary Canal according to priority, considering importance of each site and degree of the damage. On Rio Primary Canal, downstream of D11CR division point, water has not been delivered in June 2014 due to large scale of collapse of the canal cum flood defense dyke. The defence dike was already repaired by ARA-Sul, but the canal portion has not yet repaired completely by HICEP in June 2014.

Along downstream part of about 1 km of D5 secondary irrigation canal, right bank service road was eroded and vehicle cannot pass there. The rehabilitation seems not be done in June 2014.

At the crossing point of D11 secondary canal with Main Drain 5 (*Vala* V), pipe aqueduct together with connected earth canal was washed away. So, delivery of water downstream has stopped. HICEP started its recovery with siphon, and the construction was going on by a contractor in June 2014.

Along tertiary irrigation canals, which are to be maintained by farmers' groups, some of the concrete flumes fell down by the flood flow place to place. It is informed that at least one of the farmers' groups put flumes in order as before by themselves but some have taken no action so far.

In some reaches of General Canal and Rio Canal, the left bank serves both as the canal bank and as the defense dike against flood of the Limpopo River. Of General Canal, such sections are between 3.13 km and 4.83 km (box culvert), and between 7.65 km and 9.28 km. In the section at about 7.7 km of General Canal, 80 m length or so of the left bank was flushed away. So, water level of the canal cannot be raised to design level. HICEP has jurisdiction over the canal and ARA-Sul over river and flood defense dike. Along the left bank-cum-defense dike, HICEP and ARA-Sul are in charge of repair of the canal and defense dike, respectively. Repair of the dike section was mostly completed by ARA-Sul in June 2014. But, repair of irrigation canal bank was not done completely in June 2014.

At breaches or collapses on Rio Primary Canal, original ground was washed away. Some was around 100 m long and some 20 m deep. Repair works for the defence dike were done by ARA-Sul, but those for the irrigation canal were not yet made by HICEP in June 2014.

- Flood damage to Chokwe drainage system

  Main Drain 1 (*Vala* I) was connected to the Limpopo River through pipe culvert (9 pipes of φ36" or about 900 mm with flap gate) under the defense dike. Left side bank and upper part of the pipe culvert were washed away by the flood. The drain water was flowing broken left side after the damage. A pipe was deformed and moved down at abandoned drainage pump station on the right bank. Rehabilatation works were going on in June 2014 by HICEP through a contractor. Near by damaged and breached defence dike was also under rehabilitation in June 2014.

- Flood damage to flood defense dike of the Limpopo River

  The defense dike was remarkably damaged at such points that the Limpopo River meanders convexly to the Chokwe Irrigation Scheme, including those between Macarretane and Matuba, between outlets of Main Drains I and II, and Chiguidela. Particularly the dike cum Rio Canal left bank in Chiguidela was seriously damaged as abovementioned.

  Rehabilitation of the defence dike was not completed by January-March 2014, and high water of the Limpopo River intruded into the CIS area with certain damages. The dike rehabilitation was mostly done in June 2014 by ARA-Sul.

- As some agri-machinery was moved to higher place before flood, flood information seemed to be delivered to certain extent. Flood forecast and warning system should be installed soon.

- Impact to Chokwe Irrigation Scheme by flood in 2014

Of the Limpopo River, high water levels recorded at Chokwe station reached to about 6 m in February and about 7 m in March, 2014. Flooded river water intruded to field site through some formerly damaged parts of the defence dike, which were not yet rehabilitated completely at that time.

The General Canal was damaged to certain extent by the floods in 2014.

On the General Canal at about 0.35 km upstream from the railway crossing, JFS (Joao Ferreira do Savior) Intake is placed on the right bank for irrigation of 500 ha. The breach at the intake became much wider in June 2014 than before by erosion.

HICEP restricted the canal discharge to protect the canal, so some parts of the CIS could not receive irrigation water sufficiently for a week or more.

6) Drought

Hydrological year is from October in the previous year to September in Mozambique. In southern region of the country, drought years of 1980, 1981-83, 83-84, 91-92, 94-95 and 2002-03 are presented in Table 8 in "The Role of Water in the Mozambique Economy, May 2005, World Bank". Estimated

frequency of drought event seems approximately once in 5 years in average.

Drought of the Limpopo River was quite severe in 2005/06, when decreased river water interfered with intake of irrigation water for Chokwe Irrigation System (refer. to Table 6-3-9 and Figure 6-3-11). In the year, sowed area was only 28% of the average.

Annual rainfall at Chokwe was 340 mm in hydrological year 2004-2005 or 63% of the average. That in 2005-2006 was 474 mm or 89%.

7) HICEP

HICEP (*Hydraulica de Chokwe. Empressa Publico*, Chokwe Hydraulic Public Corporation) was installed in 1997 under the Ministry of Agriculture. Its predecessor was SIREMO (*Sistema de Regadio "Eduardo Mondlane"*). SIREMO controlled the river also and was related to construction of the Massingir Dam. At present, ARA-Sul (*Administracao Regional de Aguas do Sul*) under the Ministry of Public Works and Housing has jurisdiction over river management.

Organization chart of HICEP is shown in Figure 6-3-9. Number of the personnel was 131 in 2012 and increased to 150 in 2013 as seen in Tables 6-3-5 and 6-3-6.

Table 6-3-5 HICEP Personnel 2012

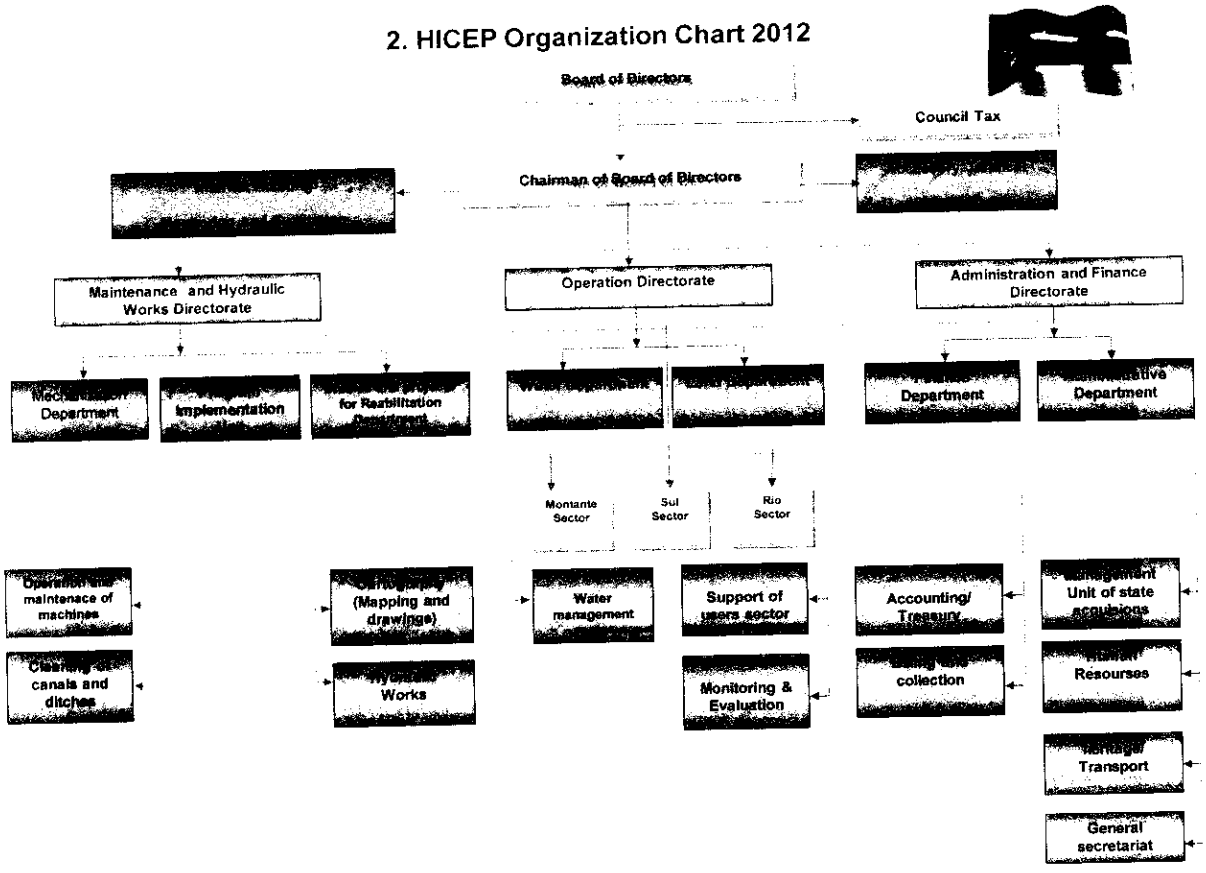
Description	Number
Engineers	14
Medium technicals	24
Basic technicals	10
Elementary training	6
Without training	77
Total	131

Source: HICEP

Table 6-3-6 HICEP Personnel 2013

No. Ord	Description	Sex		Total
		M	F	
1	PHD	1	0	1
2	Technician - Superor	11	7	18
3	Technician - Medium	26	8	34
4	Technician - Basic	38	3	41
5	Elementary	54	2	56
	Total	130	20	150

Source: HICEP, 2013



Source: HICEP

Figure 6-3-9 HICEP Organization Chart (2012)

CIS is divided into three sectors, namely Montante (upstream), Sul (southern) and Rio (downstream, along right bank of the Limpopo River).

HICEP owned vehicles for moving and heavy equipment for maintenance are listed up with numbers in Table 6-3-7. The number of excavators has increased recently.

Table 6-3-7 HICEP Vehicle and Equipment

2012

Vehicle/Equipment	Quantity
Nissan 4x4 single cable	3
Nissan 4x4 double cable	3
Toyota Fortune	1
Excavator with long boom	3
Excavator with short boom	2
Bulldozer	1

Source: HICEP

2013

Vehicle/Equipment	Quantity
Nissan 4x4 single cable	3
Nissan 4x4 double cable	3
Toyota Fortune	1
Toyota Land cruser	1
Toyota double cabin	3
Toyota single cabin	2
Toyota Prado	1
Excavator with long boom	3
Excavator with short boom	2
Bulldozer	1

Source: HICEP

Water tax of the Limpopo River to be paid from HICEP to ARA-Sul is 0.097 MT/m3 and is estimated at 11.52million MT/year recently, which HICEP has not paid actually. The tax amount is not prepared in the budget and it is the matter between the government agencies, so it is not problematic, according to HICEP.

Recent budget of HICEP is presented in Table 6-3-8. The budget is approx. 1.70 million US$ in 2012, of which O&M budget is about 0.39 million US$. Allocation to O&M cost is increasing year by year and its rate reached around 23% in 2012.

Table 6-3-8 Recent HICEP Budget

Year	Budget (1,000US$)		O&M (%)
	Total	O&M	
2008	944	90	9.6
2009	983	135	13.7
2010	1,100	207	18.8
2011	1,697	282	16.6
2012	1,702	385	22.6

Source: HICEP

In the water and land management, following actions are planned by HICEP.

① Water Management

- Cleaning of 202.6 km of irrigation canals (98.7 km of main cannals and 103.9 km of secondary canals), from total of 366.2 km of irrigation canals of all irrigation scheme (98.7 km of main canals and 267.5 km of secondary canals)
- Cleaning of 279.3 km of drainage canals (100.8 km of main drainage canals and 178.5 km of secondary drainage canals), from total of 563 km of all drainage canals in the entire irrigation scheme (113 km of main drainage canals and 450 km of secondary drainage canals)
- Strengthen the maintenance unit, with acquisition of more equipment
- Provide water at planned area of 7,000 ha for rice and 1,500 ha for other crops
- Participate in rehabilitation of 7,000 ha with IDB financing

② Land Management

- Cultivation of 7,000 ha for rice and 1,500 ha of other crops
- Empower users to manage their own Association
- Look for finacing for the agricultural campaign
- Fortifying the machine park for land preparation and harvesting rice
- Acquisition of agricultural inputs (fertilizers and herbicides) for rice production
- Make operational the Rice Mills factory
- Empower the Water Users Associations Union (UNAR)

8) Fluctuation of Crop Cultivation Area

Fluctuation of crop cultivation area from 2004/05 to 2012/13 is shown in Table 6-3-9 and Figure 6-3-10. A remarkable depression in 2005/06 is due to sharp decrease of the Limpopo River flow caused by severe drought. Stored volume of the Massingir reservoir was not enough at that time.

Table 6-3-9 Fluctuation of Crop Sowed/Planted Area

Season	Crop	Sowed Area (ha)									
		2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Average
Hot	Rice	1,998	156	2,713	2,981	6,200	7,567	2,877	4,585	3,798	2,596	3,547
	Others	663	65	1,143	1,430	1,659	1,579	777	1,196	898	987	1,040
	Sub-total	2,661	221	3,856	4,411	7,859	9,146	3,654	5,781	4,696	3,583	4,587
Cool	Horticulture	2,883	1,889	3,115	4,134	3,271	2,349	2,358	2,718	2,020	848	2,559
Total area		5,544	2,110	6,971	8,545	11,130	11,495	6,012	8,499	6,716	4,431	7,145
Irrigation rate (%)		21.3	8.1	26.8	32.8	42.8	44.2	23.1	32.7	25.8	17.0	27.5

Source : HICEP

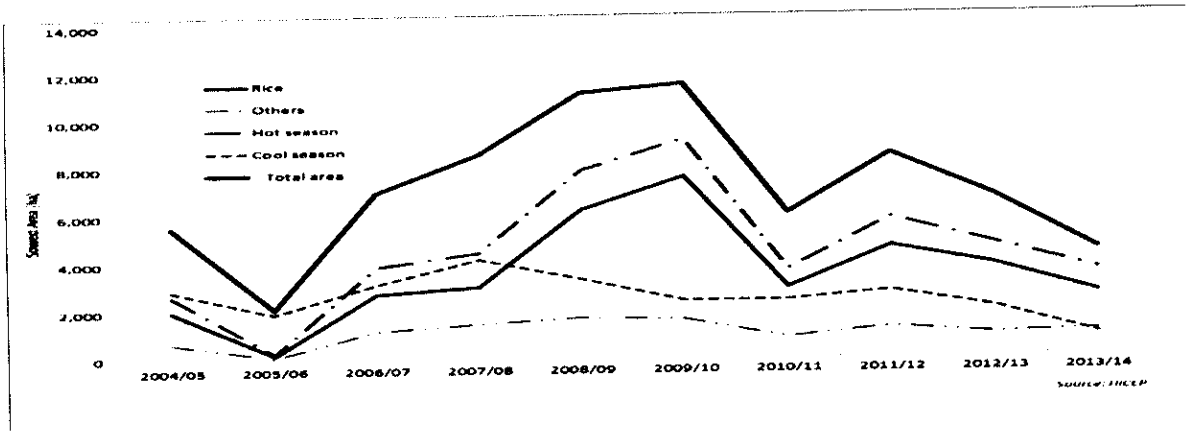


Figure 6-3-10 Fluctuation of Crop Sowed/Planted Area

Irrigation plan in the basic design study in 2001 identified total of existing field area as 26,030 ha, consisting of paddy field area of 18,686 ha and other crops area of 7,344 ha. As abovementioned, target cultivation area of HICEP is 7,000 ha for rice and 1,500 ha for other crops at present. Table 6-3-9 and Figure 6-3-11 suggest that other crops area (maize, vegetable, etc. except for rice) is larger than the HICEP target area. On the other hand, rice cropping area has been lower than the target area except for 2009/10, and is less than a half of the target area except for 2008/09 and 2009/10. The rice cropping area changes widely and is not stable compared with other crops area.

9) Irrigation System and Drainage System

HICEP provided the project team with an irrigation system diagram as in Figure 6-3-12, which is the same one as in the Basic Design Study Report, JICA, 2001. As in Table 6-3-10 and Figure 6-3-11, the General Canal and three main/primary irrigation canals (Direito, Nwachicoluane and Rio) compose main irrigation network.

Table 6-3-10 General Canal and Main/Primary Irrigation Canal

Name	Length (m)	No. of 2ndary canal	No. of regulators			Discharge (m3/s)
			static	dynamic	total	
General/Geral	14,337	8	2		2	46.4
Direito	37,392	26	3	5	8	43.9
Do Rio	39,903	12	6	2	8	13.2
Nwachicoluane	7,078	4	1		1	6.6
Total	98,710	50	12	7	19	46.4

Source: *Manual de Operação e Manutenção*, 2003, BRL

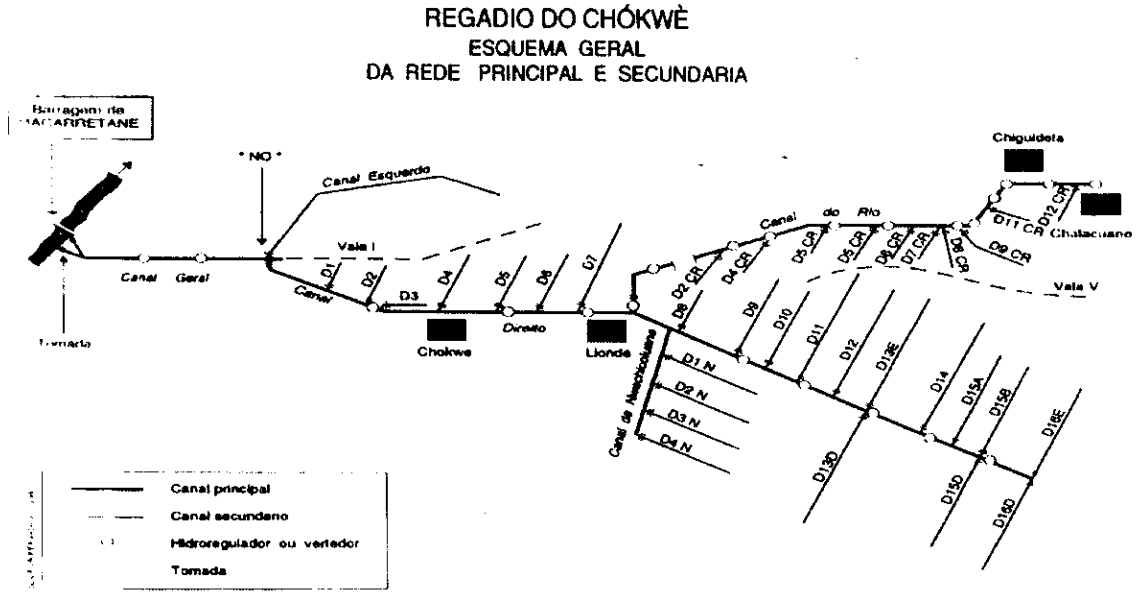
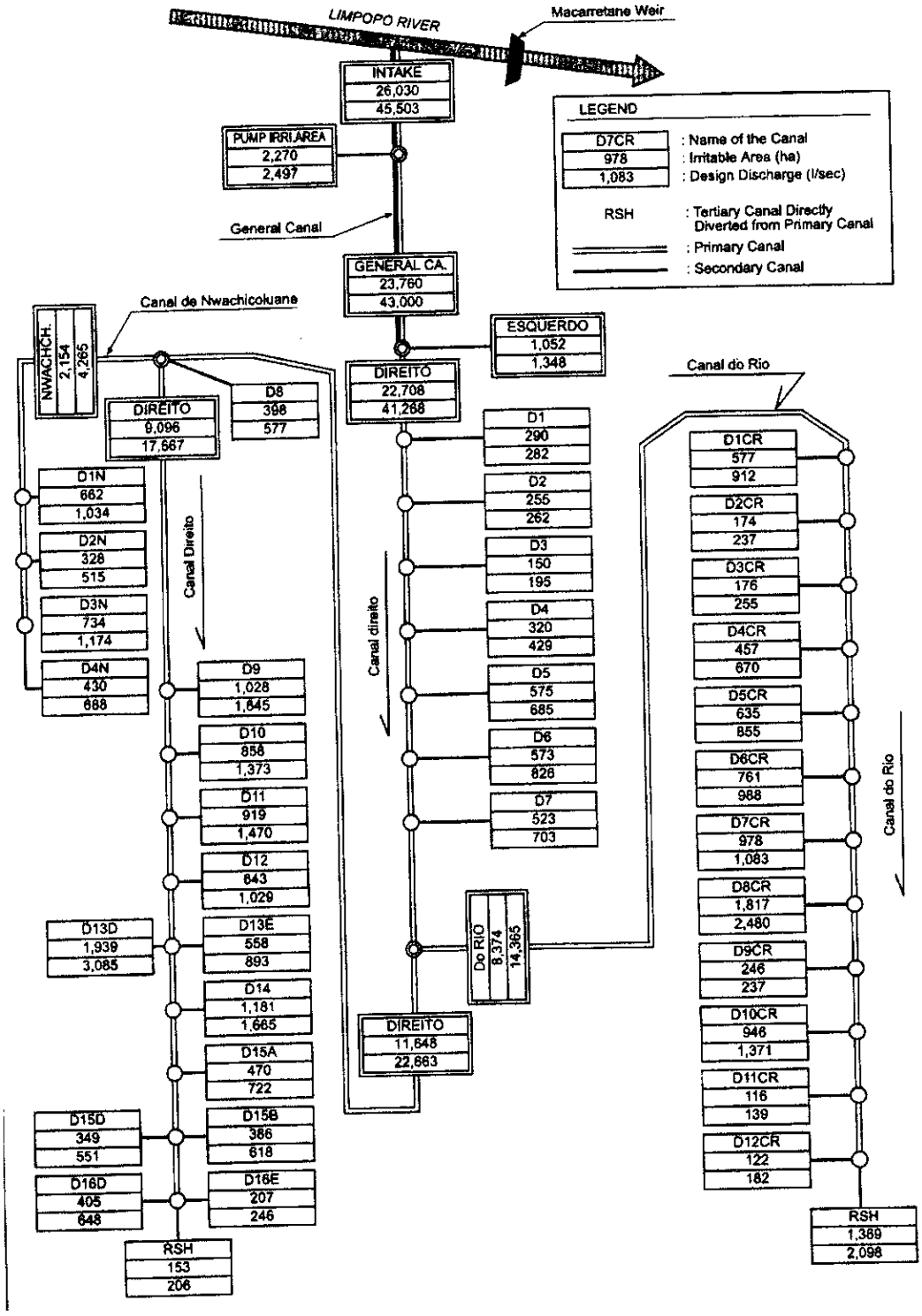


Figure 6-3-11 Main and Secondary Irrigation Canal Network



Source: HICEP

Figure 6-3-12 Chokwe Irrigation Scheme - Irrigation System Diagram

HICEP is responsible for operation and maintenance of General Canal, and primary and secondary irrigation canals now. As mentioned in 10) below, responsibility to the secondary irrigation canal was shifited to HICEP recently. Farmers' group is in charge of tertiary irrigation canal and lower level. As for drainage system, the same charges are taken as in above.
HICEP is carrying out the operation and maintenance of main facility of Chokwe irrigation system based on Operation and Maintenance Manual (*MANUAL DE OPERAÇÃO E MANUTENÇÃO*) prepared by BRL (French) on June 2003.
HICEP prepares every year (for example, 2013/14) plan of cropping and irrigation based on talking with farmers. Planned discharge at division and intake points is calculated in weekly base.

"Cantoneiro", being member of HICEP, measures water levels twice a day on 6 and 15 o'clock at upstream and downstream of water level regulator and at inlet of division/intake gate structure of secondary irrigation canal, then reports to water management department. If water level is going down, he may ask to open gate. According to instruction of the department, he operates gate of division structure and control discharge. He monitors cropping conditions, listen to farmer's request, advises farmers, and help collection of water fee. According to interview in 2013, their problems include insufficient transportation machinery such as bicycle and motorcycle, long distance or wide cover to move, insufficient communication tools such as radio and so on.
In training for cantoneiros in July, 2014, questionnaire was filled by each participant. Issues by the cantoneiros include difficulty in reading water level at dark 6 am in winter, lack of gate padlock, grease/oil, instruments, equipment, etc., poor irrigation/drainage canals, insufficient maintenance without cleaning canal, damage of the facility by cattle, delayed or no water fee payment from farmer, delayed billing and receipt to farmer, and so on.

HICEP sometimes hires labors for grass cutting along canal bank. It was observed that some labors throw cut grass into Direct primary irrigation canal. Cut leaves may get entangled at gate, so a rule of putting cut grass on the ground must be followed perfectly.
In the abovementioned manual, calculation/conversion tables (abaco) are presented and discharge and other values can be gained easily. However, a lot of plants or bush may cause larger error. From discharge at BP of General Canal and total of each intake discharge, loss may be estimated and delivery and distribution conditions of irrigation water may be known. Leakage water may partly function as environmental maintenance flow of drain.

Irrigation system diagram composed of General Canal, and primary and secondary irrigation canals was basically prepared in "Basic Design Study Report on the Project for Rehabilitation of Chokwe Irrigation Scheme", June 2001, JICA, Nippon Koei, and it is used at present. Former naming method for tertiary canal was changed, and now from upstream to downstream along secondary irrigation canal, left side tertiary canal is named R plus odd number and right side R plus even number.

Drainage system was reviewed and revised in 2003 OM Manual, BRL. Number of secondary drainage

canal increased considerably. Naming of tertiary drainage canal has not yet done.

The drainage system consists of 11 main drains (main drainage canal or *Vala*), out of which some are connected and drained to the Limpopo River like No.1 – 3 Main Drainage Canals. Some of them are connected to No.5 Main Drainage Canal, which flows to the Chinanga Lake with a drainage area of more than 19,400 ha and approximately 30 km in length. A broken drainage pump station of No.1 Main Drainage Canal remains at the outlet to the Limpopo River. Sewage water from Chokwe town also flows into No.1 and No.2 Main Drainage Canal systems. Insufficient flow capacity of the systems is one of the causes of inundation in January 2012.

HICEP seems to confirm mostly route of secondary drainage canals on map, but drainage system diagram covering the whole area does not seem to be prepared nor be provided. Some secondary drains are difficult to be confirmed at site due to hindrance by sediment and thick grasses and bushes. Salinity problem land may be less covered by vegetation. Many wild birds inhabit in swampy bushed land of poor drainage including old river courses,

10) Land Use and Water Charges

- Seminar on October 27, 2011

  In the seminar, some important items below were decided to be realized from September 2012.

  - Change of person in charge of maintenance of secondary irrigation/drainage canals from farmers' group to HICEP
  - For around 10 years, irrigation water charge has been unchanged at 550 MT/ha for the rainy season (September - February) and 250 MT/ha for the dry season (March - August). Rate of the water charge to rise to 800 MT/ha for the rainy season and 400 MT/ha for the dry season, and is scheduled to be reviewed for rechange in 2014.
  - Dormant land (infrastructure) tax is to be revived. The rate is to be 600 MT/ha/year. This intends withdrawal of unused land and its re-distribution to those who have will to use this land.

- Present Land Use Situation

Planned irrigation area is 26,030 ha, but recent average cropping area of the both seasons is less than 30% of the planned area (ref to Table 6-3-9). It is broadly known that some parts of the area are not cultivated due to salinity and poor drainage problems.

- Present Water Use Situation

Actual irrigation area is much lower than the planned irrigation area at present, so flow capacity shortage is not felt so much along the main irrigation system. It is seen that surplus irrigation water at the end of tertiary irrigation canal (mostly concrete flume canal) is stagnant and worsens poor drainage condition. Leakage of water from deteriorated tertiary irrigation canal is generally observed, however such problem seems to be regarded as comparatively minor one in D5 and D6 areas. When actual irrigation area be increased, water delivery and distribution losses as well as insufficient flow capacity on main irrigation system will be gradually problematic.