CARD
COALITION for African Rice Development

JICA

JICA TECHNICAL MANUAL FOR RICE CULTIVATION IN AFRICA

- CARD Implementation Review 2008-2018-

APRIL, 2021

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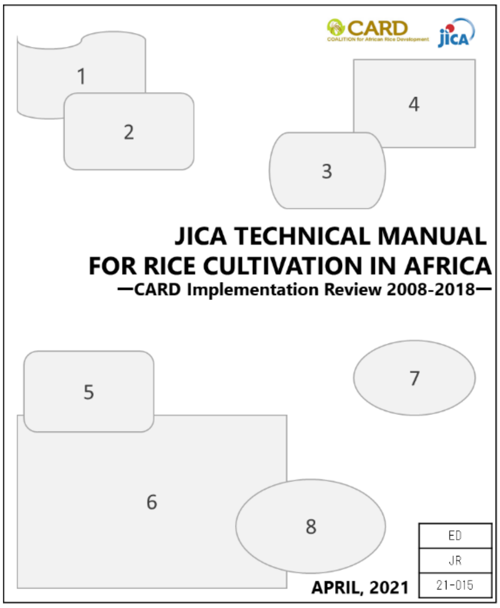

Description of the cover photos:

1. *TZA-06 Training on record management in storage facilities (Completion report)*
2. *CIV-01 Tasting of domestic rice (Project completion report)*
3. *GHA-06 Inspection of irrigation facilities (Operation and Management Manual)*
4. *TZA-02 Main channel (Appendix of Final Report)*
5. *SLE-02 Differences in growth between fertilizer application and non-fertilizer application (Project progress report 2)*
6. *MOZ-01 Transplanting (MANUAL DE CULTIVO DE ARROZ)*
7. *CMR-02 Milled rice (Résultats de l'étudede marché)*
8. *SEN-03 Combine harvester (Manuel pratique sur la technologie post-récolte)*

CARD member states[1]

[1] *Source: Prepared by JICA study team based on CARD home page (https://riceforafrica.net/)*

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Unit and Currency

kg	kilogram
t, MT	Metric tones = 1,000 kg
h	hour
mm	millimeter
cm	centimeter
km	kilometer
ha	hectare
HP	Horsepower
km^2, sq.km	square kilometer
m^3	cubic meter
MCM	million cubic meter
a.s.l.	above sea level
MW	mega Watt
LPS, l/s	litters per second
mm/mon	millimeter per month
mm/d	millimeter per day
km/h	kilometer per hour
m/s	meter per second
m^3/s	cubic meter per second
ºC	degrees centigrade
%	percent
US$	United States of America Dollar
EUR	EURO

Abbreviation (1/2)

ADERIZ	Agence pour le Développement de filière Riz (Cote d'Ivoire, French)
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
ANADER	Agence Nationale d'Appui au Développement Rural (Cote d'Ivoire ,French)
CARD	Coalition for African Rice Development
CFAMA	Centre de Formation et d'Application de Machinisme Agricole (Madagascar, French)
CGL	Comprehensive Guidelines (Tanzania)
COVID-19	Corona Virus Disease
C/P	Counterpart
DF/R	Draft Final Report
EAC	Estação Agrária do Chokwe (Mozambique, Portuguese)
F/R	Final Report
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FARA	Forum for Agricultural Research in Africa
FBO	Farmer Based Organization (Sierra Leone)
FFS	Farmer Field School
FRG	Farmer Research Group (Ethiopia)
FSG	Farming Support Group (Mozambique)
GIS	Geographic Information System
HICEP	Hidráulicas de Chokwe EP (Mozambique, Portuguese)
IC/R	Inception Report
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IMT	Irrigation Management Transfer
IRRI	International Rice Research Institute
ISRIC	International Soil Reference and Information Center
IVS	Inland Valley Swamp
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency (Japan)
JIRCAS	Japan International Research Center for Agricultural Sciences (Japan)
JOCV	Japan Overseas Cooperation Volunteers (Japan)
JST	Japan Science and Technology Agency (Japan)
KATC	Kilimanjaro Agricultural Training Centre (Tanzania)
KIS	Kpong Irrigation Scheme (Ghana)
MATI	Ministry of Agriculture Training Institute (Tanzania)
MIS	Mwea Irrigation Scheme (Kenya)
M&E	Monitoring and Evaluation
NaCRRI	National Crops Resources Research Institute (Uganda)
NEPAD	The New Partnership for Africa's Development
NERICA	New Rice for Africa
NRDS	National Rice Development Strategy
OIRiC	Optimum Input Rice Cultivation (Ghana)
OJT	On the Job Training
O&M	Operation and Maintenance
PIM	Participatory Irrigation Management
RECs	Regional Economic Communities
R/D	Record of Discussion
R&D	Research and Development
SAED	Société d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé (Senegal, French)
SATREPS	Science and Technology Research Partnership for Sustainable Development
SDAE	Serviço Distrital de Actividades Económicas (Mozambique, Portuguese)

Abbreviation (2/2)

SHEP	Smallholder Horticulture Empowerment & Promotion
SL	Sales Leader (Tanzania)
SNS	Social Networking Service
TICAD	Tokyo International Conference on African Development
ToT	Training of Trainers
TP-R	Technical Package on Rice Production (Sierra Leone)
UNVDA	Upper Noun Valley Development Authority (Cameroon)
WB	World Bank

INTRODUCTION

Background

The demand for rice has increased rapidly in Africa since the latter half of the 1990s, and its increasing dependence on imported rice has become evident. The rise in global grain prices between 2007 and 2008 accentuated the problem of food insecurity for many, in particular poverty-stricken households in Africa. The threatening situation called for emergency measures including medium-to long-term production expansion. Rice can be considered possibly the only major grain consumed in Africa with an extensive potential for expansion on the continent. Coherent national policies and international support in this sector will not only contribute to resolving some of the major food insecurity threats faced on a medium and long term basis, but also to alleviate poverty in general and promote rural development.

On this note, JICA and the "Alliance for a Green Revolution in Africa (AGRA)" jointly announced the establishment of the "Coalition for African Rice Development (CARD)" on the occasion of TICAD IV held in Yokohama in May 2008. This comprehensive initiative comprises of a consultative group of donors, research institutions and other relevant organizations to support national efforts to expand rice production in Africa.

Various cooperation projects were financed by JICA to promote rice cultivation within the CARD framework. Technical cooperation in rice cultivation, focused in particular, on assistance and training provided to ministerial agents and farmers in the CARD member countries. The impact assessments of these projects clearly show the effectiveness of this cooperation; the target of increasing the total annual production from 14 million tons to 28 million tons from 2008-2018 was achieved, thereby "Doubling rice production in 10 years"[2].

Useful technical rice cultivation solutions were identified in each target country during each project implementation. A technical handbook and project assessment review were also prepared and shared for every project. It would thus be important to extract the lessons learned from these projects and to evaluate the most effective technical solutions that contributed to the achievement of the CARD objectives.

The second phase of CARD starting from 2019, aims to double rice production from 28 million tons to 56 million tons over a period of 12 years ending in 2030. JICA will continue to provide the necessary technical assistance during the given period. An assessment of the useful technical solutions applied during the first phase of CARD would further improve the quality of technical cooperation.

This document is the result of a comprehensive analysis of all the handbooks and related project reports (first phase of CARD) including sector reviews from advisory experts. The effective technical solutions (including policy and strategic approach) are also extracted from the analysis of the project output and compiled in the document. This technical manual, officially known as "JICA Technical Manual

[2] *JICA, "Review Survey for Coalition for African Rice Development (CARD) Final Report", March 2018*
https://openjicareport.jica.go.jp/pdf/12305736.pdf

for Rice Cultivation in Africa: CARD Implementation 2008-2018" is thus the fruit of the compilation of the above-mentioned-information. This manual would be a useful tool for the formulation of future rice cultivation projects and technical assistance in Sub-Saharan Africa. The manual exists in four versions, French and Portuguese, Japanese and English to facilitate comprehension and communication by all involved in rice cultivation on the continent.

JICA and CARD

JICA, as one of the Steering Agencies of CARD, works with 10 international organizations and research institutes[3] to assist the 23 African CARD member countries[4] to formulate their National Rice Development Strategy (NRDS). JICA has also played an active role in supporting these countries in their efforts to increase rice production in line with their strategies. A total of 218 rice projects amounting to a global sum of 9 billion US$, were implemented by governing bodies and state authorities (of which, 48 financed by JICA) to double total production in 2018.

In the first phase of CARD (2008 – 2018), the approach deployed to achieve the targeted goal was namely via the development of: value chain, agro-ecology, human resources and South-South cooperation (right Fig).

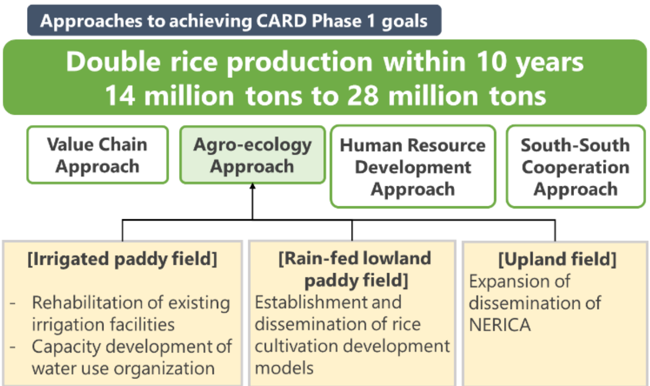

Fig Approach adopted for phase 1

Many JICA projects sought to develop agro-ecology in Africa within three farming environments: "irrigated paddy fields", "rain-fed lowland paddy fields", and "upland fields". These projects include selecting the appropriate varieties and introducing necessary cultivation techniques as well as inputs (water, fertilizer, etc.) for each environment Others involve the rehabilitation of irrigation facilities to improve water regulation of paddy fields and capacity development of water users associations. Assistance also extended to rain-fed lowland paddy fields with the establishment and dissemination of rice cultivation development models and to upland farming with the dissemination of NERICA rice.

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[3] *AfDB, Africa Rice Center, AGRA, FAO, FARA, IFAD, IRRI, JICA, JIRCAS, NEPAD and WB*

[4] *The first group countries of CARD are Cameroon, Ghana, Guinea, Kenya, Madagascar, Mali, Mozambique, Nigeria, Senegal, Sierra Leone, Tanzania, Uganda, and the second group is Benin, Burkina Faso, Central African Republic, Cote d'Ivoire, Republic of Congo, Ethiopia, Gambia, Liberia, Rwanda, Togo, and Zambia.*

The second phase of CARD was launched in 2019. JICA pledges to continue its technical assistance for the next 12 years to help further double rice production from 28 million to 56 million tons in 2030.

In this phase, the emphasis will not only be made on the expansion of production volume and cultivation area. The "RICE approach" will be adopted to focus on the distribution and the business of producing "high quality marketable rice" with the support of regional communities (RECs) as shown in right Fig. In short, the valuable technical solutions identified during the first phase will be deployed to achieve the new goals based on the "RICE approach" in the second phase.

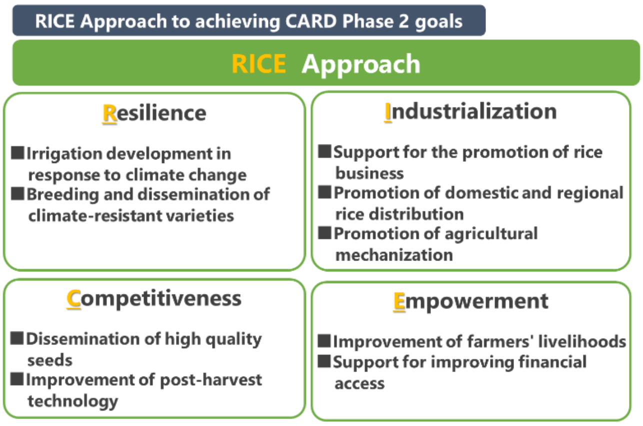


Fig RICE approach adopted for phase 2

User Guide

This manual gives an insight to a variety of useful rice cultivation techniques developed and disseminated during the implementation of the JICA projects that contributed largely to the eventual elaboration of rice cultivation policies and systems. The contents of this document are designed to motivate readers to promote rice cultivation regardless of their perspectives and to examine the diverse solutions.

This manual is intended to provide guidance to the users listed below. This document is shared externally with all the partners involved in rice cultivation projects to allow everyone to draw on our experiences and put them to practical use on the grounds. We hope that the good practices and effective solutions described in this manual will be reflected in the NRDS of CARD member countries in their elaboration of efficient domestic rice promotion policies and strategies to attain the new goals.

[Target users]

- Concerned with CARD (in particular, project planners and experts related to rice)
- Focal persons in charge of NRDS, task force members, and officials from relevant ministries and agencies
- Donors and international organizations that support CARD
- Volunteers such as JOCV
- Students who are interested in agriculture in Africa (especially general of rice cultivation)

There are four chapters in this manual as shown below. The dominant technical issues are featured in the second and third chapters.

Chapter 1 CARD Achievement on Phase 1
Chapter 2 Rice Cultivation Technique
Chapter 3 Technique Transfer and Extension
Chapter 4 Policy Recommendations

Organization of Chapter 1 CARD Achievement on Phase 1

- As mentioned earlier, the goal of "Doubling rice production in 10 years (2008 – 2018)" was achieved in first phase of CARD. This chapter summarizes the situation of the 23 Sub-Saharan member countries at the end of Phase 1, with supporting statistical data. The 23 countries are divided into two groups. The progress attained by each country is described and analyzed according to production volume trends, area harvested, and annual average yield (Section 1-3 NRDS Achievements of Target Countries).

Organization of Chapter 2 Rice Cultivation Techniques

- Chapter 2 consists of 8 parts as shown below. It may be easier for readers, unfamiliar with rice cultivation in Sub-Saharan Africa, to begin with Section 2-1 Overview of Rice Cultivation. This will probably facilitate understanding of the context in which specific technologies were developed and disseminated in each field.

- In addition to production and post-harvest technology highly emphasized by rice cultivation policies there is a need to address the issues related to the entire rice value chain from the market perspective in order to achieve the objectives in phase 2 Section 2-6 Rice Farming Management and Value Chain Development, provides an insight on the issues and measures that would improve financial accessibility and coordination flow from the upstream to the downstream of the value chain through better farming management planning, sales, and structural reinforcement.

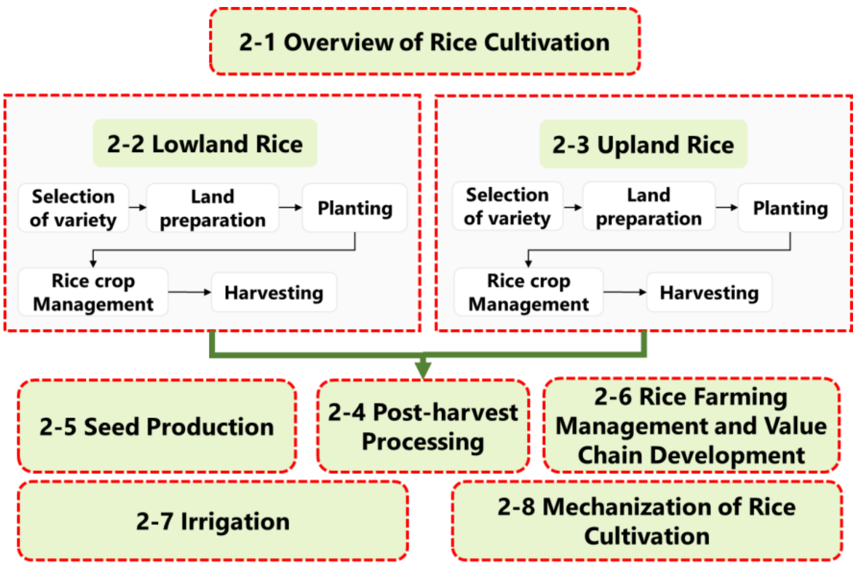


Fig Organization of Chapter 2 Rice Cultivation Techniques

- As for the cultivation techniques adapted to different farming systems, rice farming solutions for irrigated and rainfed paddy fields (lowland and deep-water) are described in section 2-2 Lowland rice and for upland fields in section 2-3 Upland Rice respectively. Other issues common to the described farming systems are mentioned for example, in section 2-2 Lowland rice with a sub-section 2-2-3 Planting.
- Section 2-5 Seed Production provides an insight on the role of seed production systems, seed testing laboratories, work processes, points of concern, issues and examples of support for seed production (different from the general rice production), based on project implementation experiences.
- Irrigation issues including water management in the fields are described in "Rice crop management" explained in Section 2-2 Lowland rice and Section 2-3 Upland Rice. Section 2-7Irrigation describes the technical aspects of a wide-area water supply and distribution system from water sources to fields, focusing on the construction of facilities and the role of water management organizations in facility and water maintenance as well as management respectively.
- The issues of agricultural mechanization during cultivation and post-harvest periods are described in section 2-2 Lowland rice, section 2-3 Upland Rice and Section 2-4 Post-harvest Processing respectively. The development, improvement, manufacture, promotion, use, maintenance, and safety of agricultural machinery are described in a sector-wide manner, rather than in terms of individual operations in section 2-8 Mechanization of Rice Cultivation.

Organization of Chapter 3 Technique Transfer and Extension

- Four major issues are dealt with in Chapter 3 (as shown below). Readers who may not have sufficient knowledge about technology transfer and dissemination are advised to first read section 3-1 Structure of Technique Dissemination. This would provide a better understanding of the major actors involved in dissemination and the basic dissemination methods (ToT, OJT, and FFS).
- Issues relating to target techniques, technique transfer and dissemination methods are discussed in two sections; section 3-2 Technique Transfer to Project Partners and section 3-3 Dissemination to Farmers.
- The organizations responsible for dissemination are described in section 3-2 Technique Transfer to Project Partners while the adoption and dissemination of appropriate technologies are explained in section 3-3 Dissemination to Farmers.
- Section 3-4 Establishment of a Sustainable and Deployable Dissemination System is a compilation of information on dissemination plans, dissemination systems, and technological developments as matters necessary for dissemination after completion of projects.

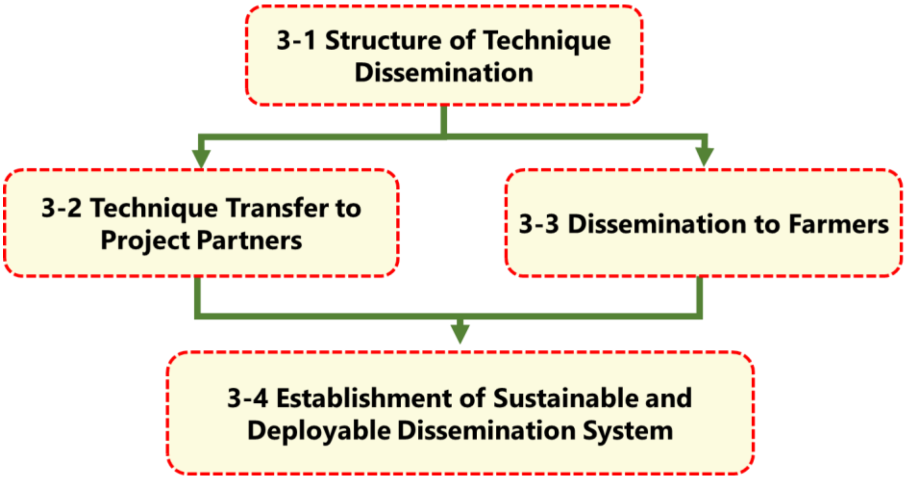


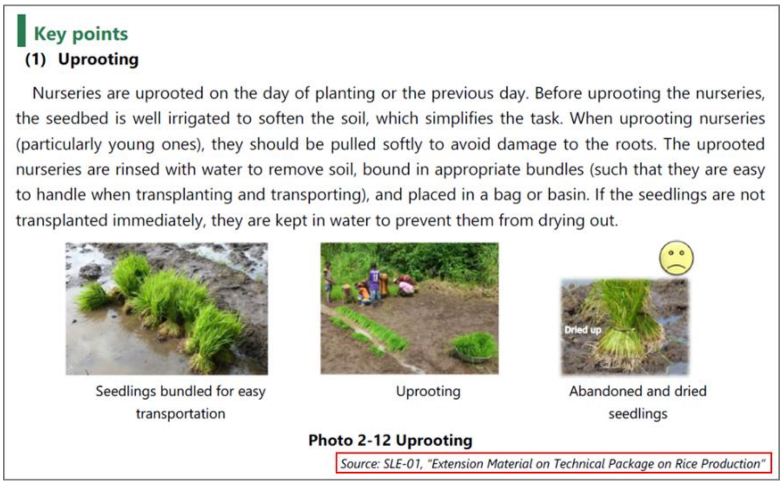
Fig Organization of Chapter 3 Technique Transfer and Extension

Organization of Chapter 4　Policy Recommendations

- In Chapter 4, solutions to enhance the rice sector in the 32 member countries are proposed for the second phase of CARD. These suggestions are based on the output and the good practices experienced in rice related CARD projects financed by JICA in 16 of the member countries (in the first group). The report covering a wide range of topics based on case studies, include value chain, policies, strategies, organization, budgets, subsidies, dissemination and research. We hope that actors and organizations in the rice sector of each country would refer to this chapter when evaluating the actual sector status prior to proposing future improvement measures.

Verification of source documents

- Effective technologies, case studies, and important points are recalled in this manual of which the sources range from handbooks, guidelines, reports, to other materials prepared by JICA teams in the various CARD projects implemented across the continent.
- The detailed information and the reference materials of this manual are organized and summarized in Appendix 2.


Key points

(1) Uprooting

Nurseries are uprooted on the day of planting or the previous day. Before uprooting the nurseries, the seedbed is well irrigated to soften the soil, which simplifies the task. When uprooting nurseries (particularly young ones), they should be pulled softly to avoid damage to the roots. The uprooted nurseries are rinsed with water to remove soil, bound in appropriate bundles (such that they are easy to handle when transplanting and transporting), and placed in a bag or basin. If the seedlings are not transplanted immediately, they are kept in water to prevent them from drying out.

Seedlings bundled for easy transportation | Uprooting | Abandoned and dried seedlings

Photo 2-12 Uprooting

Source: SLE-01, "Extension Material on Technical Package on Rice Production"

Fig Verification of source documents

Project code and URL links to source materials

(Excerpt from the Manual 2-2 Lowland rice)

- Alphabetic-numeric characters in the text and in the sources refer to the "project code" made up of the country name and the serial number. The details are provided in the Table and Table : "Project Code List" and in the Appendix 1: Project Outline Table .

Appendix

- The following appendixes are attached to the manual.

  Appendix 1 Project Outline Table
  Appendix 2 Deliverables List

- The Project Outline Table in Appendix 1 provides detailed information on each project, listing the duration period, the type of intervention, the cultivation systems on the project site, and the technical solutions taken into consideration by the project.
- The Deliverables List in Appendix 2 provides an index for the manuals and guidelines elaborated by each project facilitated by details like keywords and the language of publication for easy tracing of the original document.

Table I-1 Project Code List (1/2)

Project Code	Country	Title of the Project	Duration of the Project
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	February 2008 - February 2012
BFA-02	Burkina Faso	(French) Projet études pour la formulation d' un programme national de développement de bas-fonds	February 2017 - February 2019
BFA-03	Burkina Faso	(English) Project on establishment of the model for fertilizing cultivation promotion using Burkina Faso phosphate rock	May 2017 - May 2022
BFA-04	Burkina Faso	(English) Rice production adviser	2009 - 2010
BFA-05	Burkina Faso	(English) Agricultural and Rural Development Policy Advisor	2007 - 2009
BFA-06	Burkina Faso	(English) Agricultural and Rural Development Policy Advisor	2011 - 2014
BFA-07	Burkina Faso	(English) Agricultural and Rural Development Policy Advisor	2016 - 2018
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d' Ivoire (French) Projet de Promotion du Riz Local en République de Côte d' Ivoire	February 2014 - March 2020
CIV-02	Cote d'Ivoire	(English) Agricultural technical advisor	2013 - 2015
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	May 2011 - May 2016
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	June 2016 - June 2021
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	March 2010 - March 2015
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	November 2015 - November 2020
ETH-03	Ethiopia	(English) Agricultural Development Advisor	2005 - 2008
ETH-04	Ethiopia	(English) Agricultural Development Advisor	2008 - 2010
ETH-05	Ethiopia	(English) Agricultural Development Advisor	2010 - 2011
ETH-06	Ethiopia	(English) Agricultural Development Advisor	2011 - 2014
ETH-07	Ethiopia	(English) Agricultural Development Advisor	2014 - 2016
ETH-08	Ethiopia	(English) Food Security Adviser	2012 - 2014
ETH-09	Ethiopia	(English) Agricultural Adviser	2016 - 2019
GHA-01	Ghana	(English) Small-Scale Irrigated Agriculture Promotion Project *	August 1997 - July 2004
GHA-02	Ghana	(English) Farmer Participatory Irrigation Management in Irrigation Projects in Ghana *	October 2004 - September 2006
GHA-03	Ghana	(English) Upper West Integrated Agricultural Development in the Republic Ghana	April 2008 - March 2010
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	July 2009 - December 2014
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	May 2016 - March 2021
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	January 2016 - January 2021
GHA-07	Ghana	(English) AGRA Collaboration and Rice Breeding	2010 - 2012
GHA-08	Ghana	(English) Promotion of Mechanization of Small-Scale Farmers	2014 - 2017
GIN-01	Guinea	(English) Research on Sustainable Rural Development in the Central/Upland Guinea	July 2008 - May 2011
GIN-02	Guinea	(English) Agricultural Development Management Advisor	2014 - 2018
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	January 2012 - January 2017
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	May 2013 - May 2018
KEN-03	Kenya	(English) Irrigation Policy Advisor	2011 - 2013
KEN-04	Kenya	(English) Irrigation Policy Advisor	May 2018 - May 2020
KEN-05	Kenya	(English) Agricultural Promotion Advisor	2014 - 2017
KEN-06	Kenya	(English) Agricultural Promotion Advisor	2017 - 2019
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	January 2009 - July 2015
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmè tres Irrigué, (PAPRIZ Phase2)	December 2015 - December 2020
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	May 2017 - May 2022
MDG-04	Madagascar	(English) Agricultural and Rural Development Advisor	February 2016 - February 2019
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	March 2007 - March 2010
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	February 2011 - November 2014
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	January 2011 - January 2015
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province(ProAPA)	November 2016 - November 2021
MOZ-05	Mozambique	(English) Irrigation Adviser	2012 - 2014
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	September 2011 - April 2016
NGA-02	Nigeria	(English) Policy Advisor to Federal Ministry of Agricultural and Rural Development	2018 - 2019
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	November 2010 - October 2013
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	October 2014 - September 2019
RWA-03	Rwanda	(English) Irrigation Adviser	2011 - 2013
RWA-04	Rwanda	(English) Agricultural Mechanization Advisor	2012 - 2015
RWA-05	Rwanda	(English) Irrigation Adviser	2013 - 2016
RWA-06	Rwanda	(English) Irrigation Adviser	2016 - 2018

** indicates a project that was designated as a target JICA project but was not implemented before the CARD was implemented.*

Table I-2 Project Code List (2/2)

Project Code	Country	Title of the Project	Duration of the Project
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	Novermber 2009 - March 2014
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d' Appui à la Production Durable du Riz Pluvial	August 2014 - July 2018
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	May 2016 - May 2021
SEN-04	Senegal	(English) Agricultural technical advisor	2012 - 2014
SEN-05	Senegal	(English) Agricultural Adviser	2015 - 2016
SEN-06	Senegal	(English) Improving the Quality of Domestic Rice	2007 - 2011
SEN-07	Senegal	(English) Agricultural Policy Advisor	2018 - 2020
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	October 2010 - September 2014
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	June 2017 - June 2022
TZA-01	Tanzania	(English) Technical Cooperation for Formulation and Training of the DADP Guidelines on Irrigation Scheme Development	December 2010 - June 2014
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	June 2007 - June 2012
TZA-03	Tanzania	(English) Capacity Development for the Promotion of Irrigation Scheme Development under the District Agriculture Development Plan (DADPs)	December 2010 - June 2014
TZA-04	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project *	July 1994 - June 1999
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II) *	October 2001 - September 2006
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	August 2012 - June 2016
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	November 2012 - December 2019
TZA-08	Tanzania	(English) The Project for Irrigation Human Resource Development by Strengthening the Capacity of Arusha Technical College (AIHRD-Project)	June 2014 - May 2017
TZA-09	Tanzania	(English) Capacity Development for the Promotion of Irrigation Scheme Development under the District Agriculture Development Plan (DADPs) Phase 2	August 2015 - August 2019
TZA-10	Tanzania	(English) Project on the Revision of National Irrigation Master Plan	October 2016 - October 2018
TZA-11	Tanzania	(English) Construction Management of Irrigation Fields and Facilities	2011 - 2014
TZA-12	Tanzania	(English) Design of Irrigation Facilities	2011 - 2014
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	June 2008 - June 2011
UGA-02	Uganda	(English) NERICA Rice Promotion Project in Uganda	August 2008 June 2011
UGA-03	Uganda	(English) Promotion of Rice Development Project	November 2011 - March 2019
UGA-04	Uganda	(English) The Project on Irrigation Scheme Development in Central and Eastern Uganda	May 2014 - April 2016
UGA-05	Uganda	(English) Agricultural Planning Advisor	2013 - 2015
UGA-06	Uganda	(English) Irrigation Adviser	2013 - 2015
UGA-07	Uganda	(English) Irrigation Adviser	October 2017 - October 2019
UGA-08	Uganda	(English) Agricultural Planning Advisor	2015 - 2017
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	June 2012 - June 2015
ZMB-02	Zambia	(English) Rice Dissemination Project	December 2015 - September 2019
ZMB-03	Zambia	(English) Support for Increased Production of Rice Seeds	2009 - 2010
ZMB-04	Zambia	(English) Agricultural and Rural Development Advisor	2007 - 2009
ZMB-05	Zambia	(English) Agricultural and Rural Development Advisor	2009 - 2012
ZMB-06	Zambia	(English) Agricultural and Rural Development Advisor	2012 - 2015
ZMB-07	Zambia	(English) Advisor to Department of Agriculture	2015 - 2018
ZMB-08	Zambia	(English) Advisor to Department of Agriculture	2018 - 2021

** indicates a project that was designated as a target JICA project but was not implemented before the CARD was implemented.*

Chapter 1 CARD Achievement on Phase 1

1-1 Global View of Rice Sector in Sub-Saharan Africa

The trends in rice production, area harvested, and yield in Sub-Saharan Africa from 2007-2018 are described in this section with the help of FAO statistics. Statistical data concerning consumption, self-sufficiency rate, rice price, and import volume are also presented to illustrate the changes in rice demand and the corresponding self-sufficiency rate in the Sub-Saharan Africa.

1-1-1 Trends in rice production

The total rice production (of paddy rice) of 45 Sub-Saharan African countries increased from 14 million tons in 2007 (base year) to 31 million tons in 2018, achieving the target of doubling rice production in the first phase of CARD (Fig 1-1). Rice production did increase prior to this period from 11 million tons in 1998 to 14 tons in 2007 but the rise was less significant, compared to the 30 million tons attained by the 23 CARD target member countries. The change in production volume of these countries is shown below in section 1-2 Rice sector of CARD Phase 1 Target Countries. In 2018, these countries accounted for the majority of the rice produced in the Sub-Saharan Africa. Needless to say, the enhanced development of domestic rice in the CARD member countries contributed successfully to attaining the goal set in phase 1.

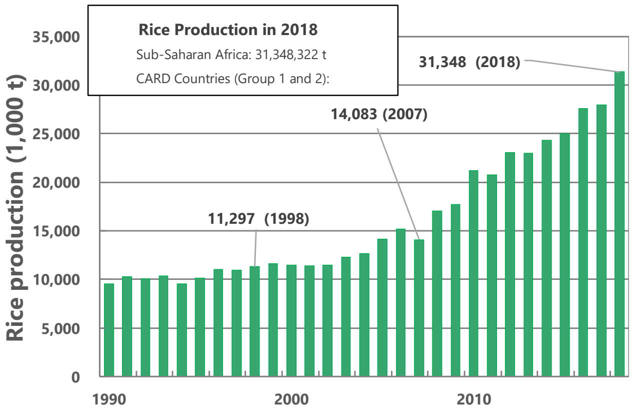


Fig 1-1 Changes in rice production in Sub-Saharan Africa

Source: FAO Statistics, "Crops" (paddy, accessed 13-January-21, same as below)

1-1-2 Trends in area harvested and rice yields

The rice area harvested in Sub-Saharan Africa increased from 8 million ha in 2007 to 16 million ha in 2018. On the other hand, the level of rice yields remains rather flat (Fig 1-2). Rice production was doubled due to a dominant factor: the increase in the area harvested.

In the near future, the goal of higher rice production should not only be attained with the expansion of harvested area but also with

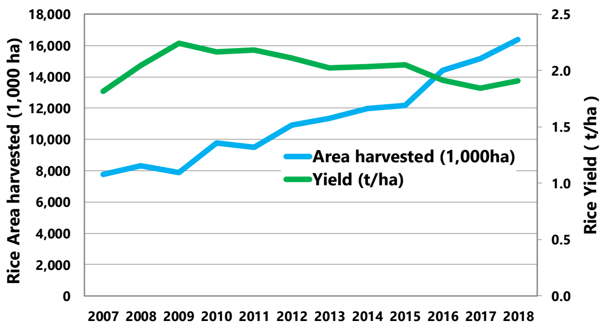


Fig 1-2 Changes in area harvested and yield in Sub-Saharan Africa

Source: FAO Statistics, "Crops" (paddy, accessed 13-January-21, same as below) the adoption of appropriate technique to stimulate rice yields.

1-1-3 Increase in rice consumption

In 2018, the three major cereals consumed in Sub-Saharan Africa were: maize (42 million tons), wheat (27 million tons), and rice (22 million tons) (Fig 1-3).

From 1990 to 2018, the consumption of maize declined from 56% in 1990 to 46% in 2018. In parallel, the rate of rice consumption increased slightly from 22% in 1990 to 24% in 2018; the quantity of rice consumed rose by 2.8 times.

The annual total consumption of rice per capita increased from 21.5 kg in 2007 to 24.0 kg in 2018 (Table 1-1). Section 1-2-3 provides more details on the total per capita annual consumption by country. The increase in annual consumption of rice per capita is due to various factors including population growth and rising urbanization. Compared to potatoes or other cereals, rice can be stored over a long period of time and requires less effort to prepare and cook. Hence, its demand tends to increase especially in urban areas where households have higher purchase power.

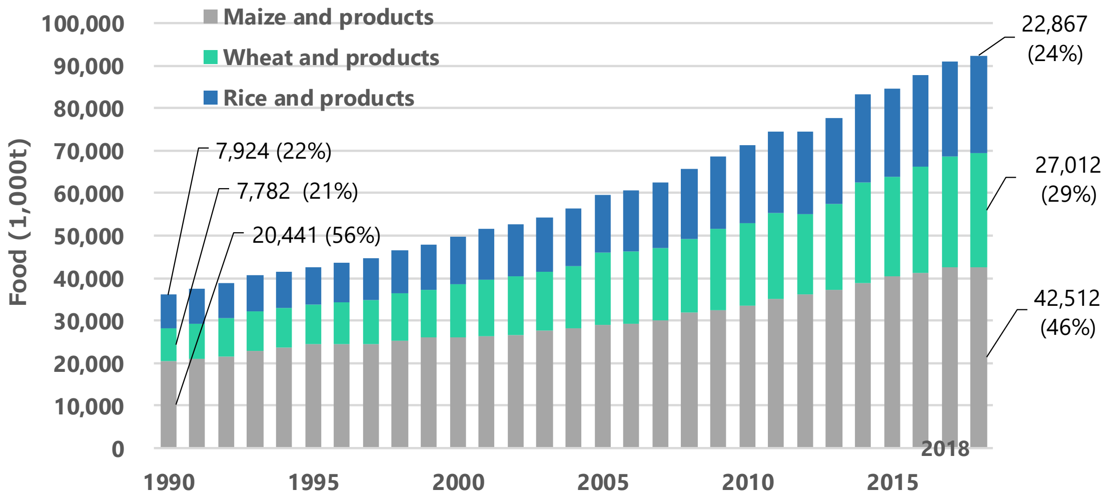


Fig 1-3 Changes in the world's three most important grains in Sub-Saharan Africa (maize, wheat and rice)

Source: FAO Statistics "Food Balances" (Old Food Balance: prior to 2013 and New Food Balance: Post-2014) Data is as of 2-February 2021. As rice consumption quantities are not available, the volume consumed is deduced at it closest value by equating it with: Domestic supply quantity- Feed – Seed – Losses – Processing - Other uses (non-food) - Tourist consumption - Residuals. The Food Balance statistics from 2014 onwards are probably converted from paddy to milled rice. Hence, milled rice weight = unhulled rice weight x 0.667.

Table 1-1 Changes in rice consumption and population in Sub-Saharan Africa

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Food (1,000 tonnes)	**TOTAL**	15,437	16,453	17,195	18,229	19,159	19,531	20,375	20,847	20,668	21,637	22,198	22,867
Food supply quantity (kg/capita/yr)	**AVERAGE**	21.5	22.3	22.8	23.5	24.1	24.1	24.5	24.3	23.5	23.9	23.9	24.0
Population (1,000 persons)	**TOTAL**	717,219	736,193	755,711	775,751	795,233	808,871	830,110	856,981	880,066	903,679	927,795	952,359

Source: FAO Statistics "Food Balances" Data as of 2 February 2021

1-1-4 Trends in trading and import

The aforementioned increase in rice consumption has been accompanied by a rise in the volume of imports, bridging the demand and supply gap (Fig 1-4). As of 2018, Sub-Saharan Africa as a whole imported a total of 10.9 million tons of rice. The largest exporters of rice to Africa in 2018 were: Thailand (5 million tons), India (2.77 million tons), Pakistan (1.36 million tons), and China (1.07 million tons). Exports from these 4 countries accounted for 95% of total exports to Africa, indicating clearly that the majority of imports for Africa originate from Asian countries (Fig 1-5).

The self-sufficiency rate has remained between 50 and 60 per cent, with a slight upward trend, but the rate, in itself, has not improved significantly (Fig 1-4).

The price of rice traded in the international market rose to a high 1,015 US$/t (in April 2008) due to the global food crisis (2007-2008) but it dropped to about 400 US$/t in 2018. The latter is still relatively high compared to the prices traded between 1991 and 2006 (Fig 1-6).

The expected growth in population will certainly lead to a higher consumption of rice; it is thus vital to accelerate domestic rice production to meet this rising need.

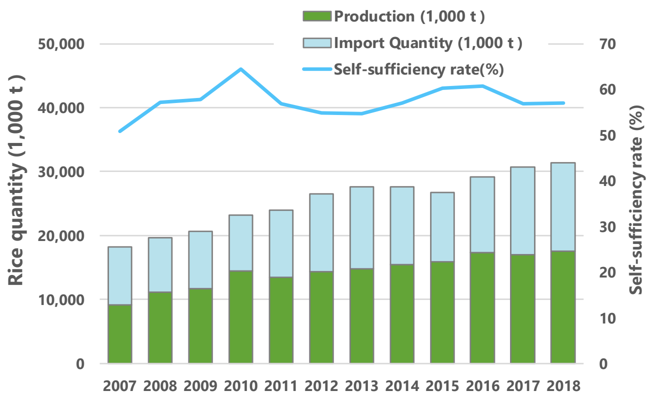


Fig 1-4 Trends in rice production and import

Source: FAO Statistics "Food Balances" conversion from paddy to milled rice after 2014, Self-sufficiency rate is calculated based on "Food Balances".

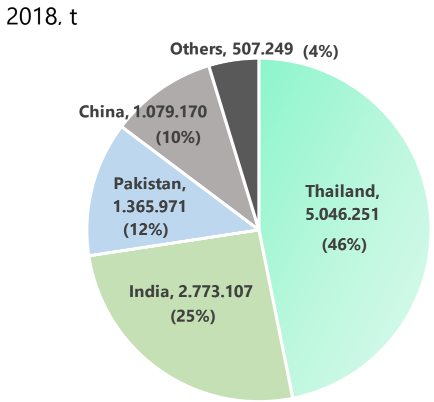


Fig 1-5 Volume of exports to Africa

Source: ITC TRADE MAP

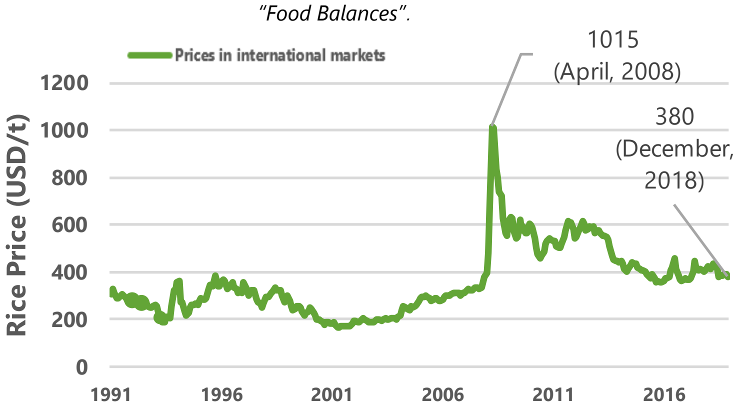


Fig 1-6 Trends in international market prices of paddy rice

Source: IMF commodity data portal, "Rice" (Paddy, accessed 13-January 2021)

1-2 Rice sector of CARD Phase 1 Target Countries

This section presents the characteristics of the rice sector of the 23 countries concerned by the first phase of CARD. Statistical data including production, area harvested, yield, consumption quantities, self-sufficiency rate and imports are used to identify the trends and challenges of each country.

1-2-1 Changes in production volume

In 2018, the largest rice producers were Nigeria, Madagascar, Mali, Tanzania, Guinea, and Côte d'Ivoire (Fig 1-7). They produced a total of 23.3 million tons of rice, representing 77% of the total rice (30.2 tons) produced by the CARD member countries in the first phase. In particular, Nigeria, Mali, Tanzania, and Côte d'Ivoire increased their rice production by 2.1 to 3.5 times compared to 2007, and this contributed greatly to doubling rice production.

In countries where the rice production volume is less than 2 million tons, production has risen significantly compared to their performance in 2007 (Fig 1-8); 6.2 times in Senegal, 4.1 times in Ghana and 4 times in the Democratic Republic of the Congo. This shows that with the introduction of appropriate technical dissemination and assistance and rice production can be improved in countries where domestic rice cultivation practices and farming techniques are yet to be firmly established.

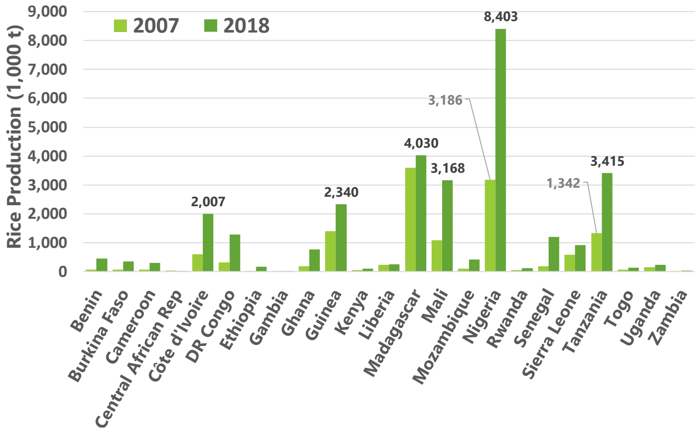


Fig 1-7 Changes in rice production of CARD phase 1 group countries

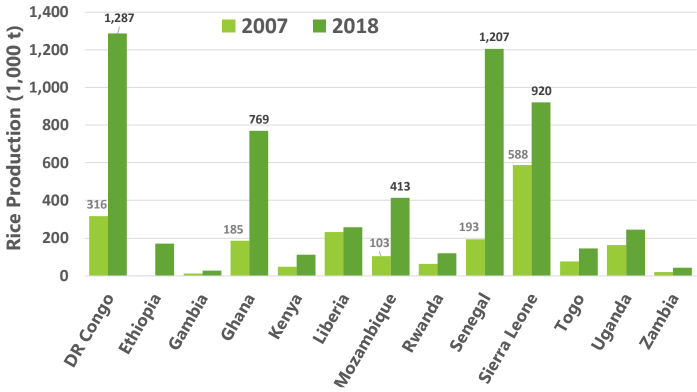


Fig 1-8 Rice production in CARD phase 1 group countries which are less than 2 million t

Source: FAO Statistics "Crops"(Paddy)

1-2-2 Relationship between area harvested, yield and self-sufficiency rate

The top 3 countries that had the largest area harvested in 2018 were Nigeria (5.87 million ha), Guinea (1.86 million ha), and the Democratic Republic of the Congo (1.69 million ha) (Table 1-2). The total area harvested of the member countries in the first phase of CARD increased by 2.1 times in 2018 in comparison to the year 2007. The countries that had the largest expanded areas were Ethiopia (150 times), Benin (4.9 times), Burkina Faso, Cameroon, and the Democratic Republic of the Congo (around 4 times).

On the other hand, between 2007 and 2018, the self-sufficiency rates of the Gambia, Cameroon, Senegal, and Ethiopia increased by a factor of 2 (Fig 1-9). The country in which the yield doubled was Uganda.

Table 1-2 Rice area harvested

1000 ha	2007	2018	Changes
Benin	27	135	4,9
Burkina Faso	41	161	4,0
Cameroon	68	256	3,8
Central African Rep	25	7	0,3
Côte d'Ivoire	356	757	2,1
DR Congo	419	1.693	4,0
Ethiopia	0,4	63	150,5
Gambia	17	39	2,3
Ghana	109	272	2,5
Guinea	789	1.860	2,4
Kenya	16	26	1,6
Liberia	160	238	1,5
Madagascar	1.272	786	0,6
Mali	392	970	2,5
Mozambique	362	870	2,4
Nigeria	2.451	5.874	2,4
Rwanda	15	34	2,3
Senegal	80	324	4,0
Sierra Leone	432	796	1,8
Tanzania	558	1.033	1,9
Togo	33	87	2,6
Uganda	119	89	0,7
Zambia	12	30	2,5
TOTAL	**7.754**	**16.400**	**2,1**
AVERAGE	-	-	**8,9**

Source: FAO Statistics "Crops"

Based on the relationship between yield and self-sufficiency rate, the CARD member countries in phase 1 are divided into four categories:

<u>Major countries with high yields and self-sufficiency</u> rates: Madagascar, Mali, and Rwanda, where the increase in yields was highly significant.

<u>Countries with high yields but low self-sufficiency rates</u>: Senegal and Ethiopia. Although both the yield and the self-sufficiency rates of these 2 countries have increased compared to 2007, the self-sufficiency rate is still about 30%. The future increase in rice production would very much depend on the degree of the area harvested.

<u>Countries with high self-sufficiency rates but low yields</u>: Zambia and Nigeria. Despite the improved self-sufficiency rate of these 2 countries compared to 2007, the yield per unit of production has remained flat. It is therefore important to focus on the yield improvement issues for these countries.

<u>Countries suffering from low yields and low self-sufficiency</u>: Cameroon, Gambia, and Mozambique. On the other hand, for countries like Cameroon where the area harvested has already been increased (Table 1-2), it is necessary to take further measures for yield improvement taking into account the area expansion.

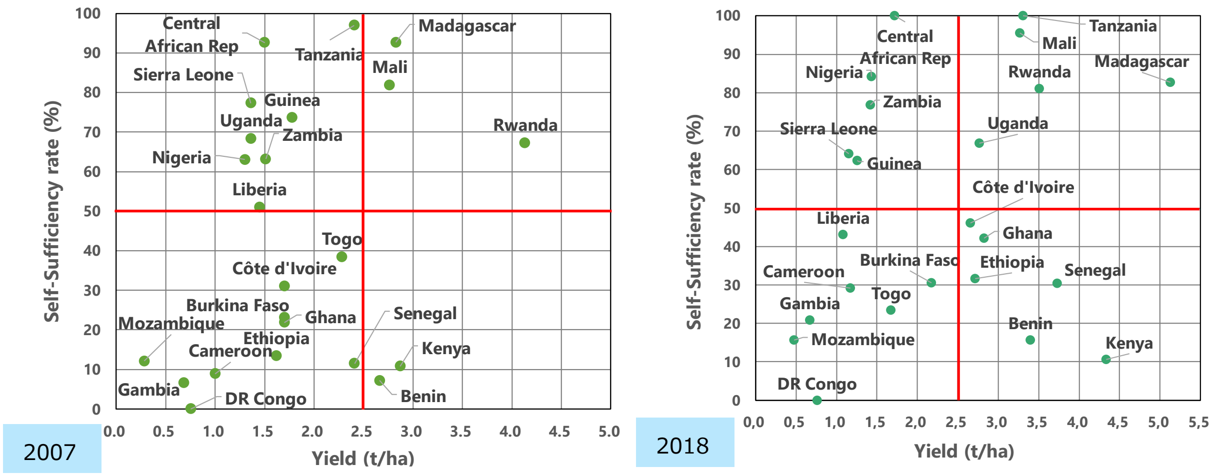


Fig 1-9 Relationship between yield and self-sufficiency rate [5]

Source: FAO Statistics "Crops" (Paddy), self-sufficiency rate is calculated based on "Food Balances".

[5] *Due to the absence of related statistics, the self-sufficiency rate of DR Congo (Democratic Republic of the Congo), was set to 0.*

1-2-3 Changes in consumption per capita

In 2018, the top 5 countries with the highest annual per capita consumption were Guinea (112 kg), Sierra Leone (107 kg), Madagascar (104 kg), Senegal (79 kg), and Liberia (74 kg). The amount of consumption is rising in countries where the traditional rice-eating culture is deeply rooted particularly in West Africa. The consumption rates are higher in West Africa than in Japan (54 kg) (Table 1-3). Rice consumption is also rapidly rising in countries such as Ethiopia, Kenya and Cameroon. This signifies that the demand for rice in these 23 countries will only increase annually.

Table 1-3 Changed in rice consumption per capita

kg/capita/yr

Country	2007	2018	Changes
Benin	48,7	58,5	1,2
Burkina Faso	16,2	17,2	1,1
Cameroon	19,3	27,1	1,4
Central African Rep	6,8	1,5	0,2
Côte d'Ivoire	68,4	65,2	1,0
DR Congo	n.a.	n.a.	n.a.
Ethiopia	0,7	2,6	4,0
Gambia	58,5	49,6	0,8
Ghana	25,4	25,1	1,0
Guinea	92,9	112,6	1,2
Kenya	7,6	14,6	1,9
Liberia	73,3	74,2	1,0
Madagascar	102,4	104,4	1,0
Mali	53,4	42,4	0,8
Mozambique	19,7	24,4	1,2
Nigeria	23,2	26,1	1,1
Rwanda	5,6	7,5	1,3
Senegal	73,5	79,8	1,1
Sierra Leone	94,0	107,5	1,1
Tanzania	19,9	23,5	1,2
Togo	23,2	16,2	0,7
Uganda	4,7	5,7	1,2
Zambia	1,5	2,0	1,3
AVERAGE	**38,1**	**40,3**	**1,1**
JAPAN	56,3	54,1	1,0

* n.a. indicates no data

Source: FAO Statistics "Food Balances" (Rice and products, paddy, conversion from paddy to milled rice 2018 data)

1-2-4 Changes in import

In 2018, the top 3 largest rice importers were Côte d'Ivoire (1.6 million tons), Benin (1.6 million tons), and Senegal (1.2 million tons) (Table 1-4). Countries with the highest import growth rates compared with 2007 were Ethiopia (4.6 times), Togo (4.1 times), Sierra Leone (3.0 times), and Madagascar (2.9 times).

Meanwhile, Nigeria, biggest importer of foreign rice within sub-Saharan Africa in 2007 decreased its imports to 850,000 tons in 2018. Strict restrictions of rice imports were imposed to promote domestic rice production[6].

Table 1-4 Changes in rice import

1000 t

Country	2007	2018	Changes
Benin	660	1,645	2.5
Burkina Faso	153	245	1.6
Cameroon	471	492	1.0
Central African Rep	2	0	0.0
Côte d'Ivoire	899	1,663	1.9
DR Congo	n.a.	n.a.	n.a.
Ethiopia	45	208	4.6
Gambia	113	137	1.2
Ghana	443	706	1.6
Guinea	335	939	2.8
Kenya	265	620	2.3
Liberia	149	228	1.5
Madagascar	192	562	2.9
Mali	160	98	0.6
Mozambique	500	492	1.0
Nigeria	1,247	852	0.7
Rwanda	20	30	1.5
Senegal	1,069	1,280	1.2
Sierra Leone	115	343	3.0
Tanzania	47	0	0.0
Togo	82	333	4.1
Uganda	74	87	1.2
Zambia	12	13	1.1
TOTAL	**7,053**	**10,973**	**1.6**

* n.a. indicates no data

Source: FAO Statistics "Food Balances" (Rice and products, paddy, conversion from paddy to milled rice 2018 data)

[6] *Source: Journal of Agricultural Policy Research, Cross-sectional and comprehensive agricultural strategies of major countries, Pro-Laboratory Material No. 8, March 2018*

1-3 NRDS Achievements of Target Countries

The production, cultivation area, and yield targets of every concerned country defined for the phase 1 of CARD are reflected in the National Rice Cultivation Promotion Strategy (NRDS). The achievement assessment of these countries is described in this section.

1-3-1 Countries in Group 1

(1) Cameroon

The rice production volume in 2018 was 300,400 tons, corresponding to a NRDS target achievement rate of 31% (Table 1-5). In 2018, the area harvested and yield were 256,206 ha and 1.2 t/ha, respectively representing target achievement rates of 74% and 43%, respectively.

In Cameroon, the focus was on the promotion of rainfed rice cultivation. The NRDS target area was set at a high 279,000 ha in 2018. The 6-fold increase of total area harvested in comparison compared to 2008 concerned mainly the rainfed rice cultivation. The CARD projects in the country focused on improving rainfed rice farming techniques and on the training of extension workers with the goal of promoting NERICA cultivation. The number of new rainfed upland rice farmers was reported to have increased (CMR-01).

Besides promoting upland rice cultivation, JICA technical cooperation also focused on seed production development. The capacity of human resources was reinforced not only in technical skills but also in the selection of appropriate varieties and in seed production. The remarkable improvement made in seed sector was recognized by the Government as one of the major achievements[7].

Table 1-5 Achievement of NRDS –Cameroon-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated rice	Rainfed rice	Lowland rice	Total/ Average	Irrigated rice	Rainfed rice	Lowland rice	Total/ Average	Achievements	
Production (t)	50,000	30,000	20,000	100,000	165,000	697,500	105,000	967,500	300,400	Achievement rate 31%
Area (ha)	14,300	20,000	10,000	44,300	33,000	279,000	30,000	342,000	256,206	Achievement rate 74%
Yield (t/ha)	3.5	1.5	2.0	2.2	5.0	2.5	3.5	2.7	1.2	Achievement rate 43%

Source: MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, "NATIONAL STRATEGY FOR RICE GROWING IN CAMEROON (MILLING) III ", March 2009, FAO Statistics "Crops" (Paddy)

(2) Ghana

The production volume in 2018 was 769,401 tons corresponding to the achievement rate of 51% of the NRDS target (Table 1-6). In 2018, the area harvested and yield were 272,476 ha and 2.8 t/ha, respectively, representing high NRDS target achievement rates of 72% and 70%, respectively.

High production (1,050,000 t) and cropped area (300,000 ha) targets were set for rainfed cropping in lowland areas as it is the most common farming system in Ghana, accounting for 78% of the total in 2008[8]. On the other hand, the development of rainfed lowland farming alone is insufficient to achieve the target of total production; targets were also set for irrigated paddies. CARD training programs were carried out to reinforce maintenance skills of depleting irrigation facilities, and water committees' capacity in water management was also strengthened (GHA-06).

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[7] *JICA, Coalition for African Rice Development (CARD) Final Review Assessment Final Report, March 2018*

[8] *MINISTRY OF FOOD AND AGRICULTURE THE REPUBLIC OF GHANA, "NATIONAL RICE DEVELOPMENT STRATEGY (NRDS) ", February 2009*

Table 1-6 Achievement of NRDS –Ghana-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Rainfed upland	Rainfed lowland	Total/ Average	Irrigated	Rainfed upland	Rainfed lowland	Total/ Average	Achievements	
Production (t)	75,500	10,600	230,100	316,200	180,000	112,500	1,050,000	1,500,000	769,401	Achievement rate 51%
Area (ha)	18,900	7,100	92,000	118,000	30,000	45,000	300,000	375,000	272,476	Achievement rate 72%
Yield (t/ha)	4.0	1.5	2.5	2.6	6.0	2.5	3.5	4.0	2.8	Achievement rate 70%

Source: MINISTRY OF FOOD AND AGRICULTURE THE REPUBLIC OF GHANA, "NATIONAL RICE DEVELOPMENT STRATEGY (NRDS) ", February 2009, FAO Statistics "Crops" (Paddy)

(3) Guinea

The production volume in 2018 was 2,339,747 tons, corresponding to an achievement rate of 86% of the NRDS target (Table 1-7). In 2018, the area harvested and yield were 1,859,767 ha and 1.2 t/ha, respectively, representing NRDS achievement target of 140% and 60%, respectively.

The production target in Guinea was set at a high 1,023,953 tons (almost equivalent to that of upland farming of 1,397,479 t) as the main production in the country is concentrated in the mangroves along the coastal areas and in the alluvial plains. The target area harvested set was also ambitious; 331,286 ha for mangroves and alluvial plains and 861,344 ha for upland farming. As a result, the production volume and area harvested in 2018 increased by about 2 times compared to 2008. The increase in production is mainly due to an increase in area harvested.

Table 1-7 Achievement of NRDS –Guinea-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Alluvial plains/ Mangroves	Upland	Lowland	Total/ Average	Alluvial plains/ Mangroves	Upland	Lowland	Total/ Average	Achievements	
Production (t)	445,310	595,134	166,471	1,206,915	1,023,953	1,397,479	305,029	2,726,461	2,339,747	Achievement rate 86%
Area (ha)	208,089	541,031	83,236	832,356	331,286	861,344	132,515	1,325,145	1,859,767	Achievement rate 140%
Yield (t/ha)	2.1	1.1	2.0	1.4	4.2	2.0	4.0	2.0	1.2	Achievement rate 60%

Source: REPUBLIC OF GUINEA Labor-Justice-Solidarity, MINISTRY OF AGRICULTURE AND LIVESTOCK, "NATIONAL STRATEGY FOR THE DEVELOPMENT OF RICE GROWING", April 2009, FAO Statistics "Crops" (Paddy)

(4) Kenya

The production volume in 2018 was 166,099 tons, and its NRDS achievement rate 93% (Table 1-8). In 2018, the area harvested and yield were 50,751 ha and 3.2 t/ha, respectively, representing achievement rates of 144% and 63%, respectively and reflecting the successful increase in area harvested.

About 90% of the rice produced in Kenya is cultivated in irrigated paddy fields[9], but high targets were also set for other cultivation systems. Irrigated paddy field production increased greatly from 58,513 tons in 2008 to 146,886 tons to 2018 accompanying the increase in rainfed lowland production from 8,777 tons in 2008 to 13,120 tons in 2018.

As efforts are made to improve farming output, farmers are faced with fierce competition from inexpensive imported rice, hindering them from selling more crops to consumers and from improving their livelihoods[9]. According to a survey conducted by the JICA technical project in Mwea, rice is sold through 2 distribution intermediaries (farmers, traders and retailers), making it nearly 40% more expensive than imported rice (KEN-01). The need for effective post-harvest marketing and sales strategies should be looked into in the near future.

[9] *REPUBLIC OF KENYA, MINISTRY OF AGRICULTURE, "NATIONAL RICE DEVELOPMENT STRATEGY (2008-2018)", 2009*

Table 1-8 Achievement of NRDS –Kenya-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				NRDS 2018 (Achievements)				Remark
	Irrigated	Rainfed upland	Rainfed lowland	Total/ Average	Irrigated	Rainfed upland	Rainfed lowland	Total/ Average	Irrigated	Rainfed upland	Rainfed lowland	Total/ Average	
Production (t)	58,513	5,851	8,777	73,141	145,600	14,800	18,180	178,580	146,886	6,092	13,120	166,099	Achievement rate 93%
Area (ha)	12,500	2,150	3,180	17,830	26,000	5,050	4,100	35,150	40,120	4,231	6,400	50,751	Achievement rate 144%
Yield (t/ha)	4.7	2.8	2.7	4.1	5.6	3.7	3.8	5.1	4.2	1.4	2.1	3.2	Achievement rate 63%

Source: REPUBLIC OF KENYA, MINISTRY OF AGRICULTURE, "NATIONAL RICE DEVELOPMENT STRATEGY (2008-2018) ", 2009, REPUBLIC OF KENYA MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES AND COOPERATIVES STATE DEPARTMENT FOR CROP DEVELOPMENT AND AGRICULTURAL RESEARCH, "NATIONAL RICE DEVELOPMENT STRATEGY-2(2019–2030) ", 2020, FAO Statistics "Crops" (Paddy)

(5) Madagascar

The production volume in 2018 was 4.03 million tons, corresponding to a NRDS target achievement rate of 33% Table 1-9). In 2018, the area harvested and yield were 786,265 ha and 5.1 t/ha[10], respectively; the achievement rate of area harvested was 30%.

Severe droughts in 2017 caused damages to the rice fields in the central and northern areas where 80% of domestic rice is produced. This led to a decrease in rice production from 4.91 million tons in 2008 to 4.03 million tons in 2018. The cropping area also decreased11 from 1,620,815 ha in 2008 to 786,265 ha in 2018.

In 2018, Madagascar is the 2nd largest producer among the CARD member countries in phase 1 Nevertheless, there is much place to improve local rice production as the high demand of national consumption is presently still met by imported rice.

Table 1-9 Achievement of NRDS –Madagascar-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated (High season)	Rainfed	Rainfed (Off-season)	Total/ Average	Irrigated (High season)	Rainfed	Rainfed (Off-season)	Total/ Average	Achievements	
Production (t)	3,531,737	554,453	828,262	4,914,452	7,150,000	1,800,000	3,150,000	12,100,000	4,030,000	Achievement rate 33%
Area (ha)	1,060,114	281,439	279,262	1,620,815	1,300,000	600,000	700,000	2,600,000	786,265	Achievement rate 30%
Yield (t/ha)	3.3	1.9	2.9	3.0	5.5	3.0	4.5	4.6	5.1	Achievement rate 111%

**Irrigated and rainfed (double crop) described as high season and off-season, respectively, in the national rice cultivation promotion strategy (NRDS).*
Source: Madagascar, "NATIONAL STRATEGY FOR THE DEVELOPMENT OF RICE GROWING (NSDR) ", February 2017, FAO Statistics "Crops" (Paddy)

(6) Mali

The production volume in 2018 was 3,167,528 tons, corresponding to a NRDS achievement rate of 98% (Table 1-10). In 2018, the area harvested and average yield were 969,519 ha and 3.2 t/ha, respectively, representing high achievement rates 95% and 103%, respectively. Mali is the second largest producer in West Africa after Nigeria, and 90% of rice consumption is covered by domestic rice7.

The total production in 2018 doubled compared to 2008 (from 1,607,647 tons to 3,167,528 tons). In particular, irrigated rice cultivation is thriving in the floodplain of the Niger River in southern Mali[12], and the expansion of these irrigated rice paddies is supposed to have greatly contributed to the increase in production and area harvested. Rice production needs further expansion to promote Mali as an exporting country in the future.

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[10] *Table 1-5 (5) refers to FAO Statistics, but many smallholder farmers have not reached average yields superior to 4 t/ha.*
[11] *USAID Commodity Intelligence Report "Madagascar Rice: Severe Drought Lowers Production", June 2017*
[12] *Agricultural Development Consultants Association, Project Finding Study Report for the Republic of Mali, November 2007*

Table 1-10 Achievement of NRDS –Mali-

	NRDS		FAOSTAT	Remark
	2008 (At the time of formulation)	2018 (Targets)	2018 (Achievements)	
Production (t)	1,607,647	3,224,000	3,167,528	Achievement rate 98%
Area (ha)	626,573	1,013,740	969,519	Achievement rate 95%
Yield (t/ha)	2.5	3.1	3.2	Achievement rate 103%

Source: REPUBLIQUE DU MALI, "STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE SNDR II 2016-2025", November 2016, FAO Statistics "Crops" (Paddy)

(7) Mozambique

The production volume in 2018 was 413,000 tons, corresponding to a NRDS achievement rate of 30% (Table 1-11). In 2018, the area harvested and the yield were 869,572 ha and 0.4 t/ha, respectively, representing achievement rates of 223% and 13%, respectively. The area harvested increased about 4 times compared to 2008 (231,301 ha to 869, 572 ha).

Rice cultivation is dominated by small-scale farmers, many of whom produce only at subsistence level. Projects operated by JICA concerned mainly small-scale farmers with the aim of improving cultivation techniques and strengthening the activities of farming groups to improve yields.

A survey carried out amongst demonstration plot farmers revealed a yield decrease in irrigated and rainfed lowland farming due to drought and flood damages (MOZ-04). This could be one of the reasons for the decrease in production yield in 2018 compared to 2007. In addition, lack of sufficient support from donors due to financial constraints could also be another cause of the decrease in production[7]. In the future, there is a need to develop cultivation techniques that are resistant to difficult weather conditions and to foresee budgetary support for rice cultivation.

Table 1-11 Achievement of NRDS –Mozambique-

	NRDS		FAOSTAT	Remark
	2008 (At the time of formulation)	2018 (Targets)	2018 (Achievements)	
Production (t)	265,098	1,363,199	413,000	Achievement rate 30%
Area (ha)	231,301	389,485	869,572	Achievement rate 223%
Yield (t/ha)	1.1	3.5	0.4	Achievement rate 13%

Source: REPUBLIC OF MOZAMBIQUE MINISTRY OF AGRICULTURE, "National Rice Development Strategy Mozambique", March 2016, FAO Statistics "Crops" (Paddy)

(8) Nigeria

The production volume in 2018 was 8,403,000 tons, corresponding to a NRDS achievement rate of 63% (Table 1-12). In 2018, the area harvested was 5,873,615 ha, representing a high achievement rate of 168%. The yield at 1.4 t/ha, was lower than that in 2008.

Nigeria, mainly using rainfed lowland and irrigated rice farming systems, produced the most rice amongst the CARD member countries of phase 1. High production targets were set for rice production using the two mentioned farming systems thereby increasing production in rainfed lowland farming from 2,471,880 tons in 2008 to 7,021,000 tons in 2018 and in irrigated fields from 167,297 tons in 2008 to 4,480,000 tons in 2018.

Total production volume doubled from 3,465,458 tons in 2018 to 8,403,000 tons in 2018. However, due to a lack of adequate post-harvest transformation technology, the volume of rice processed does not cover national consumption. This is one of the reasons why the volume of imported rice is higher than other countries. Insufficient post-harvest transformation technology has become a bottleneck in its effort to further increase the production volume. Therefore, it is important to strengthen post-harvest processing technology in the future.

Table 1-12 Achievement of NRDS –Nigeria-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated lowland	Rainfed lowland	Rainfed upland	Total/ Average	Irrigated lowland	Rainfed lowland	Rainfed upland	Total/ Average	Achievements	
Production (t)	167,297	2,471,880	826,281	3,465,458	4,480,000	7,021,000	1,750,000	13,251,000	8,403,000	Achievement rate 63%
Area (ha)	47,799	1,243,151	510,050	1,801,000	560,000	2,065,000	875,000	3,500,000	5,873,615	Achievement rate 168%
Yield (t/ha)	3.5	2.0	1.6	1.9	8.0	3.4	2.0	3.7	1.4	Achievement rate 38%

Source: FEDERAL REPUBLIC OF NIGERIA, "NATIONAL RICE DEVELOPMENT STRATEGY (NRDS)", March 2009, FAO Statistics "Crops" (Paddy)

(9) Senegal

The production volume for the year 2012 targeted in the NRDS was 469,640 tons, corresponding to an achievement rate of 31% (Table 1-13). In 2012, the area harvested and yield were 117,729 ha and 3.9 t/ha, respectively, and the achievement rate of area harvested was 36%.

The target of production and area harvested are highest in irrigated valley paddy fields of Senegal (production: 1,088,596 tons and area harvested: 175,580 ha)

The production volume of rainfed rice in 2008 amounted to 30% of the total production but its target production volume was set at 327,500 tons just about twice of that in 2008 (160,000 tons). Technical assistance in this rice cultivation system is insufficient but high target values were set with the aim of strengthening the techniques of rainfed paddy fields for sustainable domestic rice development in the future[13]. Activities in CARD related projects included measures to improve the quality and the productivity rainfed rice farming. The production achievement rate of the target in 2012 was as low as 31% in the production and that of cropping area was 36%. Nevertheless, the production and the area harvested in 2018 increased by about 3 times compared to 2012, probably due to the promotion of local rice.

Table 1-13 Achievement of NRDS –Senegal-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT (Achievements)		Remark
	Irrigated in valley of Senegal*	Irrigated in valley of Anambé*	Rainfed	Total/ Average	Irrigated in valley of Senegal*	Irrigated in valley of Anambé*	Rainfed	Total/ Average	2012	2018	
Production (t)	341,000	34,000	160,000	535,000	1,088,596	87,884	327,500	1,503,980	469,640	1,206,587	Achievement rate 31%
Area (ha)	55,000	7,500	80,000	142,500	175,580	20,500	131,000	327,080	117,729	323,635	Achievement rate 36%
Yield (t/ha)	6.2	-	-	-	6.2	-	-	-	3.9	3.7	-

**Irrigated in valley of Senegal and Anambé indicate the area of irrigated paddy fields located in the basins of each river.*
Source: REPUBLIQUE DU SENEGAL MINISTERE DE L'AGRICULTURE, "PROGRAMME NATIONAL D'AUTOSUFF ISANCE EN RIZ", February 2009, FAO Statistics "Crops" (Paddy)

(10) Sierra Leone

The production volume in 2018 was 919,785 tons, corresponding to a NRDS target achievement rate of 29.6% (Table 1-14). The yield in 2018 was 1.1 t/ha and its target achievement rate was 27%. The area harvested in 2018 was 796,354 ha representing a high target achievement rate of 72%.

[13] *REPUBLIQUE DU SENEGAL MINISTERE DE L'AGRICULTURE, "PROGRAMME NATIONAL D'AUTOSUFFISANCE EN RIZ", February 2009*

Rice cultivation in Sierra Leone is mainly practiced by small-scale farmers. During the 2014 – 2015 cropping season, 44% of the farmers cultivated at least 1 ha, and 56% had less than 1 ha[14]. They would have to overcome their present hurdles of using simple tools, working with limited labor and hardly any fertilizers to attain higher yield returns.

Two strategies have been adopted in the NRDS for further domestic rice development: expansion of cultivated area mainly on underutilized land and yield improvement regardless of rice cultivation systems (including upland and rainfed farming). Inland valley wetland farming was improved and seed production systems were developed in CARD related projects.

Table 1-14 Achievement of NRDS –Sierra Leone-

	NRDS		FAOSTAT	Remark
	2007 (At the time of formulation)	2018 (Targets)	2018 (Achievements)	
Production (t)	637,983	3,100,000	919,785	Achievement rate 29%
Area (ha)	659,487	1,100,000	796,354	Achievement rate 72%
Yield (t/ha)	0.9	4.0	1.1	Achievement rate 27%

Source: SIERRA LEONE, NATIONAL RICE DEVELOPMENT STRATEGY (NRDS), 2009, FAO Statistics "Crops" (Paddy)

In 2018, the production, cropping area, and yield were 3,414,815 tons, 1,032,902 ha, and 3.3 t/ha, respectively, corresponding to high achievement rates of 174%, 149%, and 118%, respectively (Table 1-15). The highest target production expected is from irrigated farming at 1,365,000 tons which accounts for about 70% of the target total production in 2018. This target production corresponds to large-scale irrigation development goals. On the other hand, the target area of rainfed lowland farming was reduced from 464,000 ha in 2008 to 274,000 ha in 2018 with the doubled target yield from 1.0 t/ha in 2008 to 2.0 t/ha in 2018. This shows a strong will to improve productivity via improved farming systems.

Given the initiative taken in the first phase, links between research institutions and private seed companies should be targeted to work on improved seed varieties and to distribute high-yielding prototypes to enhance productivity.

Table 1-15 Achievement of NRDS –Tanzania-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average	Achievements	
Production (t)	426,000	464,000	9,000	899,000	1,365,000	548,000	50,000	1,963,000	3,414,815	Achievement rate 174%
Area (ha)	200,000	464,000	17,000	681,000	390,000	274,000	31,000	695,000	1,032,902	Achievement rate 149%
Yield (t/ha)	2.1	1.0	0.5	1.3	3.5	2.0	1.6	2.8	3.3	Achievement rate 118%

Source: THE UNITED REPUBLIC OF TANZANIA MINISTRY OF AGRICULTURE FOOD SECURITY AND COOPERATIVES, "NATIONAL RICE DEVELOPMENT STRATEGY", May 2009, FAO Statistics "Crops" (Paddy)

The production volume in 2018 was 245,910 tons, corresponding to an achievement rate of 36% (Table 1-16). In 2018, the area harvested and yield were 88,796 ha and 2.8 t/ha, respectively, representing high target achievement rates of 40% and 89%, especially for yield returns.

There are strong expectations in production from the commonly used rainfed lowland farming in Uganda and high[15] targets are set for: production increase from 104,130 tons in 2008 to 442,553 tons

[14] *SIERRA LEONE, NATIONAL RICE DEVELOPMENT STRATEGY (NRDS), 2009*

[15] *MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES, "Uganda National Rice Development Strategy (NRDS)", 2008-2018, 2012*

in 2018 and increase in cropping area from 43,388 ha in 2008 to 130,163 ha in 2018. These targets correspond to about 60% of the total targeted production and area for 2018.

Uganda disposes of much land without adequate agricultural machinery for farm development and thereby limiting the expansion of area harvested. There is a need to promote the use of agricultural machinery to expand rice production.

Table 1-16 Achievement of NRDS –Uganda

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average	Achievements	
Production (t)	15,000	104,130	58,740	177,870	40,000	442,553	200,250	682,803	245,910	Achievement rate 36%
Area (ha)	5,000	43,388	26,680	75,068	10,000	130,163	80,100	220,263	88,796	Achievement rate 40%
Yield (t/ha)	3.0	2.4	2.2	2.3	4.0	3.4	2.5	3.1	2.8	Achievement rate 89%

Source: MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES, "Uganda National Rice Development Strategy (NRDS)", 2008-2018, 2012, FAO Statistics "Crops" (Paddy)

1-3-2 Countries in Group 2

(1) Benin

The production volume in 2018 was 459,313 tons, corresponding to a high target achievement rate of 77% (Table 1-17). In 2018, the area harvested were 135,185 ha and 3.4 t/ha, respectively, representing NRDS achievement rates of 98% and 79%, respectively. The average altitude in Benin is 200 meters and there are many lowland areas suitable for rainfed rice cultivation[16]. Hence, high targets for both production (from 21,000 tons in 2008 to 210,000 tons in 2018) and area harvested (from 10,500 ha in 2008 to 70,000 ha in 2018) were set in the NRDS. The expansion of cropping area contributed predominantly to the increase in production.

The production and use of certified seeds were reported to have improved in the NRDS. The seed production volume in 2014 was 2,800 tons, but it increased to 5,219 tons[7] in recent years. Improved access to inputs such as pesticides and herbicides also contributed to the increase in production. On the other hand, the availability of fertilizers is still limited and its accessibility needs improvement.

Table 1-17 Achievement of NRDS –Benin-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Lowland	Rainfed	Total/ Average	Irrigated	Lowland	Rainfed	Total/ Average	Achievements	
Production (t)	14,000	75,000	21,000	110,000	90,000	300,000	210,000	600,000	459,313	Achievement rate 77%
Area (ha)	3,100	21,420	10,500	35,020	13,846	54,545	70,000	138,391	135,185	Achievement rate 98%
Yield (t/ha)	4.5	3.5	2.0	3.1	6.5	5.5	3.0	4.3	3.4	Achievement rate 79%

** Lowland includes rainfed system with partial irrigation*
Source: REPUBLIC OF BENIN, MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES GENERAL SECRETARIAT PLANNING AND FORECASTING OFFICE, "NATIONAL RICE DEVELOPMENT STRATEGY FOR BENIN", April 2011, FAO Statistics "Crops" (Paddy)

(2) Burkina Faso

The production volume in 2018 was 350,392 tons, corresponding to a target achievement rate of 42% (Table 1-18). In 2018, the area harvested and yield were 160,949 ha and 2.1 t/ha, respectively, representing achievement rates of 78% and 53%, respectively.

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[16] *MINISTÈRE DE L'AGRICULTURE, DE L'ÉLEVAGE ET DE LA PÊCHES RÉPUBLIQUE DU BÉNIN, "Stratégie Nationale de Développement la Riziculture-deuxième génération (SNDR 2) 2019-2025", October 2019*

Efforts were made in the first phase to expand crop acreage, resulting in an approximately 3-fold increase in area harvested from 78,000 ha in 2008 to 207,295 ha in 2018. A large-scale rice cultivation promotion project was also implemented in a CARD related project. Upon its completion, subsidies for high quality foundation seeds were provided by the government to facilitate farmers' access to fertilizers[7].

Table 1-18 Achievement of NRDS –Burkina Faso-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Lowland	Rainfed	Total/ Average	Irrigated	Lowland	Rainfed	Total/ Average	Achievements	
Production (t)	104,500	117,500	13,200	235,200	247,065	440,000	155,000	842,065	350,392	Achievement rate 42%
Area (ha)	19,000	47,000	12,000	78,000	35,295	110,000	62,000	207,295	160,949	Achievement rate 78%
Yield (t/ha)	5.5	2.5	1.1	3.0	7.0	4.0	2.5	4.0	2.1	Achievement rate 53%

**The production of irrigated paddy fields of NRDS in the above table refers to a second crop; the area and yield shown are calculated using coefficients provided by the source.*
Source: Burkina Faso, "National Rice Development Strategy", October 2011, FAO Statistics "Crops" (Paddy)

(3) Central African Republic

The production volume in 2018 was 12,000 tons, corresponding to a NRDS target achievement rate of 16% (Table 1-19). In 2018, the area harvested and yield were 6,971 ha and 1.7 t/ha, respectively, representing achievement rates of 25% and 61%, respectively.

Table 1-19 Achievement of NRDS –Central African Republic-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018	Remark
	Irrigated	Lowland	Rainfed	Total/ Average	Irrigated	Lowland	Rainfed	Total/ Average	Achievements	
Production (t)	6,000	12,500	38,500	57,000	8,225	16,949	52,224	77,398	12,000	Achievement rate 16%
Area (ha)	2,000	5,000	16,500	23,500	2,350	5,810	19,200	27,360	6,971	Achievement rate 25%
Yield (t/ha)	3.0	2.5	2.3	2.4	3.5	2.9	2.7	2.8	1.7	Achievement rate 61%

Source: REPUBLIQUE CENTRAFRICAINE MINISTERE DE L'AGRICULTURE ET DU DEVELOPPEMENT RURAL, "STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE (SNDR) EN REPUBLIQUE CENTRAFRICAINE", October 2012, FAO Statistics "Crops" (Paddy)

(4) Cote d'Ivoire

The production volume in 2018 was 2,007,000 tons, corresponding to a NRDS target achievement rate of 62% (Table 1-20). In 2018, the area harvested and yield were 756,623 ha and 2.6 t/ha, respectively, and the achievement rate of area harvested was 53%.

Increasing the self-sufficiency rate of rice is a priority for the government. Therefore, the Ministry of Agriculture and Rural Development's rice cultivation field became independent from the Ministry of Agriculture and Rural Development, and the Ministry of Rice Development was established as an organization under the jurisdiction of formulation and promotion of NRDS. The agency responsible for the development in the rice sector, Agence pour le Développement de filière Riz (ADERIZ)[17] was established. This initiative to create an allocated structure, that neighboring countries have yet to take, goes to show the importance of local rice development (CIV-01) accorded by the state authorities in the country.

[17] *After January 2018, Office National de Développement de la Riziculture (ONDR) was reorganized and its name was changed to Agence pour le Développement de filière Riz (ADERIZ).*

Table 1-20 Achievement of NRDS –Cote d'Ivoire-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irrigated	Rainfed	Flood	Total/ Average	Irrigated	Rainfed	Flood	Total/ Average		
Production (t)	180,000	749,600	-	929,600	500,000	2,600,000	150,000	3,250,000	2,007,000	Achievement rate 62%
Area (ha)	41,000	937,000	-	978,000	100,000	1,300,000	30,000	1,430,000	756,623	Achievement rate 53%
Yield (t/ha)	4.3	0.8	-	-	5.0	2.0	5.0	-	2.6	-

Source: MINISTRY OF AGRICULTURE NATIONAL RICE DEVELOPMENT OFFICE (NRDO), "REVISED NATIONAL RICE DEVELOPMENT STRATEGY FOR THE CÔTE D'IVOIRE RICE SECTOR (NRDS) 2012–2020", January 2012, FAO Statistics "Crops" (Paddy)

(5) Democratic Republic of the Congo

The production volume in 2018 was 1,286,872 tons, corresponding to a NRDS target rate of 92% (Table 1-21). In 2018, the area harvested and yield were 1,693,498 ha and 0.7 t/ha, respectively, representing a successful target achievement rate of 223% of area harvested and 39%, of yield achievement.

Flooded lowland farming accounted for only about 2% of the farming area in 2008. With the expectation of increasing production[18] via the development of flooded lowland and flatland farming, the target cultivated area for flooded lowland farming was set at a high 140,000 ha, which covers 18% of the cultivated area. As a result, the total area harvested drastically expanded from 419,016 ha in 2008 to 1,693,498 ha in 2018.

Table 1-21 Achievement of NRDS –Democratic Republic of the Congo-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irrigated	Rainfed	Flood	Total/ Average	Irrigated	Rainfed	Flood	Total/ Average		
Production (t)	40	328,800	17,000	345,840	80,000	900,000	420,000	1,400,000	1,286,872	Achievement rate 92%
Area (ha)	16	411,000	8,000	419,016	20,000	600,000	140,000	760,000	1,693,498	Achievement rate 223%
Yield (t/ha)	2.5	0.8	2.0	0.8	4.0	1.5	3.0	1.8	0.7	Achievement rate 39%

Source: REPUBLIQUE DEMOCRATIQUE DU CONGO MINISTERE DE L'AGRICULTURE ET DU DEVELOPPEMENT RURAL Secrétariat Général de l'Agriculture, Pêche et Elevage Task-force Riz, "STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE (SNDR) ", December 2013, FAO Statistics "Crops" (Paddy)

(6) Ethiopia

The production volume in 2018 was 170,630 tons, corresponding to a NRDS target achievement rate of 4% (Table 1-22). In 2018, the area harvested and average yield were 57,576 ha and 3.0 t/ha, respectively, representing achievement rates of 7% and 59%, respectively.

The goal in NRDS2 is to increase crop acreage for both small- and large-scale farmers19. Required investments in irrigated paddy fields will be done with the establishment of profitable and financially sustainable models of irrigated paddy fields.

Women and their important labor burden is still an important underlying issue to be resolved. It is thus important to introduce women to farming tools and machinery and provide the necessary training to enhance their involvement in the value chain activities.

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[18] REPUBLIQUE DEMOCRATIQUE DU CONGO MINISTERE DE L'AGRICULTURE ET DU DEVELOPPEMENT RURAL Secrétariat Général de l'Agriculture, Pêche et Elevage Task-force Riz, "STRATEGIE NATIONALE DE DEVELOPPEMENT DE LA RIZICULTURE (SNDR) ", December 2013

[19] The Federal Democratic Republic of Ethiopia Ministry of Agriculture and Rural Development, "National Rice Research of Agriculture and Rural Development Strategy of Ethiopia", 2009

Table 1-22 Achievement of NRDS –Ethiopia-[20]

	NRDS 2009 (At the time of formulation)				NRDS 2019 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irrigated	Lowland rainfed	Upland rainfed	Total/ Average	Irrigated	Lowland rainfed	Upland rainfed	Total/ Average		
Production (t)	107,120	272,802	118,409	498,331	1,173,620	2,214,165	570,538	3,958,323	170,630	Achievement rate 4%
Area (ha)	26,780	85,251	43,855	155,886	167,660	442,833	163,011	773,504	57,576	Achievement rate 7%
Yield (t/ha)	4.0	3.2	2.7	3.2	7.0	5.0	3.5	5.1	3.0	Achievement rate 59%

Source: The Federal Democratic Republic of Ethiopia Ministry of Agriculture and Rural Development, "National Rice Research of Agriculture and Rural Development Strategy of Ethiopia", 2009, FAO Statistics "Crops" (Paddy)

(7) Gambia

The production volume in 2019 was 22,000 tons, corresponding to a NRDS target achievement rate of 7% (Table 1-23). In 2019, the area harvested and the average yield were 65,000 ha and 0.3 t/ha, respectively, representing the target achievement rates of 47% and 14%, respectively. In 2013, rainfed upland rice accounted for 62% (53,800 t/86,800 t) of the total production surpassing the 2019 target of 42% (130,000 t/306,000 t). High target areas set for irrigated paddy fields (10,000 ha) and rainfed lowland (63,000 ha) will eventually be the next future goals.

In relation to CARD projects, the AfDB implemented a value chain management program that included the establishment of processing plants and training of instructors in post-harvest processing and production process management.

Table 1-23 Achievement of NRDS –Gambia-

	NRDS 2013 (At the time of formulation)				NRDS 2019 (Targets)				FAOSTAT 2019 Achievements	Remark
	Irrigated lowland	Rainfed lowland	Rainfed upland	Total/ Average	Irrigated lowland	Rainfed lowland	Rainfed upland	Total/ Average		
Production (t)	16,000	17,000	53,800	86,800	50,000	126,000	130,000	306,000	22,000	Achievement rate 7%
Area (ha)	4,600	17,400	48,900	70,900	10,000	63,000	65,000	138,000	65,000	Achievement rate 47%
Yield (t/ha)	3.5	1.0	1.1	1.2	5.0	2.0	2.0	2.2	0.3	Achievement rate 14%

**The production volume of irrigated lowland of NRDS is considered for the double cropping. Hence, the yield value is obtained by dividing the production volume by two times the area.*
Source: THE GAMBIA Ministry of Agriculture (MOA), "NATIONAL RICE DEVELOPMENT STRATEG (NRDS)", November 2014, FAO Statistics "Crops" (Paddy)

(8) Liberia

The production volume in 2018 was 257,995 tons, corresponding to a NRDS target achievement rate of 29% (Table 1-24). In 2018, the area harvested and yield were 238,090 ha and 1.0 t/ha, respectively, representing NRDS target achievement rates of 79% and 34%, respectively.

In the first NRDS, high priority is given to the development of irrigated paddy fields and rainfed lowland paddy fields with the production target set at 273,000 tons for irrigated farming and 225,750 tons' rainfed lowlands.

The assessment of seed development and input support program including farming equipment improvement was also listed as activities in the first NRDS. Consequently, the establishment of the Seed Act and Seed Board were realized through the support of the CARD to enhance the development of seed technology[7].

[20] *The low rate of production achievement of 4% can be attributed to the fact that the figure for 2009 (current situation) was higher than the FAO statistic (NRDS production: 498,331 t, FAOSTAT: 103,128 t); the target also reflected higher values.*

Table 1-24 Achievement of NRDS –Liberia-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irrigated lowland	Lowland rainfed	Upland	Total/ Average	Irrigated lowland	Lowland rainfed	Upland	Total/ Average		
Production (t)	4,000	24,000	171,000	199,000	273,000	225,750	380,000	878,750	257,995	Achievement rate 29%
Area (ha)	2,000	20,000	190,000	212,000	45,500	64,500	190,000	300,000	238,090	Achievement rate 79%
Yield (t/ha)	2.0	1.2	0.9	0.9	6.0	3.5	2.0	2.9	1.0	Achievement rate 34%

Source: Ministry of Agriculture Monrovia, Liberia, "National Rice Development Strategy of Liberia Doubling Rice Production by 2018", May 2012, FAO Statistics "Crops" (Paddy)

(9) Rwanda

The production volume in 2018 was 119,932 tons, corresponding to a NRDS target of 33% (Table 1-25). In 2018, the area harvested and yield were 34,205 ha and 3.5 t/ha, respectively, and the achievement rate of area harvested was 120%.

Rwanda, with the many steep slopes in the country, is threatened with a serious soil erosion problem that may eventually affect its soil fertility. The Water harvesting and Hillside irrigation Project (LWH) was initiated by several donor agencies to develop steep-slope soil conservation technologies and to support the irrigation schemes[21]. In addition to hilly irrigated rice fields, the project also developed lowland farming around the hilly areas, which contributed to the expansion of the cultivated area of irrigated rice fields and lowland farming.

Table 1-25 Achievement of NRDS –Rwanda-

	NRDS 2008 (At the time of formulation)			NRDS 2018 (Targets)			FAOSTAT 2018 Achievements	Remark
	Irrigated	Rainfed lowland	Total/ Average	Irrigated	Rainfed lowland	Total/ Average		
Production (t)	66,000	-	66,000	364,000	5,000	369,000	119,932	Achievement rate 33%
Area (ha)	12,000	-	12,000	54,500	2,500	28,500	34,205	Achievement rate 120%
Yield (t/ha)	5.5	-	5.5	7.0	2.0	-	3.5	-

**The production and area of irrigated paddy fields of NRDS show for double crop.*
Source: REPUBLIC OF RWANDA MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES, "NATIONAL RICE DEVELOPMENT STRATEGY (PERIOD 2011-2018)", September 2011, FAO Statistics "Crops" (Paddy)

(10) Togo

The production volume in 2018 was 145,489 tons, corresponding to a NRDS target achievement rate of 63% (Table 1-26). In 2018, the area harvested and the yield were 86,805 ha and 1.6 t/ha, respectively, representing NRDS achievement rates of 131% and 46%, respectively.

A high target area was set for all cultivating practices (Irrigated: 17,290 ha; lowland: 36,575 ha; rainfed upland: 12,635 ha). The total area harvested increased significantly compared to 2008 (36,492 ha in 2008 to 86,805 ha in 2018), achieving its set target.

In phase 1, Togo focused mainly on seed production and organizational strengthening of seed producers. A seed research institute has also been established to enhance the seed development sector[7].

Table 1-26 Achievement of NRDS –Togo-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irriagted	Lowland	Rainfed upland	Total/ Average	Irriagted	Lowland	Rainfed upland	Total/ Average		
Production (t)	25,662	51,324	8,554	85,540	69,825	139,650	23,275	232,750	145,489	Achievement rate 63%
Area (ha)	9,488	20,070	6,934	36,492	17,290	36,575	12,635	66,500	86,805	Achievement rate 131%
Yield (t/ha)	2.7	2.5	1.2	2.3	4.0	3.8	1.8	3.5	1.6	Achievement rate 46%

[21] *MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES, "LWH SUMMARY COMPLETED PROJECT" http://lwh-rssp.minagri.gov.rw/index.php?id=36*

Source: REPUBLIC OF TOGO MINISTRY OF AGRICULTURE LIVESTOCK AND FISHERIES, "NATIONAL RICE DEVELOPMENT STRATEGY (NRDS)" October, 2010, FAO Statistics "Crops" (Paddy)

(11) Zambia

The production volume in 2018 was 43,063 tons, corresponding to a NRDS target achievement rate of 34% (Table 1-27). In 2018, the area harvested and yield were 30,297 ha and 1.4 t/ha, respectively, representing NRDS achievement rates of 72% and 47%, respectively. Although Zambia has the lowest annual per capita consumption among the CARD member countries, rice is regarded as one of the most promising crops due to its recent high demand that surpasses domestic production.

In a CARD related project, potential factors for increased rice production were identified and rice cultivation techniques and adapted farming systems were introduced. In addition, a map that integrates satellite imagery and GIS data was created to facilitate understanding of farming conditions and environment (ZMB-02).

Table 1-27 Achievement of NRDS –Zambia-

	NRDS 2008 (At the time of formulation)				NRDS 2018 (Targets)				FAOSTAT 2018 Achievements	Remark
	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average	Irrigated	Rainfed lowland	Rainfed upland	Total/ Average		
Production (t)	800	3,300	36,900	41,000	31,500	31,500	63,000	126,000	43,063	Achievement rate 34%
Area (ha)	600	2,500	27,900	31,000	10,500	10,500	21,000	42,000	30,297	Achievement rate 72%
Yield (t/ha)	1.3	1.3	1.3	1.3	3.0	3.0	3.0	3.0	1.4	Achievement rate 47%

Source: THE MINISTRY OF AGRICULTURE AND COOPERATIVES (MACO), "ZAMBIA NATIONAL RICE DEVELOPMENT STRATEGY (2011 – 2015)", August 2011, FAO Statistics "Crops" (Paddy)

Chapter 2 Rice Cultivation Techniques

2-1 Overview of Rice Cultivation

2-1-1 Lifecycle of rice

Rice cultivated in Africa

Asian rice (*Oryza sativa* L.) and African rice (*Oryza glaverrima* Steud.) are widely cultivated in Africa. There are three varieties of Asian rice, including indica, javanica, japonica, of which indica varieties are mainly cultivated in Africa. In 1992, the West Africa Rice Development Association (WARDA; presently, Africa Rice Center) introduced the New Rice for Africa (NERICA) variety developed by crossing Asian and African rice. Since then, 18 upland and 60 lowland varieties have been released, and they are cultivated in sub-Saharan Africa.

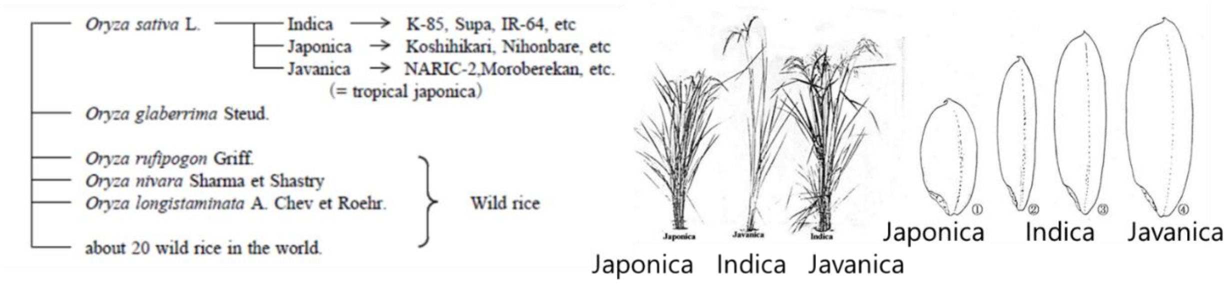


Fig 2-1 Classification of rice

Source: Prepared by the JICA study team based on UGA-03, "Rice Cultivation Handbook"

Lowland and upland rice varieties are cultivated in different environments, such as lowland, flat land, and hilly areas, in many regions of sub-Saharan Africa. Lowland rice is subjected to flooding during most of the growth period (water) and require much water. Meanwhile, upland rice is cultivated in fields and hilly areas, because it requires less water than lowland rice owing to its specific physiological characteristics.

Growth stages of rice

Although the period required for rice growth varies depending on variety, cultivation environment, and climate (temperature and day length), the growth stages of rice can be classified into three stages: (1) vegetative stage, (2) reproductive stage, and (3) maturity stage.

Table 2-1 Growth stages of rice

Growth stage	Outline
1. Vegetative stage	It refers to the period from germination/emergence to the formation of young panicles (panicle primordium). During this period, the number of stems can be increased by activity tillering. Note: Germination refers to the emergence of plumule. Emergence refers to the appearance of any part of the plant from the soil.
2. Reproductive stage	It refers to the period from panicle formation to heading/flowering. This period includes panicle differentiation, panicle formation, meiosis, booting, and heading.

Growth stage	Outline
3. Maturity stage	It refers to the period from heading/flowering to maturity. This period includes flowering, pollination, and ripening. The ripening stage is divided into four phases, namely mil-ripe, dough-ripe, yellow ripe, and full maturity stage.

Source: Prepared by the JICA study team based on CMR-01, "GUIDE for NERICA CULTIVATION"

The morphological characteristics of each stage are shown in the figure below.

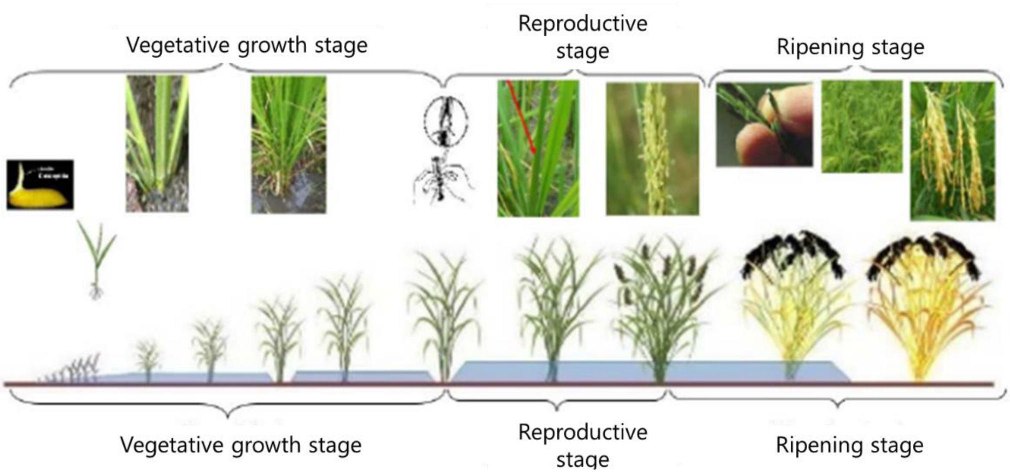


Fig 2-2 Growth stages of rice

Source: SEN-02, MANUEL PRATIQUE DE RIZICULTURE PLUVIALE DANS LE BASSIN ARACHIDIER

(1) Rice Morphology

Each part of the rice plant is shown in the figure below.

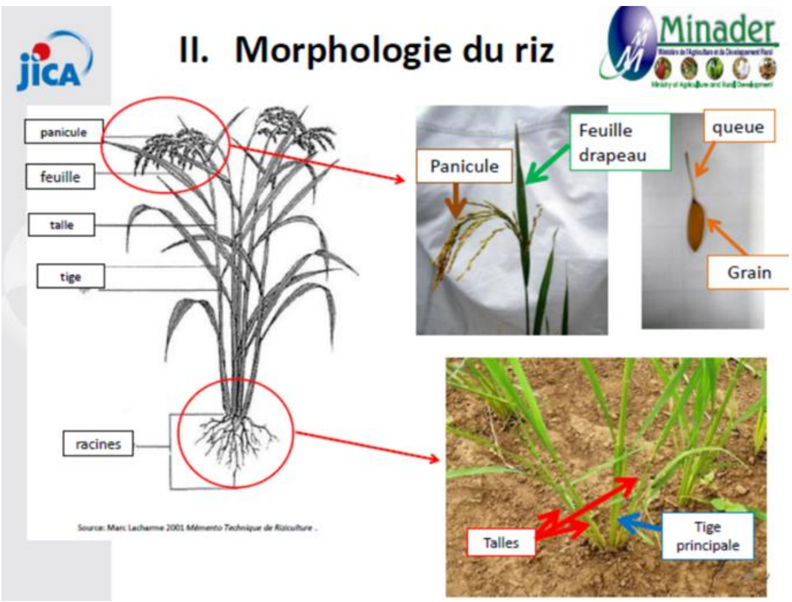


Fig 2-3 Rice morphology

Source: CMR-02, " Généralités sur le riz "

(2) Confirmation of the status of panicle formation

As described in detail in section 2-2-4 Rice crop management and 2-3-4 Rice Crop Management, for confirming the status of panicle formation to determine the timing of topdressing, the leaf sheath is peeled off and visually observed, as shown in the following figure. The panicle formation stage refers to the time point at which the panicle length can be confirmed visually (2 mm). Fertilizer is applied after this point to avoid lodging.

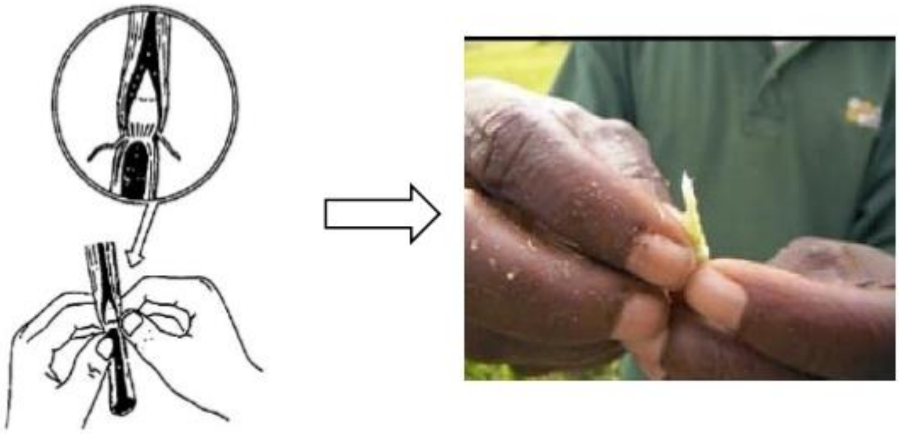


Fig 2-4 Confirmation of panicle formation

Source: SEN-02, LE PROJET D'APPUI A LA PRODUCTION DURABLE DU RIZ PLUVIAL (PRiP)
Deuxième Formation des Conseillers Agricoles 01~14

1) Same variety but different growth periods

The number of days required for growth varies depending on the variety, cultivation environment, and climate. For instance, NERICA 4 (upland rice variety) require approximately 100 days to grow in the tropical lowlands of West Africa, UGA-03 requires 110-120 days, and ZMB-02 requires 110-130 days. Of note, even within the same variety, the number of growing days may vary depending on the environmental conditions of the country or region.

2) Earliness of rice varieties

The areas for rice cultivation depend on weather conditions and vary across different regions. Typically, varieties that require intermediate growth periods and can be naturally cultivated in specific areas are called middle-maturing varieties. Meanwhile, varieties with that require shorter or longer growth periods are called early- or late-maturing varieties, respectively. Thus, even the same variety can be early-, middle-, or late-maturing when cultivated in different areas. The earliness or lateness of such varieties is based on the length of the vegetative growth period and is determined by cultivar-specific base vegetative growth as well as photoperiod and temperature sensitivity during transition from vegetative to reproductive growth. The length of the reproductive and maturity periods is approximately 30 days, and it is nearly the same for all varieties.

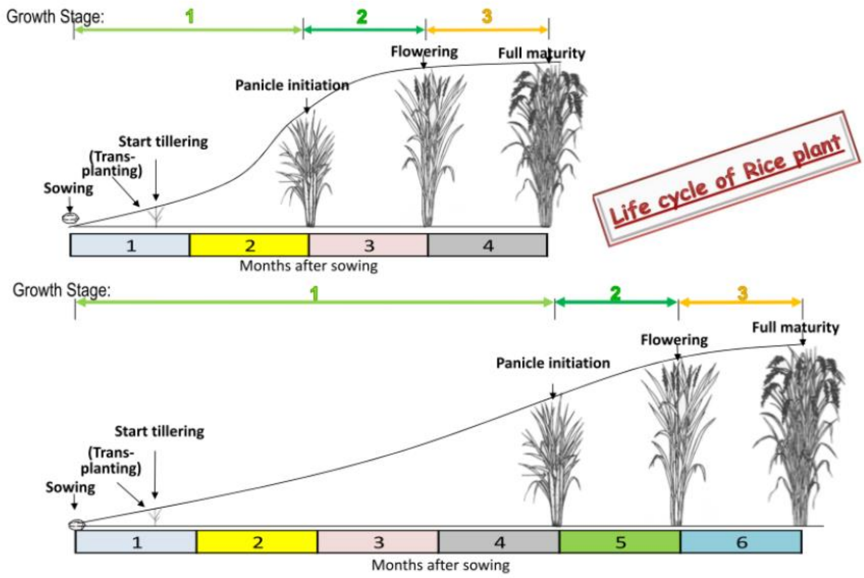


Fig 2-5 Differences in the length of growing period in various varieties

Source: SLE-01, "Extension Material on Technical Package on Rice Production"

The upper and lower figures present examples of the growth stages of early-maturing (length, -120 days) and late-maturing (length, -180 days) varieties in SLE-01, respectively. In both cases, the period from panicle formation to harvest was approximately 2 months, but the vegetative growth period was respectively 2 and 4 months for the early-maturing and late-maturity varieties. However, consider that the ripening period is affected by the weather.

2-1-2 Rice cultivation environment

Rice cultivation environments are classified into four categories: irrigated lowland rice fields, rainfed lowland rice fields (lowland and deep-water), and upland fields. Generally, irrigated lowland rice fields are fields in which there is a water source around the field, drainage channels and ridges are constructed in the field, and water flow can be controlled as required. Rainfed lowland rice fields (lowland and deep-water) are fields that can be cultivated only during the rainy season and include various environments, from relatively small-scale lands, such as inland valleys, to vast areas, such as floodplains. Depending on the topography, these can be divided into lands that are supplied with water by a relatively stable rainfall, lands that easily dry out, lands that are easily flooded, and lands that easily dry out and become flooded. Similar to that in rainfed lowland fields, cultivation in upland fields is limited to the rainy season, and these vary from relatively lowland fields, where maize and sorghum are cultivated, to hilly areas. Upland fields are more susceptible to drought than lowland fields. Definitions of cultivation environment in MOZ-04 are summarized in the table below.

Table 2-2 Definitions of cultivation environment in MOZ-04

	Cultivation environment			
	Irrigated lowland rice fields	**Rainfed lowland rice fields (lowland)**	**Rainfed lowland rice fields (deep-water)**	**Upland fields**
Definition of cultivation	—	It is flooded once during the cropping season, but the water depth is 50 cm or	Water depth of 50 cm or above, and flooding lasts over a month.	—

	Cultivation environment			
	Irrigated lowland rice fields	**Rainfed lowland rice fields (lowland)**	**Rainfed lowland rice fields (deep-water)**	**Upland fields**
environment		below and does not affect the growth and yield of rice.		
Type of rice	Lowland rice	Lowland rice	Lowland rice	Upland rice
Variety used	High-yield and improved varieties (local varieties depending on field condition)	Local varieties (high-yield and improved varieties depending on field condition)	Local varieties	Local and improved varieties (e.g., NERICA)
Water management	Possible	Partially possible	Impossible	Impossible
Photo				

Source: CMR-02, lGénéralités sur le riz"ENERALITES SUR LE RIZieties (e.g., Nrainfed (lowland), rainfed lowland (deep-water), and upland rice fields in MOZ-04 were obtained from Japanese experts.

Box. Project implementation policy for each cultivation type

Irrigated rice fields: The aim is to obtain a high yield through appropriate water management, use of improved varieties, and high input (e.g., the yield of 10 t/ha could be obtained in SEN-01).

Rainfed rice fields (lowland and deep-water): In SLE-01, rainfed fields are classified as mangrove swamps, inland valley swamps (IVSs), bolilands (inland basin-shaped lowlands), and reverain grasslands (floodplains). IVSs are considered an ecosystem with the highest productivity, and water management is possible by installing bunds in these fields. Therefore, in IVSs, the aim is to obtain the highest possible yield by selecting fields with a higher potential and by performing water management and fertilization (In SLE-01, the aim was to obtain a yield of 3.0 t/ha with cultivation management.)

Upland rice fields: Cropping depends solely on rainfall, and precipitation is one of the most important factors. Fertilization is required to obtain high yields using improved varieties, such as NERICA, but there is a risk of unstable water supply and few farmers apply fertilizers. In areas where upland rice is newly introduced (e.g., CMR-01), existing crops (e.g. maize, sorghum, millet) are prioritized, and delays in upland rice cultivation may lead to water shortage in the latter half of the cropping season, leading to decrease in yield. In CMR-01, rice cropping may even be skipped when the conditions are clearly unsuitable for cultivation due to delays in the start of the rainy season, light rain, or delays in sowing.

In terms of policy-making, in TZA-07, "irrigated fields" with high potential productivity are managed from the viewpoint of national food security. In addition, "rainfed fields (upland)" and "rainfed lowland fields" with low productivity are considered important from the perspective of farmers' food security.

2-1-3 Formation of rice yield

Composition of rice yield

Lowland rice yield constitutes "number of panicles," "the number of spikelets per panicle," "the percentage of ripened kernels," and "kernel weight (g/1,000 grains)", which are collectively called yield components. Yield is calculated by multiplying these factors. These components indicate the effects of weather and cultivation management on yield. We expect that the knowledge of yield composition can contribute to the preparation of farming plans and review of techniques requiring improvements to achieve the target yield.

Key points

(1) When to determine each yield components

Each element is determined at a specific growth stage.

Since "the number of panicles" is determined by planting density, maximum tiller number, and fruitful culm rate (number of panicles divided by maximum tiller number), it is affected by weather during the vegetative growth period, cultivation management, and fertilization.

Since "the number of spikelets per panicle" is determined by the difference in the number of degenerated spikeletes and the number of spikelets produced during the reproductive stage, it is affected by fertilization at the panicle formation stage.

Since "the percentage of ripened kernels" is determined by the sterile rate (the proportion of grains that are completely empty inside) and endosperm starch accumulation at the ripening stage, it is affected by weather conditions from the heading to ripening stage. In particular, high or low temperatures and drought from meiosis to flowering increase sterility and decrease yield.

"The kernel weight (g/1,000 grains)" is affected by endosperm starch accumulation at the ripening stage. In rice, it is determined to some extent by the variety. Therefore, this component shows little fluctuation compared with the others.

(2) Points for improving yield in each element

To improve yield, appropriate cultivation management is paramount at stages when each element is determined. The strategies recommended for each growth stage in SLE-01 and GHA-04 are summarized in the table below.

Table 2-3 Appropriate cultivation management at different growth stage

	How can we increase the number of ripened kernels at each growth stage?		
	Vegetative growth stage: increase in the number of panicles	**Reproductive stage: increase in the number of spikelets**	**Ripening stage: increase in the percentage of ripened kernels**
SLE-01	1) Use of good quality seeds 2) Appropriate field preparation 3) Appropriate and healthy seedlings 4) Uprooting that does not damage seedlings 5) Appropriate transplanting 6) Water management 7) Weeding 8) Appropriate time/amount of fertilizer application	1) Appropriate water management 2) Appropriate time/amount of fertilizer application 3) Adequate sunlight	1) Appropriate water management 2)Adequate sunlight 3) Appropriate harvest time
GHA-04	1) Number of seedlings per hill 2) Number of hills per square meter 3) Number of directly sown seeds 4) Planting depth 5) Water depth at the tilling stage 6) Amount of basal and top dressing (2nd time)	1) Appropriate time/amount of top dressing (3rd time)	1) Time/amount of top dressing (4th time) 2) Water management 3) Adjustment of the number of kernels per square meter 4) Weed, pest, and disease control

Source: SLE-01, "Guidelines for the Dissemination of the Technical Package on Rice Production through Farmer Field Schools"; GHA-04, "In-House Training"

Recommendations

(1) Yield survey method

When measuring yield, it is desirable to perform a full harvest (harvesting the entire field to be surveyed) such that the yield can be reliably determined. However, a full harvest is time-consuming and labor-intensive, and an alternative estimation method therefore generally used. In this method, a part of the field is harvested to estimate the yield and yield components are analyzed.

1) Tsubogari (plot sampling)

		
1. Samples are collected from three plots measuring 1 m^2. Sampling plots must be carefully selected: plots at	2. After harvesting, the number of hills is counted for yield component analysis. Then, five hills are sampled and stored in individual bags.	3. The samples are separately threshed.

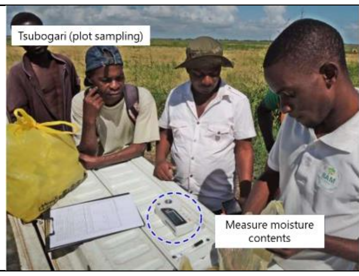
<table>
<tr><td>the borders are avoided, and areas with average growth are selected.</td><td></td><td></td></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td>4. Winnowing is performed to remove unfilled grains or other foreign matter.</td><td>5. Mature grains are weighed.</td><td>6. Moisture content is measured. Moisture content is 20-25% immediately after harvest. Yield is estimated assuming 14% moisture.</td></tr>
</table>

Fig 2-6 Tsubogari (plot sampling)

Source: MOZ-04, *Project Progress Report (phase 2) (annex)"*

The points of consideration at the time of sampling is as follows:

* It is necessary to increase the number of samplings to obtain more accurate data, taking into account the time, labor, and cost required for the survey.

* When collecting samples in a 1 m^2 plot, the hills should fit in the wooden frame as much as possible.

* When applying correction, the actual planting density should be calculated and the error should be correct by comparing with the number of hills harvested in a 1 m^2 plot (average value of sample plots) .

Correction factor = **(a)/(b)**
(a) 1,0000/(c)×(d)
(b) Average planting density of the Tsubogari (plot) sampling plots (number of hills/m^2)
(c) Average distance between rows of sampling plots = Distance between rows/number of hills
(d) Average hill distance of sampling plots = Distance between rows/number of hills

(2) Yield components analysis

Yield components are typically analyzed by selecting representative hills. The number of panicles each 10 hills in several plots with average growth in the field is counted, the average value is calculated, and five hills with the closest value to the average are selected. The following surveys are conducted on the five selected hills.

Photo 2-1 MDG-01 Yield components analysis

Source: MDG-01, "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)"

The following formula is used to calculate yield based on the yield components:

(1) [Number of hills per square meter (hills/m^2)] × (2) [Number of panicles per hill (panicles/hill)] × (3) [Number of kernels per panicle (kernels/panicle)] × (4) [Percentage of ripened kernels (%)] × (5) [Kernel weight (g/1,000 grains)]

Each element is calculated as follows:

1) Number of hills per square meter (hills/m^2)

* For broadcasting and drilling, rice is harvested from a 1 m^2 plot and the number of hill is counted.

* For transplanting and dibbling, planting density is calculated, and the number of plants per hill (number of grains per hills) is counted.

2) Number of panicles per hill (panicles/hill)

* For broadcasting and drilling, the number of harvested panicles is counted and divided by the number of hills.

* For dibbling, the number of panicles is counted and divided by the number of hills.

3) Number of kernels per panicle (kernels/panicle)

* Regardless of the sowing methods, the number of kernels per unit area is counted and divide by the number of panicles.

4) Percentage of ripened kernels (%)

* This refers to the proportion of fertile kernels among all kernels. The number of floated and sunken kernels is counted, and the number of sunken kernels is divided by the total number of kernels.

5) Kernel weight (g/1,000 grains)

* A total of 1,000 grains (sunken kernels) are counted and weighed. Alternatively, the number of ripening kernels with predefined weights (2 or 5 g) is counted. This is repeated three to five times for averaging, and the number of grains per predetermined weight (grains/g) is obtained and converted to weight per 1,000 grains.

The figure below shows an example of simple yield calculation.

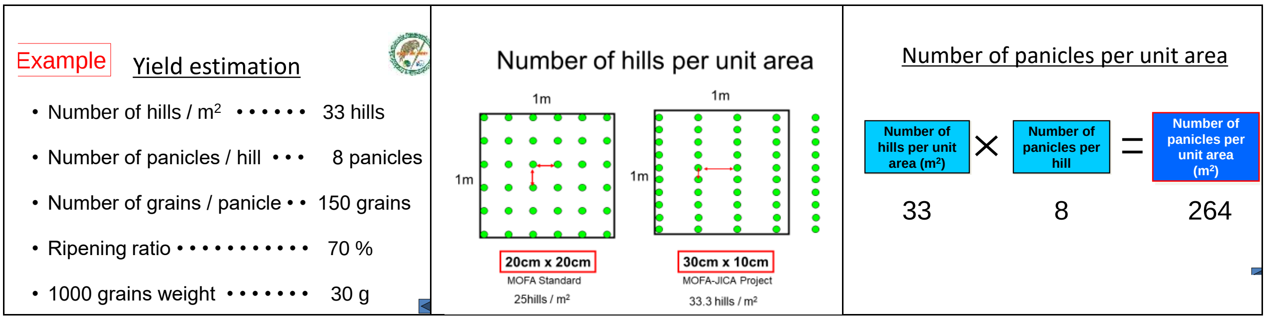


Fig 2-7 Yield calculation

Source: GHA-04, In-House Training "RC IHT 3-4 Yield Components"

Box. Yield component analysis using a semi-synchronization method (MDG-01)

For yield component analysis, in principle, the same material should be used for the survey of yield and yield components analysis (tentative name: synchronization method) to obtain reliable results. However, in reality, it is very difficult to conduct multiple surveys in a short time due to challenges such as poor access to the field and difficulties in contacting the farmers. Therefore, the following semi-synchronization method was developed for yield survey in a short time: (1) Only three elements (number of kernels per panicle, percentage of ripened kernels, and 1000-grain weight) are measured on representative hills in Tsubogari (plot sampling) and (2) the number of panicles is estimated based on the yield of Tsubogari (plot sampling) and formulas for calculating yield components.

The survey procedure is presented in the figure below:

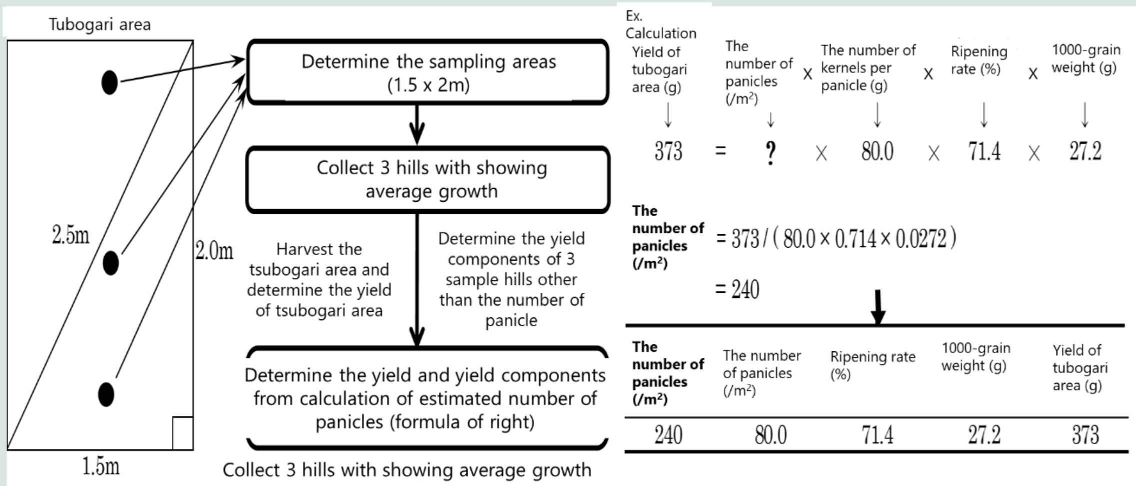


Fig 2-8 Yield component analysis using a semi-synchronization method

Compared to the conventional method with five oblique lines that required 175 minutes to complete the survey, the semi-synchronization method required only 80 minutes, which is less than half the time required with the former method. Therefore, the proposed method is practical and allow for all data to be collected on site without bringing the material back to the laboratory.

Source: MDG-01, Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition) "

2-2 Lowland rice

2-2-1 Selection of varieties

Selection of varieties

Numerous local varieties are cultivated in many countries in sub-Saharan Africa. Of these, many local varieties are photosensitive and therefore affected by the day length and have a fixed heading time. Therefore, if the start of rainy season and transplanting are delayed, sufficient vegetative growth cannot be achieved, as evidenced by decrease in yield due to drought and low temperatures. Meanwhile, the improved varieties developed in recent years are non-photosensitive and require a short maturity period; therefore, by introducing these varieties into the cropping systems, including paddy and upland farming, yield losses due to environmental adversities, such as floods and droughts, can be avoided. Moreover, the improved varieties show high lodging tolerance and pest resistance, strong fertilization effect, and high cold and salinity tolerance, among other beneficial features; thus, they can easily provide stable yield and quality. Many of agricultural research institutes examine the regional adaptability of the introduced or cultivated improved varieties and promotes the appropriate varieties for a specific region.

Key points

(1) Use of recommended varieties

Varieties that are clearly superior to the existing ones (in terms of yield, pest and disease resistance, quality, and cultivation characteristics, among others) are registered and disseminated as the recommended varieties. For instance, points to consider when selecting varieties for cultivation in GHA-06 are listed in the table below.

Table 2-4 Points to consider to when selecting varieties for cultivation in GHA-06

1	Select varieties preferred by the target markets such that marketing of the produce does not become a problem.
2	Select varieties with good grain quality (cooking characteristics, color, shape, taste and aroma, and head-rice recovery).
3	Select varieties with the appropriate duration of growth to match the season. Avoid varieties that need to be planted or harvested very early or late compared with other varieties planted in the surrounding areas to avoid growth problems under adverse environmental conditions.
4	Select varieties with resistance to major disease and pests and tolerance of dominant stresses in the area.
5	Select varieties with adequate tillering capacity to shade out weeds and produce a sufficient number of tillers for ensuring optimum yield.
6	Select varieties with adequate yield potential and stability across seasons.

Source: GHA-06: "Guide for Optimum Input Rice Cultivation under Irrigation"

The table below summarizes the recommended varieties and characteristics of the target areas adopted by the JICA project.

Table 2-5 Examples of recommended varieties for each country adopted in the JICA project

Project code	Varieties	Features	(Origin)
GHA-06	Legon Rice 1 Gbewaa (Jasmine85) AGRA Rice	Panicle number-type and short stem Panicle number-type and short stem Panicle weight-type	
MDG-01	Mailaka (X265) FOFIFA160 Makalioka 34 X1648 2509	Non-photosensitivity, middle grain, and rice blast resistance Long grain and photosensitivity Photosensitivity and good taste Rice blast resistance Middle grain	IRRI Improved variety Local variety IRRI IRRI
SEN-02	Sahel 10 ROK5 BG-90-2	Salinity tolerance	Africa rice Sierra Leone (Improved variety)
SEN-03	ISRIZ Line ISRIZ1 ISRIZ7 ISRIZ10/11	Higher cold and salinity tolerance during the vegetative growth and ripening period than the existing Sahel varieties Early maturity, cold tolerance, and aroma High yield, sticky texture, and aroma High salinity tolerance and light aroma	Korea International Cooperation Agency (KOICA) Africa rice center University of Louisiana (USA) Brazilian Research Cooperation

(1) Important traits when selecting varieties

It is important to select varieties with higher yield than the existing ones. In addition to yield, the following factors must be considered: pests and diseases typical of the region, environmental influences (low temperature, flooding, drought, and so on), consumer preferences (taste and aroma), and ease of cultivation for farmers (plant height and shedding habits).

For instance, in MOZ-04, farmers consider the following traits important. All farmers select and cultivate several local varieties, because their cropping season is short and the yield is high. An early harvest time gives farmers (particularly women) the time to harvest other crops. In addition, being able to harvest quickly makes it possible to immediately secure food for self-consumption. In this way, it is important to select cultivars considering not only yield but also the working environment and food security of the household.

Recommendations

(1) Variety test

In many projects, comparative cultivation of local (existing) and improved varieties has been implemented to determine the morphological characteristics and yield of the latter. In one of the methods, farmers observe the growth and yield of each variety in a test field and select the variety that they wants to cultivate according to the evaluation criteria recommended by the project.

In SEN-02, upland, lowland, and salt-tolerant rice varieties were cultivated according to the ecosystem of uplands, lowlands, and saline lowlands, and the varieties were evaluated by farmers. The traits emphasized by majority of the farmers included (1) short growing period, (2) many tillers, (3) high yield, (4) many panicles, and (5) long stems. Among these emphasized traits, the (2) number of tillers and (4) number of ears were selected because they are closely related to yield. In addition, the tendency to emphasize (1) short growing period indicates the importance of stable rice production in rainfed rice fields prone to water shortage.

Box. Good practices for lowland rice cultivation in each project

In lowland rice cultivation, local varieties are used, and early-, middle-, or late-maturing varieties are selected according to field conditions. Under deep-water conditions, the water level sometimes exceeds the plant height; therefore, how to avoid flood damage is important. Under such conditions, the water level often exceeds the shore; therefore, shore construction is not important. In addition, only few weeds can grow much; thus, weeding is not important either. Farmers often reduce the risk of flooding damage by direct sowing half of the field and transplanting the other half (MOZ-04).

Several different varieties are cultivated in one season (e.g., combination of early-, middle-, and late-maturing varieties). Fields are divided into plots, with a single variety in one plot (SLE-01).

Upland rice varieties can grow in both upland and flooded fields (UGA-03).

2-2-2 Land preparation

Land preparation

Land preparation may be practiced after the first rainfall after the rainy season begins, when the soil becomes moist, or before the start of the rainy season. The start time of rainy season varies depending on the region and environment. In land preparation, plowing, harrowing, and puddling are the main tasks, but strategies and farm equipment used vary depending on the scale and condition of the field. In addition, in areas where transplanting is practiced, seedlings are prepared in parallel with field preparation; hence, it is important to set a schedule that does not delay the work, such as when to start the work and secure labor.

Key points

(1) Land selection

Rice requires more water than other crops. In particular, lowland rice requires flooding conditions; therefore, when selecting a field, it is important to select a wet site throughout the cropping season. In SLE-01, the soil is not fertility and there are potential problems of weeds, pests, and floods, among others. These factors must be considered when selecting lowland sites in this region. In ZMB-01, selection of wet sites throughout the cropping season is recommended to ensure adequate water supply from planting to ripening near dumbos (seasonal wetlands) and rivers. In GHA-04, undulating land should be avoided and flat terrains or terrains with a gentle slope should be selected as much as possible. Furthermore, permanent rivers are the recommended water sources, and floods not exceeding the knee height and constant soil moistening are desired.

(2) Tillage and soil preparation

The purpose of tillage is to produce optimal conditions for crop growth by improving the physical structure of the soil. Tillage is generally practiced in the following steps: (1) plowing (primary tillage), (2) harrowing as secondary tillage, and (3) puddling. In addition, in cultivated lands, rotary tillers are used in driven-type tillage for plowing, harrowing, leveling, and puddling. In integrated tillage with a rotary tiller, the horsepower of the tractor may be relatively small, and a lightweight and waterproof tractor for lowland rice fields made in Japan is suitable. The details of each practice are summarized below.

1) First plowing

The first plowing is performed using a tractor, animal power, or human power. For instance, a 30-60 hp tractor equipped with disc and moldboard plows is used for first plowing in CMR-01, GHA-04 (northern region), KEN-01, and MOZ-02.

Moldboard plow（reversible）

Disc plow

Photo 2-2 First plowing with a tractor equipped with moldboard (reversible) and disc plows

Source: SEN-03: "Project Progress Report (phase 3)", "4-2 TRAVAIL DU SOL"(left), MOZ-02: "MANUAL ON RICE CULTIVATION"(right)

Box. Points to note when preparing fields for introducing agricultural machinery

In CMR-01, since there is no access road to the field, the bunds between the fields and irrigation canal are broken during plowing and a tractor is introduced, and because the field is not leveled well, it is polygonal. Therefore, work efficiency is poor. To enable effective use of agricultural machinery, it is also important to improve the infrastructure that accompanies mechanization.

When using livestock, an animal-drawn plow is attached. The advantages and disadvantages of human-powered, animal-powered, and mechanical tillage are summarized in the following table in SEN-02.

Table 2-6 Advantages and disadvantages of human-powered, animal-powered, and mechanical tillage

	Human-powered tillage	Animal-powered tillage	Mechanical tillage
Advantage	Can work in difficult-to-access areas Cheap Traditional farming methods suitable for the area	Affordable price for many farmers Same plowing depth Slight uniformity	Sufficient plowing depth Uniform tillage (maintaining soil fertility)

	Human-powered tillage	Animal-powered tillage	Mechanical tillage
Disadvantage	Inefficiency Non-profitability Non-uniform tillage depth	Difficult to reverse by deep plowing and plow Operation skills of livestock workers are essential	Expensive

Source: SEN-02: Rainfed lowland rice cultivation technology training materials

2) Second plowing

After the first plowing, the soil is crushed and leveled using a disc harrow, drive harrow, or rotary tiller. Depending on the soil conditions, the soil may be cultivated and crushed using a tractor or cultivator equipped with a rotary tiller without first plowing. In GHA-05, tractors are most commonly used, which seems to have led to the expansion of planting area. Although plows are used for plowing, soil crushing with disc harrows is not common, and there are many fields with insufficient leveling.

3) Puddling and leveling

Puddling is an important task conducted before transplanting or direct sowing. Sufficient kneading of the soil after irrigation is effective for preventing water leakage from the field and controlling weeds. In addition, elimination of clods and unevenness on the surface of the rice field and softening of the soil render the transplanting easy. promoting the rooting of seedlings. Leveling as the finishing of puddling improves watering by flattening the surface of the field using a wooden board and allows for the uniform the growth of rice after transplanting or sowing.


Puddling by stepping

Leveling tools


Puddling/leveling by animal power

Photo 2-3 Puddling methods

Source: GHA-04: In House Training "LD-IHT.1-4-1 Land leveling and Paddling (Ashanti Region)" (left and center), MOZ-01: "MANUAL ON RICE CULTIVATION" (right)

Most of the puddling work is performed manually. In GHA-04, stepping and wooden farming tools are used to level the seedbeds, and direct sowing and transplanting without tillage are practiced. Similarly, in SLE-01, puddling and leveling are conducted using wooden farm tools. In MOZ-01, puddling and leveling are performed using animal power. In MOZ-02, the effects of cultivator puddling and conventional manual puddling on yield and yield components were verified, and a significant increase in yield and panicle number per unit area was observed when using cultivators.

(3) Repair or reinforcement and construction of bunds

The main role of bunds is to secure the necessary water during the growing season and to prevent the runoff of fertilizer (soil nutrients) from the field due to heavy rains and floods. In fields that already have bunds, it is important to weed, repair, and reinforce the bunds before the start of planting to prevent water leakage. In addition, when developing a new rainfed lowland field, bund construction is recommended in areas where with a high possibility of water shortage. In MOZ-04, bunds are very important for maintaining water in rainfed lowlands, and water retention can be improved by dividing the surroundings of the field and the inside of the field into several plots by constructing bunds.

Photo 2-4 Soil band coating with soil paste

Source: RWA-02, "SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity"

The above photograph shows bund repair in RWA-02. During repair, weeds on the bunds are first cleaned and then soil mixed with water is applied on bunds for reinforcement (i.e., bund plastering with soil paste).

(4) Basal dressing and compost

Basal dressing is applied before plowing, puddling, or transplanting (at the time of puddling) to promote rooting and increase the number of tillers after transplanting. Of note, the amount of fertilizer applied depends on the type of fertilizer that can be used, soil fertility, weather conditions, and variety. For application in rain-fed lowland fields, bunds must be constructed to retain water in the field for a certain period of time and prevent the outflow of fertilizer due to rainfall and drying of soil due to water shortage. Although compost is not very common in Sub-Saharan Africa, it is recommended when available because it helps improve soil fertility.

Table 2-7 Basal dressing application recommended by the project

Projects code	Type of fertilizer	Amount of fertilizer	Method and timing of application	Cultivation environment
CIV-01	NPK	200 kg/ha	Before second plowing	Irrigated
GHA-06	Urea TSP (45% P) MOP (60% K)	125 kg/ha 150 kg/ha 75 kg/ha	Immediately after plowing or transplanting	Irrigated
KEN-01	Urea, TSP, or MOP	50 kg /ha	On the day of transplanting	Irrigated
MDG-01	Manure NPK (11:22:16)	5 t/ha 300 kg/ha	Before plowing Before puddling *e.g., Vakinankaratra region	Irrigated
RWA-02	NPK (17:17:17)	200 kg/ha	Before irrigation at the time of puddling	Irrigated

Projects code	Type of fertilizer	Amount of fertilizer	Method and timing of application	Cultivation environment
SEN-01	DAP NPK (9:23:30)	100 kg/ha 200 kg/ha	At the time of land preparation	Irrigated
SEN-02	NPK (15:15:15)	150 kg/ha	At the plowing or after sowing	Rain-fed
SLE-01	NPK (15:15:15)	183 kg/ha	At 2-3 weeks after sowing	Rain-fed
TZA-07	Manure or Green manure	10-40 t/ha	At the time of land preparation (before plowing)	Irrigated
UGA-03	DAP (18:46:0) Urea (46:0:0)	62.5 kg/ha 62.5 kg/ha	Before finishing puddling (One the water drained)	Rain-fed
ZMB-02	D-Compound or fully matured manure	100-200 kg/ha 10 t/ha	At 16-21 days after germination	Rain-fed

In SLE-01, the following recommendations are provided. Yield can be increased to 1 t/ha using improved technology, and fertilization is indispensable to secure the yield beyond this value. In addition, to obtain the fertilizer effect, leveling, use of herbicides and healthy seedlings, and appropriate water management are imperative. In fields with water flow, the project instructs fertilizer is not applied due to the fertilizer flows out.

Box. Example of improving soil fertility by plowing-in rice straw

In RWA-01, plowing-in of rice straw was recommended to improve soil fertility. By plowing-in rice straw, the water retention capacity and fertility of the soil can be improved, which leads to increase in the number of panicles, number of kernels per panicle, ripening rate, and 1000-grain weight, and, ultimately, yield. (Scattering rice straw on the soil surface after harvest, plowing-in it at first tillage.)

2-2-3 Planting

Seed preparation

Seeds can be obtained by self-sowing, purchasing certified (guaranteed) seeds from a seed producer or private seed company, and obtaining certified (guaranteed) or non-certified seeds distributed with the support of various projects. In many countries in Sub-Saharan Africa, certified (guaranteed) seeds are rarely distributed to farmers, and many farmers use home-grown seeds. The use of home-grown seed for a long period can lead to deterioration of the quality and yield due to contamination of varieties or reduction of pest and disease resistance. Therefore, the purchase of certified (guaranteed) seeds and their renewal once every 3 years are recommended as much as possible. Seed preparation includes selection, soaking, and pre-germination. It is particularly recommended for lowland rice cultivation and is important for healthy seedling production. The purpose of seed preparation is to select healthy seeds that are not affected by disease through sorting, soaking, and germinating; seeds of uniform quality are selected to equalize growth after sowing.

Key points

(1) Seed selection

Seed selection is practiced to select well-nourished heavy seeds for uniform germination by using water or salt water. For selection using water, seeds are placed in a bucket containing clean water and stirred well. Seeds that float on the surface of the water are removed by hand, and only seeds that sink to the bottom of the bucket are used.

(2) Seed sterilization

Seed sterilization is performed at the time of soaking to prevent seed borne diseases such as bakanae, blast, brown spot, and bacterial blight, which occur during seedling growth, specifically when seeds that are not certified (guaranteed) seeds (e.g., self-seeded seeds). Since the distribution of agricultural chemicals to sterilize seeds varies depending on the country or region, their use is recommended in the regions where they are available.

A chemical-free method of sterilization is the hot water treatment in which seeds are soaked in hot water at 60°C for 10 min. In GHA-06, hot water treatment of seeds is recommended to control rice blast and reduce pesticide use.

Table 2-8 Seed sterilization methods

Project code	Method
KEN-01	Seeds (15 kg) + water (20 L) + chemicals (0.2 L): soaked in JIK (sodium hypochlorite) for 24 h
RWA-01/02	Water (1 L) + chemical (5 g): soaked in Beam and Benlate for 24 h. After soaking, the seeds are dried until the surface is dry.
GHA-06	Clean water is heated to 60 °C in a pan and maintained at 60°C. Seeds are placed in a bag, soaked in hot water for 10 min, taken out, and soaked.

Source: KEN-01, "Guideline of WSRC Water Saving Rice Culture For Mwea Irrigation Scheme"; RWA-02, "SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity"; GHA-06, "Optimum Input Rice Cultivation under Irrigation"

(3) Soaking and pre-germination

Soaking and pre-germination are practiced to ensure uniform germination of seeds and water absorption. The number of soaking days is based on the integrated temperature (temperature × number of days) at 100°C.

The pre-germination treatment is performed to warm the soaked seeds for germination. Pre-germination is performed for 36-48 h, depending on weather and temperature. Seeds are placed in a breathable bag to maintain temperature and prevent water evaporation. The sprouts should measure approximately 1 mm after germination to avoid damage during sowing.

Fig 2-9 Soaking and pre-germination and condition of seeds after soaking

Source: GHA-06, "Optimum Input Rice Cultivation under Irrigation"

Recommendations

(1) Salt water selection

In addition to the above-mentioned methods using water, another method with salt water can be used for seed selection. In this method, seeds are selected based on specific gravity; therefore, only filled seeds can be selected. However, the cost of purchasing salt may be a burden for farmers; therefore, it recommended depending on the local scenario. To achieve a salt water specific gravity of 1.10, 2 kg of salt is dissolved in 10 L of water. The specific gravity can be confirmed by floating a fresh egg in salt water.

(2) Germination test

By examining the germination rate, the required amount of seeds can be calculated in more detail, and the viability (quality) of seeds can be evaluated. The method of germination test shows the below table.

Table 2-9 Method of germination test and evaluation

1. A handful of seeds are randomly sampled from the top, bottom, and middle of the bag; mixed well; and 50 seeds are select three times. 2. A plate (cutlery) with a well-moistened cotton cloth is used. 3. Fifty full seeds are counted and arranged in five rows of ten; then pour water. 4. The seeds are covered with a piece of cotton cloth and placed in a ventilated place, away from rats. 5. Moisture is maintained (by watering) for 72 to 96 h and then the cotton cloth is removed. 6. Moisture is maintained (by sprinkling water) for 7 to 10 days and then the number of germinated seeds is counted.
  
Judgment: - If the germination rate exceeds 80%, the recommended sowing amount can be applied. - If the germination rate is 60–80%, the sowing amount should be increase beyond the recommended value. - If the germination rate is below 60%, new seeds should be selected.

Source: SEN-02, Rainfed lowland rice cultivation technology training materials "LE PROJET D'APPUI A LA PRODUCTION DURABLE DU RIZ PLUVIAL (PRiP), DeuxièmeFormation des ConseillersAgricoles 01~14"

Nursery preparation

Seedlings are raised in nurseries in upland and wet fields (flooded). In the JICA project, (1) semi-irrigated seedbeds are used most often, but (2) improved wet seedbeds, (3) dapog seedbeds, and (4) dry seedbeds are also introduced. These are used depending on the field environment. The table below summarizes the characteristics of the nursery techniques introduced in each project.

Table 2-10 Seedbeds introduced in the project

Type	Semi-Irrigated seedbed	Improved wet seedbed	Dapog seedbed	Dry seedbed
Project code	CIV-01, GHA-06, MDG-01, MOZ-01, SEN-01, SEN-02, SLE-01, TZA-07, and ZMB-01,and so on.	GHA-04	UGA-03, MDG-01, KEN-01	MOZ-03, SLE-01
Features	A strip-shaped nursery is created with a width of 1-1.2 m and height of 10 cm, and water is released to the height of the nursery. Sowing is performed after water drainage. Spindly growth due to	A seedbed is formed at a corner of the field.	Nurseries can be raised anywhere. It is eased uprooting of nurseries. The seedling raising period is short, and the nurseries are small. However, frequent irrigation is required.	In SLE-01, nurseries are raised on dry seedbeds to avoid the flooding of nurseries due to heavy rains during the rainy season.

Type	Semi-Irrigated seedbed	Improved wet seedbed	Dapog seedbed	Dry seedbed
	excessive water can be prevented with this technique.			
Photo	 (MDG-02)	 (GHA-04)	 (UGA-03)	 (MOZ-03)

Source: MDG-01, "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)", GHA-04, In-House Training "RC IHT1-2-1 NURSERY PREPARATION AND SOWING"; UGA-03, "Dapog Seedling", MOZ-03: "MANUAL TÉCNICA DE CULTIVO DE ARROZ"

Key points

(1) Semi-irrigated seedbeds

In the conventional wet seedbeds, seeds keep submerged at germination, and the sowing density is very high; thus, the problem of spindly growth arises. However, in the case of dry seedbeds, there are drawbacks such as requirement of frequent irrigation, troublesome management, and development of wilt disease. There are some advantages of wet seedbeds and dry seedbeds; (wet seedbed) less damage to birds, less weed growth, (dry seedbed) nursery does not float, and nurseries take root quickly after transplanting. Therefore, many projects recommend the cultivation of healthy seedlings using semi-irrigated seedbeds, which have advantages of both dry and wet seedbeds.

In the semi-irrigated seedbeds, the seedbeds are made before irrigating the water. The size of the seedbed is 1-1.2 m wide, which is easy to work with, and the distance between furrows is 30-50 cm. The surface is made as flat as possible and flooded to a level slightly lower than the height of the seedbed.

Photo 2-5 Preparation of semi-irrigated seedbeds

Source: RWA-02, "SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity"

(2) Improved wet seedbeds

For the size of the nursery, refer to the semi-irrigated seedbeds in (1) above. A seedbed is made at the corner of the field, where puddling is performed. The area is plowed, water is irrigated, and the area is puddled. A rope is used to determine the width and length of the seedbed. To ensure uniform growth after sowing, the surface is made as flat as possible by hand or using a stick.

Photo 2-6 Preparation of improved wet seedbed

Source: GHA-04, In-House Training "RC IHT 1-2-1 NURSERY PREPARATION AND SOWING"

(3) Dapog method

The Dapog method of raising nurseries is widely used by rice farmers in the Philippines. It has the following advantages: shortening of the nursery raising period, reduction of the nursery raising area (since there is no need to raise nurseries in the field, such as wet seedbeds and dry seedbeds, nurseries can be raised anywhere in a sunny place), and requirement of less labor for transplanting seedlings. In MDG-01, the roots of the nurseries are cut when the nurseries were planted, which makes it easier to loosen and lift the nurseries and improves the speed of transplanting. However, the disadvantage is that the nurseries are densely planted, increasing the number of nursery than usual, frequent irrigation is required, and the nursery rearing period is short, leading to the development of small nurseries.

(4) Dry seedbed

Dry seedbeds are used to grow seedling in an upland field or backyard. It is important to select an open place, where the nurseries receive adequate sunlight. In SEL-02, raising nurseries in upland fields is recommended because there is a risk of flooding due to heavy rains and diseases due to high humidity if nurseries are grown in a place adjacent to the field during the rainy season.

(5) Seedbed areas and sowing amount per hectare

In the conventional method of seedling raising, many seeds are sown in small seedbeds. Under such dense planting conditions, competition between nurseries causes a lack of sunlight and soil nutrients, increasing the rearing period and resulting in the development of weak nurseries that are susceptible to diseases. Therefore, it is important to apply an appropriate nurseries area and sowing amount.

Table 2-11 Seedbed areas and sowing amount recommended in the project

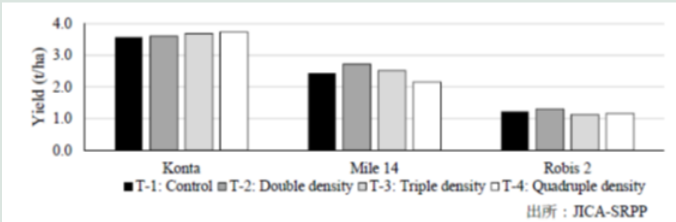
Project code	Required seedbed areas	Sowing amount of seedbed	Sowing amount per1ha
KEN-01	375 m^2/ha	100 g/m^2	38 kg/ha
GHA-04	500 m^2/ha	100 g/m^2	50 kg/ha
GHA-06	150-200 m^2/ha	-	40-50 kg/ha
MDG-01	100 m^2/ha	180 g/m^2 (pre-germinated seeds)	
MOZ-02	200-330 m^2/ha	-	60 kg/ha
RWA-02	300 m^2/ha	100 g/m^2	20-25 kg/ha
SEN-02	120-150 m^2/ha	200 g/m^2	25-30 kg/ha
UGA-03	250-375 m^2/ha	100 g/m^2	25-38 kg/ha

Box. Verification of yield difference due to sowing density in different seedbeds (SLE-02)

Based on the above table, the recommended sowing density of seedbeds can be 100 g/m^2, but there are almost no case studies in which the appropriate sowing density has been confirmed by trial cultivation. In SLE-02, if yield is not affected even with the increase in sowing density, the area of the seedbed can be reduced. From the viewpoint of reducing labor, field experiments on the effects of various seedling densities on rice yield were conducted.

The difference in yield in the test section was considered to be due to the effect of soil environment and climate at that time; however, no differences in yield due to differences in sowing density were observed. Specifically, even when four times the recommended sowing amount was used, the delay in growth after transplanting could be recovered and there was no difference in yield.

However, when four times the sowing amount was used, severe growth competition occurred in the nursery, and many seedlings died before transplanting; thus the recommended sowing amount was 200 g/m^2.



Source: SLE-02, "Project Progress Report (phase 3)"

(6) Nursery management

Nursery management includes fertilization, weeding after sowing, and water management, and control of bird damage after sowing and until nurseries grow certain period.

Recommendations

(1) Appropriate sowing amount

The standard sowing amount is set depending on the cultivation area and variety; however, it is important to determine the sowing amount that does not waste the seeds considering the seed quality and condition of the field.

The sowing amount can be calculated based on the field area, planting density, number of plants, germination rate, and 1000-grain weight.

For instance, if germination rate 80%, planting density is 25 hills/m^2, number of hills planted is 3, 1000-grain weight is 25 g, and cultivated area 1 ha, the sowing amount can be calculated as follows: (25 hills/m^2 × 3 hills × 25) ÷ (1,000 × 0.8) = 2.34 g/m^2 or - 2.4 kg/ha.

(2) Appropriate nursery raising period

When the nursery rearing period is long, the nursery becomes densely populated and tillering is suppressed; this shortens the vegetative growth period after transplanting, and sufficient growth cannot be achieved, which affects the number of panicles and spikelets. Particularly for early-maturing varieties, this effect is strong, and it is important to consider the work schedule, such as field preparation, to achieve the desired the seedling raising period.

In UGA-03, the effect of different seedling ages on yield was examined using lowland rice varieties (K-85). The yield difference was 5.9 t/ha for 3-week-old nurseries and 4 t/ha for 6-week-old nurseries, corresponding to a 1.5-fold change. In this case, nurseries with a rearing period of 2 to 3 weeks achieved high yields, while large nurseries were not negatively affected when using traditional photosensitive varieties. In SLE-01, even when planted in the early rainy season, such varieties required a long growing period, and the vegetative growth period could be secured even after transplanting; therefore, they are preferred by farmers who grow traditional varieties. In SEN-01, in the case of dry season cropping, 3-week-old nurseries did not grow to a size suitable for transplanting due to the effects of strong sunlight and low temperature and required a minimum raising period of 1 month.

Transplanting

Transplanting is conducted in the order of uprooting, transportation, and transplanting. However, it is necessary to consider the arrangement of workers and schedules such that each activity can be conducted easily. Traditionally, large nurseries raised for 1 to 2 months are planted by cutting the leaf tips; however, their growth is delayed, making it difficult to secure a high spikelet yield. Therefore, in improved rice cultivation, the use of young seedlings raised for 25 days or less is recommended to secure tillering at an early stage. However, since young seedlings taken more time for uprooting, transportation, and transplanting than large seedlings, it is necessary to fully inform the farmers about their purpose and handling.

Key points

(1) Uprooting

Nurseries are uprooted on the day of planting or the previous day. Before uprooting the nurseries, the seedbed is well irrigated to soften the soil, which simplifies the task. When uprooting nurseries (particularly young ones), they should be pulled softly to avoid damage to the roots. The uprooted nurseries are rinsed with water to remove soil, bound in appropriate bundles (such that they are easy to handle when transplanting and transporting), and placed in a bag or basin. If the seedlings are not transplanted immediately, they are kept in water to prevent them from drying out.

Seedlings bundled for easy transportation

Uprooting

Abandoned and dried seedlings

Photo 2-7 Uprooting

Source: SLE-01, "Extension Material on Technical Package on Rice Production"

(2) Transportation

When transporting seedlings, care should be taken to avoid drying of seedling roots, and a bag or basin should be use while transporting.

(3) Transplanting

Traditionally, random planting is practiced, but many projects recommend line planting. Line planting is advantageous in that it renders post-transplantation weed management easier using a weeder. In MOZ-04, farmers practice either row planting or random planting, because row planting is time-consuming although the yield is high and weeding is easy; because, field size, available labor, and time spent on transplanting depend on the farmers.

For line planting, line markers are used to draw lines to guide transplanting or ropes are used to make markings at regular intervals. The planting density (interval between plants) is set according to soil conditions, variety, and characteristics of the target area (e.g., size, 20 cm × 20 cm or 25 cm × 25 cm).

Photo 2-8 Transplanting using rope

Photo 2-9 Drawing lines using a line marker

Source: MDG-02, "Technique Spécifique Pour Riziculture Irriguée" (left); UGA-03, "Rice Cultivation Handbook" (right)

Two to three seedlings per plant are transplanted and raised for 2 to 3 weeks after sowing. It is important to use young seedlings, old seedlings show delayed growth. If the number of seedlings planted per hill is very high, competition between individuals may occur and yield may decrease.

If the planting depth is very high, tillering can be hindered. The standard depth is approximately 3 cm. When tillering is inhibited, the number of panicles per unit area and, ultimately, yield decrease.

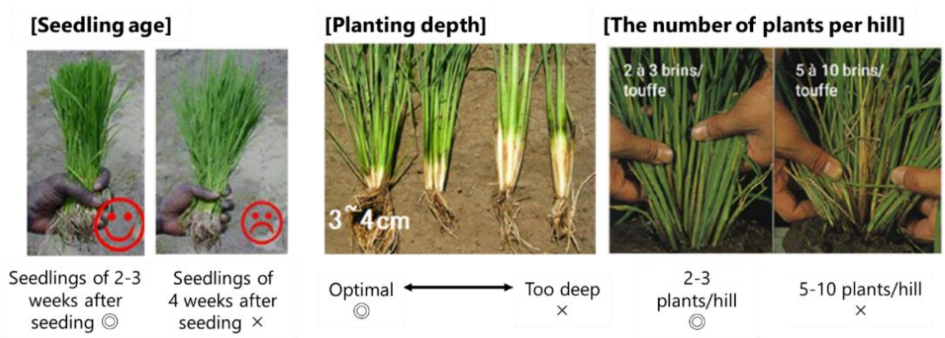


Photo 2-10 Seedling age, planting depth, and number of seedlings per hill

Source：UGA-03: "Rice Cultivation Handbook" (left and center), MDG-02: "Technique Spécifique Pour Riziculture Irriguée" (right)

(4) Refiling of missing hills

If there is a missing hill, the remaining seedlings are used for supplementary planting approximately 10 days after transplanting. Many missing hills lead to weed growth and low yield. The remaining seedlings after refilling since prone to the source of disease so that they should be disposed of outside of the field.

Recommendations

(1) Planting density

Planting density depends on the degree of fertilization (composition and amount) and soil fertility in the field. If soil fertility is high, planting should be "sparse," and if soil fertility is low, planting should be "dense."

In addition, the optimum planting density differs depending on the characteristics of the variety (number of tillers, ripening period, and so on).

Table 2-12 Guideline for planting density according to fertility

(1) Fertile soil

	No of hills/m^2	Spacing	Varieties
1	11.1	30 cm × 30 cm	[High tillering variety]
2	16	25 cm × 25 cm	
3	20	25 cm × 20 cm	WAT, Bryohe
4	22.2	30 cm × 15 cm	Nsisebashonhe, Yuni Yen, Yuni Keng, Gakire

(2) Low fertile soil

	No of hills/m^2	Spacing	Varieties
1	11.1	30 cm × 30 cm	[Low tillering variety]
2	16	25 cm × 25 cm	Ndmirabahinzi
3	20	25 cm × 20 cm	Nemeyubutaka, Rum buka, Mpembuke

Source: RWA-01, "Technical Manual for Rice Cultivation, Water Management and Post-Harvest Practice"

(2) Technique for transplanting in phosphorus-deficient fields

In MDG-03, rice yield and fertilization efficiency can be significantly improved by soaking seedlings in a muddy liquid, which is a mixture of phosphorus fertilizer and paddy soil, and then transplanting them (p-dipping). This treatment effectively shortened the number of growing days, avoiding the stress of low temperatures, and increased yield by 9% to 35% compared with the conventional fertilization method (surface fertilization).

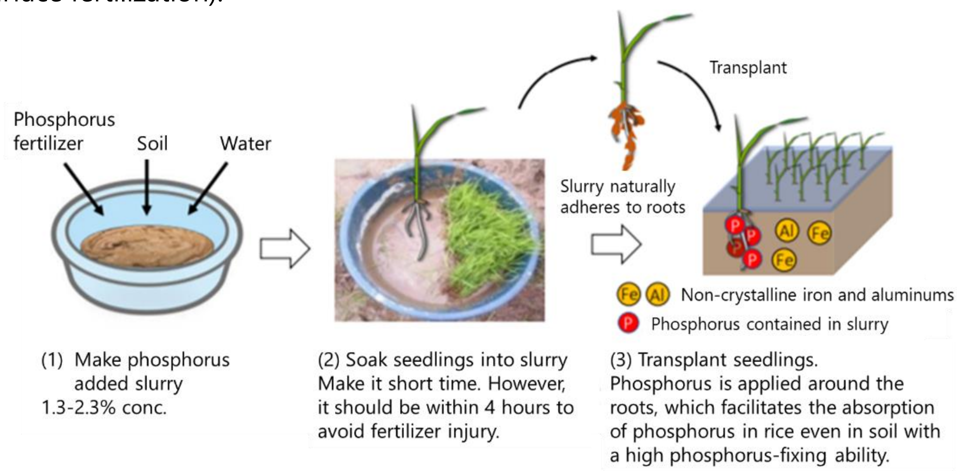


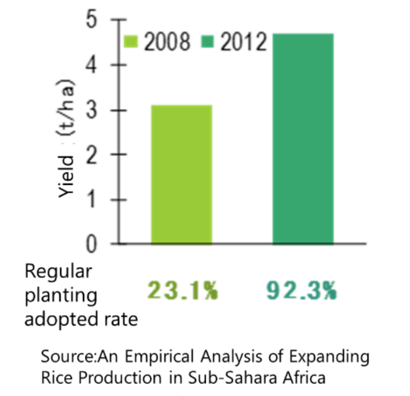
Fig 2-10 Phosphorus soaking treatment

Source: MDG-03, Implementation report (2019)

Box. Good practices in Tanzania (irrigated paddy fields)

In TZA-07, implementation of regular transplanting was encouraged under technical guidance, and the yield of target farmers and implementation rate of regular transplanting were greatly improved, as shown in the graph on the right.

Similar technical guidance was offered in other projects, and the yield was improved compared to that with the conventional random planting.



Source: "The Impact of Training on Technology Adoption and Productivity of Rice Farming in Tanzania: Is Farmer-to-Farmer Extension Effective?" JICA-RI Working Paper, No.90, March 2015, JICA Research Institute

Direct sowing

Direct sowing of lowland rice is a labor-saving method of raising seedlings and transplanting compared with transplanting. However, to improve yield, more careful land preparation (harrowing and leveling) is important. Direct sowing includes dry direct sowing, in which seeds are sown in the field, and wed direct sowing, in which seeds are sown after irrigation and puddling.

Direct sowing is employed when there is no water source in the surrounding area and there is a high risk of water shortage because water cannot be secured as needed (GHA-04 and 05); to avoid flooding and strong wind damage after transplanting in lowlands when seedlings are small (MDG-01); there is delay in transplantation due to certain circumstances (MOZ-04); and the field area is large and the cost of cultivation and transplanting is high (SEN-01).

Key points

(1) Seed preparation

See the Transplantation section for details. In case of wet direct sowing, pre-germinated seeds are often used. In case of dry direct sowing, pre-germinated dry seeds or dried seeds are used.

(2) Land preparation

For land preparation, refer to the section on transplanting until plowing and harrowing.

For wet direct sowing, puddling and leveling are conducted in the same way as that for transplanting. It is important to flatten the field surface as much as possible. In dry direct sowing, if there was a previous crop, the residue and weeds must be sufficiently cleaned. If such residues or weeds remain, they use fertilizer, thus decreasing yield. For instance, in MOZ-02, after the first tillage, waterways and ridges for furrow irrigation are constructed in the field, secondary tillage is conducted after rainfall, and the clod was made as fine as possible to flatten the surface after sowing and uniform growth was ensured.

(3) Sowing

1) Wet direct sowing

In wet direct sowing, broadcasting is generally practiced. In GHA-06, after puddling, water is drained, the field is slightly leveled, and pre-germinated seeds are sown. In addition, the following methods are used to sow seeds uniformly in the field. The field is divided into 5-m-wide strips and marked (at a width that can be sown by hand). The seeds are also divided into five equal lots and sown in each section while moving back and forth in the field. The field surface should be maintained such that the seeds are visible without sinking after sowing.

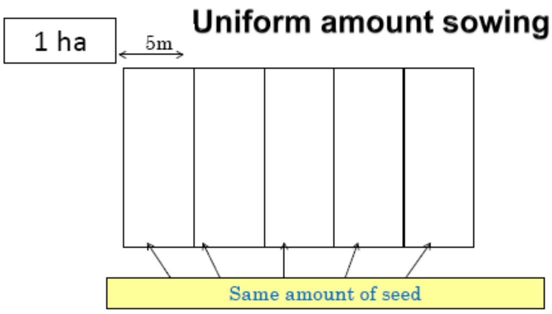


Fig 2-11 Uniform sowing

Fig 2-12 Desirable state of seeds after sowing

Source: GHA-06, "Guide for Optimum Input Rice Cultivation under Irrigation"

2) Dry direct sowing

Dry direct sowing involves (1) drilling (manual sowing or manual sowing machine) and (2) dibbling. The seeds are covered by soil after sowing. If too much soil covered, seeds will not be able to emergence. To ensure uniform sowing by hand, broadcasting described in section 1) above or a line marker are used.

In MDG-01, an Indonesian expert developed a drum-type dibbling seeder. In MOZ-04, a prototype of a human-powered 2-4 drilling seeder is used, and its manufacturing method, price breakdown, and necessary tools and information are available to the public. In SEN-02, drilling using an animal-powered sowing machine is the most common.

Drilling by manual sowing machine

Human-powered drilling

Broadcasting

Photo 2-11 Drilling with a manual sowing machine in Mozambique, human-powered drilling in Ghana, and broadcasting in Senegal

Source: MOZ-04, "Project Progress Report (phase 2)" (left); GHA-04, In-House Training" (center); SEN-02, "LE PROJET D'APPUI A LA PRODUCTION DURABLE DU RIZ PLUVIAL (PRiP) DeuxièmeFormation des ConseillersAgricoles" (right)

Recommendations

(1) Sowing amount

It is necessary to adjust the sowing amount according to the soil fertility and variety. The table below presents sowing amounts recommended in each project.

Table 2-13 Sowing amount used in each project

Project code	Sowing amount	Sowing method
GHA-04	80-100 kg/ha	Drilling (using a line marker or manual)
GHA-06	60-80 kg/ha	Broadcasting (Flooded field)
MDG-01	60-100 kg/ha 45-60 kg/ha	Drilling Dibbling
MOZ-02	100-120 kg/ha	Sowing machine
MOZ-04	50 kg/ha 50-60 kg/ha	Drilling (Sowing machine) Broadcasting (hand)
SEN-02	60 kg/ha 70-80, 40-60, or 30-40 kg/ha	Dibbling Drilling (depends on the specification of the sowing machine)

The recommended sowing amount is determined based on the results of the germination test; however, the final sowing amount should be determined based on the results of the germination test to avoid seed wastage. In MOZ-02, the recommended sowing amount is 100-120 kg/ha, and this amount should be adjusted depending on the germination rate (120 kg/ha for 100% germination rate, 132 kg/ha for 90%, and 156 kg/ha for 70%). In GHA-06, farmers sow 120 kg or more seeds per hectare in conventional farming, and the cost is also high. Therefore, to reduce the sowing amount, a field trial was conducted to determine the effect sowing amount on yield. As a result of cultivation with sowing amounts of 60 and 120 kg/ha using three main varieties, the difference in yield due to the difference in sowing amount was small, and the project recommended of 60 kg/ha as the appropriate sowing amount (when using good-quality seeds).

(2) Sowing methods (dry direct sowing)

There are three sowing methods for dry direct sowing: broadcasting, drilling, and dibbling. Although drilling and dibbling require more time and effort for sowing than broadcasting, subsequent weeding work can be performed efficiently.

In MOZ-04, it takes nearly 6 h per half a hectare for drilling using a manual sowing machine.

Table 2-14 Sowing methods and sowing depth

Type of sowing	Features and methods
Broadcasting	It is important to sow as uniformly as possible because the seeds are scattered by hand.
Drilling	Sowing is performed manually or using a seeder. The spacing between rows is 30 cm, and the sowing depth is 3-5 cm.
Dibbling	Sowing is labor-intensive, but weeding can be done efficiently. The planting density is 20 cm × 15-20 cm; the sowing amount is 3-5 grains; and the sowing depth is 3 cm.

2-2-4 Rice crop management

Water Management

Water management is very important after transplanting to ensure high yield. The simplest method of water management is to maintain the water level at 2-4 cm throughout the cultivation period. If the water level is too high, the development of tillers is suppressed, which leads to a decrease in the number of panicles and subsequent yield. If the water level is too low, weeds grow and weeding becomes difficult.

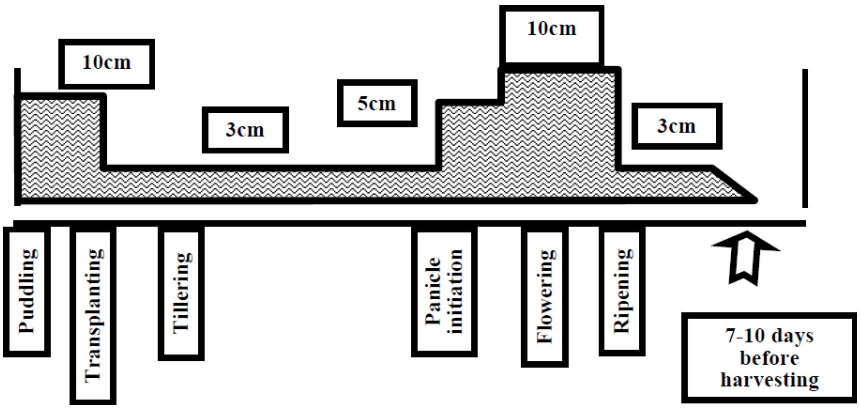


Fig 2-13 An example of water management

Source: TZA-07 "Group Training Text"

Key points

(1) Deep-water after transplanting

The water level may be slightly deep (5-10 cm) after transplanting in order to reduce transplanting damage and promote rooting.

(2) Deep-water at panicle initiation stage

It is recommended to maintain the water level at about 10 cm during the panicle initiation stage. In areas where cold damage is a concern at the latter stages of cultivation (e.g., high altitude areas, such as Madagascar and Rwanda), the damage caused by cold can be reduced by maintaining a deeper water level (15-20 cm) for 2 weeks before heading.

(3) Retain water after fertilization

To prevent the outflow of fertilizer components, water should be retained in the field after fertilization.

(4) Water management in direct sowing

In direct sowing, water management after sowing is very important. MOZ-02 recommends the "seeping irrigation" technique, in which the field is divided into small plots and the first irrigation starts soon after sowing a plot is completed. Move on to the next plot when 90% of the soil of the previous plot turns blackish because of water seeping to avoid submergence. It is optimum timing to apply the second irrigation when the soil clods are whitish, dry, and possibly even cracked. Seeping irrigation should be continued until germination is completed and the plant is established. Flood irrigation should be applied when the plant reaches a height of 5-7 cm to avoid weed growth. GHA-04 recommends increasing the water level gradually after germination.

Recommendations

(1) Construction of bunds, leveling, and securing of drainage

Constructing bunds during field preparation is important for maintaining water. Leveling the field is also very important to maintain the appropriate water level for the entire field.

There are many problems with waterlogged field, such as agricultural machinery such as tractors and combine harvesters cannot be used, soil fertility decreases, salt damage, and suppression of rice growth because oxygen supply to roots is obstructed. Therefore, it is important to secure a drainage channel. In addition, RWA-01 shows countermeasures that facilitate drainage by digging a small ditch in or around the field.

Bunds and canals (for irrigation and drainage) need to be maintained regularly.

(2) Intermittent irrigation

In fields where irrigation and drainage can be well controlled, intermittent irrigation can save water and increase yield. Intermittent irrigation is timed to occur after rooting or from the highest tillering stage to the panicle initiation stage. There are several methods of intermittent irrigation. For example, 1) After irrigating to a depth of 2-5 cm, the water level naturally decreases due to permeation and evapotranspiration. When the water level decreased to 10 cm below ground level, irrigate to a depth of 2-5 cm again (KEN-01). 2) Repeat the process of irrigating for 3 days and letting the field dry out for 7 days (KEN-01). 3) Irrigate to 10 cm and when the water level drops to 0 cm, repeat the process (GHA-06). 4) Irrigate every 2-3 days (RWA-02). With case 1 of KEN-01, 20% water was saved on irrigation, and the yield was 13% higher than that of the conventional method.

Fertilization Management

Fertilization is very important for a higher yield. Fertilization is indispensable, especially for improved high-yield varieties. It is obvious that the expected yield cannot be obtained with insufficient fertilizer. However, too much fertilizer has several negative effects as well, such as making the crop susceptible to lodging, pests, and disease and reducing paddy quality, subsequently reducing the farmers' profits. Therefore, it is important to apply an appropriate amount of fertilizer at the appropriate time.

Key points

(1) Fertilizer components and their roles

Nitrogen (N), phosphorus (P), and potassium (K) play important roles in the growth of rice. The role of each element is as follows: N is a constituent element of protein and it promotes foliar growth. P is a constituent element of nucleic acids and it promotes tillering and root and flower development. K has a strong relationship with osmotic pressure and it strengthens the foliage, protecting the plant from disease and lodging.

The following are the minor mineral nutrients needed by the rice plant: Silicon (Si), Sulfur (S), Calcium (Ca), Magnesium (Mg), Copper (Cu), Iron (Fe), Zinc (Zn), Manganese (Mn), Boron (B), Hydrogen (H), and Molybdenum (Mo).

(2) Top dressing

Chemical fertilizer (urea or ammonium sulfate) is used for top dressing. Top dressing is often applied twice under the irrigation condition. The first time is to increase the number of tillers and the second time is to increase the number of grains. On the other hand, in rain-fed rice cultivation, the cultivation environment is complicated and it varies largely among regions. Nonetheless, top dressing is applied at least once at the panicle initiation stage.

The table below shows examples of top dressing in each project.

Table 2-15 Recommended top dressing method by project

Project code	Type of fertilizer	Quantity	Application method and timing	Cultivation environment
CIV-01	1. Urea 2. Urea	50 kg/ha 50 kg/ha	3 weeks after transplanting Panicle initiation stage	Irrigation
MDG-01	1. Urea 2. Urea	50 kg/ha 30 kg/ha	DAT 15 Panicle initiation stage * Example of Vakinankaratra district	Irrigation
RWA-02	1. Urea 2. Urea	50 kg/ha 50 kg/ha	DAT 30 Booting stage	Irrigation
MOZ-01	Urea	Total 100-150 kg/ha	DAT 7-10: 50% DAT 14-20: 25% 18-20 days before heading: 25%	Irrigation (Transplanting)
MOZ-01/ MOZ-02	Urea	Total 100-150 kg/ha	DAS 20-25: 35% DAS 30-35: 35% DAS 65-70: 30%	Irrigation (Dry direct sowing)
SEN-01	1. Urea 2. Urea 3. Urea (if necessary)	125 kg/ha 100-125 kg/ha 25 kg/ha	DAT 15-25 Panicle initiation stage Heading stage	Irrigation (Rainy season)
	1. Urea 2. Urea 3. Urea (if necessary)	150 kg/ha 120-150 kg/ha 30 kg/ha	DAT 15-25 Panicle initiation stage Heading stage	Irrigation (Dry season)
GHA-04			1. Tillering stage (2 weeks after transplanting) 2. Tillering stage (4 weeks after transplanting) 3. Panicle initiation stage 4. Booting – Heading stage	Rainfed (Transplanting)
			1. Tillering stage (3 weeks after sowing) 2. Tillering stage (5 weeks after sowing) 3. Panicle initiation stage 4. Booting – Heading stage	Rainfed (Direct sowing)
SEN-02	1. Urea 2. Urea	75 kg/ha 75 kg/ha	Tillering stage Panicle initiation stage	Rainfed
SLE-01	NPK (15-15-15)	87 kg/ha	Panicle initiation stage	Rainfed
UGA-03	Urea	62.5 kg/ha	Panicle initiation stage	Rainfed
ZMB-02	Urea	Total 50-100 kg/ha	Tillering stage Panicle initiation stage	Rainfed

The Table below summarizes the points of fertilization for each project.

Table 2-16 Points of fertilization of the projects

Project code	Points
RWA-02	The dosage of fertilizer should be less in fertile soil and/or with low yield potential varieties. Conversely, the dosage should be more in poor soil and/or with high yield potential varieties. The first top dressing can be applied early with high tillering varieties and/or early maturing varieties, and late for late varieties. The second top dressing can be applied early in cases of poor rice growth, and late in cases in which rice grows well and/or with easy-lodging varieties.
GHA-06	A soil map is developed in the Kpong irrigation scheme. The soil is categorized by fertility into three groups: low fertility, medium fertility, and high fertility. The recommended N application rate is shown to be between 60-120 kg/ha for each location. Based on the soil analysis results and recommendations by the University of Ghana, urea, not ammonium sulfate (SA), is recommended for top dressing because SA makes the soil acidic.
TZA-07	The explanation for four organic fertilizers, namely, farmyard manure, green manure, compost, and organic mulch, and the methods of making them are provided.
SLE-01	When soil fertility is relatively high, the first fertilization (basal application) can be delayed (from the puddling stage to several weeks after transplanting). However, in many rainfed lowlands, because soil fertility is low and excess iron toxicity occurs immediately after transplanting, fertilizer should be applied before transplanting.
MOZ-04	When local varieties are used, the project does not recommend using fertilizer.
MOZ-01/02, SEN-01, GHA-06, etc.	The amount of fertilizer to be applied is expressed by the number of bags, not kg, to help farmers understand better.

(3) Points for fertilization

Applying fertilizer when the leaves are wet with dew may cause fertilizer burn, so do not apply it early in the morning, in the evening, or immediately after rain. In addition, if the fertilizer is not applied uniformly, the rice plants will grow unevenly. As a result, ripening will not be uniform, the yield will decrease, and harvesting will be difficult. Therefore, it is important to apply fertilizer uniformly.

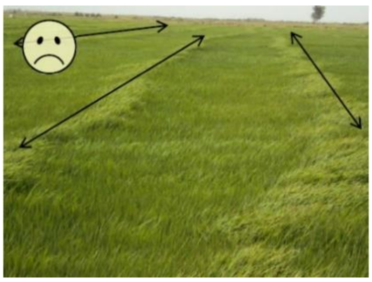


Photo 2-12 Example of uneven growth due to uneven fertilization

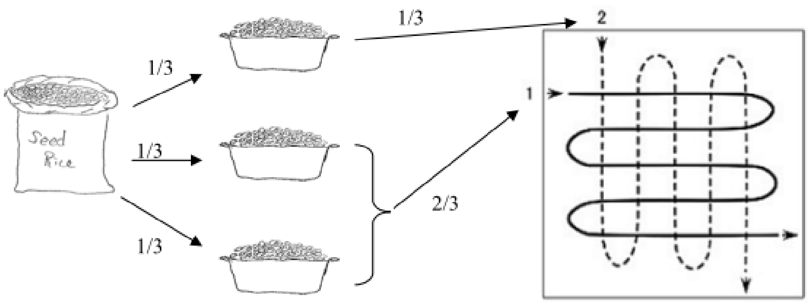


Fig 2-14 Example of uniform fertilization

Source: SEN-01 Guide du Vulgarisation de la Riziculture Irriguée "9- Gestion de l'engrais" (left), SLE-01 "Guidelines for the Dissemination of the Technical Package on Rice Production through Farmer Field Schools" (right)

(4) Weeding and water management

If necessary, weeding should be done before fertilization, especially before top dressing. At the time of fertilizer application, the water level needs to be low (5 cm or less), and it needs to be maintained for about 1 week after fertilization to avoid the outflow of fertilizer. If there is a possibility of the irrigation water overflowing after fertilization because of heavy rain in the rainy season, it is necessary to take measures such as draining water before fertilization. In addition, since the benefits of fertilizer cannot be obtained without water, it is important to secure water at the time of fertilization, especially in rain-fed lowlands.

Recommendations

(1) Importance of identifying the panicle initiation stage

Since the duration of the vegetative growth stage differs among varieties, the number of days until the panicle initiation stage differs. In addition, since the cultivation duration of the same variety changes depending on the temperature, the number of days varies based on the place and season of cultivation. It is very important to identify the panicle initiation stage accurately in order to apply fertilizer effectively. If the fertilizer is applied too early, it will cause lodging, and if it is applied too late, it will be ineffective in increasing the number of grains.

(2) Symptoms of nutrient deficiency/excess

Symptoms caused by the deficiency/excess of elements in the soil are as follows.

Table 2-17 Rice symptoms due to deficiency/excess of element

Element	Rice symptoms
N (deficiency)	- Retarded early growth, reduced tillering - Leaf shape: thin, short, and vertical; leaf color: yellow-green from lower to upper leaves - Accelerated flowering and ripening
P (deficiency)	- Retarded early growth, reduced tillering - Leaf color: dark green, mixed with red and purple
K (deficiency)	- Retarded Early growth - Leaf color: yellowing interveinal zone from top to bottom, dark green, brown spots (helminthosporium)
S (deficiency)	- Retarded growth retarded, reduced tillering - Young leaf color: pale yellow. Plant height is reduced
Si (deficiency)	- Reduced tillering - Yellowing or death of lower leaves - Sterile - Decrease in pest and lodging resistance
Fe (excess)	- Leaf color: purple-brown discoloration - Small brown spots from tip to basal part of lower leaves
Al (excess)	- Roots do not lengthen - Leaf color: interveinal zone becomes orange, white, and necrotic.
Salts (excess)	- Retarded early growth, poor tillering - Leaf color: leaf tip and other parts become white

Weed Management

Weeds compete with rice for nutrients, light, water, which causes a decrease in yield. In addition, weeds also serve as nests for pests and habitats for rodents, and the contamination of weed seeds leads to deterioration of paddy quality. As weeds grow, weeding becomes more difficult. Hence, it is important to weed when the weeds are small (timely weeding). Weeding from the time of transplanting to the highest tillering stage is especially important. Weeding should be conducted at least twice during the cropping season. Usually, the first time is 7-14 days after transplanting and the second time is 7-14 days after the first weeding. It is also important to weed not only the field, but also the bunds and canals. It is important to weed before fertilization in order to improve the effects of the fertilizer. Observing and recording the types of weeds after transplanting and at harvesting make it easier to plan for proper weed management.

Key points

(1) Weeding methods

There are three methods of weeding: manual weeding, mechanical weeding, and the use of herbicides.

1) Manual weeding

It is a method of weeding by hand or using tools such as a hoe. It is often laborious and it is impossible to complete weeding in a timely manner.

2) Mechanical weeding

Weeding with a manual push weeder is advantageous over manual weeding because it requires less time. Based on the KEN-01 case, the rotary push weeder does not work well with overgrown weeds, high standing water, or a dry (hard) soil surface. According to KEN-01, the estimated time for weeding is 10 person-days per ha when using a rotary push weeder.

The weeds that remain after mechanical weeding are to be removed by hand.

Photo 2-13 Push weeder for lowland rice

Source: RWA-01 "Technical Manual for Rice Cultivation, Water Management, and Post-Harvest Practice"

3) Herbicides

The required time for weeding can also be reduced by using herbicides (compared with manual weeding). The use of herbicides has the advantage of reducing the required time for weeding, especially for large areas. However, it also has the disadvantage of increasing production cost.

There are two types of herbicides: non-selective and selective. Non-selective herbicide is used before cropping, at the land preparation stage. Selective herbicides are used for weeding after planting. Since the target weed species differs depending on the type of herbicide, read the application standard carefully before use. In addition, since the water management method differs depending on herbicide, attention should be paid to usage to optimize the effect. For example, SEN-01 states that the field should be flooded when Londax (component: Bensulfuron methyl) is sprayed, and drained when Propanil (component: Propanil) or Weedone (component: 2, 4-dichlorophenoxyacetic acid; 2.4-D) is sprayed. The effectiveness of the herbicide decreases as weeds grow, so timely weeding (when the number of weed leaves is 2-3) should be done. It is also important to weed the remaining weeds manually after spraying.

Spraying should be done from upwind to leeward to avoid damage to health. Do not spray in strong winds or high temperature. Keep in mind that the unused herbicide should not be drained into canals or rivers.

Photo 2-14 Example of correct protection for spraying

Source: SEN-01 Guide du Vulgarisation de la Riziculture Irriguée "10- Gestion des mauvaises herbes"

(2) Points for weeding in the direct sowing method

In the direct sowing method, weed seeds and rice seeds germinate simultaneously, and the number of weeds in the field increases every year, so weed management is always necessary. For example, in MOZ-02 (dry direct sowing), weeding is conducted three times in total, twice in the first half of the tillering stage, and once 70-80 days after sowing. Herbicide usage is recommended for the first weeding, with manual weeding for the second and third weeding. In addition, it is more effective to repeat the use of herbicide twice; the first time immediately after sowing and the second time 20-25 days after sowing. In MOZ-04 (dry direct sowing), weeding is conducted at least twice, and the first weeding is conducted 5-7 days after germination. GHA-06 (wet direct sowing) recommends spraying non-selective herbicide one day before sowing, spraying selective herbicide 11-14 days after sowing, and manual weeding 60-70 days after sowing.

(3) Weeding in rain-fed lowland

Rainfed lowland requires earlier weeding than with irrigation. For example, in GHA-04, weeding should be conducted at least twice, 3 and 5 weeks after sowing. A hoe is used for the first weeding and herbicide for the second. On the other hand, weeds are not a problem in the deep-water condition.

Recommendations

(1) Utilization of high-quality seed

The emergence of weeds can be prevented by using high-quality lowland rice seeds that are not mixed with weed seeds.

(2) Land leveling

If the soil is not well leveled, the soil surface will vary in height. The high part will be exposed above the water surface and weeds will grow easily. Therefore, land leveling is important for weed control.

(3) Line planting

In order to conduct mechanical weeding, it is necessary to perform line planting at the time of transplanting (drilling or dibbling in direct sowing). In addition, with line planting (drilling or dibbling), it becomes possible to use manual weeding tools such as a hoe, reducing the work involved in weeding.

Box. Examples of weeds found in Africa

In SEN-01, the main weeds found in irrigated fields are classified as follows and introduced with photos.

Gramineae

Cyperaceae

Dicotyledonous (Broad leaves)

Source: SEN-01 Guide du Vulgarisation de la Riziculture Irriguée "10- Gestion des mauvaises herbes"

In addition, UGA-03 summarizes the characteristics and countermeasures of 112 species of weeds found in irrigated, rain-fed lowland, and upland rice cultivation environments as "Major Rice Weeds in Uganda."

Pest and Disease Management

The types of pests and diseases, and the timing and frequency of outbreaks vary depending on the region and year. Some diseases can be prevented by using resistant varieties or seed disinfection. However, there are diseases that cannot be prevented and must be dealt with only after their occurrence.

Pest and disease control measures include 1) physical control (fire, animals, traps, nets, noise, etc.), 2) biological control (beneficial insects, biological agents, etc.), 3) cultivated control (resistant varieties, etc.), and 4) chemical control.

Key points

(1) Types of diseases and countermeasures

Table 2-18 Typical diseases and countermeasures

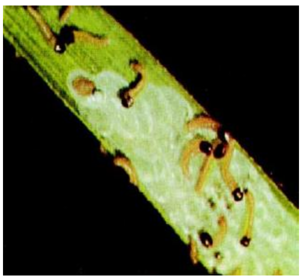
Type of disease	Countermeasures
  Blast: A seed-borne disease. Blast easily infests rice in low temperatures (under 18-24 degree in Rwanda, 25-28 degree in Ghana), and in humid, cloudy, or rainy weather. It occurs in almost all parts of the plant, such as stem nodes, leaves, neck of panicles, and the grain. Oval or rhombic lesions are visible on the leaves. *Source: GHA-06 "Guide for Optimum Input Rice Cultivation under Irrigation" (left), UGA-03 "Rice Diseases and Insects" (right)*	- Use of resistant varieties - Seed disinfection - Plowing rice straw into the soil to supply silica acid to improve the rice plant's resistance - Avoid transplanting infected seedlings - Avoid excess application of nitrogen fertilizer - Improve ventilation in nursery and field - Use of fungicide such as Kitazin, Beam, and Tebuconazole (RWA-02)
  Rice Yellow Mottle Virus (RYMV): It appears during the active tillering stage. It is characterized by molting and yellow streaking of leaves. It is transmitted by insects, and animal and human activities. It can be carried over from one season to the next by infected stubbles remaining in the field, such as ratoon. *Source: RWA-02 "Refreshment Training Workshop for FFS Facilitators on Rice"*	- Use of resistant varieties - Remove the infected rice plants from the field and burn them - Control vectors by insecticides - Dry the field for several months to eradicate living host plants in the field
 Sheath blight: It causes spots on the leaf sheath. High temperature and humidity increase its severity. No variety has a high level of resistance to the disease. *Source: UGA-03 "Rice Diseases and Insects"*	- Do not apply too much nitrogen fertilizer
 Bakanae: A seed-borne disease. Infected plants elongate abnormally and die before panicle initiation or ripening. *Source: TZA-07 "Group Training Text"*	- Use of resistant varieties - Remove the infected plants

Type of disease	Countermeasures
 Brown spot: It is common in soils that are poorly drained or deficient in nutrients. The symptoms are brown spots on the leaf and grain. *Source: ZMB-02 Rice Extension Package "REP Vol.1_Rice Cultivation Manual"*	- Grow rice in good soil and provide adequate nutrients - Potassium fertilizer or NPK compound fertilizer is effective in remedying the disease

Other diseases include false smut (GHA-04, UGA-03), leaf blight (TZA-07), leaf scald (SLE-01, UGA-03), sheath rot (UGA-03), grain rot (UGA-03), kernel smut (UGA-03), etc.

(2) Type of pests and countermeasures

Table 2-19 Typical pests and countermeasures

Types of pests	Countermeasures
 Mole cricket: kills plants by cutting them off at the base *Source: RWA-01 "Technical Manual for Rice Cultivation, Water Management, and Post-Harvest Practice"*	- Flooding a field makes the cricket damage migrate to the bunds
 Stalk-eyed flies: prefer an aquatic habitat, attack the rice plant from the nursery to the tillering stage in larval form, and cause dead heart. This pest appears in the mornings. *Source: RWA-01 "Technical Manual for Rice Cultivation, Water Management, and Post-Harvest Practice"*	- Spraying Cypemetrine when pest density is high (RWA-01)
 Stem borer: causes dead heart and white head *Source: TZA-07 "Group Training Text"*	- Since the borers feed inside the stem, chemical spraying does not control the infestation effectively. The following are preventive measures: use of resistant varieties, using early maturing varieties since the pest comes late in the season, cutting the affected plants very close to the ground, and plowing the land immediately after harvesting to destroy eggs and pupae. - Raise level of irrigation water periodically to submerge eggs on the lower parts.

Types of pests	Countermeasures
 Rice stink bug: feeds on ripened rice grains in both adult and nymph stages. Their feeding during the milk stage results in empty grains, while their feeding during the dough stage results in lower grain quality due to grain discoloration. *Source: TZA-07 "Group Training Text"*	- Use of resistant varieties - Field sanitation
 Rice skipper: the larvae feed on the leaf blade from the margin inward, then parallel to the midrib *Source: TZA-07 "Group Training Text"*	- Use of resistant varieties - Field sanitation - Chemical spraying
 Rice green caterpillars: normally eat the leaves *Source: TZA-07 "Group Training Text"*	- Use of resistant varieties - Field sanitation
 Rice beetles: adult beetles eat and severely damage the leaves *Source: TZA-07 "Group Training Text"*	- Use of resistant varieties - Cleaning bunds and irrigation and drainage canals - Chemical spraying

Other pests include African rice gall midge (SLE-01, UGA-03), rice leaf folder (UGA-03), rice mealy bug (UGA-03), rice hispa (MDG-01, UGA-03), caseworm (UGA-01/UGA-03, SLE-02), black beetle (ZMB-02), Termite (refer to 2-3-4), grasshopper, etc.

Recommendations

(1) Use of certified (guaranteed) seeds and seed disinfection

The use of certified (guaranteed) seeds and seed disinfection can prevent seed-borne diseases in particular.

(2) Seed amount/planting density

Poor ventilation and overcrowded conditions can promote the outbreak and reproduction of pests and diseases, so an appropriate amount of seeds should be used and the planting density should be suitable.

(3) Weeding inside and outside the field for pest control

Weeds and bushes inside and outside the field can be habitats for insects and fungi, so weeds should be removed.

(4) Points for chemical use

Change the chemicals used regularly to prevent the development of resistant pests and diseases.

(5) Appropriate amount of fertilizer

Excessive N application may promote the outbreak of pests and diseases.

Bird and Animal Damage Management

Bird damage occurs most often between the heading stage and ripening. It is not easy to prevent bird damage, and in most cases, birds are chased manually. The following physical measures are used to prevent bird damage: setting up a bird net, placing a sounding device around the field, setting traps, etc.

Photo 2-15 Bird damage countermeasure using a bird net

Source: GHA-04 "In-House Training "

In addition to physical countermeasures, countermeasures such as planting surrounding fields simultaneously to avoid being targeted by birds and avoiding cultivation when there are many birds can be considered.

Animal damage includes feeding damage by rodents to leaves, stems, and grains. Physical control by installing fences or traps, cleaning around the field frequently to eliminate hiding places of rodents, using rodenticides, and flooding during the ripening stage to keep rodents away from rice plants are possible countermeasures.

2-2-5 Harvesting

If the harvest is too early, immature grain will be included, and if it is too late, cracked rice grain will have been produced and the quality of paddy will be low. In addition, if the harvest is too late, yield will decrease because of lodging by rain and wind, grain shattering, bird and animal damage, insect damage, etc. Timely harvesting is important for achieving high quality and high yield of paddy.

Drain Water before Harvesting

Drain the water in the field at least 7-15 days before harvest to facilitate harvesting. In addition, draining water during the ripening stage has the effect of maintaining the vitality of the roots, synchronizing the ripening, and suppressing harvest loss.

It is necessary to drain water in a timely manner to dry the field properly, especially when using a combine harvester.

Judgment of the Harvest Timing

The harvest timing is often determined by the change in the color of the panicles, and in most cases, harvest is timed to when 80% of the whole panicles (grains) turns yellow. The following are examples of other ways to judge harvest timing: when the entire paddy field turns yellow, when the color of the panicle neck changes, when the water content becomes 20-25%, or when grains shatter when lightly grasped. One method to estimate the water content of grains for harvesting without using a moisture meter is by checking the hardness of the rice grains. The ideal hardness would be if they do not break easily when chewed.

Another method is to use the number of days after heading to judge harvest timing. However, since the number of days can be affected by the weather (for example, 25-30 days after heading in GHA-06, 30-45 days after flowering in NGA-01, and 40-50 days after heading in RWA-02), it is necessary to determine the optimum number of days for each target area.

SLE-01 advised that because it is difficult to thresh with moisture from morning dew, harvesting in the early morning should be avoided.

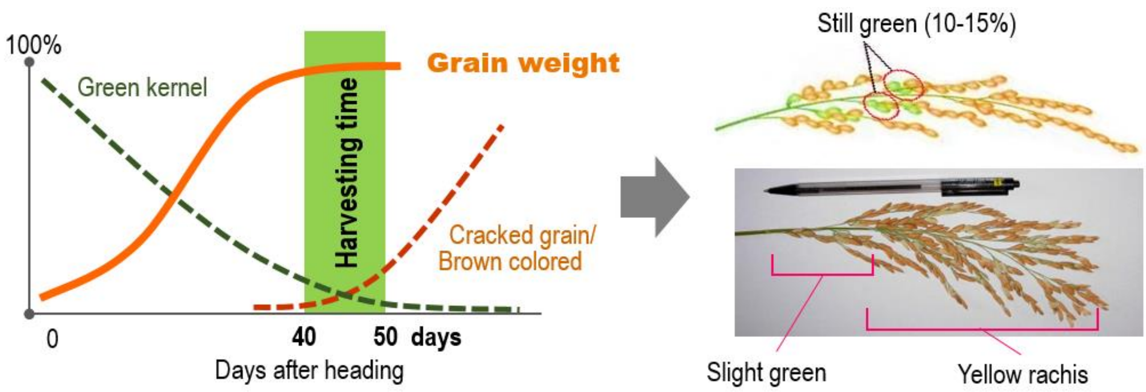


Fig 2-15 Image of timely harvesting

Source: RWA-02 "Refreshment Training Workshop for FFS Facilitators on Rice"

If the optimum time for harvest is missed, the incidence of cracked grain (section 2-4Post-harvest Processing) will increase, which often impairs commercial value, so caution is required (In some countries such as Senegal (SEN-03), where cracked grain has almost the same commercial value as perfect grain; however, this is only if the cracked and perfect grains are properly sorted). According to MOZ-01, the harvest and milling loss is estimated at 15% or more and 25% or more 10 days and 20 days after the optimum harvesting date, respectively.

Harvesting Method

(1) Manual harvesting

Manual harvesting is suitable when the field has not sufficiently dried, or the field is small. In case of varieties with high shattering characteristics, the harvest loss becomes large.

1) Harvesting by hills

This is a method of cutting entire rice plants at a height of 10-25 cm from the ground using a sickle, knife, or sword. This method is suitable when the yield is high because of high work efficiency. It is important to use a tool that cuts well to avoid shattering. In Guinea (GIN-01), it is estimated that manual harvesting by sickle requires the labor force of 5-12 persons/ha, while in Senegal (SEN-02), the required labor force is 20 persons/ha.

2) Harvesting by panicle

In this method, a knife or scissors are used to cut under the panicle neck. When the ripening is not uniform, this method has the advantage that the only ripened panicle can be cut.

(2) Mechanical harvesting

The major machines used for rice harvesting in Africa are the reaper and the combine harvester.

1) Reaper

As shown below, the reaper can be adjusted to a cutting width and height of 30 cm and 10-30 cm, respectively. The transport units consist of a chain and a guide rod, and they transport the cut rice and discharge it to the right of the machine. Its structure is simpler than that of the combine harvester, and because it is compact and walkable, it is possible to adapt to the size and shape of the field. However, varieties with high shattering characteristics tend to exhibit higher harvest loss. Among CARD target countries, KEN-01 and TZA-07 use reapers, and locally made reapers were introduced in SEN-03 on a trial basis.

Paddy reaper

Reaping operation

Paddy crop placed in rows after reaping

Photo 2-16 Reaper

Source: KEN-01 "Guidelines of MACHINE HARVESTING OF PADDY RICE for Mwea Irrigation Scheme"

1) Combine harvester

A combine harvester is a harvesting machine that threshes and cuts simultaneously. Although many farmers aim to start using it because of its high work efficiency, among the CARD target countries, it is used only in countries with relatively advanced mechanization, such as KEN-01, MOZ-01, SEN-01/03, TZA-07, and GHA-06, because it is expensive and requires developed field infrastructure and experienced operators.

The guidelines for harvesting by combine harvester are shown next page.

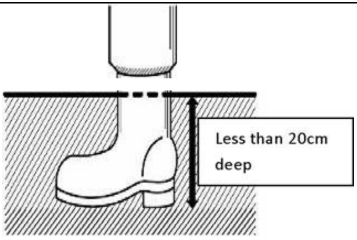
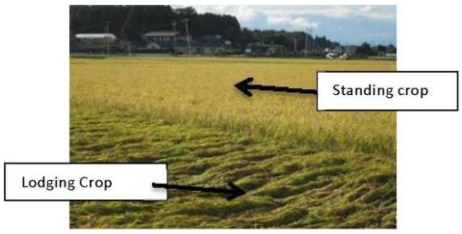
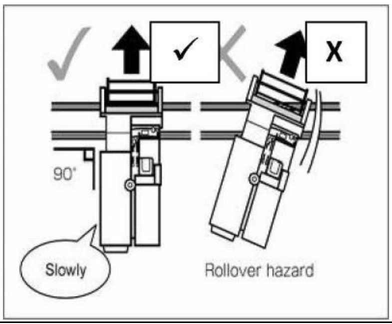
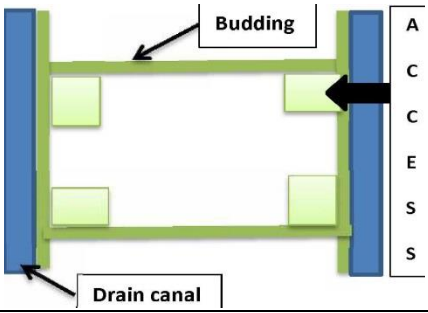
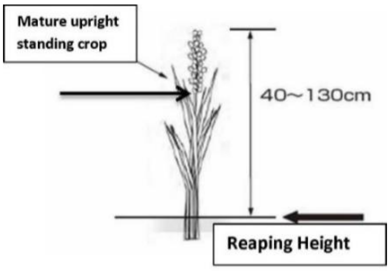
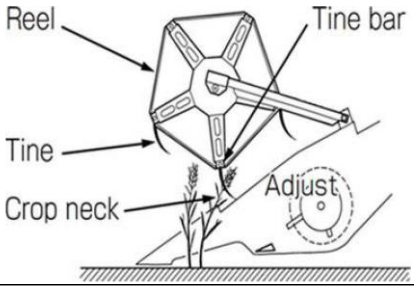
<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Water depth measurement</td><td>Lodged rice should be harvested manually (harvesting lodged rice with a combine harvester will result in large harvest loss)</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Access the field straight for ease of control of the machine; it can tip sideways if the operator drives at an angle. An assistant machine operator guides the operator. Place a bridge structure appropriately and ensure it is stable enough for the combine harvester to pass over.</td><td>Manual cutting at the corners is suggested to avoid damage to the crop during access and while turning corners.</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td colspan="2">Explanation of cutting height</td></tr>
<tr><td></td><td>
</td></tr>
<tr><td>Maintenance before harvesting</td><td>Harvesting operation</td></tr>
</table>

Fig 2-16 Guidelines on harvesting by combine harvester

Source: KEN-01 "Guidelines of MACHINE HARVESTING OF PADDY RICE for Mwea Irrigation Scheme"

2-3 Upland Rice

2-3-1 Variety selection

Selection of varieties

Upland and lowland rice cultivation is practiced in many countries in Sub-Saharan Africa, and local varieties are cultivated. Many of the local varieties of upland rice are photosensitive and are affected by day length. Sowing is delayed due to fluctuations in the beginning the rainy season, making it impossible to achieve sufficient vegetative growth. In addition, due to the effects of rainfall during the rainy season and drought caused by the early end of the rainy season, sufficient water cannot be obtained and desired yield and harvest cannot be achieved. Meanwhile, in recent years, improved varieties such as those exhibiting lodging tolerance, high fertilizer application effect, short growing period, and pest and disease resistance have been developed. Among these, the upland NERICA variety is being introduced and disseminated in each country through multiple projects as upland rice variety developed by the Africa Rice Center (WARDA) since 1992.

The varieties to be introduced are selected by taking a limiting number of factors into account, such as agroecosystems, rainfall, temperature, and soil conditions. In addition, depending on the purpose of production, early-maturing varieties (upland NERICA rice) are recommended in regions with little rainfall and where the main purpose is self-consumption.

Key points

(1) Use of recommended varieties

Similar to lowland rice varieties, upland rice varieties are also registered as recommended varieties (yield, pest resistance, quality, cultivation characteristics, and so on.), which are recognized as clearly superior to the existing varieties. The table below shows the varieties that are widespread in sub-Saharan Africa. In particular, when selecting upland rice varieties for cultivation in rainfed fields, it is important to pay sufficient attention to not only yield and quality but also the natural environment (weather and soil) of the area in which they are introduced.

Table 2-20 Recommended varieties by each project

Project code	Variety	Features	(Origin)
CMR-01	NERICA3 NERICA8 NERICA10	Stable cultivation, growing period of 110-115 days Short stem, high tillering, and growing period of 105-110 days Awn and early-maturity	WARDA WARDA WARDA
MDG-01	3737 (Telorirana) B22 FOFIFA161 NERICA4 Sebota70	Lodging tolerance, rice blast resistance, growing period of 140 days Lodging tolerance, rice blast resistance, growing period of 145-150 day Rice blast resistance, growing period of 110-120 days Rice blast resistance, growing period of 110-120 days	Brazil Brazil FOFIFA WARDA Brazil
TZA-07	NERICA1 NERICA2 NERICA4	Aroma, early-maturity, purple tips (of the panicle) and roots Awn and short stem	WARDA WARDA WARDA

Project code	Variety	Features	(Origin)
	NERICA7 WAB450-12-2-BL1-DV4	Stable yield, good taste, most disseminated variety Large grain and long stem -	WARDA Africa rice Center
SEN-02	NERICA1 NERICA4 NERICA6 WAB56-50	Aroma, early-maturity, purple tips (of the panicle) and roots Stable yield, good taste, most disseminated variety Large grain, slightly round, long stem, low tillering Short grain, good fertilization effect	WARDA WARDA WARDA Africa Rice Center
UGA-03	NERICA1 NERICA4 NERICA10 NERICA6	Aroma, early-maturity, purple tips (of the panicle) and roots Stable yield, good taste, most disseminated variety Awn and early-maturity Large grain, slightly round, long stem, low tillering	WARDA WARDA WARDA WARDA
ZMB-01/02	NERICA4	Stable yield, good taste, most disseminated variety	WARDA

Box. About NERICA

According to some reports, NERICA can product stable yield without fertilization. However, fertilization or cultivation in fertile land is recommended for NERICA as much as possible. Repeated cultivation on the same land decreases soil fertility. Therefore, a sustainable farming system must be established by crop rotation with beans, which effectively improves soil fertility via nitrogen fixing, and by repeated cultivation of different types of crops on the same cultivated land for a certain period of time.

NERICA is a drought-tolerant variety. However, CG14 (*Oryza glaberrima* Stued.), the paternal variety of NERICA, consumes much water. Therefore, NERICA varieties require much water and are less drought tolerant than other crops, such as maize, millet, and sorghum. In addition, rice yield is drastically reduced under severe drought. Therefore, NERICA should not be cultivated instead of maize, sorghum, and millet in arid and semi-arid zones. The photographs right show differences in growth with differences in irrigation amount in Uganda. In photograph of the left, the growth is delayed and heading is not observed under drought (little irrigation), as opposed to that in photograph on the right.

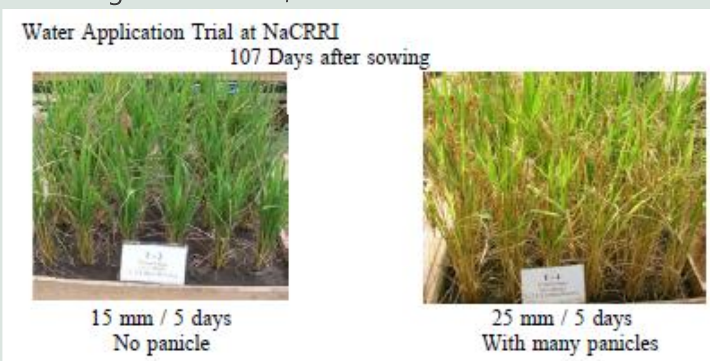


Photo 2-17 Growth difference due to difference in irrigation amount

Source: UGA-03, "Rice Cultivation Handbook"

(2) Important traits for selecting varieties

Similar to lowland rice varieties, yield and disease resistance are important traits for upland rice varieties; however, to avoid the risk of drought damage due to water shortage, drought resistance and length of cultivation period are also important traits for upland varieties. In addition, salinity tolerance is an essential trait because there are areas in which salt accumulation occurs due to drought. In the variety selection test conducted at SEN-02, farmers selected the three traits, namely yield, cultivation period, and shattering habit, as the most important traits. There were four reasons for selecting varieties: early growth, high yield, high environmental adaptability, and good taste.

2-3-2 Land preparation

Land preparation

Upland rice is cultivated on not only flat land but also hilly and sloping areas. Land preparation begins with the removal of weeds and residues from the previous crop in the field or newly developed land, followed by first and secondary tillage (harrowing and leveling). These activities use human power (hoe), animal power (cow, horse, or donkey), and agricultural machinery, such as tractors. On slopes (hills), the runoff of surface soil due to heavy rains during the rainy season and wind is a problem. In particular, when nothing has been planted in the field at the start of cultivation and there is only a small amount of vegetation, heavy rains during the rainy season lead to soil erosion, which decreases soil fertility. In addition, upland rice is often planted upland fields, and soil fertility may be reduced due to the cultivation of maize and vegetables as the previous crop and repeated cropping of upland rice. Therefore, it is important to pay attention to the selection of upland rice fields.

Key points

(1) Land selection

The table below shows the criteria for selecting suitable land for upland rice cultivation for each project.

Table 2-21 Criteria of selecting land for each project

Project code	Good practices
CMR-01	Rice can be cultivated on slopes, but it is important to sow it perpendicular against the direction of the slope to avoid soil erosion due to rain. A sunny land should be selected. Salt-damaged areas should be avoided. Cultivation following cassava as the previous crop should be avoided. The field should be far from grazing lands. If damage by domestic animals is anticipated, fencing is recommended.  Fig. 9 : Example of a land selection and seeding method.
TZA-07	Although NERICA 1 has some degree of drought tolerance, it prefers moist soil. Thus, is should be sown in highly fertile and moist soils. It should be cultivated at a lower level than other field crops, or in a areas where the soil is too moist to be used for maize cultivation. It should not be grown on steep slopes.
UGA-03	Lowland rice varieties are preferred as much as possible to obtain water required for maturation. Upland varieties can also be cultivated as a mixed crop with maize, soybeans, bananas, or coffee.

<table>
<tr><th>Project code</th><th>Good practices</th></tr>
<tr><td>ZMB-02</td><td>Lowlands where seepage water can be used should be selected as much as possible. Soils with a high water holding capacity (preferably dambos), fertile, and rich in organic matter, sandy-loam to clay-loam with a pH of 4.5-7.0 is preferred.
<table>
<tr><th>Soil condition</th><th>Soil texture</th><th>Soil colour</th><th>Slope</th></tr>
<tr><td rowspan="3">Better
↕
Acceptable</td><td>Clay</td><td>Black</td><td>Flat</td></tr>
<tr><td>Loam</td><td>Grey</td><td>Gentle</td></tr>
<tr><td>Sand</td><td>White</td><td>Slope</td></tr>
</table>
</td></tr>
</table>

In TZA-07, there was not enough information to determine the target area for upland rice cultivation; hence, areas that are not necessarily suitable for rice cultivation, such as those with adverse weather, high humidity, and low rainfall, were selected. Therefore, when starting upland rice cultivation, meteorological conditions of the target area should be thoroughly examined in advance.

(2) First plowing

Land preparation is almost the same as that for lowland rice, starting when the soil becomes soft after the start of the rainy season and weeds and residue of the previous crops in the field are removed. In the first plowing, it is desirable to remove as much roots and clods as possible to make leveling easier (refer to the section on land preparation of lowland rice for details).

Photo 2-18 Slashing of bushes and weeds (left) and removal of weeds by burning (right)

Source: CMR-01, "GUIDE for NERICA CULTIVATION"

(3) Second plowing

It is important to crush the clods into smaller pieces by second tillage and to make the soil surface as flat as possible to achieve uniform growth after sowing. In particular, in the case of drilling or dibbling, it is necessary to make furrow for sowing at a certain depth; thus, soil should be sufficiently crushed and leveled (refer to the section on field preparation for paddy rice).

Photo 2-19 Plowing (left) and leveling (right)

Source: CMR-01, "GUIDE for NERICA CULTIVATION"

(4) Ridge and terrace construction

When cultivating on slopes, the higher location, the lower the water content of the soil. Therefore, construction of terraces surrounded by ridges is recommended to secure water during the growing period.

The photographs below show a field on the slope in UGA-03. In the left photograph, because the ridges are built around it, seeds do not run off due to rainfall, and no missing hills are seen. In the right photograph, because there are no ridges, seeds are washed away by rainfall and many hills are missing.

Photo 2-20 Growth after sowing with or without ridges

Source: UGA-03, "Rice Cultivation Handbook"

(5) Basal dressing and compost

The timing of basal dressing varies depending on the project, from the time of tilling to approximately 3 weeks after sowing. In addition, compost is not required when the soil is fertile, but it is applied depending on soil fertility.

Table 2-22 Basal dressing application method recommended by the project

Project code	Type of fertilizer	Amount of fertilizer	Method and timing of application
CMR-01	NPK (20:10:10)	200 kg/ha	After 10-14 days of sowing (if sandy soil, after 2 weeks of sowing or later, possibly at the third-leaf stage)
MDG-01	NPK (11:22:16) or DAP Manure/green manure Dolomite	200 kg/ha 100 kg/ha 5-10 t/ha 250 kg/ha	In case of drilling, fertilizer is applied in a streak or 5 to 10 cm below the ground before sowing Apply at the field preparation (before tillage) Apply at the field preparation (before tillage)
SEN-02	NPK (8:18:27, 6:20:10, or 15:15:15) Manure	100-200 kg/ha 7-10 t/ha	At tillage or after sowing At tillage or after sowing
TZA-07	TSP	20 kg /ha	Before sowing
UGA-03	DAP (18:46:0)	50 kg/ha	Before sowing
ZMB-01	Compound D (10:20:10)	250 kg/ha	At 21 days after emergence

Project code	Type of fertilizer	Amount of fertilizer	Method and timing of application
ZMB-02	Compound D (10:20:10) Fully matured compost	100-200 kg/ha 10 t/ha	At 16-21 days after emergence When available

Source: CMR-01, "GUIDE For NERIC CULTIVATION"; MDG-01, "PAQUET TECHNIQUE POUR LE RIZ PLUVIAL (V0)"; UGA-03, "Rice Cultivation Handbook"; ZMB-01, "Upland rice cultivation In Kafue District (2011/2012)Version 1.1"; ZMB-02, "REP Vol.2_NERICA 4 Production and Extension Manual"

Box. How to prepare rice straw compost?

In CMR-02, rice straw compost was introduced as a type of compost that can be easily prepared. Only rice straw is used, and rainfall is the water source. 1. Rice straw is piled. 2. The straw is mixed every month after raining. 3. Soil is applied before plowing.

It is important for farmers to use materials that are simple to handle and readily available.

Source: CMR-02, "Généralités sur le riz"

Recommendations

(1) Cultivation on slopes

In MDG-01, cultivation on slopes (sloping fields) of 5% or less is possible. Of note, differences in soil moisture content at the top and bottom of the slope can also affect yield. The figure below shows harvest at different slopes in UGA-03. Growth deteriorates as the vertical distance from the groundwater level increases. Therefore, higher locations should be avoided as much as possible, and a location close to the groundwater source should be selected.

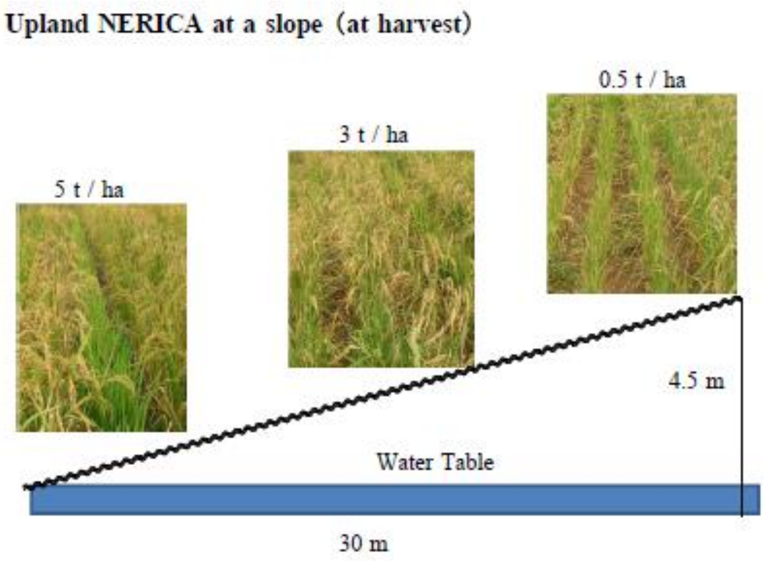


Fig 2-17 Growth of rice at different locations on slopes

Source: UGA-03, Rice Cultivation Handbook"

2-3-3 Planting

Direct sowing

Direct sowing is commonly practiced in upland rice. The main activities include seed preparation (see paddy rice section), sowing (see paddy rice section), and supplementary planting.

Key points

(1) Seed preparation

A germination test is recommended after seed selection, and the germination rate is estimated before seed preparation (see the section on paddy rice for the germination test method). In winnowing, light kernels and foreign matter are removed by wind, leaving only heavy kernels. For water selection, refer to the section on lowland rice. However, in the case of direct sowing, seeds must be dried in the sun after water selection.

(2) Sowing

1) Seeding rate

The seeding rate varies depending on the variety, soil fertility, and sowing method used. Compared with transplanting cultivation, direct sowing uses more seeds.

Table 2-23 Seeding rate recommended in each project

Project code	Drilling	Dibbling
CMR-02	70-80 kg/ha (row distance: 30 cm)	35 kg/ha (20 × 20 cm)
MDG-01	70-80 kg/ha (row distance: 20-25 cm)	40-50 kg/ha (20 × 20 cm, 5 grains/hill)
SEN-02	Seeding board (row distance, 30 cm) 30-32 holes: 70-80 kg/ha 24 holes: 40-60 kg/ha	60 kg/ha (20 × 15-20 cm, 3-5 grains/hill)

Project code	Drilling	Dibbling
	16 holes: 30-40 kg/ha	
TZA-07	(30 × 1.8 cm, 1 grain/hill)	30 × 12.5 cm, 7 grains/hill
UGA-03	50 kg/ha (30 × 1.8 cm)	50 kg/ha (30 × 12.5 cm)
ZMB-01/02	50-60 kg/ha (row distance, 30 cm, 50 grains/m)	—

Source: SEN-02, "LE PROJET D'APPUI A LA PRODUCTION DURABLE DU RIZ PLUVIAL (PRiP) DeuxièmeFormation des ConseillersAgricoles 01~14"; CMR-01, "GUIDE for NERICA CULTIVATION"; CMR-02, "Généralités sur le riz"; UGA-03, "Rice Cultivation Handbook"; ZMB-01, "Upland rice cultivation In Kafue District (2011/2012)Version 1.1 "; ZMB-02, "REP Vol.2_NERICA 4 Production and Extension Manual"

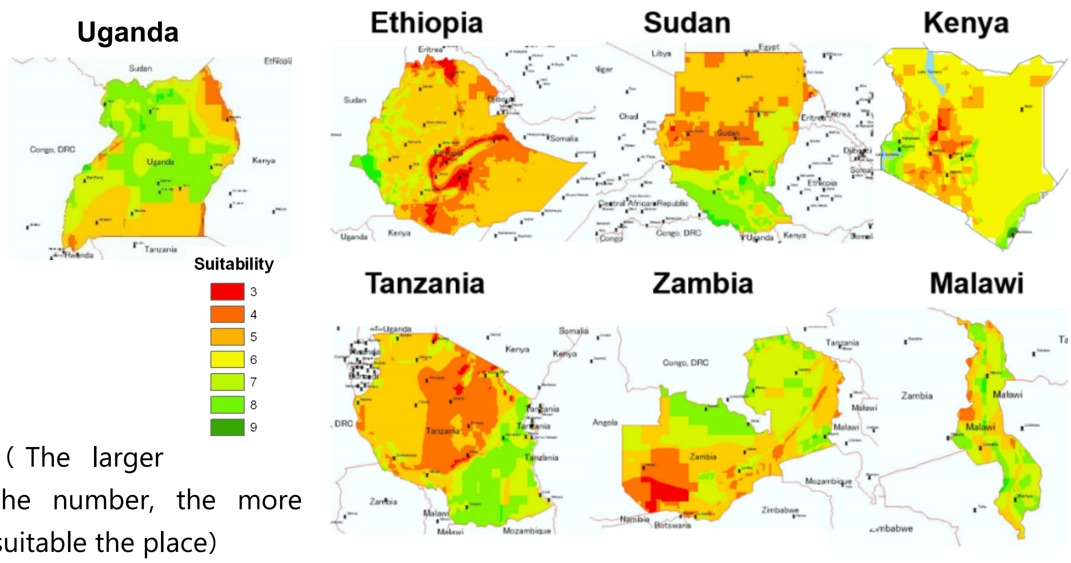
2) Rainfall and sowing time

The table below shows the amount of rainfall and sowing time for upland rice in each project.

Table 2-24 Criteria for rainfall in each project

Project code	Good practices
CMR-01	Rainfall is one of the most important factors for the growth of upland rice. Although it does not require much water at the early growth stages, insufficient rainfall from the panicle formation stage to the milky stage (2 weeks before harvest) decreases yield.
SEN-02	For upland rice cultivation, cumulated rainfall of 600 mm or more at regular intervals for 3 months or more is required.
TZA-07	Upland rice grows well in areas with annual rainfall of 800-1200 mm (optimally 1000-1200 mm). Rainfall is required throughout the growing season.
UGA-02	Based on 20 years of rainfall data, it is recommended that no fertilizer be applied in areas with little rainfall. In addition, by analyzing the probability of rainfall, it is recommended that the scale of rice cultivation be reduced and it be mixed with field crops (e.g., maize) in regions with continuous dry weather for 5 days or more.
UGA-03	Upland rice grows well in areas with rainfall of 20 mm or more for 5 days from sowing to 15 days before harvest (approximately 90 days).

A map of suitable land for NERICA cultivation in Uganda (UGA-03) and neighboring countries was created based on annual rainfall, altitude, and soil pH.



(The larger the number, the more suitable the place)

Fig 2-18 Map of suitable land for NERICA cultivation in East African countries

Source: UGA-03, Upland Rice Cultivation in Uganda"

3) Seeding method

There are three seeding methods: drilling, dibbling, and broadcasting. Drilling is recommended in many projects because of the ease of weeding, fertilization, and harvesting after seeding. In addition, seeders and line markers for drilling have been developed and improved in some projects.

For details of each technique, refer to the section on direct seeding of lowland rice (dry-seeded rice).

Box. Use of seeders for purposes of other than rice seeding

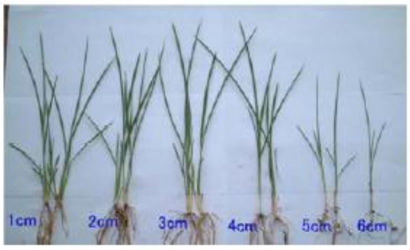
When using a seeder used for purposes other than rice seeding, attention must be paid to variations in seeding amount as the number of holes and grooves in the seeding machine vary. In SEN-02, a sowing machine for crops with different sowing boards and a sowing machine developed in the project were compared; the number of emergences after sowing were counted, and an appropriate sowing machine for upland rice was examined. The 32-hole board developed in the project was suitable considering the sowing density (2-8 Mechanization of Rice Cultivation for details).

Recommendations

(1) Seeding depth

Because sowing depth has a great effect on growth after seeding, a depth of 3 cm is recommended. If the seeding depth is low, the number of hill deficiencies increases due to the runoff by heavy rains after seeding and feeding damage by birds, which decreases yield. Meanwhile, if the seeding depth very high, the overall growth is delayed and yield is reduced due to decrease in germination rate and delay in ripening with delayed emergence.

2 weeks after sowing



4 weeks after sowing

Photo 2-21 Differences in growth due to different sowing depths

Source: UGA-03, Rice Cultivation Handbook"

Box. Differences in emergence among varieties

Using five upland rice varieties (3737, Boing22, FOFIFA161, NERICA4, and Sebota70), the following test was conducted in MDG-01. The sowing depth was set from 1 to 6 cm at 1 cm increments to identify strong and weak varieties for deep sowing. The emergence rate of NERICA4 was extremely poor when it was sown deeper than 3 cm, and the emergence rate of other varieties did not decrease when the depth was changed by 5 cm, whether it was deep or shallow. Therefore, the standard sowing depth recommended by many manuals was 3 cm. Of note, however, this value varies depending on the variety.

Source: MDG-01, Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)"

(2) Refilling of missing hills

Decrease in the yield of upland rice can be prevented by refilling the missing hills in the same way as that for lowland rice. Small seedlings are raised as supplements at the corners of the field. Supplementary planting should be performed 15-20 days after sowing and sufficient irrigation should be ensure to allow rooting as much as possible.

Pre-germinated seeds with uniform germination sown at an appropriate sowing depth, proper pest control, and prevention of surface soil and seed runoff by ridge construction around the field are recommended.

Box. Transplanting of upland rice

Upland rice is cultivated under non-flooded conditions; thus, direct sowing is desirable. However, in MOZ-04, the transplanting method is practiced. In this region, sweet potatoes, legumes, and cassava are cultivated as the previous crop; thus, field preparation for upland rice must start after the harvest of previous crop. Therefore, since the sowing time is later than usual, seedlings raised earlier in another place are transplanted as soon as field preparation is completed.

2-3-4 Rice Crop Management

Water Management

The soil of upland paddy fields is usually sandy, and it is difficult to retain water in the field. Although water freely seeps underground, little water flows on the surface. If the field is surrounded by a bund, water does not flow out and it can penetrate the soil, which contributes to increasing the moisture content of the soil. In MOZ-04, it is recommended that if farmers cultivate an upland crop before rice, the ridge of the crop be utilized for a bund for the upland rice cultivation.

Fertilization Management

Fertilization management is as necessary as it is for lowland rice cultivation.

Key points

(1) Top Dressing

The table below shows examples of top dressing in each project.

Table 2-25 Recommended top dressing method by project

Project code	Type of fertilizer	Quantity	Application method and timing
CMR-01	1. Urea 2. Urea	50 kg/ha 50 kg/ha	Panicle Initiation Stage: DAS 60-65 Meiotic Stage: DAS 70-75
MDG-01	Urea	50 kg/ha	DAS 25-30
SEN-02	1. Urea 2. Urea	50 kg/ha 50 kg/ha	Tillering Stage Panicle Initiation Stage
TZA-07	1. Urea 2. Urea	30 kg/ha, 20 kg/ha	DAE 21 DAE 45

Project code	Type of fertilizer	Quantity	Application method and timing
UGA-03	Urea	50 kg/ha	DAG 55-65
ZMB-02	Urea	50-100 kg/ha	Tillering Stage (DAG 30-35) and Panicle Initiation Stage (DAG 60)

Note: DAS (Days after Sowing), DAG (Days after Germination), DAE (Days after Emergence of seedling)

The effects of top dressing at each stage are as follows: at the tillering stage, it increases the number of tillers, at the panicle initiation stage, it increases the number of grains, and at meiotic stage, it promotes grain filling (increases percentage of ripened grains).

As the roots of the rice plant absorb fertilizer after it dissolves in water, it is more effective to apply fertilizer when the ground is moist. Rice plants and weeds compete for limited fertilizer, so it is important to conduct weeding before fertilization. Fertilizer should not be applied during cloudy or bad weather because the stomata of rice plants do not open completely and transpiration is reduced, which leads to the roots absorbing less fertilizer.

The table below shows the points of fertilization for each project.

Table 2-26 Points of fertilization of the projects

Project code	Points
CMR-01	Basal fertilizer is unnecessary where rice is cultivated for the first time, but rice grows better when it is applied.
UGA-03	Rice should not be grown continuously on the same fields; it should be rotated with other crops to conserve soil fertility. Composted organic material such as rice straw and animal manure can be added to the soil to supplement soil fertility.
MOZ-04	Local varieties are used for upland cultivation, and the project does not recommend using fertilizer.

Weed Management

The basic weed management method is the same as the method used for lowland rice, but weed management is more important for upland rice because weeds grow more easily with upland rice than with lowland rice. Weeding is conducted at least twice during the cropping season in many projects; the first time is 2-3 weeks after germination, and the second time is 6-7 weeks after germination. It is also important to conduct weeding not only in the field, but also around the field to reduce damage caused by rodents.

Key points

(1) Effect of weeding

The effect of frequency of weeding on rice yield was investigated in UGA-03, and the yield of the plot that was weeded 3 times was about 4.8 times higher than that of the plot with no weeding conducted.

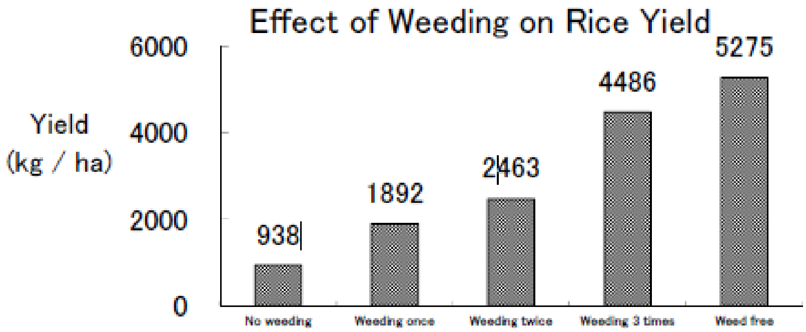


Fig 2-19 The relationship between weeding frequency and yield

Source: UGA-03 Upland Rice Cultivation Guide"

Plot with no weeding | Plot with weeding once | Plot with weeding twice | Plot with weeding 3 times

Photo 2-22 Weeding frequency and rice growth

Source: UGA-03 "Is Weeding Important?"

(2) Weeding method

Weeding by hand or by hoe is common. It should be noted that herbicide cannot be used for weeding upland, because it should be sprayed when the field is flooded.

(3) Crop rotation

In SEN-02, it is stated that crop rotation is one of the means of controlling weeds in upland rice cultivation.

Recommendations

(1) Development of the weeder

An example of mechanical weeding in upland rice cultivation is SEN-02 weeding using livestock and a weeder. When livestock and a traction-type weeder that is generally used for upland crops were tried in the target area for upland rice weeding, the growth of rice was inhibited and the yield was largely reduced. The negative impact was caused by the shape of the weeder, soil conditions (soil quality and moisture), planting interval (the planting interval of other crops are as wide as 60-80 cm), skills and experience of workers (including livestock), etc. In particular, when the first weeding was carried out at

2-3 weeks, because the rice plant had only 4-5 leaves at that stage and it was still short, some plants died because they were buried in the soil.

Based on the trial results, the project tried to develop an original weeder (attachment) for upland rice cultivation. The core structure of the developed weeder is a trapezoidal iron frame; its upper side is 40 cm, its lower side is 20 cm, and its height is 40 cm. It is a traction-type weeder and it cuts weeds with the blade on the lower side (Photo 2-23). The weeder is structured such that the inverted soil spreads outward and does not bury the rice plants. The weeder can be manufactured at a blacksmith.


Mechanical weeding


Original weeder of the project

Photo 2-23 Traction-type weeder for upland rice cultivation

Source: SEN-02 "MANUEL PRATIQUE DE RIZICULTURE PLUVIALE DANS LE BASSIN ARACHIDIER"

(2) Types of weeds in upland rice cultivation

Striga is a typical weed found in upland rice fields in CMR-02, UGA-03, and ZMB-01. Striga is a parasitic plant that takes root in host plants such as rice and absorbs nutrients.

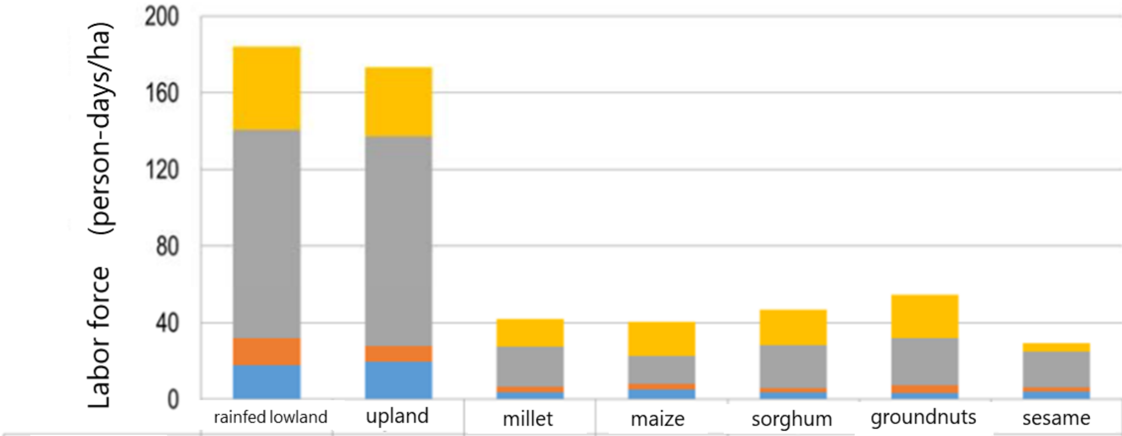

Photo 2-24 Striga

Source: CMR-02 "Généralités sur le riz"

As described in 2-2-4 "Box. Examples of weeds found in Africa," the characteristics of weeds in upland rice cultivation are summarized in "Major Rice Weeds in Uganda" in UGA-03 and presented with their photos.

Box. Comparison of labor force required for upland rice cultivation and other crop cultivations

By comparing the labor force for rice (rainfed lowland and upland) cultivation with other crops (millet, maize, sorghum, groundnuts, and sesame) in SEN-02, it was found that the labor required for weeding in rice cultivation is much larger than the labor required for other crops. This results in the labor force for rice cultivation being about five times larger than that for other crops.



	rainfed lowland	upland	millet	maize	sorghum	groundnuts	sesame
harvesting	43,6	35,9	14,6	17,9	18,4	22,8	4,7
weeding	108,5	109,6	20,9	14,6	22,5	24,5	18,7
sowing	14,4	8,3	3,1	2,9	2,2	4,0	2,0
soil preparation	17,8	19,5	3,6	5,2	3,6	3,4	4,1

Source: SEN-02 "MANUEL PRATIQUE DE RIZICULTURE PLUVIALE DANS LE BASSIN ARACHIDIER"

Pest and Disease Management

Basic pest and disease control is the same as it is for lowland rice.

Key points

(1) Types of diseases

It has been reported in CMR-01 and TZA-07 that NERICA, which is a representative variety of upland rice, has high resistance to diseases (especially blast and RYMV), and it is said that no special disease control is needed in CMR-01. In addition, ZMB-02 listed blast, sheath blight, and brown spot, and UGA-03 listed RYMV as upland rice diseases (details of all the diseases are described in 2-1).

(2) Types of pests and control methods

Type of pests		Control methods
	Stem borer: *Refer to 2-2 as well *Source: CMR-01 "Manuel 'facile' de production du NERICA"*	- Cultivation of plants, such as maize, which are preferred by the insects around the field can attract them and control the damage to a certain degree. - Use of insecticide

Type of pests		Control methods
	Termites: Termites eat and cut the stem of rice plants, resulting in the plants drying or dying. *Source: ZMB-02 Rice Extension Package "REP Vol.1_Rice Cultivation Manual"*	- It is difficult to control termites. Select a field where soil moisture can be maintained or a place as free from termites as possible.
	Cantharides: Cantharides cause empty spikelets by sucking grain or eating stamens at the flowering stage. *Source: SEN-02 "MANUEL PRATIQUE DE RIZICULTURE PLUVIALE DANS LE BASSIN ARACHIDIER"*	- Experientially, it is known that insecticides such as Decis, Diméthoates, Sumithion, Pérical, and Malathion are effective (SEN-02). - To keep Cantharides away from the field, farmers use the following method: slash and burn, burn used tires, burn neem leaves, burn carcasses, etc.

Other insect pests found in upland rice cultivation include stink bugs (CRM-01), mole crickets (SEN-02), and stalk-eyed flies (UGA-03) (all described in 2-1). CMR-01 recommends using pesticides when approximately 20% of the field is affected by insect damage.

(3) Countermeasures against pests and diseases

For pest control, it is important to use resistant varieties, disinfect seeds, use seeds and seedlings that are not infected with diseases, weed the field, use recommended cultivation techniques, ensure appropriate planting densities, and rotate crops.

Bird and Animal Damage Management

The basic control method is the same as the method for lowland rice, but it is important to note that upland rice can be damaged by livestock and poultry, and that it is more susceptible to rodent damage.

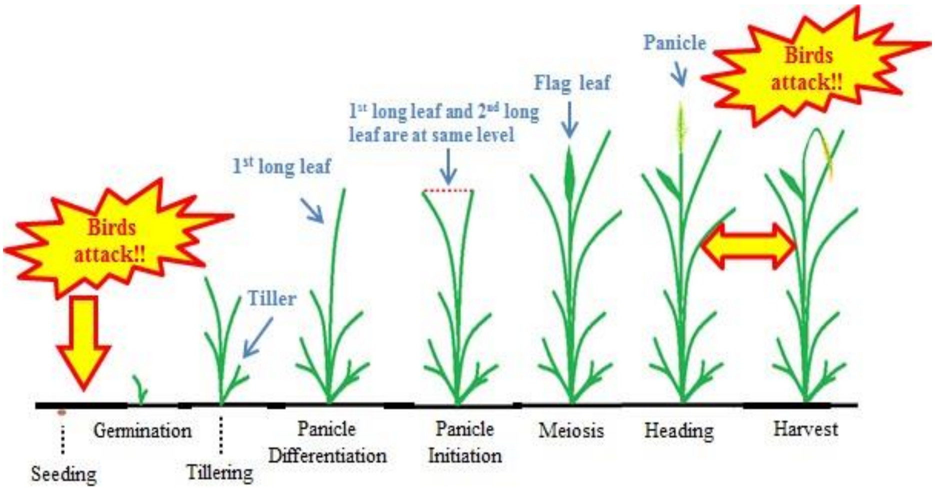


Fig 2-20 Bird damage during the rice growth cycle

Source: CMR-01 "GUIDE for NERICA CULTIVATION"

Box. Heavy work of bird chasing (CMR-01)

Even in Africa, countries that have been cultivating rice for a relatively long time (e.g., Guinea) have a custom of chasing birds with families and in groups. In order to prevent bird damage, which occurs mostly in the morning and evening during the harvesting season, bird huts are often built in the fields to chase birds throughout the day. Since Cameroon has no crops that require chasing birds, many farmers find it burdensome. The project has identified the problem of bird damage through field monitoring conducted multiple times from 2012 to 2013, and has proposed countermeasures. In a survey conducted in 2013, it became clear that the most difficult problem in upland rice cultivation is chasing birds.

2-3-5 Harvesting

The harvesting method is the same as the method used for lowland rice.

CMR-01 and CMR-02 indicate that it is better to harvest after 9-10 am to avoid dew. In case of rain, wait until the rain stops. However, if it rains every day, the crop can be harvested, but the paddy should be dried immediately after harvesting.

2-4 Post-harvest Processing

The post-harvest processing of rice varies depending on the degree of popularization and development of rice cultivation as well as the level of technology in the country or region; however, it is essential to prevent post-harvest loss and quality deterioration in this series of processes, as shown in the figure below[22]. For instance, the introduction of a consistent technology package from harvesting to storage was reported to reduced grain weight loss by half from 14.8% to 7.3% (MDG-01) or harvesting 1 week earlier reduced harvesting and threshing losses from 10% to 4.3% (TZA-07).

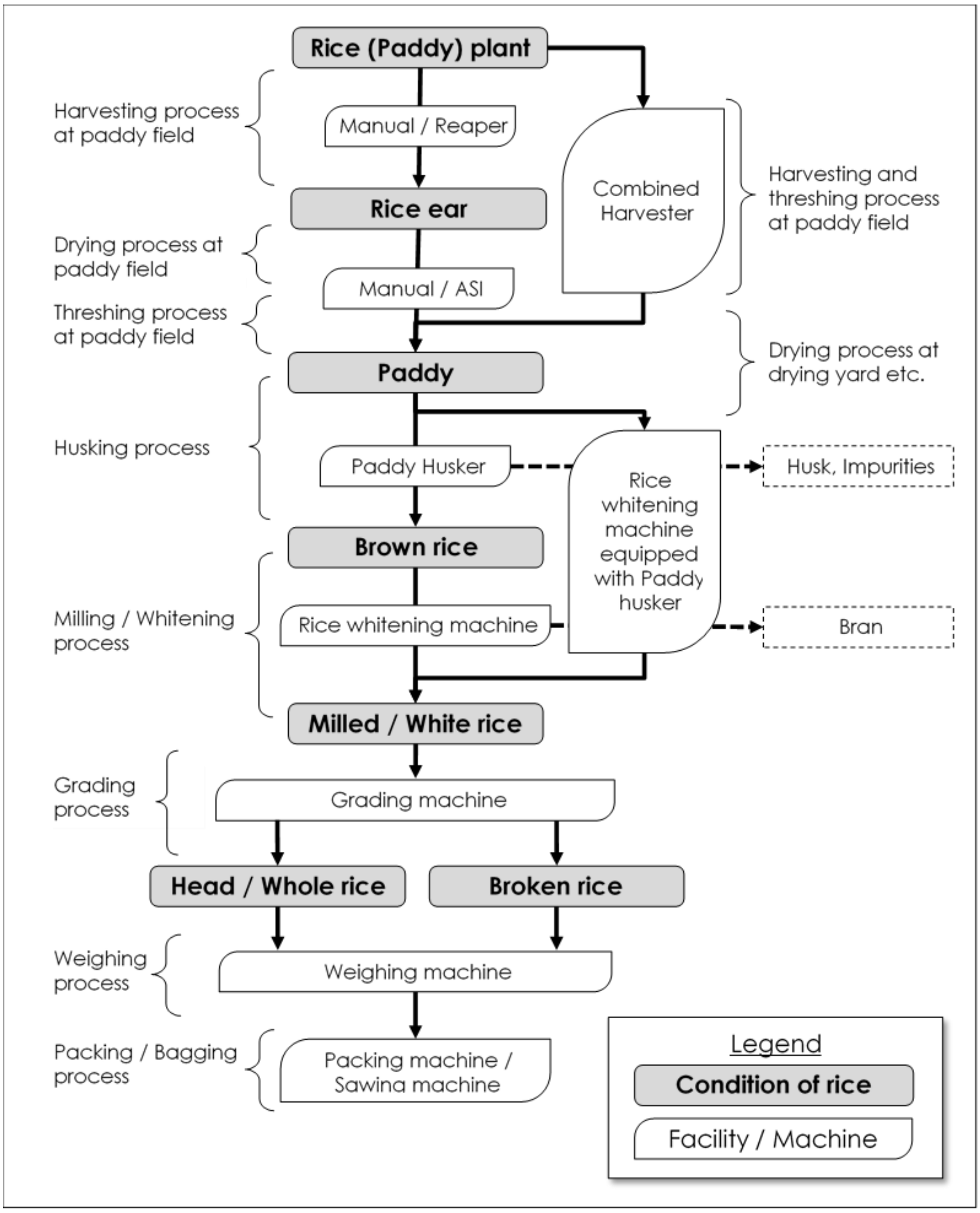


Fig 2-21 General flow of the post-harvest processing of rice

Source: SEN-03, "Practical Manual for Post-harvest Processing"

22 The destoning process by destoner is not included in this figure. It is desirable to remove stones together with other impurities during the rough sorting process before husking; however, if it is difficult to introduce the rough sorting machine, stone removal is performed after the rice milling process. ASI in the figure refers to a throw-in, powered thresher made in Senegal.

2-4-1 Threshing

Outline

In general, many rice varieties grown in sub-Saharan Africa have easy shattering characteristics compared with the Japanese varieties. Therefore, the conventional rice threshing method of beating rice ears against a metal barrel or a log or beating of rice ears spread on a sheet using sticks is practiced. Threshing by cow stamping is also adopted in some regions, such as Madagascar. Moreover, machine threshing is recommended in many projects against the backdrop of the dissemination of hard-to-shatter varieties (e.g., NERICA4) through the JICA projects and the rising demand for work efficiency associated with increased rice production. When using a combined harvester, this step is omitted because harvesting and threshing are performed simultaneously.

Key points

(1) Measurement of grain moisture contents

Threshing with appropriate grain moisture content is important, because if drying is insufficient, it may lead to poor threshing and mechanical failure in the threshing machine. For drying before threshing, a direct placement-type technique is used in the field, which is easy under dry conditions (MOZ-04). In rainfed lowland areas where water remains even at the harvest time, the harvested rice is placed on stems remaining after the harvest (GHA-04) or leaned against the bunds between paddy plots (CMR-02) to prevent the rice ear from soaking in muddy water and consequent deterioration of the quality. Grain moisture content can be easily measured using a moisture meter if available. The operation of the moisture meter is summarized in the post-harvest processing manual (SEN-03 and others). A simplified technique to manually estimate moisture content without a device is presented in section 2-2-5 Harvesting.

Drying directly on the dried fields

Temporary placement on the residual stems

Temporary leaning against the bunds between plots

Photo 2-25 Rice drying before threshing

Source: MOZ-04, "Project Progress Report (phase 2)" (left); GHA-04, "Onsite Training" (center);CMR-02, "The Project for the Development of Irrigated and Rainfed Rice Cultivation (PRODERIP) by JICA expert Sokei Introduction of Project's Activities, 2021 (right)

Box. The original aroma of rice and signs of changing behavior (CMR-02)

To produce high-quality rice, producers must understand the required quality level; however, farmers who have grown up eating rice smelling of mud or mold for many years do not know what the problem is if they are allowed to smell it. In this condition, it is difficult to make farmers understand the meaning of preventing the ear of rice from soaking in muddy water or drying it to the proper moisture content. Therefore, the project asked farmers to smell the original fresh smell of paddy rice, which was properly dried without soaking in muddy water, the puffy smell of cooked rice, and the smell of muddy and moldy rice and to compare the tastes; this improved the degree of understanding of quality among farmers.

According to UNDVA, a C/P organization of the project, farmers are aware that the selling price of paddy varies depending on the quality of rice (the purchase price of paddy by UNDVA can be divided into three levels according to the quality of paddy: 200, 150, and 125 CFA/kg). Farmer now try to preserve the quality of rice, such as by intentionally delaying the cultivation period so that rice can be harvested after water recedes from the paddy fields.

Source: Prepared by the JICA study team based on the Questionnaire Survey with Japanese Expert, 2021

(2) Prevention of the loss of paddy and contamination with impurities

Threshing on a plastic sheet is recommended for both manual and mechanical threshing to prevent loss due to scattering of the paddy during the process and contamination of the threshed paddy with seeds of other plants, stones, and soil (see Photo 2-26). In some countries where manual threshing is practiced, workers are instructed to remove their shoes to prevent contamination with mud.

Photo 2-26 Threshing on a sheet

Source: MOZ-04, "Project Progress Report (phase 2)"

When threshing different varieties, it is important not to leave the paddy of the previously threshed variety in agricultural machinery and tools. In particular, agricultural machinery contains residues inside (paddy left inside the machine) that are difficult to see. Therefore, it is necessary to understand its internal structure by referring to the schematic drawing of the threshing machine in the manual and disassembling and cleaning it.

(3) Tips for manual threshing

Manually beating rice ears against a metal barrel or a log not only increases the loss of paddy but also causes cracks in the rice kernels. To prevent these problems, several good practices are observed, such as the use of a wooden threshing stand (Photo 2-27), a wooden box called the "Bam-Bam Box" (Photo 2-28), and shifting the point of striking rice ears on stones to the ear neck side (Fig 2-22 shows a bad example on the left and a good example on the right).

Photo 2-27 Simple wooden threshing stand

Source: ZMB-01, "Upland (Dambo) Rice Cultivation"

Photo 2-28 Threshing using the "Bam-Bam Box"

Source: GHA-05, "Rice Extension Guideline_MoFAJICAProject_TENSUI2"

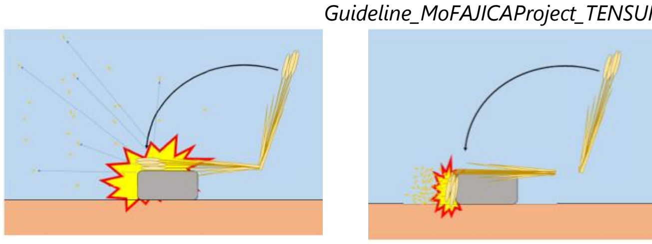


Fig 2-22 Correct strike position against stone

Source: MOZ-04, "Project Progress Report (phase 2)"

(4) Tips for machine threshing

There are two main methods of machine threshing: a simple foot-pedal thresher and a power-operated thresher with a diesel engine. In addition to the points of attention introduced in (1) and (2) of this chapter, the typical points to be noted in the operation and maintenance of threshers are summarized in the table below.

Table 2-27 Items to be considered in the management, operation, and maintenance of a thresher

Type of thresher	Items to be considered	
Common foot-pedal and engine-driven types	Management and maintenance	- Management structure for O&M of the machine - Securing the cost for O&M of the machine (saving) - Collection of contact details of the repair company - Security measures (against theft)
	Operation	- Optimum input volume at a feeder/inlet port - Securing enough number of operators (approximately five persons including assistants) - Safety measures for operators (against fingers injury, wearing shoes, and so on)
Foot-pedal type	Operation	- Lightening makes it easier to transport, but stability may be impaired if very light. - Stabilization of rotation speed

Type of thresher	Items to be considered	
Engine type	Management and maintenance	- Prior confirmation of road condition to the threshing point - Management of money for fuel - Periodical check and maintenance of the engine
	Operation	- Adjustment of engine speed - Fixing loose engine belts - Refiling cooling water

Good practices by projects

(1) Optimization of thresher (RWA-02)

In Rwanda, the traditional threshing method is to manually hit the harvested rice against a tree (Photo A). Later in the project, a foot-pedal thresher (Photo B) was introduced; however, the number of people who could perform threshing work at the same time was limited and improvement of work efficiency was needed. Therefore, the project simplified the thresher using locally available eucalyptus trees as the main material. As a result of this simplification, the manufacturing cost was reduced and the number of threshers increased, enabling simultaneous work and shortening of the threshing time. However, because paddy grains are more likely to scatter in this method than in the foot pedal-operated method, it is necessary for an assistant worker to lift the bottom of the plastic sheet in the position directly facing the operator to prevent paddy scattering (Photo C).

Fig 2-23 Optimization of threshing

Source: RWA-02, "Farmer's Textbook for Rice Cultivation, Water Management and Post-Harvest Practice Training"

2-4-2 Drying and processing

Outline

When the moisture content of grains is lowered by drying, the action of enzymes, which are the basis of biochemical reactions and require reaction with water, is suppressed, and the respiration and decomposition reactions of the paddy itself are suppressed. In addition, the rate of biochemical reactions of parasitic insects and microorganisms, such as bacteria and molds, decreases, and their activity and reproduction are suppressed. However, it should be noted that improper drying may cause cracks in rice and affect the quality and quantity of the product. The causes of grain cracking include malnutrition of rice, high temperature immediately after heading, and delayed harvesting. In post-harvest processing, rapid drying at high temperature and high temperature during the milling process are the main causes of grains cracking (Fig 2-24).

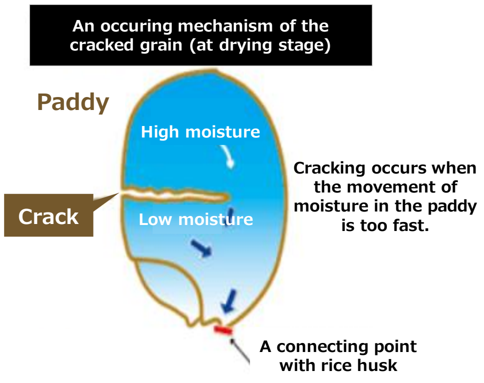


Fig 2-24 Mechanism of grain cracking

Source: ZEN-NOH, "Cultivation Techniques to Reduce the Cracked Grains 2007"

Key points

(1) Target grain moisture contents

The target grain moisture content varies depending on the purpose of use. For instance, the recommended range of moisture content is 13%-15% for milled rice or paddy for storage and 12%-13% for seeds (Table 2-32).

(2) Drying

Mechanical drying, such as flat-bed drying, has not been observed in the projects conducted so far, and paddy is commonly sun-dried manually by spreading the threshed grains on a concrete pavement or plastic sheet and dry slowly under the sun with periodic stirring and turnover for uniform drying.

Table 2-28 summarizes the thickness of the paddy layer on the pavement or plastic sheet, drying method, and frequency of paddy stirring. It is necessary to set the thickness of the paddy layer and drying time based on temperature, humidity, and rainfall pattern in the target area of each project.

Photo 2-29 Stirring of paddy

Source: RWA-01, "Manual for PiCROPP Horticulture Training"

Table 2-28 Drying methods and thickness of paddy layer during sun drying

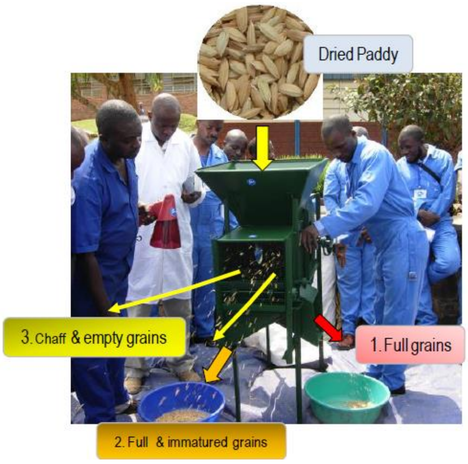
Project code	Thickness of paddy layer	Drying method and frequency of stirring paddy
CMR-02	4-5 cm	Drying on a sheet or pavement. Paddy is stirred every 1 hour for 3-4 hours per day under the sun and slowly dried in the shade. This lowers grain cracking. The moisture content is slowly reduced to the target percentage over 2-4 days, and grains are stored on the 5th day.
GHA-04/06	5-10 cm	On sunny days, paddy is stirred every 30 minutes 7-8 times a day (the number of times increases according to the moisture content). During the day, the surface temperature of the drying area exceeds 50 °C, leading to grain cracking; thus, rice is covered on hot times of the day or dried for several days. When it rains, the paddy is protected with a waterproof sheet (or tarpaulin).
MOZ-03	3-7 cm	Rice is dried on a sheet or pavement with frequent stirring.
RWA-01	5 cm	Rice is slowly sun-dried on a sheet or pavement, stirring every 30-60 minutes for 2-3 days.
SEN-01	-	In the dry season, because the humidity is high at the time of harvest, rice is dried for 1-2 additional days than usual.
SLE-01	-	Rice is slowly dried under the sun again after winnowing, stirring every 1 hour. Drying areas are as flat and clean as possible. The use waterproof sheets or pavement areas is recommended.

Project code	Thickness of paddy layer	Drying method and frequency of stirring paddy
TZA-07	3-5 cm	Rice is dried after threshing and rough grading (sieving), stirring every 30 minutes. The temperature of paddy rice is measured at regular intervals, and rice is transferred to shade or covered with a sheet before the temperature rises (50°C for grain consumption and 42°C for seed production). The paddy is transferred under the roof or covered with sheets at night and in rainy weather to protect from animals and birds.
UGA-03	4-5 cm	Rice is dried slowly and uniformly by stirring every 30-60 minutes to allow equal exposure to the sun. Daily reduction of paddy moisture content of <3% per day is recommended.
ZMB-01	5 cm	Rice is dried slowly for 3 hours a day for 3 days, with frequent stirring for uniform drying.

(3) Winnowing

Winnowing is conducted manually or using a machine to remove impurities, such as straw and chaffs, contained in paddy after threshing. For instance, in MOZ-03, the aim was to prevent an increase in the moisture content of paddy and insect damage by removing impurities and harmful insects through winnowing before transporting the paddy from the threshing site to the warehouse.

Mannual winnowing



Cleaning with a winnower (hand-operated type)

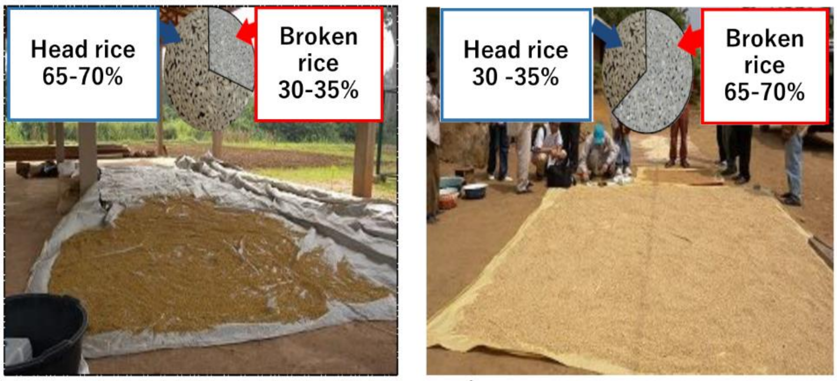
Photo 2-30 Winnowing

Source: ZMB-02, " REP Vol.2_NERICA 4 Production and Extension Manual" (left); RWA-01, "Technical Manual for Rice Cultivation, Water Management and Post-Harvest Practice" (right)

Good practices by projects

(1) Construction of drying spaces (CMR-01/02)

In the tropical forested region of Cameroon, rainfall during paddy drying was an issue; therefore, drying spaces with a roof were constructed near farmlands. Analysis of the effects of different drying methods on the proportion of cracked grain revealed that the proportion was 65%-70% with rapid sun drying and it was improved to 30%-35% with drying in the shade (Fig 2-25).



Dried gently in a well-ventilated place

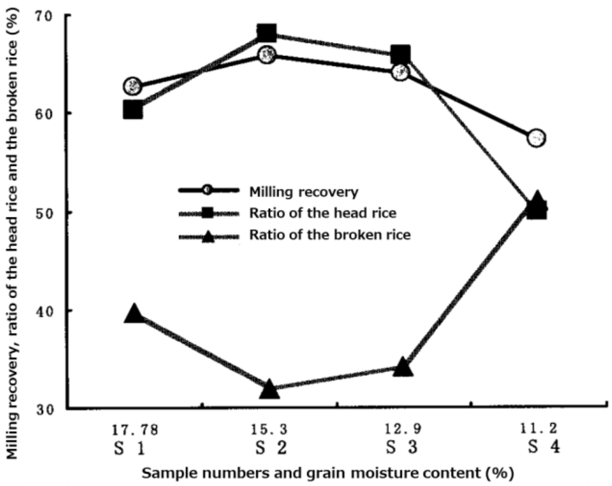
Spread in a thin layer and exposed to full sun (dried too fast)

Fig 2-25 Effects of different drying methods on the proportion of cracked grains

Source: CMR-02, "Récolte et Post-récolte du riz(riziculture pluviale de plateaux)"

(2) Tips for drying with parboiling (NGA-01)

The moisture content of paddy subjected to the parboiling process[23] is as high as 30%-35%. Because plastic sheets do not absorb moisture from the paddy, rice drying on sheets on a well-swept pavement is recommended. This method differs from the conventional drying method in that the thickness of the spread paddy layer is recommended to be 2 cm or less to facilitate drying. The target moisture content is 12.5-13%. If a grain moisture meter is not available, moisture is checked by biting the de-husked rice (brown rice) with teeth; a crisp and strong shearing feeling (click sound) is an indication of proper drying.



Sample No.	S1	S2	S3	S4
Grain moisture content (%)	17.8	15.3	12.9	11.2
Milling recovery (%)	62.6	65.8	64.1	57.3
Ratio of the head rice (%)	60.3	68.1	65.9	49.9
Ratio of the broken rice (%)	39.7	31.9	34.1	51.1

Note: Ratio is calculated on weight base.

Fig 2-26 Effects of on different grain moisture contents on milling recovery and proportion of head rice and cracked grains

Source: MOZ-01, "Project Completion Report (phase 4)"

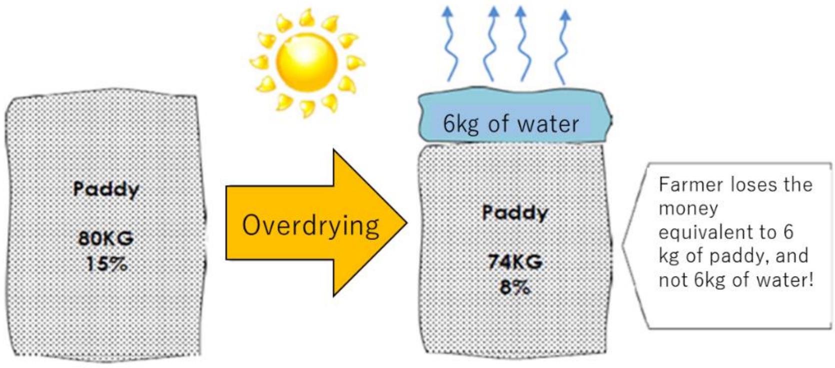
(3) Verification of the optimum grain moisture content (MOZ-01)

It is important to know the optimum grain moisture content for improving rice milling recovery and proportion of head rice. Therefore, the project prepared samples with different drying times under sun light and analyzed the data to clarify the effects of different moisture contents on rice milling recovery and head rice proportion. As shown in Fig 2-26, rice milling recovery and head rice proportion reached the highest value at a grain moisture content of approximately 15%, and the values decreased with increase or decrease in moisture content beyond this threshold.

[23] Parboiling involves a series of soaking, steaming, and drying of paddy before milling (Kimura et al., 1976, "Research on Parboiled Rice").

(4) Profit loss by over drying of paddy (SEN-03)

Decrease in the moisture content of paddy traded on a weight basis leads to grain cracking and ultimately profit loss to reduced weight. In Senegal, where the relative humidity is low, the project explained to the C/P organization that a decrease in the water content per 80 kg of paddy rice from 15% to 8% is equivalent to a decrease in the sales of 6 kg of paddy. Since then, they have become aware of the importance of controlling moisture content and have made efforts to improve rice quality.



We should avoid loss of money due to overdrying of paddy!

Moisture content	Normal (15%)		Low (8%)
Weight of paddy	Correct (80.0kg)	*Decrease 6.1 kg*	Slightly light (73.9 kg)
	e.g., paddy price is 130 Fcfa/kg		
Selling price of paddy	Correct 10,400 Fcfa	*Decrease 793 Fcfa*	Relatively reduced 9,607 Fcfa

Fig 2-27 Association between grain moisture contents and profit

Source: SEN-03, "Practical Manual for Post-harvest Processing"

2-4-3 Rice milling

Outline

Rice milling has a great impact on quality and is an area that needs to be developed for the future regional distribution of rice. In the single-stage milling method, the "Engelberg" miller is used for simultaneous rice hulling and milling; this method is widely used in the region, even though the rate of the cracked grain is high. Therefore, several projects have shown the possibility of improving the quality of rice by adopting multi-stage milling with multiple machine; different machines perform the functions of husking (rubber roller husker), milling (polisher), and sorting (to separate paddy, brown rice, and milled rice) (MDG-01, SEN-01 and SEN-03).

A quality standard system based on the size of grains (head, broken, immature, and other grains) and the contamination ratio of impurities (red, yellowish, or milky-milled rice grains), as observed in Asian countries, has not been well established in this region. However, price differentiation with differences in quality, possibility of selling in the off-season using storage facilities, and market needs for rice branding has gradually been confirmed.

Key points

(1) Husking and milling

The commonly used rice husking and milling methods in sub-Saharan Africa include (i) the Engelberg method; (ii) the one-pass rice milling method in which the upper part of the machine performs the husking function with a rubber roll and the lower part performs the milling function; and (iii) the multi-stage rice milling method in which multiple husking and milling machines are used. The outline and characteristics of each method are shown in the figure below.

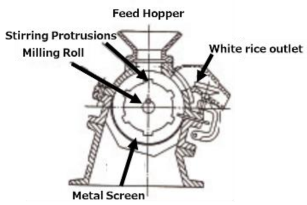
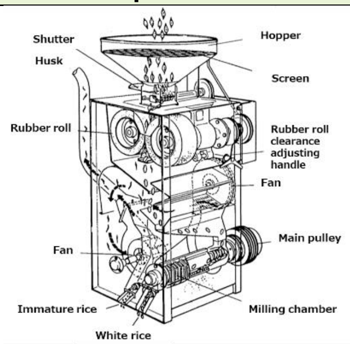
	Engelberg method	One-pass method	Multi-stage milling method
Schematic diagram			
Mechanism of husking and milling	Paddy fed from the hopper is hulled and milled by the impact of a rotating milling roller and friction between the paddy.	Charged paddy from the hopper is hulled by the upper rubber roll to reduce grain cracking and milled in the lower milling chamber.	Multiple rice husking and milling machines are installed, and husking and milling are performed separately in that order.
Characteristics	Husking and milling are performed by the same machine. The simple structure and small number of parts make it easy to manage, but since the internal milling pressure is high, grains may easily crack. In addition, grain temperature tends to rise due to frictional heat.	Husking and milling are performed by the same machine. It is superior to the Engelberg method in terms of higher rice milling recovery and lower cracked grain proportion. Grain temperature does not rise as much as that in the Engelberg type. The rubber roll, which greatly affects the milling recovery, is a consumable part that wears.	Although the cost for introducing multiple machines is incurred, fine adjustments can be made using each machine; thus, this methods has an advantages of high rice milling recovery and low cracked grain proportion.
Scale of millers	Small-scale	Small-scale	Large-scale

Fig 2-28 Typical rice milling methods in Sub Saharan Africa

Note: In SEN-03, a small friction-type rice miller called "Jet Parlor" for simultaneous hulling and milling is becoming popular (as of 2017). This machine was originally designed for removing rice bran from brown rice, but it can also perform hulling and milling simultaneously, like the Engelberg miller.

Source: Prepared by the JICA survey team based on "SATAKE, TASTY. 33 (2006)"

(2) Destoning (removing stones)

Stones should be removed by through rough sorting, which is a step prior to charging the paddy rice into a rice miller. However, only a limited number of rice milling companies have such equipment (CIV-01 and SEN-03). Some stones are removed during rice milling depending on the type of rice miller used;

however, to completely remove stones from milled rice, a rice destoner is necessary. Rice milling companies and distributors do not have a rice destoner usually remove stones by hand-picking. In addition, in one case, the parts inside the rice miller were damaged due to defects in stone removal (MOZ-01, 02). Rice with few or no stones is in high demand by consumers and is therefore traded at high prices under the name of "stone-less rice" or "stone-free rice." In NGA-01, stones were mixed with rice from harvesting to shipping of milled rice on at least three occasions. Therefore, rice destoner is essential to completely remove stones (Table 2-29).

Table 2-29 Occasions and causes of stone contamination of rice

Occasion	Causes	Milled rice	Parboiled rice
At harvesting	Harvested rice was placed directly on the field.	Applicable	Applicable
At threshing, drying, processing, and bagging	Despite the use of plastic sheets, stone contamination ratio is not zero.	Applicable	Applicable*
At drying after parboiling	Use of plastic sheet is not recommended, and stones are mixed when stirring steamed paddy and charging into the bag.	Not Applicable	Applicable
At milling	Milling twice is recommended by the project for improving recovery. Milled rice produced by the first milling and spread on the floor at the rice milling station and paddy/milled rice spilled from the machine during milling are mixed with stones when they are returned to the rice milling machine.	Applicable	Applicable

**Some stones are removed by washing paddy before soaking into the water.*

Source: Prepared by the JICA study team based on NGA-01, "Project Completion Report"

(3) Separation/sorting

Separation includes sorting head rice, large cracked grains, and small cracked grains according to the grain size and removing grains of different colors such as discolored grains. Cracked grains are removed with a vibrating sorter or manual sieve, and discolored grains are removed by hand picking or using a color sorter. The extent to which sorting and separation is required is determined by the level of market demand (2-6 Rice Farming Management and Value Chain Development).

Recommendations

(1) Considerations for selecting the rice milling method suitable for variety and purpose of use

The suitable rice milling method should be determined based on the rice variety, purpose of use, and quality standards required by the market.

For instance, in SEN-03, the process suitable for short-grain varieties is "Abrasion (Grinding) → Friction → Friction → Polishing" and the process suitable for long-grain varieties is "Abrasion → Abrasion → Polishing"; the finest combination introduced is "Abrasion → Abrasion → Abrasion → Polishing → Polishing" (corresponding to the flow from "Paddy" to "Milled/Milled rice" in Fig 2-21). Nonetheless, in NGA-01, the proportion of cracked grains could be maintained at approximately 15% even with the use of the Engelberg-type rice miller by adopting proper parboiling processing and recommended a milling system in which milling was performed twice followed by polishing at the bottom of the rice-milling machine.

(2) Operation and Maintenance (O&M)

Appropriate maintenance is essential for the sustainable operation of rice milling machines. For instance, in CMR-01/02, out of 50 CFA per kg of milling service charge, 23 CFA is reserved for future rice milling machine purchase costs, installation costs, and operator salaries; 17 CFA is used for consumables, such as fuel, oil, rubber rolls, belts, and others; and 10 CFA is used for tools and labor cost for repair work. In TZA-07, out of 60 Tsh per kg of milling service charge, 20% is used for maintenance and management costs, 10% for operator cost, 30% for electricity cost, and 40% for saving the replacement of expensive spare parts and machines. Securing spare parts is a common challenge in all countries. The key points of the O&M of the rice milling machine directed in CMR-01 are summarized in Table 2-30.

Table 2-30 Key points of O&M of milling machines: A case of one-pass-type machine in SB-10

Item	Key points of O&M
Machine main body	• Bolt tightening condition of hopper (inlet of paddy), wear condition and bolt tightening condition of rubber roller, condition of screen, condition of husk discharge outlet, tension of belt, other bolt tightening conditions, removal of bran accumulated in chamber part, and cleaning of the inside of the machine
Diesel engine	• Routine maintenance: cleaning filters and refilling cooling water (prevention of seizure) • Regular maintenance: Replacement of engine oil, filters, and other consumable parts
Others	• The rice milling station should be kept tidy and clean; no residue should be left on the floor, which can attract rats or insects.

Source: Prepared by the JICA study team based on CMR-01, Nettoyage et Révision Journalier dans une Station du Décorticage " O&M OF RICE MILLING MACHINE SB10"

Good practices by projects

(1) Assistance to rice milling companies (SEN-03)

The Senegalese market has a unique characteristic in that broken rice has almost the same commercial value as the head rice. However, proper selection of head rice and broken rice is essential for improving product value. Therefore, the project procured six sets of milled rice sorters with a destoner, vibrating sieve, and two bucket elevators on a trial basis and loaned them to small-scale rice milling companies to demonstrate that even they can produce high-value-added rice. The selling value may be improved by separating head rice and broken rice via proper selection, as shown in the table below.

Table 2-31 Change in the price of milled rice after installing the rice grading machine

S/N of milling facilities	Price of white rice before installing the rice grading machine	Price after installing the rice grading machine			
		Head rice	Large broken rice	Medium broken rice	Small broken rice
D-1	210	260	250		
D-2	210	250	250	240	-
D-3	200	270	270	250	280
D-4	210	260	240	250	140
P-1	220	270	250	250	150-160
P-2	210-220	260	240	240	140

(unit: FCFA/kg)

Source: SEN-03, "Project Progress Report (phase 3)"

(2) Trial of the mobile rice mill service (UGA-03)

As a trial of rice milling business in rural areas where road traffic networks and electric power facilities were insufficient and far from the milling station, a mobile rice mill service was introduced by placing a one-pass-type rice miller and an engine generator on a truck bed. This service had rice milling capacity of 200 kg/h and milling recovery of 62.2%.

Photo 2-31 Mobile rice mill

Source: UGA-03, "Upland Rice Cultivation Guide"

(3) Establishment of the Farming Support Group (FSG) (MOZ-01/02)

The project introduced small-scale rice milling machines in many regions, established and strengthened an organization with an appropriate size to operate and maintain the milling machines (called FSG), and introduced a microcredit system. The project provided the FSG with guidance on how to ensure a sustainable rice milling business from the project implementation period, instilled quality control and cost concepts, and led to organizational revitalization.

To calculate the cost of rice milling machines, there were no standards in Mozambique for calculating O&M costs at the time; therefore, the project referred to the Japanese standards and set the annual repair cost at 4% of the purchase cost (approximately 24,000 Mt/year) and specified in the internal regulations that a reserve of 2,000 Mt/month should be set aside. In addition, the project instructed the FSG to ensure thorough payment and record labor costs, which are of particular interest to farmers, without exception. As a result, the operation of the rice mill has contributed to a reduction in the workload of rice milling, and the FSG has been able to secure a profit from rice milling business, thereby enabling fund raising for the construction of a warehouse for paddy and for the participatory rehabilitation of irrigation and drainage canals.

In addition, the rice milling business using the rice milling machine introduced in MOZ-02 has been successfully running even though six years have elapsed since the end of the project (Photo 2-32).

According to the FSG representative, the average annual rice milling over the past 10 years was approximately 21.7 t/year. However, in addition to the difficulty in obtaining compatible spare parts, the number of customers has decreased significantly due to the establishment of new rice mills with high processing capacity near the district in recent years.

Photo 2-32 Rice milling machine in operation

Source: JICA study team

(4) Introduction of wooden mortar (CMR-01)

In CMR-01, a wooden mortar and pestle was provided to farmers, considering the high possibility that powered milling machines will fail to pay off in areas without electricity. Although the mortar has a disadvantage of increased proportion of broken rice compared with rice milling machines, farmers' demand for buying wooden mortar was confirmed.

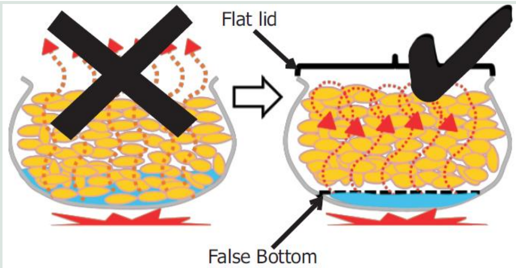
(5) Establishment of a parts supply center by a large-scale rice millers' association (SEN-01/03)

In SEN-01 (phase 1), a large-scale rice millers' association (ANR: Association Nationale des Riziers in French) collected copayments from those who installed rice milling equipment and based on this copayment, established a fund that can be used by the members of the association when they install new equipment for rice milling. However, after the completion of project, the fund was not being used at all; thus in SEN-03 (phase 2), discussions were held with ANR, and a parts supply center was established using the fund. This center aims to procure and manage spare parts for rice milling machines and sell them to the necessary companies. As of November 2020, the center has been selling spare parts to member companies. The Association of Agricultural Machinery Service Providers in other areas of the country (Podore Department) came to know about this activity and requested ANR to provide expertise for establishing similar centers in other regions.

Box. Development of improved parboiling techniques (NGA-01)

The "improved parboiling technology" developed in NGA-01 covered only two states during the project phase, but it was later taken over by the JICA Nigeria Office, which employed 10,605 parboilers nationwide (as of 2017).

Some improvements in the processes of washing, soaking, steaming, and drying in the parboiling were achieved during the project, such as the use of a false bottom at the paddy steaming stage. The project promoted an aluminum false bottom made of a sand mold casting for small pots (560 mm in diameter) and an iron false bottom of the right-left separation type for easy taking in and out for large drums (1,400 mm in diameter). However, because the large iron false bottom can easily rust and is expensive, it did not take root in the end.
Later, in local parboilers, a 15-20-cm-thick layer of rice chaff is deposited at the bottom of the drum, called the "chaff layer," as a substitute for the false bottom. This is superior to the iron false bottom in terms of cost, durability, and ease of handling, and this is a good practice that the Nigerians have embraced based on the basic concept of "to steam paddy without contacting with hot water," recommended by the project as an improved parboiling technology and flexibly adapted to local conditions by themselves.



A schematic of the use of a flat lid and a false bottom for steaming paddy

A false bottom fabricated for the traditional pot in Niger State (for a small pot)

"Chaff layer" developed in the local rice parboilers

Source: KODAMA Hiroshi (2018) "Dissemination of Improved Parboiling Technology in Nigeria", International Cooperation of Agriculture and Forestry Vol. 40, No.4; and NGA-01, "Project Completion Report", SEN-07 "Manual on the dissemination of the False Bottom Technology"

2-4-4 Transportation and storage

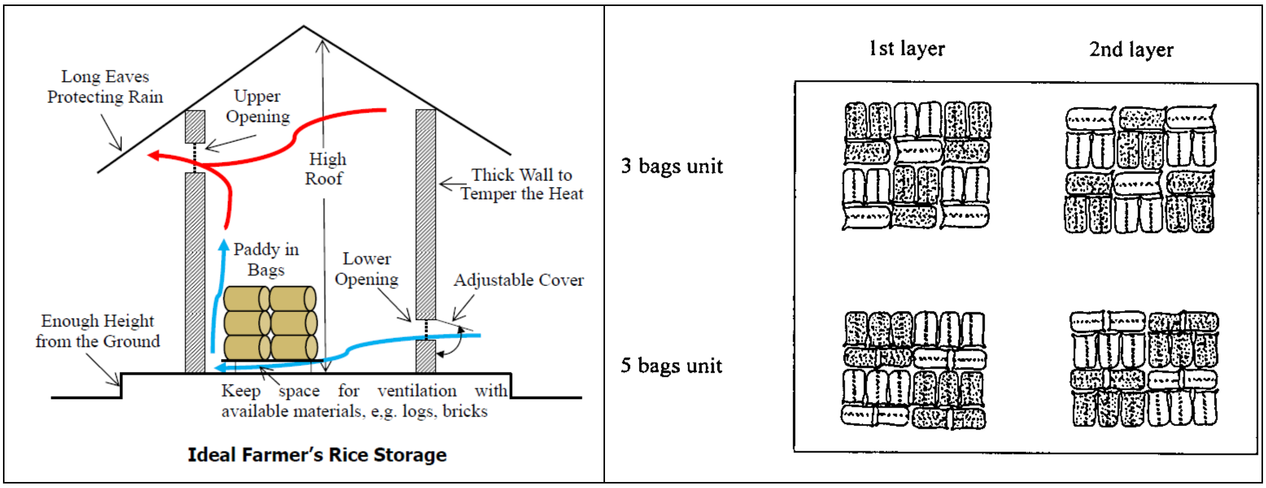
Key points

(1) Transportation

To minimize the loss of rice during transportation, it is necessary to review the transportation route (shortening the distance) and prevent rice from falling out of the truck or cart when being transported from the field with ears by ensuring that the sheet placed on the truck or cart is not damaged.

(2) Storage environment

Many projects have recommended the use of pallets; a system of piling bags (height and piling patterns); isolation between bags and wall; ventilation system; antitheft; material of bags; prevention of the breakage of bags (hammering a nail head); and prevention of damage by animals, birds, and insects. Examples of a typical layout of storage and system of piling bags are as follows.



Source: RWA-01, "Technical Manual for Rice Cultivation, Water Management and Post-Harvest practice" (left); TZA-06, "Project Completion Report" (right)

Fig 2-29 Key functions of the storage and system of piling bags

(3) Paddy moisture content and approximate storage period

As described in the drying and processing section, storing the paddy after drying to appropriate moisture content enables storage of the paddy without quality degradation due to humidity and mold.

Table 2-32 Recommended moisture contents of paddy during the storage for different uses and approximate storage period

Project code	Recommended moisture contents of paddy during the storage by different uses and approximate storage period			Remarks
	For paddy use	For seed use	For seed for a long term storage	
GHA-06	-	12%	-	
KEN-01	14%	13%	Less than 9%	
NGA-01	13-14%	-	-	
RWA-01	14-15%	-	-	
RWA-02	13-14% (6-12 months)	-	-	
CMR-01	-	Germination rate decreased dramatically over a year	-	Humidity because of tropical climate
SLE-01	About 15%	-	-	Re-dried if moisture content increases during storage
TZA-07	14-15%		-	

Note: "-" is used when no data are available.

Recommendations

(1) Motivation of quality control for storage manager

As a lesson in SEN-03, it is important not only for rice producers and rice millers but also for storage managers to understand the importance of quality control of rice during storage and to motivate them. The project provided training on quality control to both rice millers and storage managers, but the awareness of storage managers was insufficient. Moreover, moisture control of paddy was not conducted properly. This is because the main purpose of the storage is to store the paddy, and even if the storage manager manages the appropriate moisture content of the paddy, it does not pay the manager a sufficient amount of money and it does not benefit the persons concerned with the storage.

2-5 Seed Production

Local varieties are generally adapted to their surrounding conditions displaying high resistance to biological and abiotic stress in that particular area. However, they are often not high-yield breeds. The use of good quality seeds of improved varieties would be more likely to improve yield. Adaptability assessments and seed registration should be carried out prior to the introduction of improved varieties from Asia and another region. On the other hand, when breeding improved varieties, it is useful to integrate the genetic characteristics of local varieties for their environmental adaptability and accepted taste. JICA projects has been supporting on the breeding of: i) RYMV resistant varieties in Uganda, ii) high yield, cold resistant and drought resistant varieties in Kenya, and iii) low phosphate resistant varieties in Madagascar.

2-5-1 Seed production system

A certified seed production system generally involves: maintenance of breeder seed and foundation seed by research (breeding) institutions, production of registered seed by parties like semi-private seed production corporations, and production of certified (guaranteed) seed by seed producers (farmers) and private vendors. Certification is done by public seed inspection body.

The right diagram illustrates the inter-relations of actors involved in seed production in Madagascar. In short, FOFIFA, a research institute produces and supplies breeder seed and foundation seed to a seed producer (GPS). CFAMA, another research institute develops and provides agricultural machinery for seed production. ANCOS, a seed inspection institute performs seed certification, and the Seed Production Corporation (CMS) purchases seeds produced by GPS. Support in seed production techniques is provided by the PAPRiz Project. As shown in this example, many actors are inter-related in the seed production system. Its success depends on the efficiency of each actor. Currently, many countries in Africa tend to encounter difficulties in their seed production systems. Hence, there is much for improvement as far as producing good quality seeds are concerned.

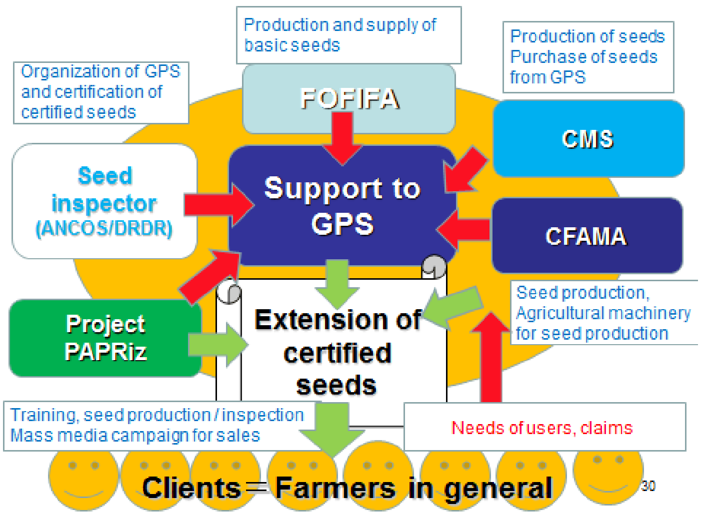


Fig 2-30 Relation among actors for seed production

Source: MDG-01 "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)"

Some projects support non-certified seed production by improving the quality of self-produced seeds by farmers. Examples of seed production challenges and supporting projects are explained in 2-5-5.

2-5-2 Quality Seed Criteria and Role of Seed Inspection Bodies

1）Criteria of Quality Seed

The criteria for quality seed are as follows: i) Varietal purity (unmixed with other varieties, free from seed contamination of other crops and/or weeds, ii) Seed viability with high potential germination rate, free from seed-borne diseases, insects, and pathogens and iii) Desirable seed characteristics: seed size, fulfilling grains, uniformly fine and not mixed with damaged grains.

Sowing good quality seeds leads to production increase, higher selling price due to quality improvement, and the increase of profit due to low input. As a result, yield can increase by 5−20% by using quality seeds like CIV-01 and GHA-06, and the case of CM-02 where the average yield increased by 1.5 times.

There are several causes of seed mixture: natural crossing, genetic mutation, and mixture by self-seeding. Special attention should be paid to avoid mixture during seed handling by farmers and inspectors (e.g., during post-harvest inspection, storage, and sowing).

Proper storing is also important. Seeds are sensitive to storage conditions and should be stored in a cool and well-ventilated place to prevent damages caused by insects, rodent and humidity. Moisture contents of seed should be below 13% for long conservation and re-drying is necessary if stored in humid conditions. Prior to storage, clear indications (harvest date, variety name, seed category, weight, and producer’s name) should be made on the seed bags to facilitate easy identification.

2）Roles and challenges of seed inspection bodies

The main roles of the seed inspection body are i) registration of the seed producers, ii) field inspection of registered seed producers, and iii) laboratory test of produced seeds. Field inspections are often carried out twice, during the booting stage and the heading stage, in CARD target countries. The following tests are carried out in laboratory; measurement of germination rate and visual observation of contaminated varieties, weed seeds, stones, mud, pests, etc.

However, in many countries, the certification of guaranteed seeds is challenged by several factors: limited number and capacity of seed inspectors and inspection equipment, field inspections are not carried out at appropriate timing and frequency, resulting in the certification of low-quality seeds.

2-5-3 Process of certified (guaranteed) seed production

Fig 2-31 shows the process of certified (guaranteed) seed production. Seed production is composed of several steps which may have an impact of the seed quality. Factors that can hinder the production of high quality seeds include low purity of the upstream seeds (breeder seed, foundation seed and registered seed), mixed with other varieties during farming and/or after harvesting.

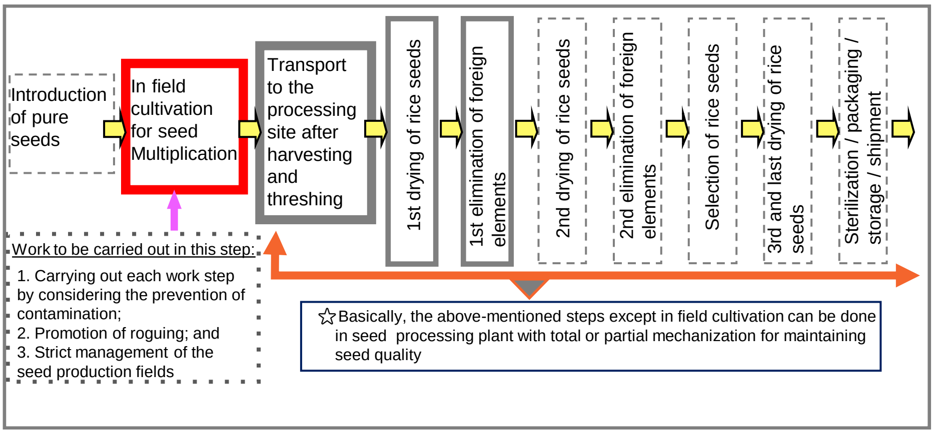


Fig 2-31 Standard process of lowland rice seed production

Source: MOZ-01 "Project Completion Report, Appendix 8"

2-5-4 Good Practices for Seed Production in the fields

There is often confusion between seed production and paddy production amongst farmers. Hence, in addition to the description of the seed production process mentioned above, here are some good seed production practices that should be considered for producing high quality seeds.

The main points and objectives of seed production are:

- Select a plot isolated from plots planted with other varieties (to avoid unintentional crossbreeding).
- Avoid using plots where rice of other varieties was planted in the previous year (to avoid mixing of volunteer seeds from the previous year in germination).
- Implement seed disinfection (to prevent seed-borne diseases).
- Use transplanting instead of direct sowing and the transplants one plant per hill if possible (for easy detection of off-types).
- Remove weeds in the paddy fields and along the bund (to prevent contamination of weed seeds and outbreaks of pests and diseases)
- Implement uniform fertilization (to avoid uneven growth due to uneven fertilization, which makes it difficult to distinguish from genetic variation)
- Carry out roguing (remove undesirable off-types) several times especially after heading (to prevent mixing of seeds).

  Avoid collecting seeds at the edge of the fields (to avoid cross-pollination).
- Avoid collecting seeds from flooded or dried-up fields (disturbed growth may result in difficulties to identify off-types)

Difference in Spikelet color

Difference in heading timing

Photo 2-33 Example of Off-types

Source：CMR-01 "Le stage international par pays 2015 « Stage destiné aux cadres du ministère de l'Agriculture du Cameroun »"（left）、GHA-06 " Guide for Certified Rice Seed production under Irrigation " (right)

Off-types can be determined by plant form, leaf (length, width, angle, and color), number of tillers, panicle length and shape, spikelet (number, length, shape, and color), awn (existence or non-existence, length, and color), timing of heading/ripening, seed shattering, etc.

2-5-5 Seed Production Challenges and Support Project Models

Support for seed production can either be for non-certified seeds (self-produced seeds) or for certified (guaranteed) seeds and/or upstream seeds.

The challenges, the beneficiaries and the support models of various projects are summarized in the following table. Please refer to the additional remarks described for the marked projects "*" on the next page.

Table 2-33 Challenges and support models in seed production

Target seed level		Project code	Challenges	Beneficiaries	Support models
Non-certified seed		CIV-01*	Breakdown of Seed certification system	Producers (target farmers)	Training to improve the quality of self-produced seeds
		SEN-02	Absence of certified seeds		
		GHA-04	Poor quality of seeds available to farmers		
Certified (Guaranteed) seed and upstream seeds	Certified (guaranteed) seed	CMR-01/02 MOZ-03	Insufficient quantity of certified seeds for the use of project activities	Project seed production fields	Production of certified seeds
		CIV-01	Breakdown of Seed certification system	Seed inspectors	Capacity building training of seed inspectors
		BFA-01 CMR-02 MDG-01	Low quality of certified seeds		
		CMR-01 SEN-02* SEN-03		Producers (Seed production groups/ farmers)	Capacity building training of seed producers
		GHA-06*			Supply of high-quality foundation seeds

Target seed level		Project code	Challenges	Beneficiaries	Support models
		SEN-02*	Breakdown of certified seed distribution and sales system	Producers (Seed producers associations)	Connecting producers with private companies and public institutions responsible for distribution
		MDG-01*	Non-utilization of certified seeds by farmers	-	Organization of certified seed promotion campaigns
	Registered seeds	CMR-01	Low quality of registered seeds	Seed production organizations	Capacity building training of seed producers
		MOZ-03		Project seed production fields	Implementation of selection of the original line
	Foundation seeds	MDG-01* MOZ-03	Low quality of foundation seeds	Research institutions	Implementation of purification of Breeders seed and foundation seed
		CMR-01/02	Low production capacity of foundation seeds	Seed production organizations	Capacity building training of seed producers

Additional remarks (*)

【CIV-01】

【A support model on how assistance can be provided within a restrained time period and financial means】

Given limited time and financial means, it was concluded that it would be difficult to improve the seed certification system. On a more practical scale, farmers were provided technical training in self-production of rice seeds in the project.

【SEN-02】

【A support model on how a series of assistance was provided for production, certification, distribution and sales of rice seeds】

Seed producers had opportunities to receive training from other donors and NGOs, but training materials specific to rice seed production were not available. Training on seed certification procedures and technical advice was given to seed production organizations in this project. A rice seed production manual and a guide were also compiled and handed over to the concerned parties.

The project also attempted to help connect seed producers with agricultural input distributors and extension agencies for the purpose of distributing and selling certified seeds.

【GHA-06】

【A support model for the production of original seeds】

The production of foundation seed from breeder seed on the project managed plots facilitated the task of obtaining high quality foundation seeds by seed producing farmers. Capacity building of seed production groups foreseen in the project helped the registration of participants as official seed producers thereby improving their capacity of producing certified seeds.

*In Ghana, the Seed Law does not allow the production of registered seeds and certified seeds produced from foundation seeds.

【MDG-01】

【A support model of how promotion for the use of certified seeds can be made through TV commercials】

A TV commercial was broadcasted to promote the use of certified seeds by a well-known actor, encouraging the use of self-produced local variety seeds for higher yields.

【MDG-01】

【A support model for the purification of breeders seeds and foundation seeds】

Seed purification was carried out by a short-term expert in this project to improve the purity of breeder seeds and foundation seeds. Training of farmers in seed purification of local varieties, which is not carried out by public institutions, was also carried out.

Box. Local Seed Multiplication Program (MOZ-04)

The local seed multiplication program proposed by the Nampula Seed Inspection Center in Northern Mozambique in 2003 with an innovative approach led by the provincial economic office in on-site product review of seeds produced in farmers' fields. Only seeds that meet certain criteria can be distributed within the county as “Guaranteed seeds”. Very often, only improved varieties and not popular local varieties amongst farmers are incorporated into the public seed multiplication system. However, with this new approach, multiplication of highly demanded local varieties is made accessible to all. This approach also allows rural producers to have easier access to seed suppliers. Three field inspection exercises are conducted with this approach at each phase of the cropping season: after transplanting, at heading and prior to harvesting. Only successful seeds are sent for screening at the laboratory to verify contamination rate and moisture contents followed by germination tests. Only successful seeds would be certified as “Guaranteed Seeds”.

2-6 Rice Farming Management and Value Chain Development

Rice farming management is an important skill for farmers in Sub-Saharan Africa who have acquired improved rice farming techniques to increase their profit margins. The majority of these farmers practice small-scale farming, who rarely consider farm planning or cost management to evaluate their expenses and earnings. Often, profit margins are not often maximized as rice is sold at a low price. The purchase of farming materials is not easy for many farmers with little access to financial assistance. Hence, the use of effective techniques by the farmers is undermined given such circumstances. Many projects financed by JICA looked into these difficulties and aimed to improve farmers' management via multiple means including the introduction of farming management, reinforced marketing, organizational support to improve profitability and better financial access.

Table 2-34 Rice farming challenges and support models

Challenges		Support models	Relating projects (Project code)
Inadequate agricultural management		Preparation of farming plans and cropping calendars	GHA-05
		Diversification of cropping system, eliminating bottlenecks for the introduction of second crop	SEN-03, KEN-01
		Training to implement accounting and household management	Many projects
Low profitability	Sales volume	Joint marketing and contract cultivation	MOZ-01, CIV-01, etc.
	Unit	Quality improvement (see 2-4 Post-harvest Processing), joint marketing, branding	
		Marketing survey, consideration of sales timing and storage method	KEN-01, TZA-07, etc.
	Cost	Joint purchase of agricultural materials	MDG-01, SEN-01
		Optimization of agricultural investment	GHA-06, SEN-01
Inadequate financial access and invest		Introduction of a credit system	CIV-01, MOZ-01/02
		Improved access to available financial schemes	RWA-01

2-6-1 Farm planning and management

In order to improve productivity by suitable cropping, it is important to develop farming plans with an appropriate cropping calendar. It is also essential to visualize profits through accounting management and income-expenditure analysis, as well as to have the appropriate techniques to enhance profitability and optimize agricultural investment to ensure sustainable rice cultivation management

Farm planning

The first step to better management using recommended cultivation techniques is to prepare a farming plan before planting. Appropriate cropping should be done according to farm plans prepared in advance to optimize output provided by any technical packages.

Key points

(1) Preparation of farming plans

The items to be considered prior to planting and plan-making are as follows:

Table 2-35 Considerations to be included in farming plans

Items	Factors to be considered	Points to remember
Targets	Target yield, sales volume, and selection of cultivation varieties	The maturity period, the seed availability and the market value of each variety (See 2-6-2 Marketing).
Cultivation condition	Location and field size for planting rice	Field conditions (water environment, etc.)
Materials/Inputs	Calculation of the quantity and cost of agricultural materials required	Procurement methods and timing
	Securing labor and financial resources	Delays in securing these resources make it difficult to do suitable cropping.
	Availability of agricultural machinery	Local availability of agricultural machinery is limited and may not be available at the appropriate time. For details on the use of agricultural machinery, see 2-8-4 Usage pattern of agricultural machinery.
Schedule	Making the cropping calendar	See "Cropping calendar" below

Box. Agricultural management planning in a farming group

In the projects in Ghana (GHA-04 and GHA-05), the target farmers were instructed to prepare action plans (farming programs) according to the cropping calendars. The farmers' groups, with mutual accord, then cultivated according to their action plans specifying target production volume, cultivation period, and variety. Training in creating action plans accompanied by planting calendars and accounting management like the given example were conducted.

Field work	Time frame	Tool and inputs
Land clearing	3 weeks	Cutlass
Seed preparation	1 week	Seeds, salt, egg, bucket, sieve
Sowing	Week 0	String, stick, hoe
Weeding	3-13 weeks	Weeding hoe
Fertilizer application	3-13 weeks	Fertilizer, container, scale
Off-type removal	13-16 weeks	Hand removal
Harvesting	18 weeks	Sickle

Example of an action plan (simplified version)

Source: GHA-04 "Onsite Training"

(2) Preparation of cropping calendars

A cropping calendar is prepared by taking into account local weather conditions and variety characteristics. It is an important process for the effective regulation of water in irrigated paddy fields and for the cultivation planning of rainfed paddy and upland rice, staying in harmony with rainfall patterns. It would also be useful to have a list of major local varieties with maturity classification to program planting and harvest periods.

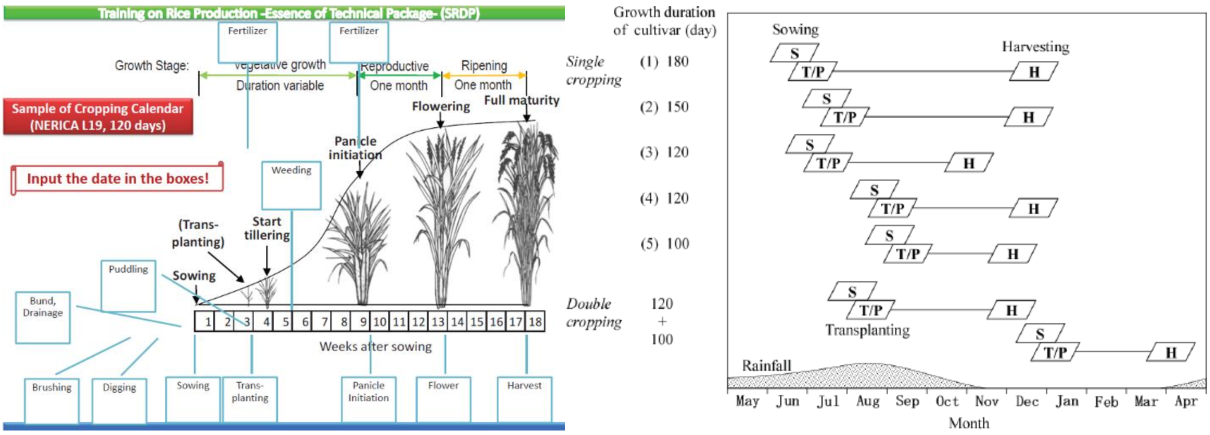


Fig 2-32 Example of cropping calendar (left) and cropping pattern on IVS in Sierra Leone (right)

Source: SLE-01 Training on Rice Production Essence of Technical Package (left), Technical Package on Rice Production Revised Edition (right)

Cropping calendar is a useful tool for promoting suitable cropping. Nevertheless, it may not be easy for farmers not familiar with this or for those with little schooling. Hence, simple and easy to use formats would be ideal to facilitate the important use of cropping calendars for both extension workers and key farmers.

(3) Optimization of agricultural investment

It is important to strike a balance between expected output, agricultural investment, and optimized agricultural investment when preparing farming plans. Depending on the regions, there is a simultaneous under and over-use of fertilizers in Sub-Saharan Africa. The following issues should be considered to maximize profits when examining agricultural investments.

Table 2-36 Points to be considered for agricultural investment optimization

Subjects		Points to be considered
Inputs	Seed	Is the seeding rate and density appropriate?
	Fertilizer	Is the type and amount of fertilizer that maximizes profit established?
	Pesticide	Is the amount and frequency of use appropriate?
Cultivation management	Panting method	Choice between transplanting and direct sowing : Direct sowing cultivation may be more profitable in consideration of local cultivation conditions and labor costs (example: MOZ-01/02)
	Water management	Can water be saved by intermittent irrigation?

In GHA-06, the baseline survey revealed high excess of fertilizers in seeding rate, planting density, and fertilizer level, making the optimization of the input level challenging. The Optimum Input Rice Cultivation (OIRiC) approach was introduced in the project to recommend agricultural investments that maximize returns. Training in appropriate cultivation management, namely, the, use of quality seeds, seed preparation, and improvement in the amount and timing of fertilizer and pesticide applications, was also provided.

Accounting management

Smallholder farmers with little schooling find cost and income bookkeeping rather challenging. Hence, training and workshops were conducted to get these farmers acquainted with the subject by way of introducing easy-to-understand formats. It is only obvious that with the knowledge of income and expenditure calculations derived from production costs, gross profit (sales amount), and net profit (gross revenue - production cost), production problems can be identified and remedied more easily. Teaching the farmers to create a balance sheet after each cropping season also helped them to be more aware of the way to improve the farming management and increase yield quantities in the next cropping season.

Key points

(1) Recording operations

The purpose of recording operations is summarized as follows. It is also necessary to conduct training and workshops to help farmers to understand the significance of this practice.

- Review completed operations and incurred costs
- Determine the level of available resources
- Facilitate detecting and resolving problems related to rice farming
- Facilitate understanding of conditions related to production management

Complicated bookkeeping formats of farm expenses and income would only discourage farmers from this practice. Hence, it is important to consider appropriate recording methods adapted to local circumstances and customs.

Operation		Date	Cost	Remark
Land Preparation	Flooding	1 July 2015	-	
	Rotavation	3 July 2015	3500	
	Puddling with weeding	5 July 2015 (2days)	3000	Hand puddling
	Leveling (hand)	5 July 2015 (2days)	2100	✔Hand ✔Animal
Sowing (100g/ m^2)		5 July 2015	1900	Seed cost
Line transplanting (30cm x 15cm)		26 July 2015	5000	
Intermittent irrigation (start)		6th August 2015	2000 + 1000	O & M, canal drainage
Intermittent irrigation (end)		4th September 2015	-	Panicle initiation time

Fig 2-33 Example of format for records of operations

Source: KEN-01 "Guideline on how to disseminate WSRC through farmer to farmer approach"

(2) Income and expenditure analysis

It is important to keep in mind that the composition of production costs varies depending on the farming system as well as the cultivation method, and to present the simplest possible way for farmers to analyze their income and expenditure. There is a need to organize workshops to reinforce farmers' capacity to select profitable cultivation methods and farming materials based on the merits (increase in production) and demerits (increase in production cost) system (example: Fig 2-34).

Production costs: Total of material costs + labor costs + land costs + water management costs + farm machinery usage fees, etc. (changes depending on cultivation conditions)

Gross revenue : sales

Net revenue : gross revenue less production costs

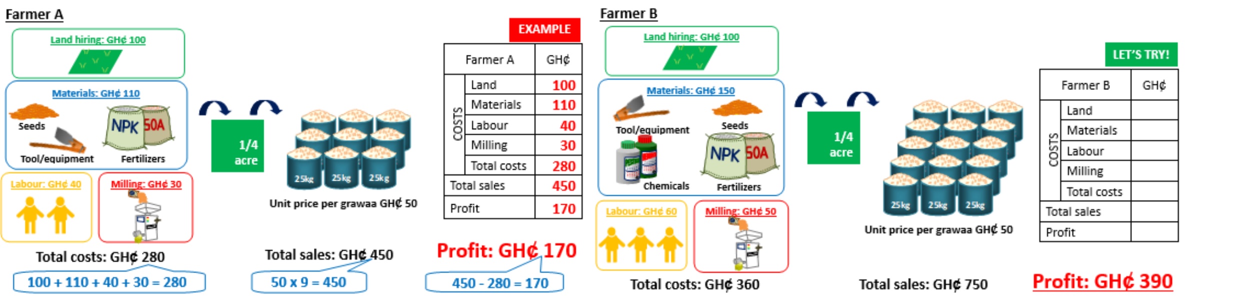


Fig 2-34 Example of a manual used to teach farmers in income and expenditure analysis (GHA-04)

Source: GHA-04 "Farm record keeping book"

(3) Gender and Family Economics Training

Successful family management of income and expenditures is the key to improving the livelihood of small-scale farmers. Household management should be a joint effort from both husband and wife to grasp both the amount of annual expenditures and rice production expenses. Training programs that include gender sensitization and family economics, as shown in the table below, improve the overall livelihood of smallholder farmers and increase farming productivity given the importance of women's role in agricultural production. These efforts are also reflected in the activities financed by JICA to promote Smallholder Horticulture Empowerment & Promotion (SHEP).

Table 2-37 Gender and family economics training contents

Subjects	Contents of training
Roles and responsibilities	Organize the role-play of farming and non-farming production activities by dividing training participants into men and women's groups to promote better gender comprehension and mutual respect.
Control of resources and management	Organize role-play of resources and management control by dividing training participants into men and women's groups to promote better gender comprehension and mutual respect.
Activity logbook	Organize daily activities (agricultural production, housework, etc.) by gender and write down them into simple calendar. After that, they can compare each other's activity calendars and review how they use their time.
Household management	Compare listed monthly expenses of men and women's groups, analyze differences in perceptions of household budgeting and debate the challenges.

Source: Prepared by JICA study team based on "SHEP Handbook for Extension Staff"[24] and RWA-02 SMAP Cooperative Management and Gender Mainstreaming Technical Manual"

[24] https://www.jica.go.jp/activities/issues/agricul/approach/shep/ku57pq00001zwgkc-att/shep_handbook_en.pdf

Box. Efforts for gender mainstreaming in Tanzania

In sub-Saharan Africa, women play a major role in agricultural work. However, they are often deprived of agricultural training, extension activities, and decision-making power within agricultural cooperatives and water users' organizations. Consequently, the projects in Tanzania were implemented with an important gender perspective. Agricultural technical training sessions were attended by an equal ratio of men and women. This form of gender training contributed to improved rice productivity and increased household income. Furthermore, the introduction of hand-operated weeding machines has not only reduced the burden of weeding works normally done by women, but has also encouraged men to do weeding works too.

Source: JICA, "Africa CARD Initiative Report on Gender Analysis in Rice Development in Tanzania", October 2010

Diversification of cropping system

Given the appropriate farming conditions, a double cropping system can help to increase farm profits with the optimization of paddy field use by alternating upland rice cropping and with a second vegetable cropping. The diversification of cropping system presents several advantages: effective use of the labor force during the off-rice-farming season, increase farm profitability by cultivating other crops, and adequate measure to prevent crop failures due to sideward waterlogging during rice flooding period.

In many cases, cash crops are introduced as the second crop to increase profits. Therefore, the choice of this second crop will depend on its storability, transportability, and consumption demand at harvest time. Considerations must be given to year-round labor allocation of human resources throughout the two cropping systems; labor peaks should not be concentrated at one given time.

Preventive measures must also be taken to prevent increased damage by rodents and birds when cultivating during the off-peak harvest period; the nuisance may increase due to absence of other crops in the surroundings.

Key points

(1) Crop-Diversification System Patterns

If single-season rice cultivation in the rainy season is the standard cropping system, the following patterns can be considered for the diversification of cropping systems. Assuming that crop diversification would increase profitability with yearlong farming activities, the cropping system should be determined after calculating the income and expenditures.

Rice paddy: double crop (rainy season crop+ dry season crop), sequential crop (rainy season crop + sequential crop)[25]

Other crops: upland crop or vegetables after rainy season

25 Sequential crop refers to the second crop grown after the harvest of the first crop, mainly carried out in tropical and subtropical areas. In some areas, the yield is about 20 - 50% that of rice grown from seedlings.

(2) Consideration of cropping plans

When considering cropping systems, attention should be paid to the subjects shown in the table below. Countermeasures for identified challenges from analysis of experiences should also be discussed.

Table 2-38 Factors to be considered for crop diversification system

Subjects	Factors
Cultivation environment	Is there adequate farming water for dry season cropping? Are there any drainage problems after the end of the rainy season when cultivating upland crops and vegetables on the paddy fields?
Funds	Is it possible to purchase agricultural materials for the dry season crops?
	Is it possible to repay loans and borrow funds?
Cropping schedule	Is the maturity time of the rice varieties used appropriate (for example, use of precocious varieties)?
	Do the planned planting and harvesting seasons correspond accordingly to the rainy and dry seasons? Are there problems relating to labor and agricultural machinery organization?

Project Examples

(1) Double cropping analysis (SEN-03)

In Senegal (SEN-03), the double cropping system was introduced to increase the rice-cropping rate and farmers' profitability. The pilot activities carried out put to light the many challenges faced in double cropping.

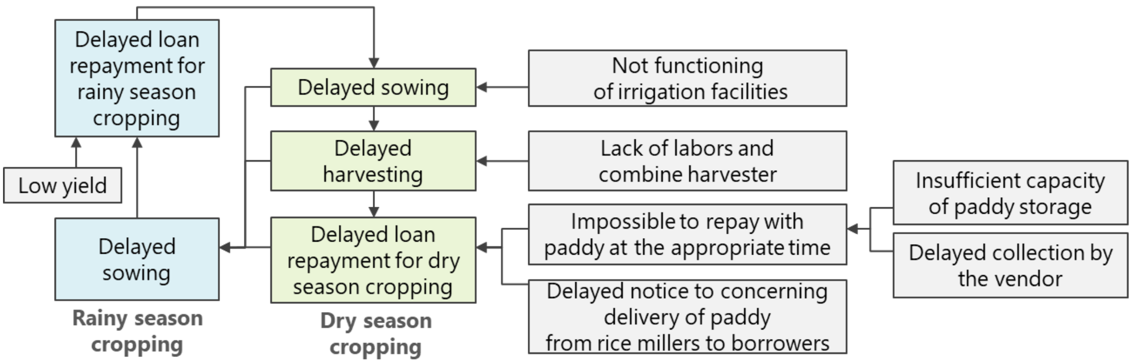


Fig 2-35 Identified challenges relating to double cropping system

Source: Prepared by JICA study team based on SEN-03 "Project Progress Report (phase 2)"

The following is a summary of the approach and lessons learnt from the pilot activities carried out in Project SEN-03.

1) **Block management**: Paddy field covered by each secondary canal is divided and managed by blocks. The same varieties are used in each block to facilitate farming and water management.

2) **Development of proper irrigation areas**: Maintenance and management activities were carried out by the cooperatives to implement two cropping seasons based on the cultivation plan. Future challenges include large-scale renovation of existing facilities and infrastructure development.

3) **Double cropping plans:** A "recommended double cropping cultivation calendar" was prepared; workshops and training were conducted to ensure that rice cultivation preparation works and farming management would be carried out at the appropriate time.

4) **Facilitation of loan repayment procedures (full-year loan)**: In the past, farmers had to submit separate bank loan requests required for both rainy and dry seasons. To address this problem, a new system was introduced in which farmers could submit simultaneous loan applications for two cropping seasons before the start of the dry season, eliminating the need for loan screening before the rainy season. This system facilitated the double cropping system in the two seasons. Nevertheless, communication within the system can be improved in the near future; the farmers and cooperatives should keep rice millers and financial creditors informed when paddy rice is stored in warehouses.

(2) Introduction of non-rice crops including ratoon cultivation (Project KEN-01)

In the Mwea Irrigation Scheme (MIS) of Kenya, the official cropping system was 1.5 cropping seasons of the main cropping season plus hickory crops, but some farmers prefer to earn higher profits by growing additional horticultural crops after the 1.5 cropping season. Therefore, in Project KEN-01, the highly profitable farming system was specified to 1) recommend "IRaP (Improved Ratoon Production)" among 1.5 cropping systems, and 2) introduce horticultural crops to increase profitability.

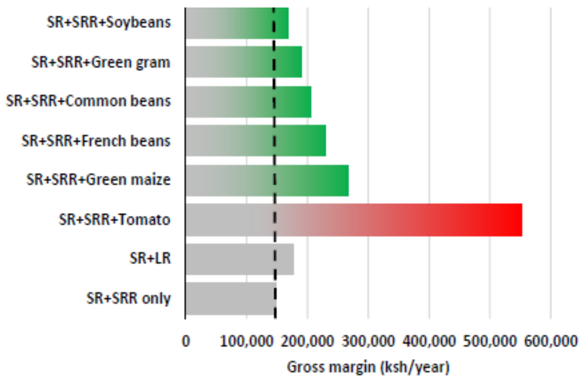


Fig 2-36 Gross margin for each cropping system

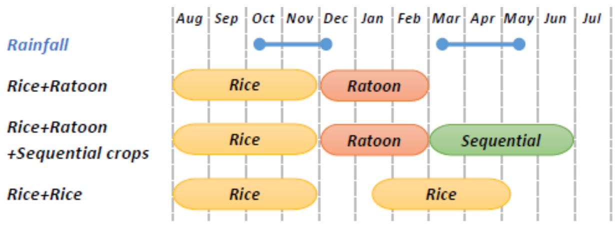


Fig 2-37Cropping calendar

** SR: Short Rain season, SRR ：Ratoon after Short Rain season*

Source: KEN-01 "Guidelines of Sequential Crop Management in MIS"

2-6-2 Marketing

Little information was known of consumers' expectations of paddy and milled rice quality to help formulate or commence the projects. Therefore, it was helpful to carry out a data collection survey to design effective sale strategies with the knowledge of: consumer preferences, quantity and quality of domestic and imported rice, price fluctuation patterns, existing quality standards and the expected roles of concerned stakeholders.

When planning and implementing the survey, it is worth bearing in mind that different regions and markets have different market needs and distribution patterns. For example, as seen in Senegal (SEN-01 and 03) and rarely anywhere else, broken rice, if completely separated from whole-wheat rice (head rice), has almost same commercial worth as the latter In northern Ghana, as shown in Fig 2-38, distribution patterns depend very much on the patriarchal or matriarchal aspect of the farming household (GHA-05).

Small-scale farmers, targeted in most JICA projects, are generally in a disadvantageous position in terms of business management with limited output, insufficient technical skills and information access, being far from the markets. Farmers, with similar challenges like these, can be grouped together to increase sales output and be trained in efficient technical as well as bargaining skills, thereby providing them with more favorable business negotiation tools.

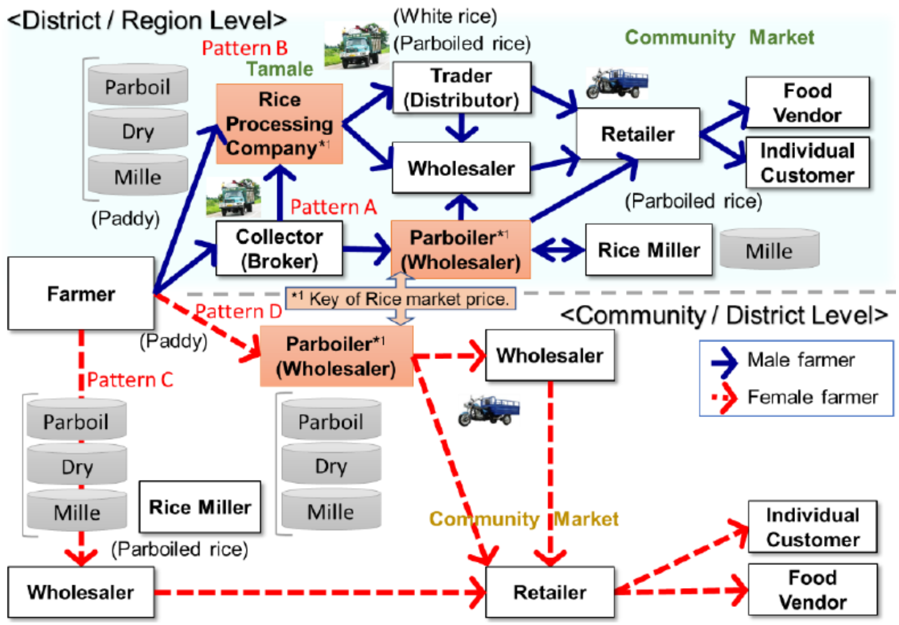


Fig 2-38 Distribution analysis of locally produced rice in Northern Region

Source: GHA-05 Project Progress Report (phase 2) "

Key points

(1) Assessing the quality and standards of unhulled and milled rice required by the market

In Tanzania (TZA-07) and other countries, baseline surveys and market surveys were conducted amongst distributors, rice milling companies, market players, restaurants, and experienced NGOS and organizations. Other activities include conducting questionnaire surveys concerning consumer preferences in agricultural trade fares to promote local rice and, gather prices at given spots in the markets in Senegal (SEN-01) and trial sales of milled rice in different package sizes in places including Cote d'Ivoire (CIV-01).

In some cases, surveys were outsourced to experienced consultants. In others, surveys were

Photo 2-34 Consumer preference survey and domestic rice promotion

Source: SEN-01 "Project Completion Report" conducted alongside project partners to initiate technology transfer in the goal of capacity building and raising awareness.

Box. Adoption of AMTUL model as an analytical method of consumer preference

CIV-01 adopted the AMTUL model, a method that can identify the consumption stages of a product. AMTUL stands for Awareness, Memory, Trial, Usage, and Loyalty.

This method is considered suitable to evaluate the consumption of rice patterns as it is a product that is purchased frequently and on a regular basis. While other consumers' behavior assessment models like AIDMA are more suitable for one-time product purchase patterns, the AMTUL method, allows the assessment of "multiple purchases and uses by consumers", quantifying the customer's purchase level at each stage.

Furthermore, the results of the baseline preference surveys can be reanalyzed using the AMTUL model by categorizing the questions and comparing the results with the final findings of the project.

Source: Prepared by JICA study team based on CIV-01 " Ligne Directrice de l'Approche du Projet and questionnaire survey with ex-project experts in 2020.

(2) Making a marketing strategy

As shown in section (1), a sales strategy can be formulated based on analysis results. For example, in the case of Kenya (KEN-01), annual fluctuation prices of paddy and milled rice are clearly traced, as shown in Fig 2-39, to suggest the advantage of selling properly stored paddy or milled rice only after March when the prices rise, instead of immediate post- harvest sales. In other words, the sale of milled rice in December or paddy rice in March would increase profit margins by 30% and by 50% if milled rice were to be sold in March. As far as annual cropping patterns are concerned, the cost-benefit ratio comparison between "Ratooning in Rainy season" and "second cropping" shows that the practice of "double cropping" can increase profits by about 30%.

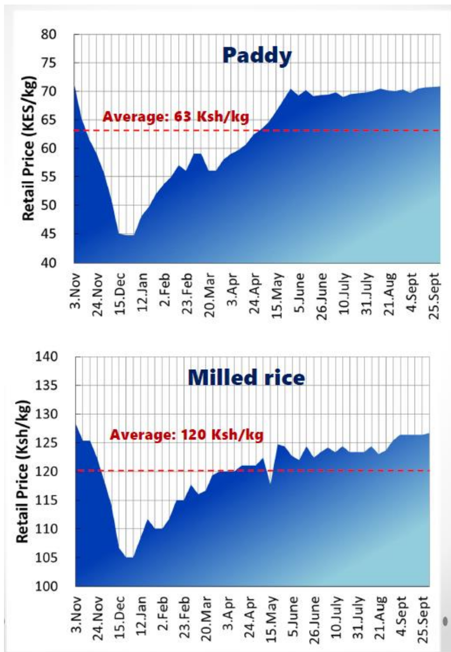


Fig 2-39 An example of price trend analysis for paddy and milled rice

Source: KEN-01 " Market Oriented Approaches "

In TZA-07, the Warehouse Receipt System was introduced during the marketing training. This system encourages farmers to have their rice stored in a warehouse until the appropriate time to sell their crops, i.e., when price of rice rises. When so, the farmers can then proceed to retrieve their rice against given receipts to sell. They are free to choose the quantity of rice to be stored, the timing or the season of the sale of their rice. In a district where the corresponding training was carried out, it was said that a warehouse and a rice milling station were put up with the support of the district office. As a result, rice could be stored and sold timely at a favorable price.

It was reported that the farmers in another village (TZA-06) sold their produce during the off-season at prices 56% to 78% higher than if they had sold their crops immediately after harvest. The perceived benefits of this system encourage these farmers to adhere to the rice storage practice as a survival mode.

On the other hand, the case in Rwanda (RWA-02) clearly showed an important lesson, that inadequate infrastructures and delays in the collection of paddy by millers hindered the increase in profits.

In Mozambique, the project of MOZ-02 not only showed that the scarcity of local rice could not meet the high demand in rice, it also put to light the challenges of low milling yields, inadequate milling quality and high labor costs in post-milling services. The three different ways in which the processing and marketing of rice by farmer groups like FSG could contribute to farmers' profits are shown in Table 2.1. The calculations of processing and all other labor costs show that farmers who work individually and sell their rice directly as milled rice at a high price, make less profits than those who sell unhulled rice to large rice mills. This is due to the high labor costs incurred for sorting and de-stoning the rice after milling. The farmers can reduce the costs of these services and increase profit margin if they were to place their orders as a group and not as individuals.

Table 2-39 Example model of cost and benefit analysis per 1kg of paddy

Items	FSG sells milled rice without sharing the costs of post-milling cleaning costs and selling (Mt.)[1]	FSG sells milled rice and farmers share the post-milling cleaning costs and selling (Mt.)	FSG sells paddy directly[2] (Mt.)
Sales[3]	15	15	8.74
Cost for milling	3	3	0
Cost for cleaning (removing stone and broken rice)	1.25	0	0
Cost for packaging	0.7	0.7	0
Cost for transportation	0.5	0.5	0.5
Cost for selling	1.5	0	0
Profit	8.05	10.8	8.24

Note: 1) Mt : Metical, the currency of Mozambique.
2) Estimation based on paddy sale with 13% of moisture contents to Inanacio de Sousa company
3) Estimation of 0.5kg of milled rice obtained from 1kg of paddy

Source: MOZ-02 "Project Completion Report"

(3) Marketing training

In many projects, much training has been provided to try to bridge the gap between marketing strategies and the reality on the ground. In some cases, market training also includes conducting surveys and baseline surveys to assess the current situations and to enhance marketing skills of beneficiaries as part of the technology transfer process. The following table shows the contents, ideas, and lessons learned in the marketing training.

Table 2-40 Example models of implemented marketing training programs

Targets (Trainees)	Training contents	Outcome : Good practices and lessons learnt	Project code
Farmers group, farmers cooperatives, etc.	Organizational management, accounting	Simultaneous training in marketing and post-harvest technology skills : two related aspects for determination of selling price	BFA-01

Targets (Trainees)	Training contents	Outcome : Good practices and lessons learnt	Project code
	Market survey	Training included a participatory market survey which unveiled consumers' major concerns: 1) price, 2) quality and 3) packaging.	CMR-01/02
	Organization, collective shipping and selling	Identified need : to establish norms to maintain an effective system of cooperation	MDG-01
	Organization of buyers' contact information, record keeping of store management, market information gathering calculation of transportation costs	A prerequisite for producing good quality rice is the application of improved technology package that farmers have learned from demonstration plots in their own fields.	GHA-05
Farmers and middlemen (Joint training)	Accounting, accessing market information, information sharing, quality control of proper paddy storage, signing of sales agreements through stakeholder meeting	Successful outcome: Price of rice sold was 10% above that before training.	TZA-07
Consumers, retailers, and other buyers (Joint training)	Introduction of different recipes using domestic rice as sample tasting, and grasp consumers' preferences and conditions to buy, trial of sales leader system (Fig 2-40)	Promotion campaign was enhanced by broadcasting diffusion via local TV station and radio programs.	TZA-06
Distributors specializing in selling local rice	Branding, packaging, setting standards of high-quality paddy and milled rice, management, and accounting	Consumer needs were analyzed via 4P/4C by distributors. Printing companies need minimum order quantities that may exceed possible output of small and medium-sized suppliers.	CIV-01

(4) Market channel development and trial sales

The type of sales configurations and targeted customers roughly classify sales development efforts and trial sales into the three following patterns. The supply chain flow, in reality more complex, is simplified here limiting brokers to distributors, intermediaries and consumers in all forms; restaurants, retail stores as well as individuals.

Pattern A: Selling of paddy to rice millers and/or distributors by individual farmers

This is a general supply flow prior to the organization of farmer groups. Farmers being exploited by intermediaries are apparently a common scenario, in production areas situated far from the markets where the necessary infrastructures like proper roads or storehouses are not available. Nevertheless, little input is needed to make adequate use of the existing sales system. Some examples are as follows.

- GHA-04: This project in Ghana newly established a "Rice Quality Improvement Forum" consisting of farmers, rice milling companies, and intermediaries, etc. It provided farmers with an opportunity to learn about consumer preferences through rice milling companies and intermediaries, and in return, the rice milling companies and intermediaries learnt about farmers' efforts to improve quality. Prior to the existence of this forum, some farmers made efforts to improve their paddy quality but were discouraged as their rice was mixed up with those unconscious of consumers' preference. When the forum was established, the millers made sure that high-quality rice was filtered from others at the distribution stage, achieving early sales and high prices.

- CIV-01: The establishment of a platform in this project in Cote d'Ivoire encouraged active participation from producers, rice milling companies, distributors, and other stakeholders. participate proactively. This platform facilitated dialogue and information exchange among all stakeholders. Training was also organized for rice millers and distributors in quality control and bookkeeping, and a paddy purchase credit was also made available to rice millers (see the section on rice millers and distributors in 2-6-4 Financial accessibility). This project resulted in a 78% increase in the volume of rice purchased by millers and a 74% increase in the volume of milled rice sold by distributors.

Pattern B: Selling of paddy to rice millers and/or distributors by farmer groups

The advantages of farmers coming together to sell their rice crops collectively include developing new markets and brands, which an individual farmer with limited output can never have. Collective crop sales require 1) clear-cut annual production plans (indicating quantity, collection and sales timing) 2) standardization and verification of varieties and 3) securing necessary farming materials and other resources (including funds) to achieve production targets. Examples of collective rice selling are as follows.

- MDG-01: In Madagascar, seed farmers including individuals or small informal groups, were brought together at the prefecture or district level to exercise higher negotiation power though collective marketing, collection and sales. Consequently, a workshop was organized in the project to develop sales channels, which led to spontaneous publicity amongst the farmers in the surrounding areas and triggered successful sales to material suppliers in local regular markets and hub cities and to large consumers in the capital. The total amount of 150 tons of seeds in the 2 prefectures were completely sold out. The lesson learned from this success revealed that with increased negotiation power, it is vital to establish norms to maintain cooperation within the farm groups.

- TZA-06: The Sales Leader (SL) system was introduced in this project in Tanzania in which members, appointed by the farmer organization, collect information on market prices and buyers of rice for collective marketing by the farmer organization. Allowing farmers to sell their produce at better prices while reducing the per capita labor involved in obtaining market information and negotiating selling prices is a big advantage of the SL system, as shown in Fig 2-40. The success of this system issubjected to the following key points: (1) the

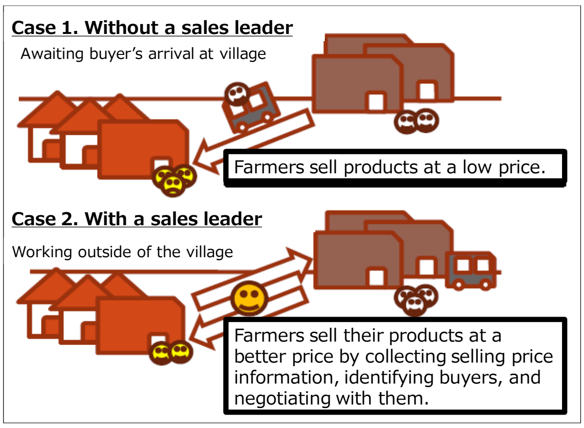


Fig 2-40 Advantage of SL System

Source: TZA-06 "Project Completion Report" cost of SL activities should be borne by the farmer organization members to encourage them to prepare realistic marketing plans and implement marketing activities, and (2) target selling prices should be set in advance among the farmer organization members. This will not only enable SLs to facilitate negotiations with buyers, but also reduce the "gambling behavior" of waiting and hoping for a price increase.

Pattern C: Selling of milled rice to distributors or customers by farmer groups

The collective selling of milled rice to distributors or consumers presents often both high risks and high returns for farmers' groups. Required conditions: 1) the groups of farmers must be highly organized, 2) close proximity to markets, namely in the suburbs of cities, 3) well-established transportation infrastructure network such as roads leading to markets, and 4) a stable production of paddy and milled rice in both quality and quantity. Inter-farmer group competition for direct sales is likely to be high with limited number of major customers. Some examples are as follows.

- MOZ-02 In this project in Mozambique, milled rice was consigned to three grocery stores in local cities. The sales in two out of the three stores went well while the one in the third shop was hindered by packaging problems. The packaging was incomplete without mention of the name of producers, production area, variety, and production year, due to the undermined capacity of the farming support group (FSG) made up of farmers. Another group of farmers tried direct sales by setting up a small stand in the downtown area of nearby city. The sale of 76 bags (5 kg/bag) in 4 days was a success but the labor costs led to higher costs.
- GHA-05: The training provided in this project in Ghana resulted in increased opportunities for direct sales to retailers and consumers at higher prices. The farmers themselves promoted the milled rice to retailers and consumers (by offering free samples) as a mean to appeal the quality of the milled rice, marking a different way of selling their rice.
- GHA-04: In this project in Ghana, an application developed by ESCO was introduced as part of its marketing training. Upon subscription, farmers will obtain vital information like market prices as well as weather data in 46 major markets across Ghana. They can also be linked to potential buyers if they register their profile and provide production quantities.
- MOZ-01: The FSG, established in this project in Mozambique, succeeded in selling their rice, as a local brand, at a high price to a restaurant in the capital of Maputo. They organized the milling, post-milling cleaning and transporting services. Their success was also partly due to their proximity to the capital; a 4-hour-car-ride on well-maintained roads.

2-6-3 Improving profitability through structural strengthening

One of the measures to better promote the ideas discussed in 2-6-1 Farm planning and management and 2-6-2 Marketing, would be to encourage organization of famers' groups and to reinforce their capacity. Grouped farmers can carry out both joint purchases of agricultural materials and bulk crop sales, hence enhancing their negotiating power as a purchaser and seller. The appropriate measures to encourage farmers' organizations and capacity building vary and depend very much on the presence or absence of farmers' unions or groups and their existing capacities. The examples of measures taken in this aspect by JICA are shown in the following projects.

Table 2-41 Types of structural strengthening of farmers' organizations

Type	Support models	Project code
Organizational Support	Establishment of the farming support groups under the jurisdiction of water unions	MOZ-01/02
	Establishment of the seed farmers' unions	MDG-01
Capacity Building	Support for farmers' groups' transition to union corporations	CIV-01
	Strengthening of existing farmers' unions through training (strengthening financial management, etc.)	RWA-01/02, SEN-01/03

Organizational Support

Organization support can be provided if there is an absence of farmer groups or unions. Water Users Organization that exist in some cases may not support farming activities in particular. In others, there may not be special unions that support seed production. The actions taken by JICA in Mozambique (MOZ-01) are shown below as an example. The activities of the concerned groups have since continued since the completion of the project a decade ago.

Key points

In Project MOZ-01, the existing water supply unions were initially established under state leadership uniquely for the management of water distribution in the secondary channel system. The smallest water users organization had more than 100 members, making it too large to support farming activities. The FSG was thus established as a sub-group within the water users organization.

(1) Election of FSG members

In this model, the FSG members were elected by the water organization members.

(2) Mutual Agreement concerning the Role and Objectives of FSG

The following terms were mutually accepted within the groups in the project. 1) The FSG would support the farming activities within the jurisdiction of the model water users organization 2) the funds generated from the use of rice milling machines would be used to support farming management and the earnings made from the demonstration plots would be used for the purchase of faming inputs.

(3) Scope of FSG Activities

In Project MOZ-01, the FSG were put in charge of the activities described in the table. There was extra-care to improve the transparency of fund management by these groups; verification of accounting matters were carried out during group meetings. The project proved that these FSG have become self-reliant because as of today, rice-milling services and microfinance services still operate with generated revenue for the concerned farmers in the project.

Table 2-42 Project support for activities and output of FSG

Type	Activity output	Actions Taken in the project
Rice milling company	The rice miller operates throughout the year and provides rice milling services to FSG members and neighboring farmers. The rice milling fees collected become in turn, the operating funds.	Introduction of rice milling machines, training on operation, maintenance and management of rice milling machines, and training of fund management
Microfinance	Tilling services and farming materials are provided to farming groups via microfinance support before cropping, and the farmers repay loans after rice harvest. The revenue generated will then be used for the next cropping season.	Support for the initial year agricultural materials and financial management training
Joint marketing	FSG sells recovered milled rice to urban areas after milling, sorting and packaging it.	Marketing support and training

Source: Prepared by JICA study team based on MOZ-01 Completion Report-

(4) Formalization of FSG statute incorporation

Clauses, drawn from the trials of the above-mentioned activities, were incorporated in the FSG statute with mutual agreement from the local authorities (SDAE, HICEP) to promote its sustainability and transparency.

Capacity development of Farmers' Organizations

Capacity development can be provided to enhance performance of existing farmers' groups or unions in the target area. Lack of accounting management skills is a common problem amongst the groups that need support. Measures taken in some projects in this aspect are as follows.

Key points

(1) Supporting the legal registration of existing farmers' groups

In CIV-01, JICA assistance was provided to support the transition process of rice producer groups to cooperative societies "SCOOP" in accordance with cooperative laws. These groups were given organizational training and simplified notions of up keeping ledgers all sorts of documents like annual activity plans, financial plans, cultivation plans and milled rice collection ledgers. During the project, 15 groups completed the transition and made profits from their grouped activities (supply of materials and sales of crops) helped by the use of prepared ledgers. As shown, structuring cooperatives in this way can be advantageous in terms of better communication, higher credibility in both sales negotiations and with regard to lenders. Nevertheless, it is important to implement active participatory management through the management of common ledgers with the aim of making profit as an organization, and not end the process simply with a formal corporate registration.

(2) Strengthening of existing farmers' unions through training

In RWA-01, a workshop was organized to analyze problems related to organizational management at key cooperatives. The results showed clearly that the associations shared common problems: lack of accounting skills, unclear division of roles expected of members, and inadequate management of cooperatives. Consequently, ToT programs were conducted for district and sectorial dissemination agents, who in turn, using the cascade method, trained the dissemination members in associations. The contents of the training programs were as follows.

Table 2-43 Training program contents

Themes	Training contents
Cooperative management	Clarify objectives to organize cooperatives, transparency, roles, authority and responsibilities of cooperative members, methods of cooperative formation, etc.
Leadership	Features of good leaders, importance of information sharing with cooperative members, cooperative structure (general meeting, officers), etc.
Gender	Definition of gender, roles and responsibilities of men and women, preparation of activity calendars and action plans
Accounting	Fundamental accounting skills, financial management (using receipts and invoices, etc., and management of receipts and payments), annual financial reporting
Formulation of business plans	Business planning method, basics of market analysis, list up of necessary resources, business impact evaluation, and revenue and expenditure forecast

Source: RWA-01 PiCROPP Organization Strengthening/ Gender Mainstreaming"

(3) Joint purchasing

One of the effective measures to reduce the investments costs would be the joint purchase of agricultural materials. This practice was implemented in Senegal (SEN-01) and Madagascar (MDG-01).

1) **Selection of suppliers**: Preference should be for agro-material suppliers willing to negotiate prices through bulk purchases; discuss procurement volume, prices, and payment methods to reduce procurement costs.
2) **Quantification of planned purchase volume**: Estimate the needed amount of agricultural materials based on the production plans made by cooperatives prior to joint purchase. In areas where fertilization is not common, the amount of fertilizers needed may be less than the planned amount; training in cultivation management is also important.
3) **Choice of payment methods**: The choice of payment between payment upon receipt or post-harvest reimbursement to the cooperatives should be made according to the terms laid down by each cooperative and the situation of each farmer.

Box. Creation of platforms comprising of actors in the local rice value chain

In the Project CIV-01 in Cote d'Ivoire, a platform was created to allow an exchange of information, problems and solutions between identified related actors (producers and private companies) in the two target provinces. For the first time, related actors in each province had the opportunity to meet up before and after the rice harvest season. The repeated activities (of networking forums, market oriented training and seminars) encouraged spontaneous mutual enthusiasm which resulted in the conclusion of some contract farming and farm machinery service contracts between farmer cooperatives and rice millers, leading to the consolidation and improvement of the entire local rice value chain.

Confirming the results of contract cultivation with platform members

Nevertheless, there were cases where farmers did not comply with the contract terms (namely by selling rice to non-contracted rice millers or lacked funds to purchase milled rice). Support was given in the project to help resolve this sort of problems through many ways ; close monitoring of rice production to crop harvest, training on contract cultivation and establishing a financial mechanism for rice milling companies (see 2-6-4 Financial accessibility).

Source: CIV-01 "Ligne Directrice de l'Approche du Projet "

2-6-4 Financial accessibility

Often, cultivation techniques could not be put to practice due to the lack of funds to purchase appropriate agricultural materials. It is also difficult for rice milling and distribution companies to secure revolving funds to continue their business. As a response to these needs, support provided in the JICA projects included improving financial access for small-scale farmers and distributors/rice millers incapable of obtaining credit from private financial institutions.

Target: farmers

Securing the necessary funds for purchasing agricultural materials is a major challenge for farmers in many cases although the situation varies, depending on the region and the size of the farms. Funds were provided in the a few projects to help farmers in this aspect. However, care was given in the following projects to promote financial measures that would help farmers to be independent and to practice sustainable farming through the cultivation of suitable crops at the appropriate time.

Key points

Pattern A: Establishment of a credit system to purchase agricultural materials based on collaboration with private financial institutions

In Project CIV-01, a credit system was established with the collaboration of private financial institutions (COOPEC) and material distributors. The policies and the lessons learnt are as follows.

- Credit provided was based on cultivation area rather than potential area for cultivation. By defining the exact dimensions of the farming area, farmers avoided purchasing excess materials.

- The farmer transfers cash equivalent to 10% of the credit amount to his account and declares an equivalent of 30% of collateral goods. The maximum amount of credit (150,000 FCFA/ha) is set based on the cultivation standards and the calculation of rice crop balance. The interest rate is 10.8% as per COOPEC normal standards.

- Successful operation of the credit system was strongly influenced by the well-functioning of the farmer's groups and cooperatives. If there were an absence of water storage facilities or properly managed irrigation system, the risk of yield loss due to water shortage would have made making repayments difficult.

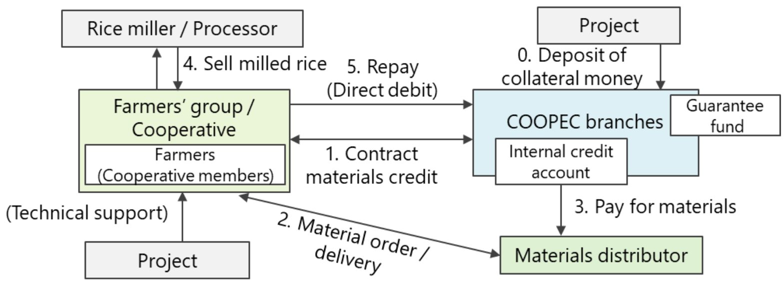


Fig 2-41 Applied agricultural materials credit system on CIV-01

Source: Prepared by JICA study team based on CIV-01 "Ligne Directrice de l'Approche du Projet "

- Material credits alone would not be sufficient for technical success. The system would need to be accompanied by the improvement of production technique, sound organization of farmers, and the securing of stable markets formed by the functioning of other actors in the value chain.

Pattern B: Establishment of a loan system within the cooperative

In MOZ-02, JICA assistance included the supply of agricultural materials to model farmers who in turn repaid the cost of agricultural materials to FSG in milled rice or cash after harvesting. To anticipate the rise in materials prices, model farmers repaid the loans with an additional 10%. The funds from the repayment were then used as revolving funds to purchase agricultural materials for the next cropping season establishing a system that supports farmers on a sustainable basis. Given the difficulties in collaborating with private financial institutions, this option could be a possible way to establish a system that does not rely on external support, namely loans.

Pattern C: Strengthening business planning capacity

In RWA-01, guidance assistance was provided for the preparation of business plans during the business plan training (Table 2-43) with the goal of capacity building of organizations. A successful example would be the business plan submitted by a cooperative (for the construction of a milled rice storehouse) to SACCO (Saving and Credit Cooperative), which was successfully approved for credit finance.

Target: Rice millers and distributors

Financial schemes available to associations in charge of rice milling, processing and distribution, as well as small and medium-sized enterprises are often limited and inappropriate. Often, the requirements for collateral and guarantors are more stringent for high-priced loans, namely, for equipment installation, and loan interest rates are too high for low-profit rice businesses. On the other hand, financial products offered by microfinance institutions do not meet their needs in terms of loan duration or maximum credit line.

Key points

Pattern A: Establishing a credit system for the purchase of paddy rice in collaboration with private financial institutions

In Project CIV-01, a credit system for the purchase of paddy rice by rice millers was jointly established with private financial institutions (ADVANS) with the use of counterpart funds reserved by the Japanese Grant Aid. Once (Kennedy Round food support) the credit was provided, the volume of paddy rice purchased by millers increased by 70% compared to the previous year, suggesting that many rice millers did not have sufficient revolving funds. The conditions and lessons learned from the system applied in CIV-01 are presented below.

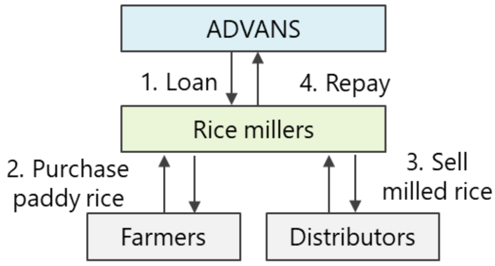


Fig 2-42 Applied the credit system for purchase milled rice on CIV-01

Source: Prepared by JICA study team based on CIV-01 Ligne Directrice de l'Approche du Projet

- Credit contracts were made between ADVANS and rice millers, at a flat interest rate of 5%, for a loan period of 8 months and with cash repayment as a condition.
- The choice of rice millers as potential credit users depended on the following factors: 1) installation of the high-performance rice-milling machines, 2) rice millers' portfolios,3) experience of partnerships agreed with rice-producing areas for the purchase of paddy rice, 4) management performance, 5) existence of collateral assets or guarantors.
- Many rice millers do not have established sales channels. Therefore, their management and marketing capacity need strengthening. Agents responsible for credit management and activity monitoring attached to private financial institutions should also be given training on the peculiarities of rice value chain.

Pattern B: Sustainability in securing revolving funds and investment funds generated by equipment purchased by the project

In the Project NGA-01 in Nigeria, a survey was conducted to see the availability of private credit services for the purchase of destoner by micro-fabricators lacking independent funds. As the survey result indicated the absence of this form of services in the target area, the project adopted a revolving fund approach; it supplied the equipment. The reimbursement of the costs by the concerned beneficiaries was reused to invest in new machines. The lessons learned from this approach are as follows.

- It helps to put small businesses on track and secures funds to repay loans. For example, providing free loans for a certain period before charging interests allows identification of problems and profitability in the actual business activities.
- There is a need to anticipate different risk factors (poor harvest due to climatic conditions, price hike of imported equipment like stonewalling machines, etc.)
- If full repayment during the project period seems difficult, measures may be taken to reduce the burden of reimbursement by subsidizing the project. This would avoid moral hazard, without making the beneficiaries bear the full cost.

2-6-5 Value chain development focusing on market needs

In addition to the fundamental factors of rice cultivation, namely, technology development and its dissemination, it is necessary to take a comprehensive approach that considers the needs of the market and overlooks the value chain to achieve the goal of further doubling rice production by 2030. Additional demand may also increase with parts of rice transformed into high-added value products such as selling mixture of milled chaff and bran for livestock feed by rice millers (MDG-01) rice powder as a supplement for the Ethiopian staple food "Injera" (ETH-02), in CARD countries. It is important to develop the rice value chain using these means.

Analysis and Strategies focusing Market Needs

It is fundamentally important to grasp the needs of consumers and markets situated at the end of the rice value chain as a starting point to develop the entire supply chain. The actors namely, producers, millers, distributors, and sellers should develop and implement strategies that keep distribution loss to a minimum and deliver quality products that meet the needs of the market in terms of quantity and pricing all year round.

Whether alone or in groups, actors at each step of the value chain should analyze consumer preferences and develop corresponding market strategies as described in section 2-6-2 Marketing.

Based on the preference survey of consumers conducted in Project CIV-01, it was confirmed that local rice is more popular than imported rice in Cote d'Ivoire, and a particular local rice variety was popular in both urban and rural area. As a response, the Rice Development Agency (ADERIZ) through its market-oriented strategy has classified this particular variety as an inspirational variety for promotion. Among the millers and distributers who have participated in CIV-01 activities, many of them looked for rice producers of the popular variety and recommended its production to farmers.

Integrated Measures for Value Chain Development

The rice value chain is not limited to direct actors on the vertical line starting from the seed producer to the retailer. Many side players like financial institutions, inputs suppliers, machine dealers, service providers, transporters are ready to provide services to the actors on the frontline. In Project CIV-01, support was given to tilling service providers, to training programs provided by machine dealers, input suppliers and to financial institutions that develop financial products.

An action plan to promote local rice was elaborated based on the project results, and presented at the NRDS2 formulation working week. The project activities not only involved direct counterparts but all the ADERIZ staff to expand the effect of the project beyond its framework and onto projects financed by other donors. This was also to install a sense of ownership within the agency after project completion.

These efforts, including the process of trial and error during the project period, are detailed in the project approach guidelines (CIV-01: "Ligne Directrice de l'Approche du Projet").

Box. Global Perception of Value Chain Projects (CIV-01)

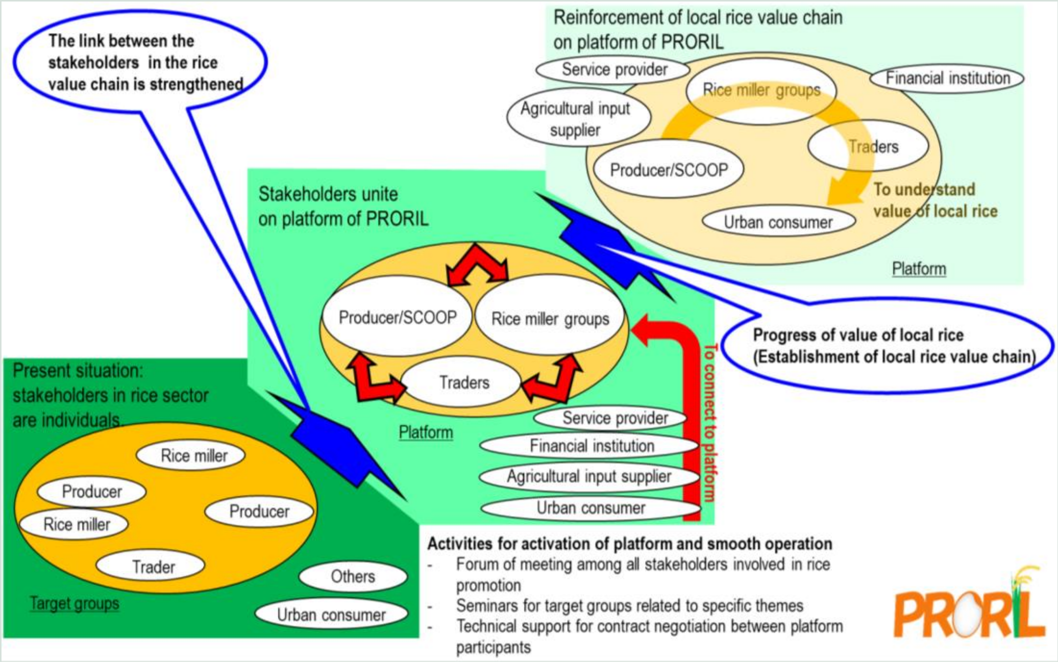
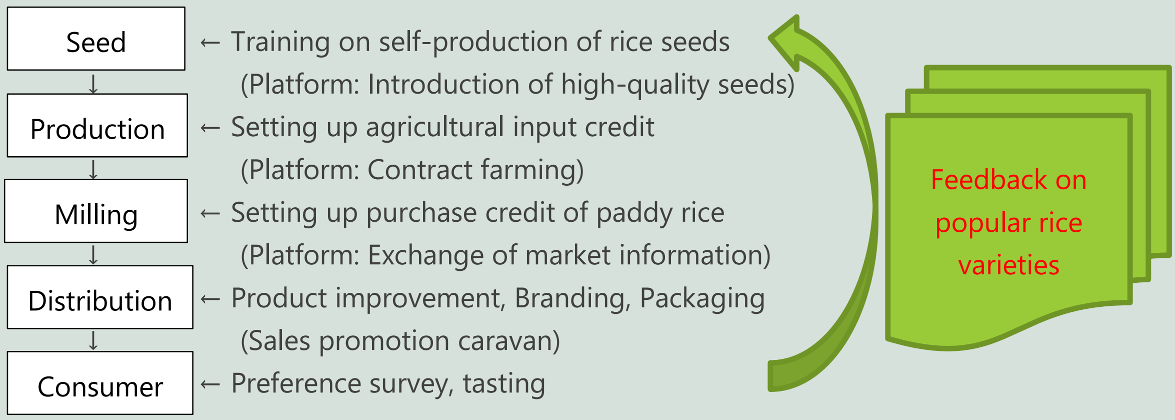


Fig 2-43 Integrated Platform Process

Source: CIV-01 "Ligne Directrice de l'Approche du Projet"

In Project CIV-01, challenges on rice distribution and sales promotion of the value chain were analyzed from the start (seed production) till its end (retailing). Together with the newly established Ministry of Rice Promotion and ADERIZ, the project has helped to accelerate exchange of information and business talks among stakeholders participating on the platform indicated in Fig 2-41. Development and reinforcement of the rice value chain has also been made with the following approach.



2-7 Irrigation

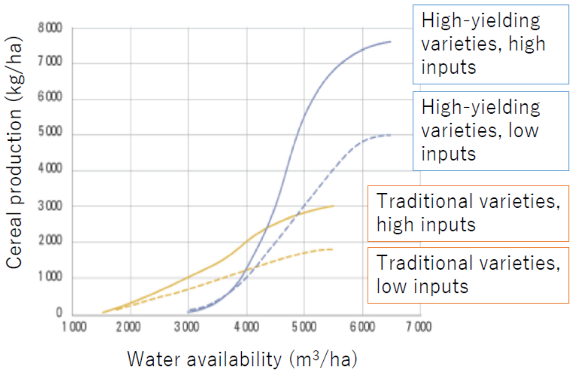


Fig 2-44 Typical response to water

Source: Smith et al., "Crop Water Productivity Under Deficient Water Supply," 2001

Rice cultivation, which originated in rainfed lowland, has been improved by irrigation. This is to stabilize production in the rainy season, make cultivation possible in the dry season, increase productivity with high-yielding varieties, and so on. Fig 2-44 shows that enough irrigation, as well as high-yielding varieties and high inputs, is necessary to increase productivity.

Originally, irrigation water was sourced from rivers/springs using a canal system. However, with improvement of construction technology, advanced irrigation systems to utilize water from reservoirs/ponds during droughts, pump water from low water sources to higher paddy fields, and save water using drip/sprinkler irrigation have been designed and developed.

It is essential not only to construct irrigation structures, but also to improve the "Operation and Maintenance (O&M)" of facilities, appropriate water distribution, and fair governance of management institutions in order to realize sustainable irrigation. Irrigation management was transferred from public organizations to water users' organizations in the 1990s. However, successful and sustainable cases/models of "Irrigation Management Transfer (IMT)" have been very limited.

Table 2-44 presents the major challenges of irrigation in CARD member countries and lists the typical/recommendable manuals responding to these challenges. Detailed information regarding this will be provided later.

Table 2-44 Typical manuals responding to major challenges

Challenges		Related manuals	Project code
Infrastructure	- Lack of canals and structures - Operating difficulties - Expensive infrastructure	Irrigation Management and Operation Manual	MOZ-01
		MANUAL ON RICE CULTIVATION	MOZ-02
Water Users' Organizations	- Lack of user-friendly structure - Lack of transparency - No accounting management	Operation and Management Manual for Water Users Association (WUA)	GHA-06
		Implementation Guideline for Subject Matter Training Course on Irrigation Scheme Management	TZA-07
Operation and Maintenance	- Repairs of damaged structures are neglected - Lack of spare parts - Unsuitable operation	O&M Manual for WUA	GHA-06
		MANUAL TÉCNICA DE MANUTENÇÃO, OPERAÇÃO DO SISTEMA DE REGADIO, IRRIGAÇÃO E DRENAGEM PARA O CULTIVO DE ARROZ	MOZ-03
Water Management	- Lack of response to water demand - Unfair distribution of water - Lack of water distribution plan	GUIDELINES ON IRRIGATION WATER MANAGEMENT IN MWEA IRRIGATION SCHEME	KEN-01
		MANUEL PRATIQUE DE GESTION DE L'EAU POUR LA RIZICULTURE	SEN-03

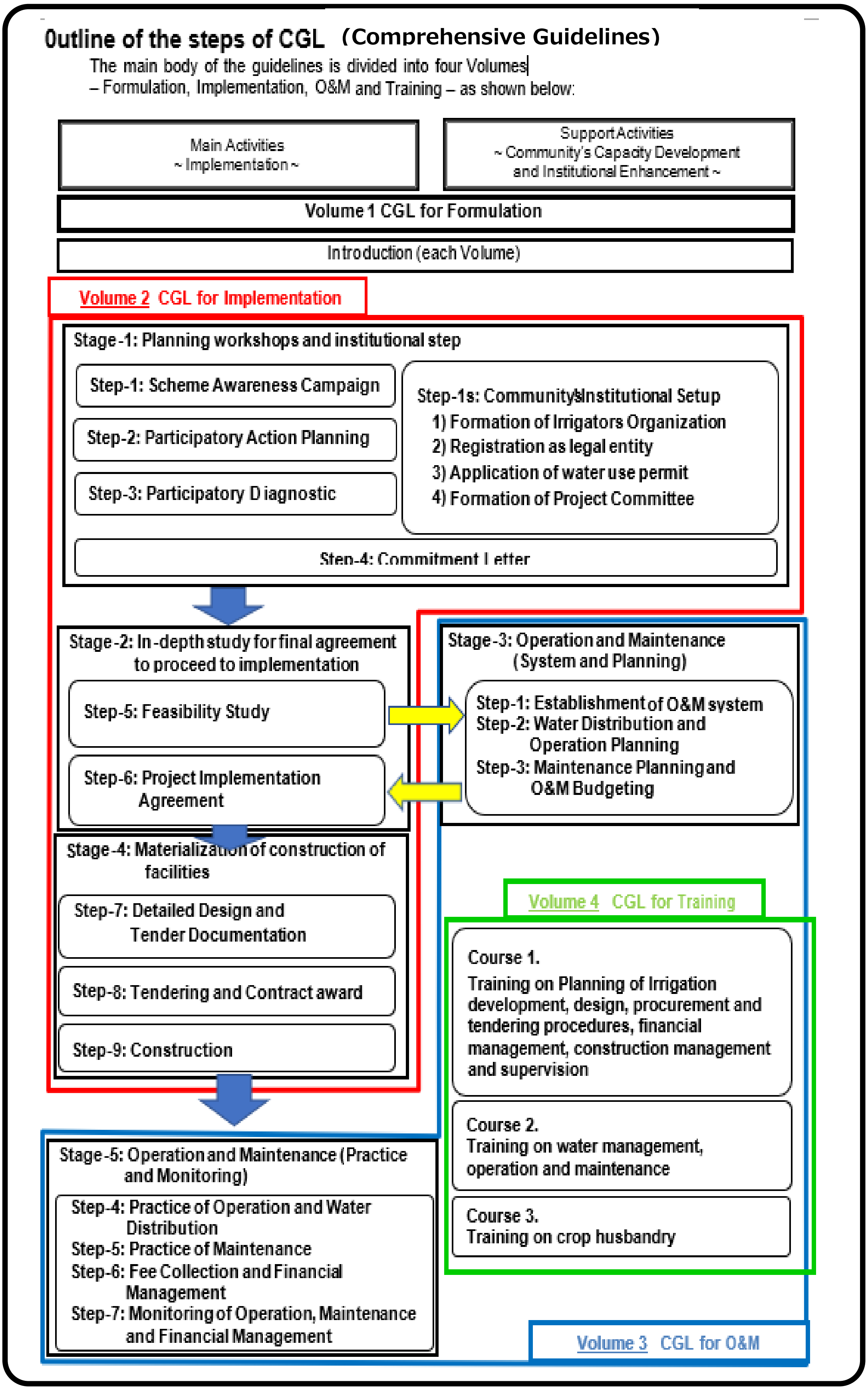


Fig 2-45 Outline of irrigation development steps

Source: TZA-09 "Project Completion Report"

The first priority of irrigation development is to secure the involvement of the related farmers in the irrigation system and their ownership, as they are its beneficiaries and operators. The system should be user-friendly and it should have appropriate cost sharing. This is possible by ensuring the farmers participate in the process from the planning stage. This is called "Participatory Irrigation Management (PIM)," which is one of the most important perspectives for irrigation development.

As an overall guideline of irrigation development, TZA-09 has developed and arranged "Comprehensive Guidelines (CGL)," as indicated in Fig 2-45. In this sub-chapter (2-7), the following key technical points to be applied in accordance with CGL in irrigation development projects are introduced: 1) basic points on irrigation; 2) construction of facilities (step 9); 3) water users' organization (step 1s); 4) O&M (steps 2, 3, 4, and 5); and 5) water management (steps 2 and 4).

Key points

(1) Basic points on Irrigation

The principle of irrigation is to calculate the water requirement for rice production. As indicated in Fig 2-46, distributed water together with rainfall will be lost through evaporation, transpiration, and percolation throughout the rice-growing period.

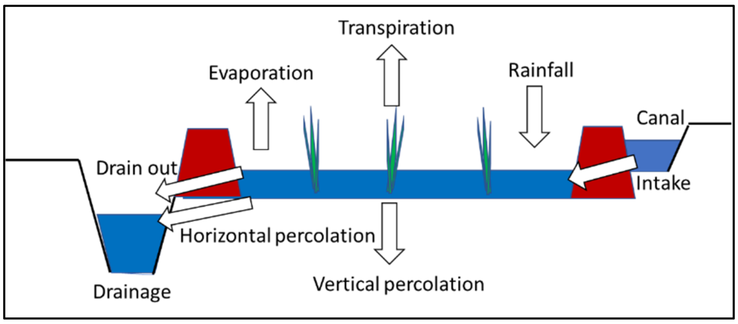


Fig 2-46 Water balance in paddy field

Source: GHA-06 "Optimum Input Rice Cultivation Manual for Water Management"

Irrigation water is mainly sourced from rivers. It is necessary to calculate the intake water by adding the water losses from the river to the paddy field, as shown in Fig 2-47. These losses vary based on geography, geology, material (concrete, masonry, or earth), and the length/condition of canals.

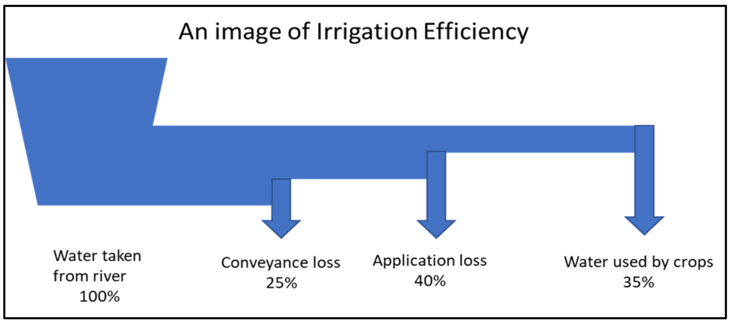


Fig 2-47 Image of irrigation efficiency

Source: GHA-06 "Optimum Input Rice Cultivation Manual for Water Management"

As indicated in Fig 2-48, irrigation facilities consist of 1) water resources (dam, spring), 2) intakes (diversion weir, pump), 3) canals (main, secondary, and farm ditch), and 4) turnouts. With pump irrigation, it is necessary to provide spare parts and mechanical maintenance in addition to power supply. Therefore, if geographic condition allows, gravity irrigation has an advantage, as summarized in Table 2-2.

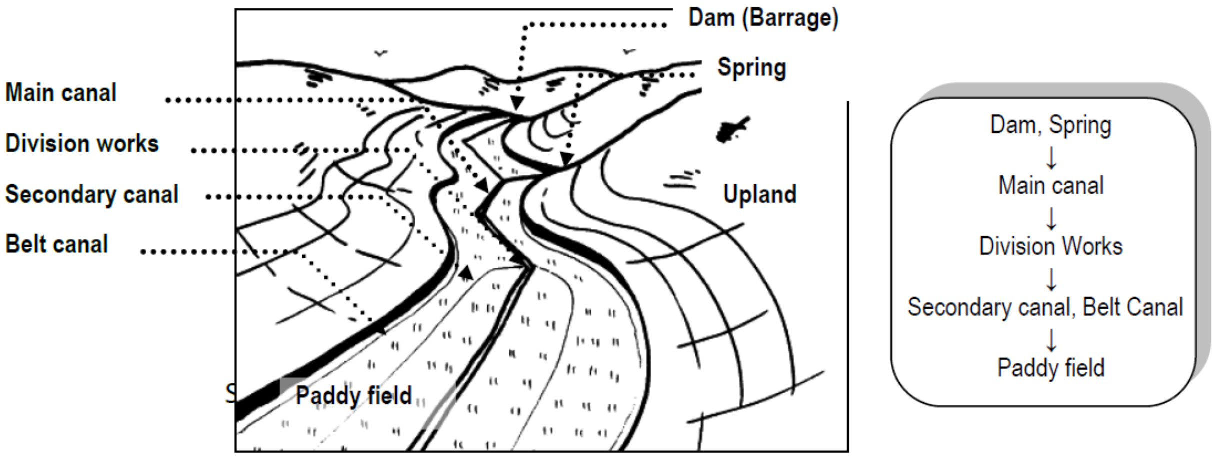


Fig 2-48 Schematic diagram of irrigation facility

Source: RWA-02 "Farmer's Textbook for Rice Cultivation, Water Management, and Post-Harvest Practice Training"

Table 2-45 Pump irrigation and gravity irrigation

Subject	Pump irrigation	Gravity irrigation
System	Pumps water from low water source to higher paddy fields	Water flows from the river or other source to lower paddy fields
Power	Electricity and/or fuel to operate water pump	Natural gravity
Advantage	Possible to distribute water to higher places where it would naturally be impossible	Sustainably distribute water without any power, if intake and canal systems are available
Disadvantage	Needs spare parts and power because of the operational pump system requirement	Needs slope with minimum gravity from water intake to paddy fields

(2) Construction of Facilities

Construction of main irrigation facilities is usually conducted by the government or through donor assistance. However, it is necessary for farmers to participate in discussions from the planning stage, because they should apply their ideas in the decision-making process as the beneficiary, user, operator, and payer after construction is completed.

Even if the irrigation project is supported by the donor community, the government should consider the necessary involvement of farmers in the project process carefully and seriously to secure their active participation in the operation of the facilities and management of the irrigation system after completion of the project.

The contents of main construction management have been summarized in Fig 2-49 by MOZ-01.

The necessary steps for planning, design, and construction (including the agreement process among stakeholders) are indicated in Fig 2-45. It is essential to confirm the applicable technical standard/regulations in each country, evaluate the technical ability/quality of the contractor and supervisor, and follow the procedures of the contract, specification, supervision, inspection, and so forth.

Construction Management Activities

1. **Control of Completed Works :** Size and concrete appearance of the constructing structure are controlled.
2. **Quality Control :** Construction material (reinforced bar, mortar, concrete, etc.) quality and strength are controlled.
3. **Operation Control :** Process of construction schedule confirming and well changes of construction progress are controlled.
4. **Safety Control :** To keeping arranges order and cleanness in construction sites and safety construction are controlled.
5. **Construction Cost Control :** To follows the contract, payment of construction expenses are managed.
6. **Construction Photograph Management :** The site construction photos are taken in regular order, and construction situations are recorded.
7. **Construction Contract Management :** Establishment of construction organization, fixation of specifications, and construction contracts are managed.

Fig 2-49 Contents of Main Construction Management

Source: MOZ-01 Irrigation Management and Operation Manual (Revised edition)

In some countries, participatory construction of small facilities, such as a simple diversion weir and a secondary/tertiary canal, by utilizing locally available materials has been conducted and it has been effective in changing the mindset of the benefiting farmers. It was reported that they came to view these facilities as their own properties (see Box below).

Box. Participatory Construction by Farmers utilizing Local Materials (RWA-01)

The introduction of a diversion weir in the irrigation system served to improve operation and appropriate water management. RWA-01 conducted training on farmers' participatory construction of a simple diversion structure by utilizing locally available material (timbers), which is also a traditional method in Japan. By this exercise, farmers' ownership was improved, their participation in the water users' organization increased, and O&M and water management activities improved.

Source: RWA-01 "Technical Manual for Rice Cultivation, Water Management, and Post-Harvest Practice"

(3) Establishment and Management of Water Users' Organizations

It is necessary for the benefiting farmers to trust their own water users' organization, pay a water fee, express opinions, and finally, follow the decisions of the organization. In order to achieve this, the management process of the irrigation system, including water distribution, O&M, training, fee collection, and accounting by the organization, should be clear for its all members.

In a newly developed irrigation scheme, without experience of organizational irrigation practice, each farmer should understand the importance/outcomes of irrigation and the necessity of water management and O&M. It takes more time and effort to realize sustainable and well-organized irrigation management than to transfer technologies of rice cultivation and/or irrigation.

It is necessary to follow rules and regulations in each country when farmers formulate/establish a water users' organization. At the very least, the following information should be provided for consensus on necessary and appropriate irrigation management among stakeholders:

1. Area of irrigation, such as benefit area, map, members' names, location;
2. Organizational structure, such as committee members, responsibility, selection process;
3. Rights and duties of members;
4. Principle of water management, O&M, such as procedure, operator, cost sharing;
5. Calculation of water fee and procedure of fee-collection; and
6. Method of managing conflict and penalty.

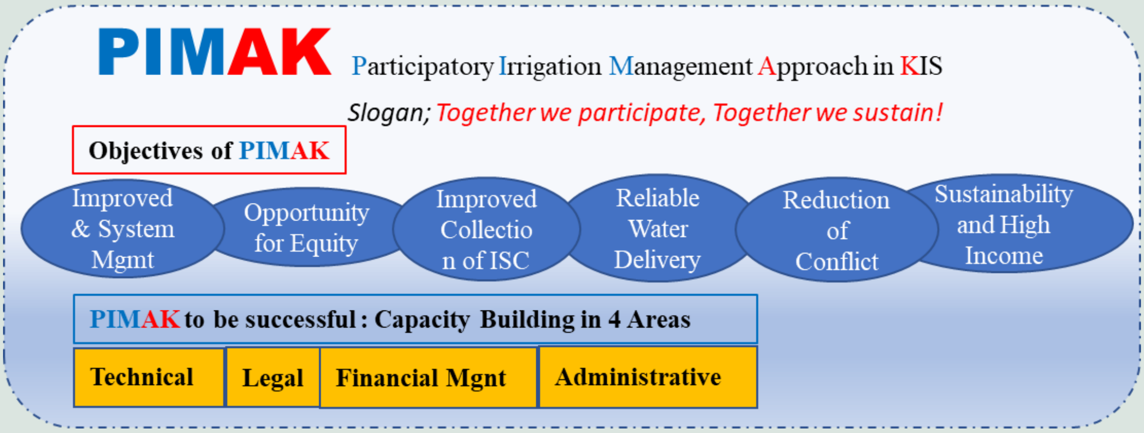
Box: Essential Characteristics of an Effective Water Users' Organization

According to Prof. Freeman, it is important to maintain equity among beneficiaries for successful irrigation system management. The six conditions listed in the table, especially the share system mentioned in points 3 and 4, are essential for this purpose.

1	Leaders of the local organization should not be cosmopolitan outsiders but irrigators representing the various reaches of the local canal system.
2	Leadership and staff of the local organization are responsible to local members.
3	Water delivery is dependent on the fulfillment of organizational obligations (i.e., distributional share system).
4	The water share system should remove head and tail distinctions in service queues (i.e., distributional share system).
5	Water resource control of members is high.
6	Propensity of members to support the local organization is high.

Source: Freeman, D., "Local Organization for Social Development", Westview Press (Boulder), 1989, partially amended by Kakuta, I., "Irrigation management problems derived by a WUA evaluation at Kpong Irrigation Scheme (KIS) in Ghana,"2019 based on Lepper, T., "Reregulating the Flows of the Arkansas River", 2007 and Freeman, D., Personal conversation by e-mail, 2009.

GHA-06 has clarified the following six objectives concerning effective and sustainable water users organizations, and four areas of capacity building to realize successful projects.



GHA-06 has clarified the following six objectives concerning effective and sustainable water users' organizations, and four areas of capacity building to realize successful projects.

Source: GHA-06 "Operation and Management Manual for Water Users' Association (WUA)"

(4) O&M

First, the owner of the properties, management organization, and cost sharing of O&M should be confirmed for each structure. The share of responsibility and payment of the national/local government, the water users' organization, and individual farmers should be clarified.

As indicated in Table 2-46, O&M consists of 1) structure check, 2) daily repair, 3) periodic repair, 4) large-scale repair, and 5) disaster rehabilitation. Among these, 1), 2), and 3) are essential. If prompt and appropriate repair can be performed, most large-scale repair might not be necessary. O&M should be conducted not only by water users' organizations, but also by the local community and individual farmers. This is sometimes more timely and effective. In case of 4) and 5), it is preferable to consult with the national/local government about technical and financial assistance depending on the scale/difficulty of the damages.

Table 2-46 Types of maintenance and repair

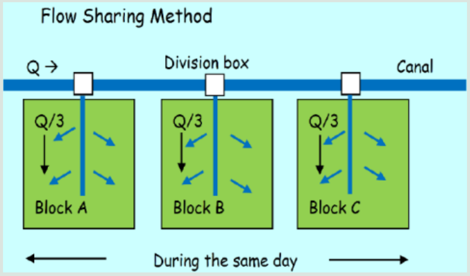
Types		Activities
Check	Daily check	Visual inspection of facilities for damage, water/oil leakage
	Periodic check	Detailed inspection inside the facilities involving pumps, gates, etc.
Repair	Daily repair	Simple repair based on daily check results
	Periodic repair	Necessary repair based on repair program
	Large-scale repair	Complicated repair based on periodic check results
	Disaster rehabilitation	Rehabilitation of structures damaged by disaster, with necessary support from the government

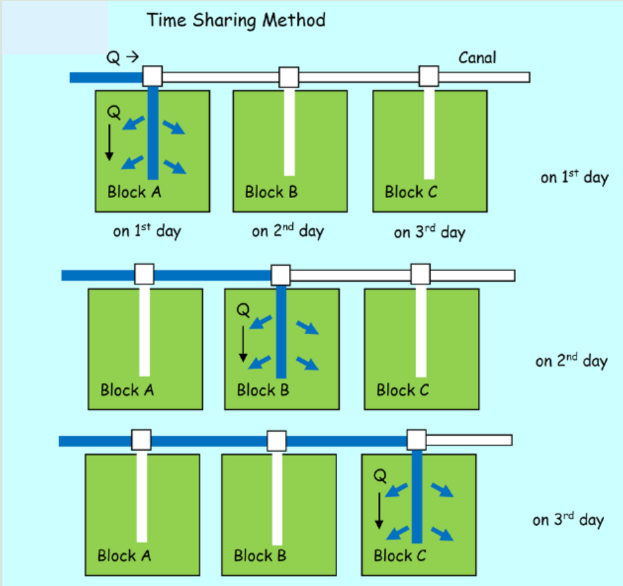
(5) Water Management

The most important role of the water users' organization is to deliver 1) the necessary quantity of water, 2) in a timely manner, 3) fairly to the command area. For this purpose, it is vital to maintain the facilities well, ensure good governance in the organization, and ensure transparency in sharing operational rules and their implementation.

Box: Rules of Water Distribution (GHA-06, etc.)

When water resources are limited in the area, it is necessary to adjust, by plot, the distribution volume of water. Depending on the irrigation structure system and the local custom of water use, the flow-sharing method or the time-sharing method shown in these figures can be used.





The prerequisite conditions to realize appropriate water management are: 1) to request the required volume of water (by farmer) to the distributer/operator; 2) to develop a fair/practical water delivery/allocation plan based on the request; and 3) to formulate a qualified/practical water delivery system.

Since water resources are limited, it is more important to conduct water management during the drought period than the ordinary period. During a drought period, it is important to deliver water fairly in accordance with the rule agreed upon by the water users' organization. Transparent sharing of information on available water volume and the water delivery plan is also essential.

Land leveling is one of the most important conditions to realize efficient water use in paddy fields (Fig 2-50). The same paddy field could have water shortage in shallow areas and inundation in deep areas simultaneously. Water can be saved, the cultivation area can be expanded, and inundation can be prevented by land leveling.

In addition to irrigation, drainage is important for water management. Even where annual rainfall is limited, local downpours could occur, and they could cause floods, inundation, erosion, and damage to facilities/crops. It is recommended to check rainfall records going back ten years or more in order to conduct runoff analysis and study necessary countermeasures.

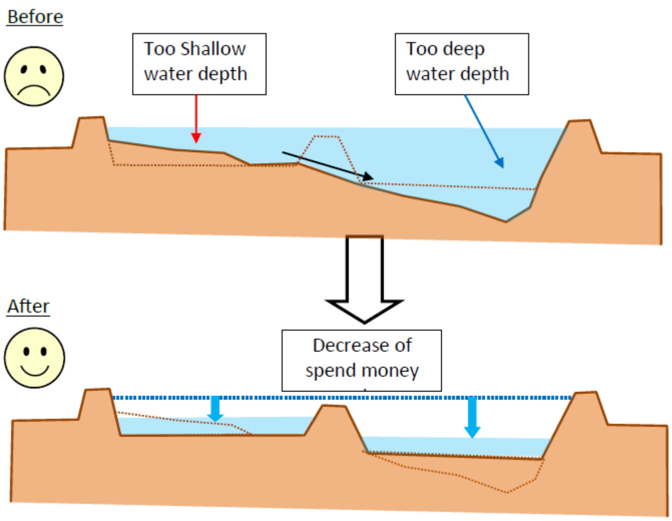


Fig 2-50 Effect of Land Leveling

Source: SEN-03 "MANUEL PRATIQUE DE GESTION DE L'EAU POUR LA RIZICULTURE"

Examples of project support

(1) Validation of Guidelines and Manuals (TZA-03/09)

CGL (see Fig 2-45) developed by TZA-03/09 have been authorized by the National Irrigation Act and its regulations. Hence, irrigation development projects in Tanzania should follow the CGL and the CGL are well known as nation-wide guidelines. It is important to validate the guidelines/manuals developed by the project as official documents in order to utilize them widely and sustainably.

(2) Collaboration with Third-Country Experts (MOZ-03)

The Mozambican C/P modified and finalized the "O&M Manual (Portuguese)" in June 2014, based on the draft developed by Vietnamese experts visiting MOZ-03. With the participation of these third-country experts, whose expertise and cultivation conditions of their own country are similar to those of the recipient country, the C/P could obtain appropriate and adaptable techniques from them in some cases.

(3) Widely-applied Knowledge Sharing (TZA-07)

TZA-07 has conducted several training programs on technical information exchange in its project site, and C/Ps of the JICA irrigation projects in the neighboring countries have been invited to them. Participants could visit irrigation projects and exchange views/experiences with the person concerned. JICA has conducted a series of irrigation projects in Tanzania since the 1980s. It is sometimes more practical and familiar to visit these project sites with a long history and to communicate with local experts than to receive the same information from Japanese experts in each country.

(4) Recognition of the Advanced Water Users' Organization (TZA-09)

The National Irrigation Committee of Tanzania is responsible for the monitoring of 32 dissemination schemes, and it utilizes monitoring sheets for its routine work. At the first Irrigators' Organization Competition Workshop held in July 2019, exemplary organizations were awarded based on the above-mentioned monitoring. It contributes to increase the motivation of irrigators' organizations, public awareness about water management, and O&M in irrigation schemes.

(5) Capacity Development of Water Users' Organizations (MOZ-01)

MOZ-01 has established the "Farming Support Group (FSG)" as a sub-group of the water users' organization in order to support the farming activities of the organization. In a typical case, the FSG has gained from management of a demonstration plot, instruction of a farming technique, rice milling, and direct selling of milled rice. As a result, the organization has also been stimulated. It is difficult for some organizations to conduct profitable activities because of weak bookkeeping/accounting. However, the utilization of multi-functional character of the irrigation system, such as fish cultivation and reservoirs for tourism, should be explored.

(6) Water management in rainfed paddies (GHA-04, SEN-02)

The layouts of bunds and catch canals, as well as land leveling has been considered for stabilized rice production and improved productivity of rainfed paddies (GHA-04). SEN-02 has conducted training courses using the "Secondary Lowland Development Manual (French)" concerning site selection of rainfed paddies and layout of bunds for water harvesting (Fig 2-51) for stabilized production by utilizing limited rainfall.

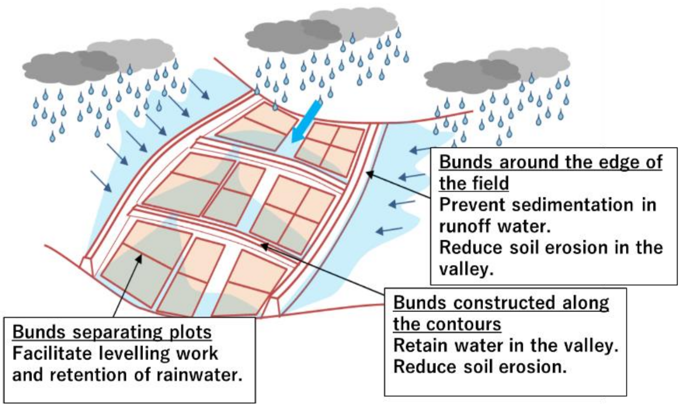


Fig 2-51 Roles of different bunds

Source: SEN-02 "Manuel d'Amenagement Secondaire des Bas-fonds"

[Reference: Typical JICA projects mainly focusing on irrigation development]

- Ghana: Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme (GHA-06).
- Kenya: Rice-based and Market-oriented Agriculture Promotion Project (KEN-01).
- Tanzania: Capacity Development for the Promotion of Irrigation Scheme Development under the District Agriculture Development Plan (DADP), Phases 1 and 2 (TZA-03/09).

2-8 Mechanization of Rice Cultivation

2-8-1 Mechanization of rice cultivation in sub-Saharan African region

Outline

The purpose of agricultural mechanization is to increase labor and land productivity and to reduce labor force. Agricultural mechanization promotes quantitative changes, such as expansion of cultivated land, and brings about qualitative changes, such as development of tillage, land preparation technology, and thorough pest control work, enabling a proper season of farm work and suitable cropping, which is important in agricultural work.

There are related factors in the three important pillars that must be kept in mind when promoting agricultural mechanization. These are "Reduction of agricultural machinery operation costs," "Reduction of labor force in agricultural works," and "Increase in yield of high-quality products." These elements are intricately intertwined (Fig 2-52).

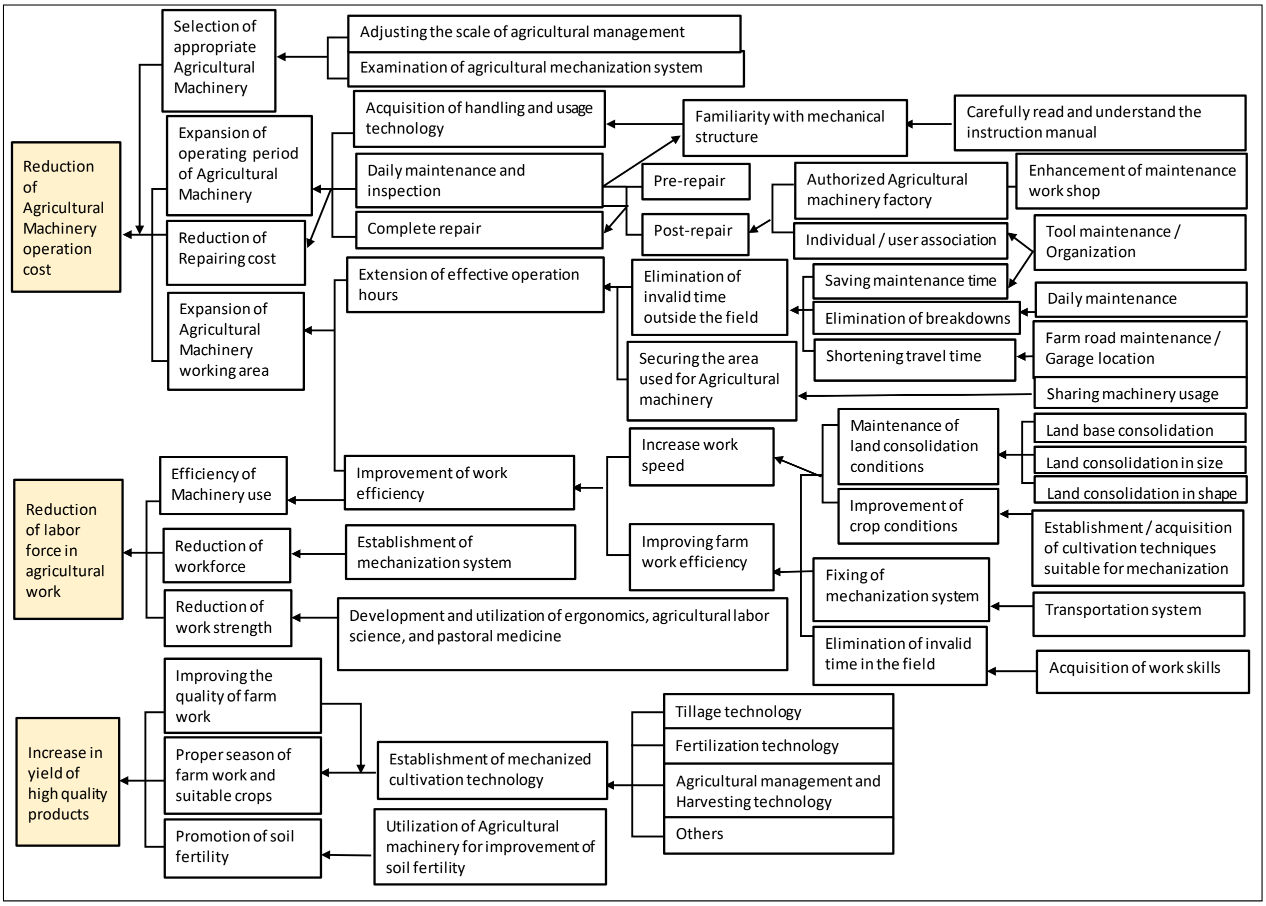


Fig 2-52 Related factors for rational agricultural mechanization

Source: Dr. Toshitami OKAMURA, "Basics of Agricultural Mechanization," Sep 1991, Hokkaido University Press

Several manual push-type weeders are being developed in the JICA Project. Weeding requires working long hours with the body bent, over a long period. Farmers have evaluated that by using the push-type weeder developed by the project, "the labor of weeding has been reduced, and the resulting free time can be used for housework." Furthermore, since this weeder has a simple structure and its materials are easily available in the region and village, it can be manufactured and maintained at local ironworks. This case is consistent with the “Reduction of agricultural machinery operation cost” point in “Movement to reduce machine usage costs” in Fig 2-52.

On the other hand, it is desirable to introduce a combine harvester with extremely high work capacity and efficiency in harvesting work because the short period of the optimum harvesting time limits the working period while requiring an intensive and large labor force. Since the combine harvester is expensive and has a complicated structure, it is necessary to conduct a feasibility study of all the elements related to the above-mentioned three pillars and pay attention to the repeated discussions with the user regarding procurement when introducing the combine harvester.

It is also important to adapt to the local soil conditions, climate conditions, and social conditions in line with the needs of the farmers when advancing agricultural mechanization. This section summarizes the direction of mechanization of rice cultivation implemented in each JICA project, in line with the items "Development and improvement of agricultural machinery," "Promotion of manufacturing / utilization of agricultural machinery," "Maintenance of agricultural machinery," and "Consideration on safety of agricultural machinery."

2-8-2 Development and improvement of agricultural machinery

Countries generally import agricultural machinery manufactured overseas, but in some instances, countries develop and manufacture their own small and relatively simple machinery. It is recommended because in addition to improving manufacturing technology in the agricultural machinery industry, it also facilitates maintenance. The mechanization of agriculture is advantageous in terms of meeting the local conditions because it contributes to the reduction of labor and the improvement of work capacity in agricultural work. Based on these perspectives, some projects are attempting to develop farm tools and agricultural machines suitable for the conditions of their respective areas. They conduct field tests using the farm tools and agricultural machines, and improve them based on the test results. Some examples of developments and improvements are shown below.

Project case study

(1) Seeder

1) Seeder towed by hand

Mozambique has been developing and improving seeders for direct sowing cultivation in dry fields for over five years. For general farmers, broadcast seeding was adopted as a conventional sowing method. In the MOZ-02 project, it was decided that direct sowing should be adopted to obtain high yield. It was judged that direct sowing would make it possible to reduce the sowing amount, maintain an appropriate planting density, and manage fertilization and weeding. Therefore, a seeder towed by hand for direct sowing (PROMPAC seeder) was developed. Sowing tests were conducted with the PROMPAC seeder. The seeder was not disseminated to farmers because the soil covering chain at the rear did not function consistently and it was confirmed that the yield decreased because of inadequate soil covering in some test fields (Photo 2-35).

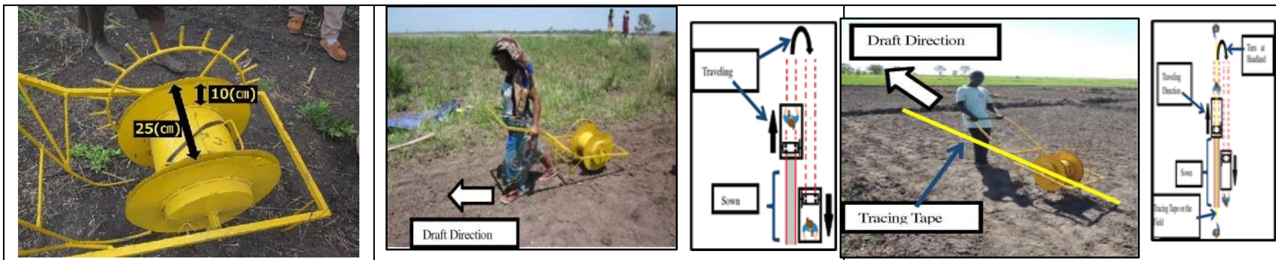

Photo 2-35 Seeder developed in Mozambique (PROMPAC Type)

Source: MOZ-02 "Project Completion Report"

In MOZ-04, it was necessary to meet the needs for direct sowing, which can significantly reduce labor in comparison to transplanting. Therefore, the MOZ-04 project developed an improved version of the seeder developed in MOZ-02. Since the PROMPAC type seeder has four rows, traction load is heavy, traveling to poorly leveled areas and storage is laborious, and turning on headland is difficult. In consideration of these points, the project developed a seeder with the following concept and production policy.

- Instead of following the 4-row 2-wheel/soil-covering chain type of the PROMPAC seeder, the project used a 1-wheel 2-row seeder with a furrow opener. In addition, it was decided that the soil would be covered with human feet after sowing (Mechanization prioritizing functions that can work).
- The furrow opener uses reinforcing bars instead of plate type bars to reduce traction load and improve the process of cutting into the soil in fields with insufficient leveling (The towing load has been reduced and even one woman can tow the seeder).
- The materials used are limited to those that can be procured in the city to reduce prices and facilitate maintenance.
- The cycle of trial production → field test → problem grasp → improvement was repeated in developing and improving the seeder, and eight seeders were finally manufactured.
- The seeders were effectively used in the test field, demonstration field, and communal field. The cost of manufacturing the seeder was 3,000 MZN, while the PROMPAC machine cost 4,768 MZN to manufacture.

However, it is necessary for the operator to ensure that two points of the row seeder's furrow opener rod and one point of the wheel are constantly in contact with the ground in row sowing work to ensure the uniform seeding amount of 50 kg / ha. In the towing method, the operator stands in the frame of the seeder and faces forward (Fig 2-53 A). Therefore, the operator's line of sight does not cover these three points and seed discharge becomes inconsistent. For this reason, a towing method was implemented in which the operator stands outside the frame, facing the seeder (Fig 2-53 B). This ensured the operator's line of sight would cover the three points, enabling appropriate rowing.



Seeder's final version	A. Face forward towing	B. With guide tape and operator faces the seeder

Fig 2-53 Seeder's final version and field test for the seeder

Source: MOZ-04 "Project Progress Report (phase 2)"

Comparative tests were conducted in the project to confirm the effect of the method of applying a guide tape (tape to indicate the straight direction) in the direction of the seeder's path and pulling along it (Fig 2-53 B). The required amount of labor and number of operator(s), required working hours, etc., were confirmed for two methods, a forward towing method (without guide tape) in one plot of the test field (10 m x 25 m) and a backward towing method (using guide tape) in three plots of the test field. The total number of required hours when using the guide tape (backward towing) was about half (286.2 minutes) of the total time (495 minutes) required when not using the guide tape (forward towing). It was judged that this was because the rows to be sown had been clarified using the guide tape and the rows were straight, which improved work efficiency at the time of soil covering.

(2) Weeder

In the JICA project, several hand-pushed weeders contributing to labor saving and increasing crop yield have been developed and used. Examples of their development and improvement in each country are shown below.

1) Development and improvement of weeders in Madagascar

The MDG-01 project is developing and improving paddy field weeders and upland rice weeders. The shape of the paddy weeder is dependent on the condition of the paddy soil. In conditions wherein the weeder is easily buried in soft soil, a star-shaped float is attached behind the rotating claws, and when the soil is hard and efficient weeding is required, two rotating claws are used. In addition, the project has designed weeders for the inter-row spacing of 20 cm and 15 cm to meet the cultivation conditions of rice (Photo 2-36).

Adaptability test	Weeder with float (soft soil)	Weeder with two rotating claws (hard soil)	20 cm inter-row spacing (Left), 15 cm inter-row spacing (right)

Photo 2-36 Paddy field weeders developed in Madagascar

Source：MDG-01 "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition) "

Development and improvement of paddy rice weeders"eThe prototype weeders were improved by examining their adaptability in the farmer's field and considering the feedback of extension workers and farmers. The price of the weeder is 45,000Ar, about twice as much as the 20,000 Ar-commercial weeder. However, users have evaluated this weeder as lightweight and effective at weeding.

Paddy field development has progressed in the central highlands of Madagascar with the increase in rural population, and there is almost no room for new paddy fields to be cultivated. Instead, upland rice cultivation is rapidly increasing. The most important factor in upland rice cultivation is weed control, and weed control is labor and time intensive. For this reason, the project also manufactured a prototype weeder for upland rice cultivation. The existing field weeder (Photo 2-37 left) agitates the soil to weed by rotating the star-shaped gears, but this weeder has problems, such as moist soil easily adhering to the gears, and in soft soil conditions, it sinks into the soil. The specifications of the upland rice weeder (Photo 2-37 right) are 12 cm weeding width, 115 cm handle length (attached to the weeding part), and 6 kg weight, assuming an upland rice furrow of 20 cm. One major improvement over the field weeder is its use of PVC pipes (132 mm in diameter and 4 mm in thickness) for the weeding section, which reduces weight and makes it less likely to get wet soil. The performance of the weeder is as follows: Weeding speed: 1-2 km/hr (including push-pull), work efficiency: 100 h/ha.


Field weeder


Weeder for upland rice

Photo 2-37 Upland rice weeder developed in Madagascar

Source：MDG-01 "Rice Productivity Improvement Project in the Central Highland of Madagascar, "Main Activities and Achievements (Revised edition)"

Upland rice weeders are more than five times more efficient than the simple weeding tool (Angaji) used locally. It is reported that the cost of workers will be reduced accordingly. Photo 2-38 shows weeding being conducted using an Angaji and upland rice weeders.


Weeding by Angaji



Weeding by upland rice weeder

Photo 2-38 Weeding by Angaji and by upland rice weeders

Source：MDG-01 "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)"

The method of using the weeder developed in the project in an actual field, assessing the results to improve it, calculating the weeding cost, extracting advantages and drawbacks, and making it an improvement point for the future is indispensable for the development of agricultural machinery (equipment).

2) Comparison of weeding costs in Kenya

In KEN-01, the costs of the hand-pushed weeder and the powered weeder are compared. The powered weeder has a working time of 3.5 hours/acre. It requires 1,195K.SH for fuel, carry-in, and operator costs, and a total of 2,395K.SH, which includes auxiliary weeding by 4 people. On the other hand, manual weeding requires 5 people x 4 days (20 person-days) for 1 acre of work, which amounts to 6,000 K.SH. Therefore, it is reported that power weeding is 3,605K.SH cheaper per acre than manual weeding. Photo 2-39 shows weeding being conducted manually, with hand-pushed weeders, and with power weeders.


Manual weeding


Weeding with hand-push weeder


Weeding with power weeder

Photo 2-39 Manual weeding, weeding with hand-pushed weeder, and power weeding in Kenya

Source：KEN-01 "Mechanization Training Material for Land Preparation and Power Weeding"

2-8-3 Manufacturing and utilization promotion of agricultural machinery

Manufacturing training on small agricultural machinery and farm tools is widely implemented by the project. There have been reports that through the training, local ironworks and farm tool manufacturers have facilitated the manufacture and repair of small machinery/tools. Examples of manufacturing small machinery/tools and utilization promotion of agricultural machinery are listed below.

Project case study

(1) Training for agricultural machinery manufacturing method

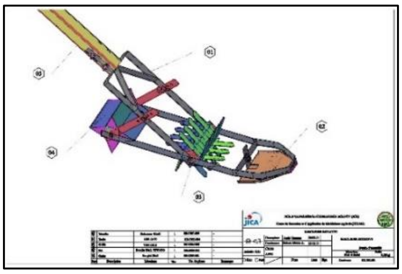
In MDG-01, various agricultural machines were developed in cooperation with Indonesian agricultural machinery experts. In order to disseminate the developed agricultural machinery, local artisans (regional machinery companies) in the five target prefectures gathered at the Agricultural Mechanization Training Center (CFAMA) to conduct manufacturing training. Indonesian experts and CFAMA instructors/engineers conducted the training. They set up the machines to be trained on and solicited participation through the DRDR (Ministry of Agriculture, Regional and Rural Development Bureau) of each prefecture. Each training program was conducted with a small group of people (about 10 to 20 people) because only one set of CFAMA machine tools for manufacturing was available, and sufficient guidance for each person was necessary, along with consideration for safety.

It is necessary to select a local artisan with the management ability to develop manufacturing and sales himself or herself for the training. Local artisan trainees learn the following methods:

- Manufacturing from raw materials (usually using used parts from other machines and appliances).
- Using blueprints to ensure the same finished product.

Fig 2-54 shows some of the training photos and blueprints provided to trainees.

Training in local artisan's workshop



Blueprints provided

Fig 2-54 Training in agricultural machinery manufacturing and rotary weeder blueprints for local artisans

Source: MDG-01 Rice Productivity Improvement Project in the Central Highland of Madagascar, "Main Activities and Achievements (Revised edition)"

(2) Training on weeder manufacturing for blacksmiths

In SEN-02, a weeder towed by livestock was used to conduct practical training on manufacturing weeders for local blacksmiths. This weeder was developed in the SEN-02 project, and many rice farmers recognize the advantages of this weeder, namely, because the unearthed soil spreads outward, the structure does not bury rice. To disseminate the developed weeder, 12 blacksmiths living in the three target areas were trained in manufacturing this weeder for two days, and design drawings of the weeder were provided to them. During the training, 23 weeders were manufactured; samples were placed at each blacksmith's location and distributed to farmers and extension workers (Fig 2-55).

Blacksmiths training on weeder manufacturing

Weeder towed by livestock

Assembly drawing of the weed cutting section

Fig 2-55 Manufacturing training, weeding work, and assembly drawing of improved weeder for blacksmiths

Source: SEN-02 "GUIDE DE CONFECTION DE LA LAME DESHERBEUSE KAPRIP"

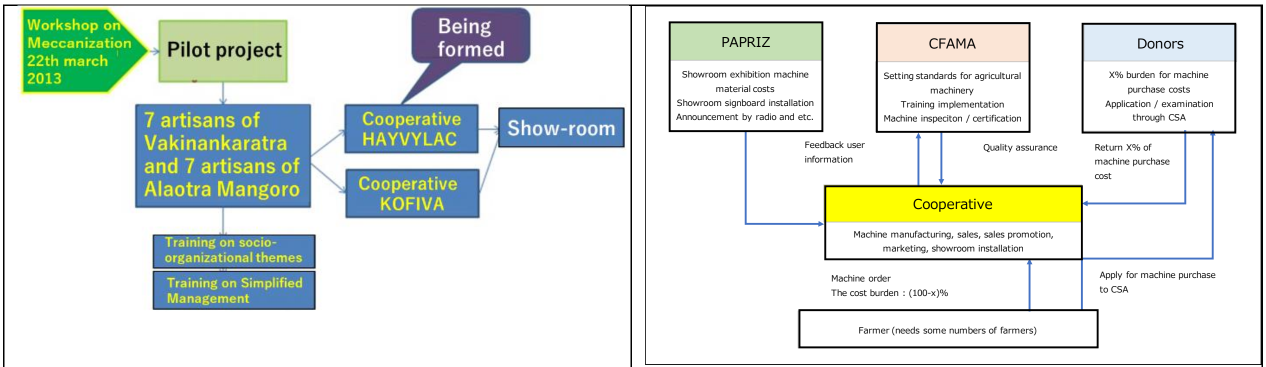
Blacksmiths who have learned manufacturing techniques through the training program have begun manufacturing agricultural machinery and farm tools in the area, and as a result, agricultural tools are becoming more widespread in the area. In addition, it is possible for farmers in areas lacking dealer agents and repair shops to obtain a favorable environment in which repairs can be carried out by the blacksmiths as local manufacturers.

(3) Organization of manufacturer/machinery trade union

In MDG-01, using the opportunity of CFAMA staff training for agricultural machinery in Indonesia, local artisans formed a machinery trade union to improve the quality and promote the use of agricultural machinery, and formulated a "pilot plan."

The machinery association plans and implements the following activities to promote the production, quality improvement, and sales of agricultural machinery (Fig 2-56).

- Strengthening the relationship with CFAMA in agricultural machinery manufacturing training, inspection, and certification.
- Building cooperative relationships with CSA (agricultural service organization established in cooperation with the EU), other donors, and microfinance organizations to improve the quality of raw materials in agricultural machinery production and secure raw materials.
- Cooperating with material dealers and farmers regarding the production, sales, and maintenance of agricultural machinery.
- Setting up agricultural machinery showrooms for sales promotion.



Established agricultural machinery association

Activities of agricultural machinery association and CFAMA

Fig 2-56 Establishment of partnerships and activities of manufacturers and CFAMA

Source : MDG-01 "Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)"

(4) Training for farmers, extension workers, and machine operators

In CIV-01, training was conducted for agricultural extension workers, farmers, and machine operators. The training consisted of three modules, namely, “agricultural machinery,” “cultivation technology,” and “harvesting and post-harvest processing.”

In the Agricultural Machinery section, agricultural mechanization training was conducted for mechanization staff, agricultural machinery operators, mechanics, and agricultural extension workers of the Rural Development Support Corporation (ANADER) of the support target sites. In the project, not only agricultural extension workers, but also leading farmers of support target sites could add to the “agricultural mechanization,” “rice cultivation technology,” and “harvesting and post-harvest processing” training by sharing the training results with other farmers. Furthermore, it was pointed out that the involvement of the private sector is necessary for the sustainable and proper development of the rice sector.

Since then, private companies engaged in the sales, maintenance, and operator training of agricultural machinery have participated in training on agricultural mechanization, and the private sector is promoting its involvement in the rice sector as well. In this way, the training content is being improved in the project through each stage. In addition, the project announces the following growth strategies, stating, "Improvement of capacity is not the only way, but cooperation between the parties (public sector, leaders, and beneficiaries) is important" (Fig 2-57).

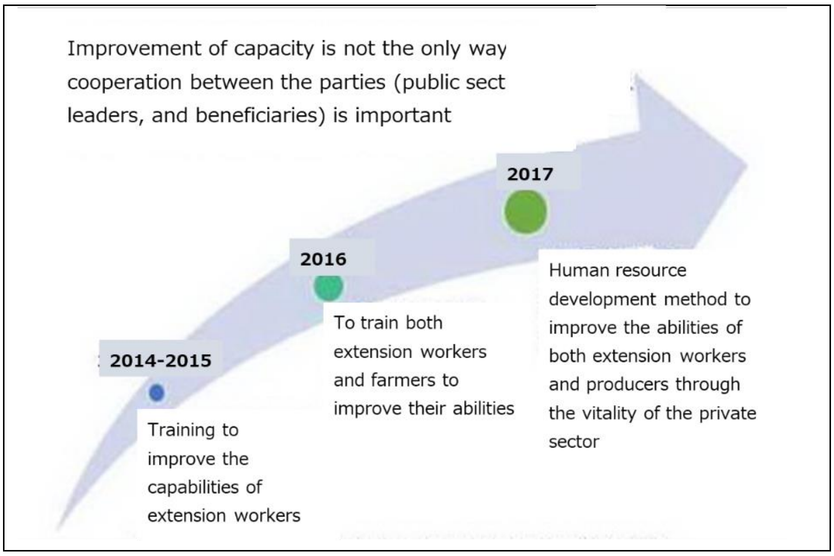


Fig 2-57 CIV-01 Growth strategy of each stakeholder according to the training content

Source：CIV-01 " Project Completion Report"

2-8-4 Usage pattern of agricultural machinery

Examples of usage patterns of agricultural machinery include private ownership of machinery, joint purchase/use of machinery, and use of service providers. The status of each usage pattern in the project, its operation method, and the economic efficiency of agricultural machinery work and the service providers are shown below.

Project case study

(1) Results of a fact-finding survey on the use of agricultural machinery

In SEN-03, a baseline survey of agricultural machinery was conducted in Dagana and Podor provinces to understand the current situation of each type of agricultural machinery (tractors, combine harvesters, and threshing machines). The confirmed contents are as follows.

- Satisfaction with the operator's driving skills:
  60% of vendors and unions responded that their operators possess sufficient driving skills.

- Responding to a customer or union member's request to rent agricultural machinery:
  In Dagana prefecture, 78% of agricultural machinery lenders and 77% of unions, and in Podor prefecture, 94% of agricultural machinery lenders and 100% of unions responded that “they were able to respond to agricultural machinery lending orders” and that “they were reasonably satisfied.”

- Causes of agricultural machinery breakdown:
  87% of manufacturers/repairers in Dagana prefecture and 78% in Podor prefecture answered that improper operation by operators was the cause of agricultural machinery failure.
- Suitability of owned agricultural machinery with local soil conditions:
  96% of venders and 90% of unions answered that tractors are "suitable." Moreover, 100% of both vendors and unions answered that combine harvesters "perform."
- Availability of spare parts:
  Venders and unions face difficulty obtaining spare parts. The main reasons for this are that compatible products are difficult to obtain in the Senegal River basin area and in Senegal, and that spare parts are expensive.

These survey results will be used as materials to show the latest progress of agricultural mechanization in the Senegal River basin area. They will also be used to study the contents of the training programs and seminars in the project and formulate agricultural mechanization.

(2) Economic efficiency of rice cultivation with agricultural machinery

In SEN-03, farm consolidation, harvesting, and threshing are mechanized. The farmers/producers bear the necessary costs for mechanization. "Addition of work by agricultural machinery" is effective in improving the work efficiency of rice cultivation. It is important for farmers/producers to understand and realize that the improvement in economic efficiency, such as the increase in yield or the decrease in labor costs, is due to the "addition of work by agricultural machinery."

The project examined the cost of using agricultural machinery in rice cultivation. According to the calculation of the production cost per ha of rice cultivation (dry season) by SAED (Senegal River Delta Senegal River Faléme River Basin Development Corporation), the income is 875,000 FCFA with a unit yield of 7 tons / ha, and the expenditure is 604,822 FCFA. The balance is 270,178 FCFA (Table 2-47).

Table 2-47 Income and expenditure per ha of rice cultivation

	Items	Amount （FCFA）
Income	Yield per ha　Paddy：7,000 kg x 125 FCFA/kg	875,000
	Subtotal	875,000
Expenditure	Farmland consolidation	90,000
	Seed	45,000
	Material (Fertilizer and Pesticides)	101,960
	Irrigation	146,540
	Labor cost	150,750
	Others	50,125
	Loan expenses	20,447
	Subtotal	604,822
Total balance		270,178

Source: SEN-03 “Project Progress Report (phase 2)”

On the other hand, the items of expenditure for agricultural machinery are included in the items shown in Table 2-47. For example, according to a survey by PAPRIZ2 (Senegal River Basin Irrigated

Rice Productivity Improvement Project), the cost of field maintenance work by tractor is 25,000 FCFA out of the total 90,000 FCFA.

When implementing mechanization of agricultural work, it is important to make a work plan based on the cost of using agricultural machinery for the entire rice cultivation process. For example, when leveling a field with a tractor, it is important to compare and confirm the cost and benefit effect before determining the benefit of using the tractor. An example of calculating the cost and benefit effect of field leveling by tractor is shown in the Box below.

Box. Example of cost and benefit effect calculation when leveling the field using a tractor

It is assumed that the cost of leveling by tractor is the same as the farmland consolidation work amount (25,000 FCFA). Based on this assumption, the expenditure for field leveling will increase by 25,000 FCFA. The increase of cost by this work is 4.1% (25,000 / 604,822) of the total rice cultivation expenditure, and the paddy amount equivalent is 200 kg (25,000/125). This is the same as the value. If the leveling work leads to an "increase in sales of 200 kg or more per hectare" or "reduced labor costs over 25,000 FCFA," the income and expenditure will increase and the benefit effect of leveling can be confirmed.

In addition, it is essential to analyze the production costs and machine usage costs for agricultural work to confirm the costs and benefits shown in “BOX. Example of cost and benefit effect calculation when leveling the field using tractor”. Throughout the project, it will be necessary to collect and analyze information from government officials, agricultural machinery lenders, unions, farmers, etc.

(3) Service provider and hiring service

1) Service provider training in Senegal

In SEN-03, training was conducted to strengthen the capacity of agricultural machinery service providers/provider-owned unions in response to the indication that agricultural machinery services could not be supplied in time and agricultural work could not be carried out according to the cultivation calendar. It has been reported that the capacity building method for service providers implemented in the project was a cascade method that repeats the following cycle, and that this training has improved the effect.

- Conduct training for contractors and union operators who are well known in the region and whose work is highly reliable.
- The trained operator becomes an instructor and trains other operators in the area.
- Operators who have received training in the area will grow and develop other operators as instructors.

2) Service provider prices in Kenya

In KEN-01, the service provider price of agricultural machinery shown in Fig 2-58 is listed in the catalog under the combined name of the project and the Muea Irrigation Business Zone (MIS). In the case of a reaper, the working time is 4.11 h/acre (10.28 h/ha), the service provider price is Kshs 3,200 / acre, and in the case of harvesting by hand, the working time is 8 h/acre (20 h/ha). Its price is Kshs

8,000 / acre. In addition, the service provider price of the combine harvester is Kshs 5,000 / acre, which is lower than the cost of harvesting by hand (Kshs 9,000 / acre).

Fig 2-58 Agricultural Machinery Catalog and Service Provider Prices

Source：KEN-01 "MECHANIZATION FOR ENHANCED PRODUCTION & POST-HARVEST SYSTEM"

2-8-5 Maintenance of agricultural machinery

One of the most important aspects of using agricultural machinery is maintenance. Even if a high-priced machine has been purchased, if it is maintained poorly, the machine may be unusable within a year. Examples of maintenance statuses in each project are shown below.

Project case study

(1) Strengthening the capabilities of users

1) Maintenance manual for Madagascar

In the MDG-01 project, manufacturing manuals for weeders developed in the project, operation manuals, etc., were prepared and distributed to facilitate maintenance (Table 2-48).

Table 2-48 Weeder manual prepared by the Madagascar project

No	Title	Language	Main distribution destinations	Year of issue year
1	Rotary weeder for paddy rice field manufacturing manual	Malagasy, English	Manufacturer	2011
2	Rotary weeder for paddy rice field operation manual	Malagasy	Manufacturer, farmers	2011
3	Upland rice weeder manual	Malagasy	Manufacturer	2011

Source：MDG-01 "Project Completion Report"

(2) Strengthening the ability of agents and repairers

As part of the capacity building of machine repairers and service providers, SEN-03 aims to acquire the knowledge and skills necessary for repairs by strengthening the capacity of agricultural machinery manufacturing and repair companies in Dagana and Podor provinces. Participants are informed that the following repair cycle needs to be repeated for the sustainable use of agricultural machinery, and they are instructed to understand it thoroughly.

- Prevention of breakdown
- On-site emergency repair in case of failure
- Identification of repair contents and arrangement of repair by appropriate judgment
- Implementation of repair
- Follow-up after repair

Furthermore, to facilitate access to agents, lists of agricultural machinery manufacturers centered on Dakar were created. The (1) agent name, (2) main location, (3) contact information, (4) person in charge, (5) repair system, and (6) other items are listed for the 10 agents. Under "repair system," the number of mechanics, the number of service cars, the tractor warranty period, the cost of parts during the warranty period, repair shop details, etc., are described.

If the number of repair contractors training in the project, the training content learned, etc., were added to this list, information such as “Confirming the technical capabilities and maintenance reliability of the agent” and “Understanding the level of the agent as a repair technician from the training content learned” can be confirmed, and it will be more effective as an agent list.

2-8-6 Considerations for the safety of agricultural machinery

Many accidents can occur in the operation of agricultural machinery, such as falling over, being caught in rotating parts, and being caught in machinery. Accidents related to agricultural work such as operating an unfamiliar machine, as well as accidents caused by reduced alertness due to familiarity, are common. The recognition of the risk of accidents will surely increase as agricultural mechanization progresses. We should understand in advance the types of accidents that occur with tractors, cultivators, combine harvesters, etc., and provide training on how to avoid accidents.

When developing a machine, it is necessary to consider basic safety measures, such as covering rotating parts and manufacturing a sufficiently strong machine. In addition, it should be instructed that a pre-start up inspection of items and an end-of-work inspection of items be routinely included as part of maintenance.

Project case study

1) Safety measures in Kenya

In the KEN-01 project, “how to handle a tractor in a muddy area” is explained in the manual (Photo 2-40). When entering or operating a tractor in a muddy area, the tractor may be unusable, and when going over ridges, there is a risk of causing a serious accident due to the tractor falling or rolling over.

After confirming the contents of the manual with the tractor owner and the operator, it is necessary to discuss safe work in muddy areas thoroughly.

		
Tractor sinking in the mud	Ridge entry and exit from mud	Discussion of the method to work in muddy land

Photo 2-40 Tractor work troubles in muddy areas

Source：KEN-01 Mechanization Terminal Presentation "PROPOSED ALTERNATIVE LAND PREPARATION METHOD"

2) Movement to acquire international certification in Madagascar

At a meeting attended by 30 staff members, including the Director General of the Agriculture, Civil Engineering and Machinery Bureau, an Indonesian expert of MDG-01 suggested that CFAMA obtain an International Certification (ISO) for agricultural machinery in the future. International certification is considered an important step in improving the quality of agricultural machinery in Senegal and ensuring the quality of imported products. However, it is very difficult to obtain international certification, and technical knowledge and experience as well as legal development are necessary.

For these reasons, it seems that it would be difficult for each country to obtain international certification, and it is conceivable to establish an agricultural machinery testing center that can be used in CARD member countries. The agricultural machinery testing center would conduct quality inspections of agricultural machinery, aiming to raise the level of technology for manufacturers, repairers, agents, etc., in each country. It is necessary to work on obtaining international certification after understanding the requirements of high-quality agricultural machinery. After understanding the requirements of high-quality agricultural machinery, when a certification test system for agricultural machinery is being constructed, it is essential to add equipment for the safety assessment of agricultural machinery in the test center, establish laws and regulations related to safety, and incorporate safety standards.

Chapter 3 Technique Transfer and Extension

The "Green Revolution" started in Asia in the 1970s. It increased the productivity of rice cultivation with the use of agricultural materials such as seeds and fertilizers, the development of irrigation facilities, and the dissemination of techniques. These effects were also seen in some African countries. However, structural adjustments were subsequently made as a condition for funding from the IMF and other financial institutions. In the structure adjustment, investment in systems and the number of systems to promote the expansion of production capacity were reduced. Additionally, the number of extension workers was significantly reduced as well. Under these circumstances, the JICA has promoted the dissemination of its technique to farmers by widely adopting the inter-farmer dissemination approach and the cascade dissemination method, in addition to transferring the technique to its counterparts (C/P). Moreover, effective public relations activities were carried out to disseminate rice cultivation technology widely, and efforts were made to construct a sustainable dissemination system.

3-1 Structure of Technique Dissemination

The structure of technique diffusion can be summarized as follows.

1. **Disseminate**: The public organization in charge of dissemination in each country will be the main actor, but there are also cases wherein NGOs and private companies (service providers, etc.) will be the main disseminators.
2. **Disseminated**: When individual farmers are targeted, the usual practice is to disseminate the technique among farmers by supporting key farmers. When farmers' groups are targeted, the technology is disseminated to the members through representatives of the organization.
3. **Technique disseminated:** The technique (see Chapter 2 Rice Cultivation Technique) whose effect is verified in experiments, research institutes of each country, and the demonstration farm of the project is utilized.
4. **How to disseminate:** For the C/P in charge of dissemination, the technique transfer is carried out through ToT (Training of Trainers) and OJT (On-the-Job Training). For key farmers, follower farmers, and general farmers, the technology will be disseminated through FFS (Farmer Field School) and demonstration farms.

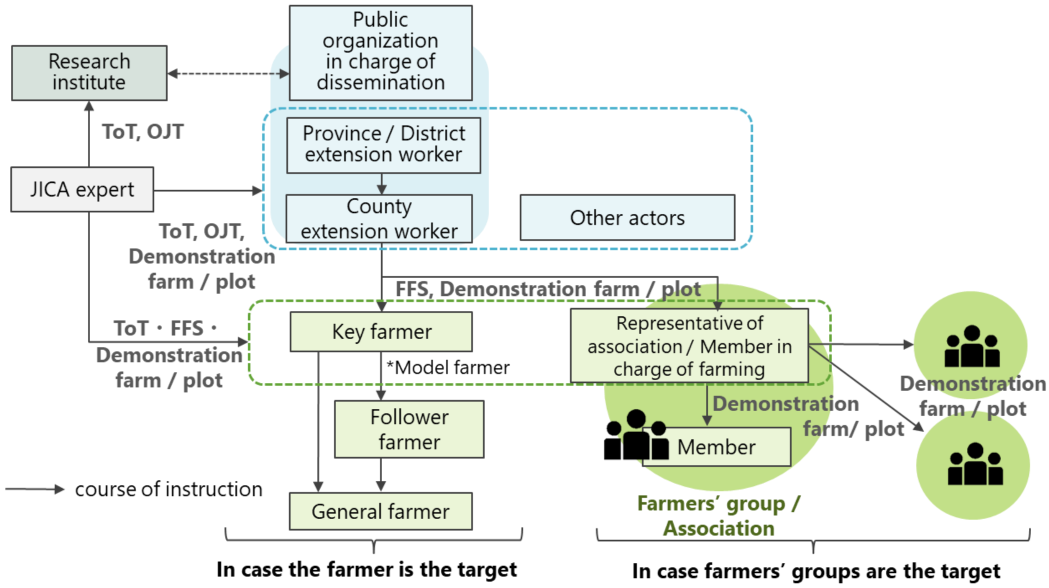


Fig 3-1 The structure of technique dissemination

3-2 Technique Transfer to Project Partners

It is very important to strengthen the capacity of public organizations responsible for dissemination and technical development to promote rice cultivation in sub-Saharan Africa. The JICA project works with the C/P to promote the improvement of problem-solving ability and ownership of partner countries. Technique transfer is promoted through daily project management and training.

3-2-1 Organization in charge of dissemination

The dissemination organization plays a major role in spreading rice cultivation techniques to farmers. In many projects, the organization in charge of dissemination has become the main C/P, and the technique has been transferred to them. The following table shows the challenges that sub-Saharan African organizations in charge of dissemination face frequently. The countermeasures for each problem are also shown.

Table 3-1 Challenges faced by organizations and countermeasures proposed by JICA projects

Target	Challenges	Countermeasure	Project code
Capacity	Capacity building of extension worker (Basic knowledge of rice cultivation and related fields, practical capacity for dissemination, monitoring and evaluation, etc.)	Capacity building through ToT and OJT	Many projects
	Technique development meets farmers' demand	Demonstration of techniques in demonstration farms	Many projects
Plan, Policies	Infrequent instructions and visits by extension workers (number of	Promotion among farmers and utilization of farmers' groups	Many projects

Target	Challenges	Countermeasure	Project code
	extension workers and transportation are limited, etc.)	Diversification of dissemination actors	SEN-02, RWA-02
		Implementation of effective dissemination and public relations activities	MDG-01, SEN-02, etc.
	Lack of activity funds	Reducing training expenses and packaging training	TZA-07
		Application and acquisition of budget through a Memorandum of Understanding conclusion by target counties, provinces, and project implementers	RWA-02
	Lack of plans and policies related to dissemination	Formulation of dissemination plans and reflection in policies	GHA-05, MOZ-01
	Lack of a monitoring system	Construction of a dissemination system utilizing a monitoring sheet	SEN-03

Technique transfer related to rice cultivation

The technique has been transferred by combining a lecture style in the classroom and a practical style, such as training in demonstration farms / plots, management of FFS, and monitoring.

(1) Training of trainers (ToT)

Implement ToT for extension workers and related administrative staff. In ToT, students first learn theory in classroom lectures. In addition, they are provided the opportunity to practice the techniques learned in demonstration farms and research fields. By doing so, they can acquire skills smoothly. The level of education varies by region. If the extension workers find it difficult to calculate the amount of fertilizer required and seeding, calculation exercises should be included as necessary.

(2) OJT in demonstration farms

When technical guidance is provided to farmers in demonstration farms / plots, their capacity is strengthened through OJT by extension workers and experts. It is important to acquire more practical skills through actual extension activities. In addition, in order to promote independent activities, it is desirable for extension workers to take the lead in activities after the second year.

(3) Conducting comprehension tests

Comprehension tests are conducted to ensure that extension workers who have participated in ToT or OJT understand the technique. After the comprehension test is completed, each participant confirms the points that he or she did not understand or misunderstood. Time for questions and answers is desirable to improve comprehension. Testing at the beginning and end of training can also be used to measure training effectiveness.

(4) Providing opportunities to reconfirm technique

Providing opportunities for extension workers who have participated in ToT or OJT effectively reconfirms their skills. In SLE-02, after the monitoring of the rainy season crop was completed, refreshment training was conducted, and opportunities were provided to explain the basic theory and important matters again. In RWA-01, extension workers who had participated in ToT repeated the cycle of practicing and confirming the technique through training for farmers to establish the techniques.

Technique transfer for extension activities

It is necessary to improve not only cultivation techniques, but also the ability to manage activities and teach techniques to farmers. Technique transfer for extension activities will be carried out through the following efforts.

(1) Training for implementation of extension activities

In addition to training on cultivation techniques, training will be provided to implement the following extension activities. Conduct the necessary training based on the capabilities and scope of activities of local extension workers.

Table 3-2 Training examples for implementation of extension activities

Targets		Content of training
Preparation	Prepare for the dissemination plan	Area for activities, the number of target farmers, consideration of necessary expenses
	Prepare a way to conduct FFS	Objective of FFS, making a schedule for FFS, how to set up demonstration farms (need to consider size, etc.)
Implementation	Facilitation	Instruction of facilitation for farmers (basic instruction: reviewing previous training, theory training, field training, reviewing) *In addition to the above, the important points for each type of cultivation management are conveyed to extension workers.
		Create cultivation management FAQ to answer questions from farmers
Monitoring and evaluation (M & E)	Monitoring	Distribute monitoring sheet to record activities in the demonstration farm and FFS
	Evaluation after FFS is completed	Confirming difference between conventional cultivation management and improved cultivation management (yield survey and income and expenditure analysis)

(2) Preparation of teaching manuals and guidelines

When preparing for the dissemination of teaching manuals and guidelines, it is desirable to prepare and finalize material with extension workers rather than have it prepared solely by experts. It is expected that ownership of teaching materials and guidelines will be supported by preparing them together, and that these will be utilized continuously even after the project is completed.

Examination method to strengthen capacity

Preparing training plans after clarifying the capacity achieved is more effective for strengthening the capacity of local administrative staff. **CUDBAS (Curriculum Development Based on**

Vocational Ability Structure) is used in JICA projects as a method for examining capacity development measures.

CUDBAS is a method of listing the human resources abilities being aimed for and organizing them structurally, leading to the development of human resource development curricula, preparation for training plans, and business improvement. Through the workshops held in NGA-01, the C/P and the Japanese experts analyzed and shared their ideal abilities from three aspects: knowledge, skills, and attitudes. They contributed to develop an action plan effectively to acquire the lacking abilities.

Box. Diversification of dissemination actors

The JICA project aims to strengthen the capacity of the administrative agencies and staff responsible for dissemination. However, in many cases, the number of dissemination staff is insufficient. Considering this situation, SEN-02 provided training on rice cultivation techniques not only for extension workers, but also for animators of local NGOs. As a result, the techniques were disseminated in the areas covered by the NGOs.

Photo 3-1 Lectures by county agricultural officers and union extension workers at FFS (RWA-02)

In RWA-02, training was also provided to the "FFS Facilitator" working at the margins of the project, and the extension workers employed by the rice farmers' association. This was in addition to the transfer of technique to the county office, which is responsible for implementing the agricultural extension project. Consequently, the construction of a system that can effectively develop the extension activity was advanced. Therefore, it is important to utilize the actors who have the potential to spread the technique in the target region actively in order to solve the problem of insufficient extension workers.

3-2-2 Research institutions

Research institutions play a major role in the development and optimization of techniques that meet diverse cultivation ecologies and socioeconomic conditions, and capacity building of research institutions is essential for promoting rice cultivation. However, the technical development capacity of research institutions in Sub-Saharan Africa is low, and there are problems, as shown in Table 3-3. JICA has been working to strengthen the capacity of research institutions in cooperation with Japanese universities and research institutions through the SATREPS, which is implemented jointly with JST.

Table 3-3 Challenges faced by research institutions and researchers and countermeasures taken in the JICA project

Targets	Challenges	Countermeasures	Project code
Capacity	Strengthen researchers' capacities	Capacity building through OJT and study in Japan	KEN-02, MDG-03, etc.

Targets	Challenges	Countermeasures	Project code
	Develop techniques to meets farmers' demand	Strengthening of laboratories	KEN-02, UGA-03, etc.
		FRG	ETH-01
Plan, policies	Unstable employment for researchers	Preparation of research strategies, such as plans for rice breeding development	KEN-02
	Insufficient budget for research activities		
	Lack of fulfilling policies for research support		
Infrastructure	Inadequate research facility and equipment	Improvement of experimental fields and introduction of equipment	ETH-02, TZA-08, etc.

Strengthening the capacity to conduct research activities

In order to strengthen the capacity to conduct research activities, it is necessary to work on both tangible factors, such as improvement of the research environment, and intangible factors of human resource development for researchers.

(1) Improvement of the research environment

As agricultural research institutes in Sub-Saharan Africa often lack sufficient fields and facilities to conduct research, infrastructure will be developed as necessary. Moreover, there may be problems in infrastructure development, such as shortage of electricity to operate research equipment and a lack of water supply facilities to provide clean water. In this case, it is necessary to plan considering the surrounding context.

(2) Preparing the research plan

The research plan is prepared after determining a research theme (selection of varieties, breeding, development of cultivation techniques, etc.) for dealing with the technical problems of local farmers. Guidance on experimental and field design should be provided as necessary to ensure scientific and realistic research plans.

(3) Conducting research activities

Research activities are conducted based on research plans. In the case of SATREPS and JICA projects, the capacity of local researchers is usually developed by OJT, in which research is conducted together with Japanese researchers and experts. In addition, necessary training will be provided in each research field on statistical analysis, sampling methods, and the usage of various analytical instruments. There are also cases in which students study at Japanese universities through the support of SATREPS, etc., in order to obtain doctoral degrees and acquire the latest technologies.

Photo 3-2 **Research activities (left / center: MDG-03, right: UGA-03)**

(4) Holding regular debriefings or meetings

Regular briefings or meetings will be held to monitor research progress and share information. In KEN-02, weekly meetings were held with visiting researchers to report their weekly activities, share problems and discuss solutions, discuss plans for the next week's activities, share the results of their research activities with researchers in the two countries, and exchange opinions on experimental plans, experimental methods, data analysis, etc. This led to improvement in the research performance and presentation abilities of Kenyan researchers.

(5) Dissemination of research results

Research results will be disseminated through presentations at international and academic conferences, paper presentations, and the creation of research journals. In ETH-01, the research results were utilized not only for research papers, but also for the preparation of teaching materials for dissemination. In order to strengthen the ability of researchers to create teaching materials, the project prepared "Extension Material Development Guidelines" and promoted the transfer of basic techniques to create teaching material, such as the types and designs of teaching materials and the method of taking photographs that can be used for teaching materials for dissemination.

Box. Rice Research for Tailor-name Breeding and Cultivation Technology Development in Kenya

There is a gap between actual and potential yields in each region. It is difficult to fill the gap in yield with only uniform technique. It is important to apply techniques focusing on the production bottlenecks in each rice-producing area. In the SATREPS "Rice Research for Tailor-name Breeding and Cultivation Technology Development" project conducted in Kenya, development of tailor-made breeding and cultivation techniques was promoted to cope with abiotic environmental stressors, such as drought, salt accumulation, cold damage, and low fertility soil. As a result, a new breed resistant to each stress was developed. In order to advance rice breeding and cultivation technology development further, a rice variety development plan and a demonstration manual for improved cultivation technology have been prepared and they are expected to be utilized after the project is completed.

Strengthening collaboration between research and extension

In order for research institutions to function effectively in promoting rice cultivation, the first requirement is to identify farmers' technical needs and develop techniques to meet those needs. Subsequently, the developed techniques are disseminated to farmers through extension workers.

It is important to strengthen the capacity of both research institutions and extension agencies. Some JICA projects have implemented measures to strengthen collaboration between research and extension. Examples are as follows.

Examples of projects

(1) Application of the Farmers Research Group approach (ETH-01)

The Farmers Research Group (FRG) is an initiative to strengthen collaboration between research and dissemination practices in Ethiopia, and it develops and improves techniques using FRG's approach. The FRG approach is a participatory agricultural research method in which a team of researchers, a group of farmers, and extension workers collaborate to conduct a study. It has the following three functions.

i) Incorporating the traditional experience and knowledge of farmers and developing new techniques or improving existing techniques in accordance with the target areas.
ii) Developing farmers' capacity to analyze problems and solve them by themselves or further improving them.
iii) Providing a platform for the parties concerned to cooperate in problem-solving and further improvement.

The basic steps of the FRG approach established through the implementation of ETH-01 are as follows:

Table 3-4 Basic steps of the FRG approach

Steps	Activities
(1) Problem (possibility) analysis (2) Formation of interdisciplinary research team (3) Establishment of the farmers' research group (4) Matching research subject candidates with problems	Start with any step (1) - (3). Regardless, it is assumed that the researcher and the farmer agree on the research theme. Validation of the proposed test theme will take into account the feasibility of the technique, consistency with the farming system, economics, social acceptability, anticipated risks, and the capacity of the research team, as well as the prioritization of farmers.
(5) Making a research proposal	Based on the above agreement, the researcher makes a proposal.
(6) Networking within the parties involved	Regarding inputs or the aim for commercialization, the government encourages participation in research activities by agricultural material suppliers, cooperatives, traders, etc.
(7) Joint preparation of research plans	All parties concerned (researchers, farmers, and extension workers) shall prepare a report and agree on their roles and schedules for regular meetings.
(8) Testing in farmlands	Extension workers and farmers collect data.
(9) M & E	Researchers, extension workers, farmers, and other participants work together to record activities. Activities will be jointly evaluated by relevant parties.
(10) Systematization of techniques	Research results are systematized as much as possible in the form of cultivation standards, etc., and teaching materials are prepared in addition to research papers.

Source: ETH-01 "Guideline to Participatory Agricultural Research through Farmer Research Groups (FRGs) for Agricultural Researchers"

According to the project completion report, 35.2% of the farmers received direct benefits and 41.8% of the farmers received indirect benefits from the FRG approach conducted in ETH-01[26]. Although some farmers acquired skills through the FRG approach, the challenges addressed by the FRG approach and farmers' needs were not always met. Therefore, technique transfers for the FRG approach and improvement of researchers' communication skills with farmers continue to be required.

(2) Strengthening the linkage between research and extension through training of master trainers (ZMB-02)

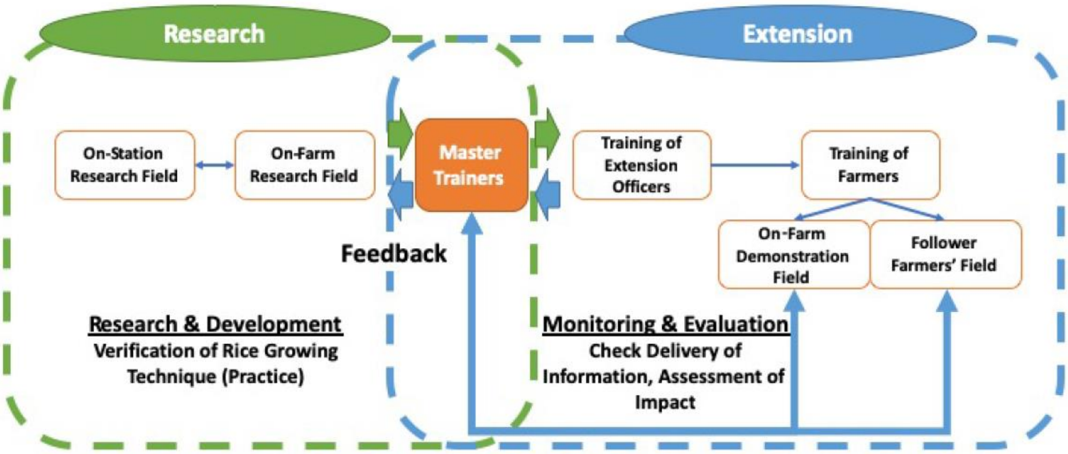


Fig 3-2 Strengthening the linkage between research and extension

Source: ZMB-02 "Rice Extension Package"

In ZMB-02, a master trainer (lecturers for extension workers selected from both researchers and extension workers) was trained. Master trainers were deployed to strengthen the linkage between research and extension, and their main roles were to: 1) prepare and revise rice extension packages, 2) train extension workers, and 3) monitor activities in follower farmers' fields. Collaboration between research and extension has been strengthened through the implementation of the project, and it is expected to strengthen collaboration further for the development and extension of rice cultivation techniques for farmers in the future.

(3) Establishment of a system of technical support for dissemination actors by research institutes (UGA-03)

In UGA-03, there were problems of knowledge and technique not being effectively utilized because of the lack of coordination among research institutions, extension actors, farmers, and other related actors. To cope with these problems, research institutions have been promoting the construction of a system to serve as a technical backstop for extension actors as knowledge banks. Specifically, the system includes the implementation of a ToT program by research institutions for extension actors, training for farmers, preparation of extension materials, and production of excellent seeds essential for extension activities. Through these activities, the National Agricultural Research Institute of Uganda has provided training to researchers from many regional agricultural

[26] *ETH-01 "Project Completion Report"*

research and development institutes and extension actors. Furthermore, through the activities conducted by the project at the demonstration sites (Musea Field School: see pages 3-20), collaboration between research and extension has been promoted by researchers' interviewing farmers about issues and conducting farm field tests.

(4) Implementation of research activities in collaboration with technical cooperation projects (MDG-03)

In MDG-03, demonstration tests of P-dipping technology (refer to 2-1Overview of Rice Cultivation, 2-2-3 Planting) have been conducted using key farmers and extension workers of the Ministry of Agriculture, Livestock, and Fisheries in regions targeted for extension by MDG-02. This research activity is linked to technical cooperation projects from the demonstration test stage, and information is regularly shared. Collaboration with technical cooperation projects is effective in disseminating research results over a wide area.

3-3 Dissemination to Farmers

In order to promote the dissemination of the technology to farmers, the degree of acceptance of the technique by farmers and the dissemination of the technique to more farmers are important. The following table shows the challenges seen in sub-Saharan Africa and the countermeasures taken by the JICA project.

Table 3-5 Challenges in dissemination to farmers and countermeasures under the JICA Project

Targets	Challenges	Countermeasures	Project code
Acceptance of the technique	Low cultivation techniques and management capabilities (technical capacity)	Rice cultivation training (use FFS and demonstration farms)	Many projects
		Improvement of techniques that are difficult to adopt	RWA-01
	Insufficient funds to implement appropriate technique (economic capacity)	Provision of inputs for technical trials	UGA-03, etc.
		Credit System (See 2-6 Rice Farming Management and Value Chain Development)	
	Less willingness to produce rice	Selection and dissemination of techniques that consider cost benefits	GHA-06
		Branding and co-marketing(See 2-6 Rice Farming Management and Value Chain Development)	
	Techniques do not get established and spread	Support for Innovators	NGA-01
Dissemination of technique	Key farmers and groups that play a major role in dissemination among farmers do not function	Selection of key farmer	Many projects
		Selection of farmers' associations by proposal	RWA-01
	Techniques do not spread beyond target farmers	Implementation of effective dissemination and public relations activities	Many projects

3-3-1 Adoption of appropriate technique

Even if techniques have been proven effective at a test farmland, farmers may not always accept them. In order to ensure farmers accept the techniques, it is necessary to consider the following three points: 1) Are they suitable for the needs of farmers? 2) Do they match the knowledge and technical level of farmers? 3) Are they suitable for their economic ability? Since many farmers are reluctant to change their conventional method, it is important to meet these three conditions and increase farmers' awareness while cultivating their satisfaction (realizing improved yield and profitability, etc.) with their participation in the project.

Adaptability to farmers' needs

As described in Chapter 2, many useful techniques have been identified. However, because of the diversity of cultivation environments, they cannot be used as uniform technical packages, and they must be adapted to the needs of farmers. It is important to conduct a demonstration test in the farmhouse field to optimize the technique.

(1) Confirmation of farmers' needs

In order to understand the technical issues faced by farmers, a baseline survey will be conducted in the target cultivation ecologies.

Table 3-6 Examples of survey items in the baseline survey

Categories	Survey items
General	The cultivation area, cultivated crops and rice varieties, rice production and sales volumes, the participation of farmer organizations and water use unions, general information on farmers (number of households, years of education, and non-agricultural income), etc.
Cultivation ecology	Weather conditions, water environment (for irrigated areas: type of agricultural water used, timing of water availability, etc.), soil type of the field, presence or absence of levees, location of the field (obtain GPS location if needed), etc.
Cultivation technique	Planting calendar, field preparation, planting method, fertility management, weed and pest control, field water management, and harvesting method
Others	Access to finance, sales methods (where and when to sell), use of agricultural machinery, etc.

In addition to the soil maps of each country, it is also desirable to confirm the nutrient characteristics of the target fields as necessary by referring to the information provided by FAO[27] and ISRIC (International Soil Reference and Information Centre) World Soil Information[28]. This is because in Sub-Saharan African countries, low soil fertility and nutrient deficiency are also considered factors in low yield.

(2) Implementation of demonstration tests in farmland

The demonstration test may be carried out in 1) FFS and other demonstration farms, and 2) it is carried out in farmhouse fields of multiple sites. Compare the conventional cultivation techniques with the improved cultivation techniques proposed by the project for technologies that require verification (variety, fertilizer level, seeding rate, etc.).

Adaptability to farmers' knowledge and technical levels

Even if a technique is effective, it will not spread unless farmers can understand and practice it. It is necessary to adapt the techniques that farmers can accept through the following measures.

(1) Improvement of techniques that are difficult to adopt

Techniques that are difficult to adopt need to be improved to make them acceptable to farmers. In RWA-01, important technical elements of the techniques for which adoption rate was low (according to the dissemination survey carried out in the middle of the project) were discussed for improvement in evaluation workshops carried out in each crop season. When a limiting factor that exceeded the capacity of the farmers or unions was identified, the focus shifted to switching to alternative techniques and increasing the adoption rate.

[27] http://www.fao.org/soils-portal/en/
[28] https://www.isric.org/

(2) Presentation of multiple technique packages

Instead of presenting a uniform technical package, the idea is to present multiple technical packages so that the appropriate technique can be selected based on the scale of farm management and cultivation environment. MDG-01 proposed a high-yield technical package that optimizes the use of chemical fertilizers for farmers with relatively large operations and the ability to invest in them. On the other hand, smallholder farmers with insufficient funds were presented with a technical package that, as much as possible, does not require external inputs such as chemical fertilizers.

Adaptability to economic capacity

It is important to consider how to introduce appropriate techniques from the following perspectives and how to conduct extension activities. Countermeasures in case of insufficient funds are described in "2-6 Rice Farming Management and Value Chain Development."

(1) Provision of inputs for technical introduction

Agricultural inputs needed to test the technique are supported by the project only in the first year. It is necessary to show a method in which farmers can implement the technique independently from the next crop by utilizing the profit gained by investing agricultural inputs and produced seeds. It should be kept in mind that a situation in which agricultural inputs cannot be invested without project support is not sustainable. Additionally, attention should be paid to the possibility of encouraging farmers' dependence on support.

(2) Selection and dissemination of techniques that consider cost benefits

As described in "2-6-1 Farm planning and management," it is important to optimize agricultural investment according to economic capacity. It is necessary to select techniques that will not only improve yields but also maximize farmers' profits for sustainable dissemination of techniques. Therefore, income and expenditure should be calculated when introducing techniques.

Box. Technology optimization and dissemination through support for innovators

Rogers' diffusion theory of new technology adoption states that a 2.5% penetration rate is the transition point from innovative technology adopters (innovator) to early adopters in small numbers, and that penetration accelerates when penetration exceeds 16%. NGA-01 selected innovators among potential rice distributors to adopt improved techniques, and supported them to improve rice quality and profitability through the adoption of improved techniques. As a result of promoting techniques development (development of prototype -> performance test -> improvement -> performance test -> improvement -> widespread production) while supporting innovators, optimizing technology, and taking actual conditions into consideration, many distributors adopted improved technology. It is possible to apply this approach to the dissemination of the technique in other fields by determining the innovator who receives the technique first for the dissemination of the technique.

Source: NGA-01 "Project Completion Report", the results of interviews with parties involved in the project

3-3-2 Dissemination method

Appropriate dissemination methods should be considered in accordance with the conditions and customs of the target areas. As mentioned above, because of the limited number of extension workers and activities, the following methods have been practiced to disseminate the techniques to more farmers: (1) dissemination through FFS, (2) dissemination among farmers through key farmers, and (3) dissemination through farmers' groups. The following table shows the characteristics of each dissemination method.

Table 3-7 Expected effects and considerations of each dissemination method

Dissemination method	Expected effects	Considerations
Dissemination through FFS	- Promotion of understanding of technique through collaboration in demonstration farm / plot - Providing opportunities for mutual learning among farmers participating in FFS - Implementation is possible by carrying out ToT for extension workers	- It is necessary to develop human resources to serve as FFS facilitators (Extension workers, etc.). - Setting up places and conditions in which many farmers can participate is necessary.
Extension among farmers through key farmers	- In the case of setting up a demonstration farm: promoting understanding of techniques - Key farmers can take the lead if extension workers are unable to visit farmers frequently - Other farmers are more likely to accept it	- Technology will not spread if key farmers are insufficiently trained (technical and communication skills) or relinquish their roles - Weak lateral communication links between farmers leads to techniques not disseminating.
Extension utilizing farmers' groups	- In the case of setting up a demonstration farm: promoting understanding of techniques through joint work - Continuous extension activities (technical guidance to members) are possible as a group - Ability to take advantage of organizational strengths, such as joint sales and purchases	- If farmer groups or unions are lacking, organizing efforts are required. - Efforts must be made to ensure that the group can continue to prepare for the costs of setting up demonstration farms.

If the dissemination system in the target area is very weak, direct guidance for farmers may be effective in ensuring the sustainability of the project. However, the extension workers are still the core dissemination agents in implementing the above-mentioned dissemination method. As described in "3-2Technique Transfer to Project Partners," capacity development of dissemination agencies remains an important issue.

Dissemination through FFS

FFS aims to improve farmers' capacity to respond to problems that arise in the field by learning agricultural techniques for improving productivity. This is done through proactive and participatory learning among farmers. FFS will be held in the demonstration farm throughout the cropping season, and it will be an opportunity to compare between the demonstration farm using recommended cultivation techniques and a conventional field using conventional techniques to convince farmers of the usefulness of the recommended cultivation techniques. As FFS also provides opportunities for extension workers to implement techniques at the field level and aid farmers, it is important for extension workers (FFS facilitator) from the perspective of capacity building.

What is FFS (Farmer Field School)

FFS, a participatory learning approach developed by FAO, has been used in Southeast Asia since the 1980s. It is now applied in more than 90 countries worldwide. The emphasis is on the idea that simply teaching a technical package does not solve farmers' problems, and that it is important for farmers themselves to strengthen their decision-making capacity to adapt to these problems.

FFS brings a group of 15 - 25 farmers together regularly to learn about agricultural techniques through actual farm work and crop observation under an FFS facilitator. The key to success is said to be the development of FFS master trainers and facilitators, who are expected to have the ability not to "teach" technique, but to "facilitate" participating farmers. FFS has been used in various fields in agriculture, including forestry and fisheries industries, and has supported more than 4 million farmers worldwide.

Source: FAO “Farmer Field School Guidance Document,” 2016

Activity steps

(1) Securing and supporting FFS facilitators

The FAO Farmer Field School Guidance Document lists the following criteria for the selection of FFS facilitators:

- have some level of advanced skills, knowledge, and experience in agriculture and be technically competent for the agro-ecosystem at hand.
- be available to facilitate the FFS.
- be able to share experiences and connect well with other community members.
- have good, participatory ways of working.
- have at least some reading and writing skills, speak the local language, and live in the local community.
- have a dynamic and confident personality.

(2) Considering schedule and venue

Although the number of FFS can vary depending on the country/region, it should be based on the cultivation schedule (timing of seedling sowing, rice planting, fertilization, pest and weed control, and harvesting). If necessary, consider holding FFS from when the farming plan is prepared.

Base activities and the demonstration farm are determined based on the following points.

Cultivation environment: suitable for rice cultivation (water conditions and field improvement), generally uniform growth.

Location : good access for farmers and extension workers and easy to observe.

(3) Advance preparation

Before each FFS session, make the following preparations: procurement of necessary materials and inputs, completion of necessary field preparation, cultivation management (completion of plowing and puddling in advance, confirmation of growth damage, etc.), and guidance for participants.

In RWA-02, the implementation guidelines for rice cultivation training specify the necessary preparations and the timing to start preparations before each section is held, and efforts were made to enable extension workers to hold FFS at an appropriate time (Table 3-8).

Table 3-8 FFS preparation schedule (example)

Activities	Day											
	–	～	-14	～	-7	-6	-5	-4	-3	-2	-1	0
1st FFS (seedbed sowing)	▼											
Monitoring of seedlings	—	—	—	—	—	—	—	—	—	—	—	—
First plowing			▼									
Determination and notification of 2nd FFS					▼							
Second plowing									▼			
Preparing for materials and inputs											▼	
2nd FFS (transplantation)												▼

Source: Prepared by JICA survey team based on the RWA-02 "Guidelines for Arrangement of Rice Training Program"

(4) Procedure

FFS is conducted multiple times throughout the cropping season, and the procedure is generally as follows.

i) Confirmation of the application of the techniques in each field by the FFS participants in the previous review.

ii) Theory training using extension materials.

iii) Practical work (on-the-job training) and observation in the demonstration farm.

iv) Review and discussion of training.


Theory training


Setting up the demonstration farm


Practical work in demonstration farm

Photo 3-3 Implementation of FFS (SLE-02)

(5) M & E

FFS facilitators and extension workers monitor growth and the status of implementation of FFS in the demonstration farm. At the end of all sessions, participants are asked to evaluate the FFS and compare the yields of the demonstration farm and conventional fields to determine the effectiveness of the recommended cultivation techniques. At this time, the expenses required for agricultural inputs are taken into account, and it is confirmed whether the cultivation technique practiced in FFS was effective for both yield and profitability.

In order to measure the effectiveness of the extension activities through the project, the following indicators are monitored and the effectiveness of the activities is evaluated in comparison with the baseline survey data.

- Rate of adoption of the recommended rice cultivation techniques (technical item, status of utilization of technical package, etc.)
- Yield, planted area, production volume, profit, sales volume, etc.

Box. Monitoring by ICT

Photo 3-4 Baseline survey (SLE-02)

Baseline surveys and extension activities have been monitored using materials such as questionnaires. However, collecting the questionnaires, labor involved in the information input, risk of generating errors, etc., are problems. In recent years, the use of ICT in agriculture has been growing in Sub-Saharan Africa, and there are some examples of its use in JICA projects. In SLE-02, smartphones with pre-installed applications were lent to extension workers every season to conduct baseline surveys and monitor progress using the applications. Thus, data collection was performed efficiently.

Source: Based on the results of interviews with SLE-02 project experts

Extension among farmers through key farmers

Technique transfer to key farmers (also known as model farmers) has been carried out in many projects to spread techniques from key farmers to surroundings farmers. There is also a project to set up follower farmers to learn skills from key farmers, which adopts a spread structure of key farmers -> follower farmers -> general farmers.

Activity steps

(1) Selection of key farmers

It is important to select the optimum key farmhouse in the target region. The selection criteria for key farmers need to be set appropriately depending on local customs and rice cultivation conditions. The common criteria generally used to select key farmers are shown in the table below.

Table 3-9 Criteria to select key farmers (example)

Categories	Items to be checked
Characteristics of farmer	Possess at least some reading and writing skills; suitable ages (set depending on local conditions); resident of the target area; balance of gender
Ability	Experience of rice cultivation; confirmation of yield and technique levels as needed
Enthusiasm	Willing to teach neighboring farmers and participate in training sessions
Relationship with surroundings	Approved by the farmers' group (water unions, cooperatives, etc.,) that is the local leader or representative

(2) Trainings of key farmers

There are two types of training for key farmers. In one, key farmers participate in ToT sessions for extension workers (direct guidance type), and in the other, extension workers participate in practical training in FFS and the demonstration field (indirect guidance type). In some projects, direct guidance is provided to key farmers during phase 1, as well as technical demonstration tests in farmland. When full-scale extension activities are being carried out in phase 2 and later, indirect guidance may be adopted.

In addition to training in cultivation techniques, capacity building to play the role of a key farmer is also required (Table 3-10).

Table 3-10 Guidance guidelines for key farmers

Stages	Items to be checked
1) Planning stage	Selection criteria for key farmer; preparation of key farmers' list; confirmation of the roles and rights of the key farmer; preparation of the activity schedule
2) Training stage	Implementation of initial training for key farmer; implementation of practical training under 4) On-farm demo stage
3) Demo plot set-up stage	Selection criteria for demonstration farm; installation method, preparation for demonstration farm; promotion of demonstration farm for general farmers by follower farmer
4) On-farm demo stage	Implementation of demonstration (raising seedlings, transplanting, fertility management, harvesting, etc.)
5) Monitoring & Evaluation stage	Confirmation of yield and profit

Source: Prepared by JICA study team based on the KEN-01 "Guideline on how to disseminate WSRC through farmer to farmer approach"

(3) Extension activity based on followers' farms

By encouraging follower farmers to set up demonstration farms / plots, the method of presenting recommended cultivation techniques to neighboring farmers is widely adopted. At this time, it is important to give due consideration to all aspects to ensure that follower farmers can set up a demonstration farm /plot by implementing the aforementioned training and distributing guidelines. In addition, necessary agricultural inputs will be distributed to key farmers in order to utilize the recommended cultivation techniques in the demonstration farm (provision of inputs may be an incentive to set up the demonstration farm).

In some cases, guidance was provided to five follower farmers and two general farmers by the key farmers (TZA-02). It is worthwhile to consider presenting concrete numerical targets to the key farmers.

(4) M & E

It is desirable to establish a system to follow the activities of key farmers through monitoring by extension workers in the target areas.

[Notes]

It should be kept in mind that if social ties in the target region are weak or technique transfer to key farmers is inadequate, there is a possibility that the technique may not spread from key farmers to general farmers.

The study conducted in MDG-03 found that of the 33 farmers who were supported directly by the farmer trainers in MDG-02, only 3 farmers (secondary communication cluster) voluntarily provided information to multiple farmers. It was shown that increasing the number in the secondary information transfer cluster is important for effectively disseminating the technique. In addition, since these farmers did not fully understand the techniques and their roles, the sites in which the use of agricultural trainers was not going well were pointed out. Therefore, it is necessary to provide support so that agricultural trainers can continue their activities in addition to implementing the "Training of key farmers" mentioned above.

Examples of projects

(1) Extension among farmers (TZA-07)

In Tanzania, JICA has been implementing technical cooperation projects for many years. As a result of trial and error and improvement, a training package called "Irrigated Rice Farming" was then established. At the beginning, the package, which had many training days and could provide careful guidance, was adopted. However, considering cost sustainability, the training package has been improved as follows, ensuring the quality of training has not reduced.

Table 3-11 Training package

Items		Initial	Revised
Number of irrigation districts targeted		1	2
Number of participating farmers per district (key farmers)		16	8
Number of participating farmers per district (follower farmers)		80	40
Number of techniques targeted for training		All (44 techniques)	Optional (less than 44)
Training of extension workers		–	4 days
Training type	1) Baseline survey	4 days	3 days
	2) Group training	12 days	5 days
	3) Practical training	Total: 3 × 4 days = 12 days	5 days
	4) Monitoring and evaluation	Total: 2 × 4 days = 8 days	3 days
Follow-up by the instructor		–	1
Budgets per scheme (Tanzanian Shillings)		30 million	15 million

Source: TZA-07 "FINAL REPORT OF THE PROJECT FOR SUPPORTING RICE INDUSTRY"

Group training was conducted at KATC and MATI. In addition, the project instructed holding a "follow-up by the instructor" along with "field day" and held a "field day" for neighboring farmers in 31 of 54 districts (57.4%).

In the first year of TZA-07, a group comprising one key farmer and five follower farmers learned the technique through joint work in a demonstration farm. In the second year, these farmers instructed other farmers, and the result was that the average yield of farmers who did not accept direct training increased from 2.6 t/ha to 3.7 t/ha[29].

(2) Musomesa Field School (UGA-03)

UGA-03 pointed out that the adoption rate of the recommended technique was low in prior projects. Therefore, the project examined a model in which human resources are developed in the community and the farmers transmit information themselves, and adopted "Musea (the local word for teacher) Field School (MFS)" as a cascading dissemination method suitable for Uganda. In this system, Ugandan researchers and extension workers use demonstration sites to support the Musomesa, and the registered Musomesa disseminates cultivation techniques and excellent seeds to neighboring farmers. To expand MFS as an excellent model, UGA-03 is conducting activities while keeping the following five points in mind.

1) **Improvement of farmers' rice cultivation skills**: follow-up by a neighboring Musomesa is key, not just the follow-up by extension workers.
2) **Support of agricultural extension workers:** provide participatory ToT and opportunities for regular communication with the research institution.
3) **Maintaining motivation without external factors:** provide opportunities to create emotional experiences and relationships of trust.
4) **Increased awareness of Musomesa:** PR activities utilizing existing media such as SNS and radio.
5) **Establishment of a system for the continuation and expansion of MFS**: establishment of a system for the continuation and expansion of MFS and establishment of a training platform to organize the training activities of each donor and secure funding.

Photo 3-5 Graduation ceremony of MFS (UGA-03)

Farmers registered as a Musomesa have taken on a more challenging role as key farmers, achieving an 85-100% technique adoption rate through MFS on the model site.

Extension utilizing farmers' groups

Taking advantage of groups and unions and conducting extension activities targeting farmers' groups and unions is also an effective method of dissemination.

[29] *Y. Nakano, et al. "The Impact of Training on Technology Adoption and Productivity of Rice Farming in Tanzania: Is Farmer-to-Farmer Extension Effective?", March 2015*

Activities steps

(1) Selection of target farmers' group

The following table shows criteria for selecting target farmers' groups. It should be customized according to local conditions.

Table 3-12 Criteria for selecting target farmers' groups (example)

Target	Criteria
Accessibility	Demonstration farm / plot to be set up is located in a place easily accessible to neighboring farmers and groups.
Agroecosystem	Suitable for the cultivation environment of rice (water environment, etc.). Have potential for increased yield.
Group/Union	Establish group/union decision-making processes. Have ability to purchase necessary inputs without financial problems. Can be a model for other groups/unions.

In many cases, extension workers select the farmers' group. However, RWA-01 adopted a bottom-up approach in which associations submitted proposals for projects, and target associations were selected with consideration to respect the associations' independence and willingness to participate in projects. This was because many associations were established solely for receiving public subsidies or were unwilling to participate in training. Hence, they had to avoid such associations intentionally. The farmers' association cooperatives adopted the proposal method and participated actively in the project activities, and the proposal method was an effective means in the target region.

Table 3-13 Procedures for selecting farmers' associations by the proposal method (example)

Steps	Period	Person in charge	Needed form
1. Post at the district office and sector office, and notice to the association concerning the recruitment of new partnerships by the sector agricultural officer	3 weeks	District and sector agricultural officer	Announcement poster for recruitment of target associations; proposal form for selection of target associations
2. Prepare for proposals by association and support preparation and submission of proposals by the sector agricultural officer		Association and sector agricultural officer	
3. Evaluation and grading of submitted proposals	3 days	District agricultural officer and project team	Proposal evaluation form for association selection
4. Consideration of the composition of the group consisting of core and public associations (comprised of associations that had submitted proposals)	1 day		-
5. Visits and interviews with the top three associations in each district	3 days		On-site survey form for union selection
6. Notification of the results of the selection to the association	1 day		-
7. Start training	-	Donor and project team	-

Source: RWA-01 "Project Completion Report"

(2) Technical guidance for the farmers' group

Technical guidance on cultivation techniques using FFS and the demonstration farm / plot is provided to representatives of farmers' groups and unions. Provide necessary training for group activities (management of activity funds, group purchases, sales, etc.). In RWA-02 in the first year, the project implemented district support with the C/P in the target district, and after the second year, the C/P adopted a cycle of indirect support in which the C/P conducts extension activities by utilizing the budget and human resources of the district office.

(3) Technical guidance for the farmers' group and union

Although projects do not often intervene directly, representatives of groups that have received technical guidance will encourage members of groups to spread the technique. Additionally, consider appropriate dissemination methods in consideration of the activities of the target groups and unions, such as using demonstration farms as bases for extension activities within groups or putting technical advisors assigned to unions in charge of extension activities.

(4) M & E

Extension workers monitor the activities of farmers' groups and unions to assess the impact on farmers' yields and group profitability.

Examples of projects

(1) Continued support for farmers' organizations (FBO) (SLE-02)

FFS, which had been implemented by the Ministry of Agriculture of Sierra Leone, was limited to one year. In the first year, seeds and fertilizers were provided, and only technique was learned, so it was not expected that the technique would be established. Therefore, in SLE-02, FFS was conducted for FBO in the first year to enable learning TP-R in the demonstration farm, and this had an effect. In the second year, the scale was expanded to a maximum of 1 acre (0.4 ha) in the group field, and rice cultivation using TP-R was conducted. At that time, seeds (13 kg) and fertilizer (about 110 kg of chemical fertilizer) were charged to the project, but in the second year, the project planned to have seeds proliferated on a scale of 100 m^2 while providing technical guidance. In the third year, the project planned to obtain seeds and fertilizer independently and continue applying TP-R. According to an estimate, if the target TP-R yield of 3 t/ha were to be achieved in one acre in the second year, the required amount of fertilizer could be purchased by selling less than half the amount of rice harvested. Several FBOs became independent and continued rice cultivation using TP-R.

(2) Farmers' organizations operating joint fields and securing a revolving fund (MOZ-04)

There were farmhouse organizations in the MOZ-04 that carried out activities such as joint plowing, joint purchase of materials, joint cultivation, and joint sales using their own fields. The project aims to disseminate the technique through the management of the joint field, using the joint field and demonstration farm as a technique extension base in the organization. Thus, this farmhouse organization can be used as an extension method Farmers participating in joint field work have adopted several of the project's recommended techniques and they are promoting their use. In addition, all rice harvested in the joint field belongs to the farmers' organization and it is used to fund the rotation. This method was devised to contribute to the sustainable management of the farmers' organization.

Use of extension materials

Extension materials are useful tools for extension workers to transfer technique to farmers. However, when extension materials are used by extension workers with little experience in guiding rice cultivation or farmers with low literacy rates, it is necessary to prepare effective extension materials in accordance with local conditions.

(1) Picture-story show style teaching materials

When extension workers or key farmers with little experience in providing guidance guide farmers, they are able to explain the techniques properly by clearly stating the explanations of each technique and the key points of the technique on the back of the teaching materials they use. Such picture-story show teaching materials were used in several projects, and training on the use of picture-story shows (CMR-01) was conducted as needed.

Photo 3-6 Training farmers using picture-story show style (CMR-01)

(2) Teaching materials that use many local languages, pictures, and photographs

It is effective to use many illustrations and photographs and prepare teaching materials in local languages to help farmers understand the contents of the teaching materials. Because some farmers find it difficult to read and write, it is necessary for them to describe how to measure seeds and fertilizers without complicated calculations. As shown in Fig 3-3, many teaching materials have been prepared to facilitate understanding.

Fig 3-3 Examples of teaching materials (left: GHA-04, right: MDG-01)

(3) Teaching materials used during practical training

When explaining the technique to a large number of farmers in a field where projectors cannot be used, it is practical to use teaching materials in the form of posters that can be seen from a distance and that are durable enough (lamination processing) to be used in a field.

Effective dissemination and public relations activity

In addition to the methods described above, effective dissemination and public relations activities are important in order to disseminate cultivation techniques and project results to a wide range of nontarget farmers. The following activities have been implemented, and it is desirable to implement effective activities appropriate to each region.

(4) Study tour and field day

Study tours and field days to visit farmers and farmer groups supported by the project are also effective as opportunities for farmers to learn directly from other farmers. In one case, a farmer's group visiting on a study tour was able to recognize the merits of forming a union by directly seeing that the group was carrying out effective activities by forming a union. Later, this group was also able to form a union. Therefore, these events, by confirming practices of other farmers, may lead to voluntary activities.

Photo 3-7 Field day (MOZ-04)

(5) Improve awareness of projects

Improving project awareness is important to ensure that the results of the project (including guidelines and manuals) are used by many farmers and related organizations. Project logos, calendars, T-shirts, project brochures, newsletters, and social networking sites can improve awareness.

(6) Use of radio and television

The use of radio and television is also effective in spreading such techniques widely. For example, in SEN-02, the recommended rice cultivation techniques were disseminated in the local language through radio programs covering three regions. Six themes (1: farming plan and cultivation calendar, 2: plowing and seeding, 3: weed control, 4: fertilization, 5: pest control, 6: harvest and post-harvest treatment) were broadcasted at the appropriate time, and this method was devised so that information could reach farmhouses in which the project could not directly provide guidance.

(7) Use of audio-visual materials

Audio-visual teaching materials are also available. MDG-01 hired actors who played leading roles in a popular comedy film in Madagascar, and worked with a local film company to produce visual materials on rice cultivation techniques (20 – 30-minute feature length and 3 – 5-minute short descriptions of individual technique). The produced DVDs and VCDs were distributed and sold. There were about 50,000 full-length editions and 500,000 short editions, and they were utilized as important teaching materials in Madagascar, where the number of popularization staff was small. The video is also available on YouTube[30]. Audio-visual materials can also be used to supplement the training of extension workers.

Fig 3-4 Sleeve of VCD teaching material

[30] https://www.youtube.com/channel/UCfL8nBb8wclwaF8B20xJvuw/videos?app=desktop

(8) Presenting at agricultural festivals and exhibitions

Senior government officials as well as many stakeholders may attend regular local agricultural festivals and exhibitions. Therefore, it is effective to present the project results at these events. In addition to distributing brochures and manuals prepared by the project, packaging and selling rice produced by the target farmers can demonstrate to consumers and stakeholders that high-quality rice can be produced by utilizing the technique recommended by the project.

(9) Holding and utilizing events

Project events to promote rice cultivation and existing local events provide opportunities to motivate farmers. Examples of projects are presented below.

- **Yield contest** (MDG-01): The yield contest was held to promote the use of the cultivation techniques and agricultural machinery developed in the project. Agricultural machines (winnower, thresher, and weeding machine) developed in the project were offered as prizes for the first, second, and third place. The purpose of the award was to increase the visibility of the agricultural machines and make them available to neighboring farmers. The award ceremony was incorporated as part of the opening of the largest exhibition in the district, reducing the cost of holding the event.
- **Best farmer** (GHA-05): In Ghana, the “Best farmer” award is presented every year at Farmers' Day throughout the country, and activities to promote the project have increased the number of farmers receiving the award.

(10) Collaborating with development partner

Collaborating with other development partners (international organizations, NGOs, etc.) working in the target region not only makes the results of the project more widely available, but also improves awareness of the project. For example, in SLE-02, the JICA project conducted training related to the operation and maintenance of agricultural machinery provided by the WFP. In UGA-03, the project cooperated with the UNHCR to carry out ToT for local stakeholders.

(11) Use of JOCV

JICA has dispatched members of JOCV to various countries, including members related to rice cultivation. In Uganda, JOCV members participated in the UGA-03 rice cultivation technical training, and later, activities were conducted to disseminate the skills they had learned to farmers in their assigned areas. Follow-up support at the field level by JOCV members can promote the effective establishment of a technique.

Photo 3-8 JOCV’s activity (UGA-03)

(12) Implementation of training in Japan and in third countries

In order to strengthen the capacity of project C/Ps and related staff, JICA has provided training in Japan and in third countries for many projects. Training in Japan included visits to government offices and lectures to advance understanding of Japan's promotion policies for rice cultivation, and visits to rice farmers and other value chain actors to develop human resources to improve productivity and quality. In third country training (recipients: Philippines, Thailand, Egypt, etc.) and human resource development in wide-area technique exchanges (accepting trainees from neighboring countries in Tanzania, Uganda, etc.), participating in technical training in other countries with similar cultivation environments had the effect of further promoting the understanding of trainees, and it made a significant contribution to human resource development.

3-4 Establishment of a Sustainable and Deployable Dissemination System

In sub-Saharan Africa, the number of extension workers and funds for activities are often limited. Therefore, in quite a few cases, extension activities are not continued after the project is completed. In order for the extension activities to be carried out continuously, it is necessary to take concrete measures to ensure sustainability. In addition, it is also important to reconfirm the appropriateness of the technique as necessary, because cultivation environments of areas to which the technique is being expanded may differ.

3-4-1 Formulation of a dissemination plan

Developing dissemination plans and action plans with the C/P after project completion and encouraging their reflection in local government policies and plans is an important step in ensuring sustainability. Dissemination plans and action plans were developed for several projects, taking into account consistency with existing agricultural policies and NRDS in each country.

Examples of projects

(1) Reflection in district plan (GHA-05)

In GHA-05, "Improve rice extension planning and budgeting capacity" was listed as one of the outputs. The output of the extension activities carried out in accordance with the "Rice Extension Guidelines" prepared in phase 1 was explained to the District Agriculture Director, and training on planning and budgeting was conducted for administrative officials. As a result, the District Agriculture drew up a District Rice Extension Plan and incorporated rice extension activities into the District Medium-Term Development Plan. The district government secured government funding, donor funding, and donations from private inputs through the annual planning and budget process after preparing the rice dissemination plan, and set up about 150 fields excluding those directly supported by the project.

(2) Formulation of the action plan (MOZ-01/02)

In the Chokwe irrigation scheme, three organizations related to rice cultivation technique dissemination (SDAE, EAC, and HICEP) formulated an action plan as an independent development plan, which was approved through a JCC meeting. The follow-up MOZ-02 held regular liaison meetings to monitor the action plan and continued to support activities by relevant local agencies to ensure sustainable activities after the completion of the project.

(3) Formulation of the master plan (SEN-03)

The master plan developed through SEN-03 was approved by the Ministry of Agriculture, and the implementing agency, National Company for Development and Exploitation of the Senegal River Delta, Senegal River, and Faleme Valley Lands (SAED) formulated a medium-term plan based on the master plan. Based on the master plan, each donor cooperated to promote more orderly rice cultivation. Furthermore, with the formulation of the master plan as a turning point, the organizational structure at the headquarters and the branch-level offices were restructured in 2018. Moreover, the roles of departments and the allocation of personnel were reviewed, and communication between the headquarters and branch offices became smooth. Thus, understanding the issues facing the host country and organizing the activities to be implemented to solve them as a master plan in cooperation with the project will encourage change in the activities of the host country and enhance the ownership of rice cultivation promotion.

3-4-2 Construction of a general-purpose dissemination system

As the project cannot directly guide all extension workers and farmers when expanding the target areas, it is important to establish a general-purpose dissemination system that can be widely used.

Examples of projects

(1) Approval and utilization of extension guidelines (SLE-02)

Technical packages and extension guidelines developed in cooperation with the C/P should be approved as official documents and utilized by the dissemination organization as a whole. Guidelines developed through JICA operations have been formally endorsed in Sierra Leone, Ghana, Senegal, and Tanzania.

In Sierra Leone in particular, the developed TP-R has been adopted by the Ministry of Agriculture as the standard rice cultivation technique for small-scale IVS. In addition, TP-R is actually used in IFAD projects and it is being promoted. This is due to the ongoing dissemination of information on TP-R concepts and technical content through various donor meetings, the publication of project newsletters, and individual donor consultations, as well as the high effectiveness of TP-R (yield increase).

(2) Construction of extension and monitoring system (SEN-03)

Even in cases wherein the extension guidelines are approved, dissemination is left to the disseminators, without a universal dissemination system. Therefore, in SEN-03, the implementation of FFS, which is a guidance method for farmers using the dissemination/monitoring sheet, was summarized as a general-purpose dissemination system in consultation with the local dissemination organization. In addition, a system in which many extension workers conduct and monitor extension activities in the same manner was introduced. The dissemination/monitoring sheet is currently being used in paper form, and the use of ICT is being considered for the future.

(3) Strengthening M & E capacity (GHA-05)

Monitoring is an important activity to measure the effect of a project. However, it is difficult to conduct continuous M & E unless the administrative officials and extension workers who conduct monitoring have sufficiently mastered the methods of data aggregation. GHA-05 listed "Improving M & E capabilities of Regional Agricultural Department and District Agricultural Department for rice extension plans" as one of its outputs. The project has enhanced the capacity of M & E staff through revisions to M & E tools and training. Specifically, the tool was changed to one that is easy to use, in accordance with the Excel usage ability of the staff in charge. Moreover, practical training was carried out.

Photo 3-9 Data entry exercise (GHA-05)

3-4-3 Area-wide dissemination of techniques

When the cultivation environment and conditions of the region where the technique is to be disseminated are different, it is necessary to re-examine whether this technique is appropriate. It is desirable to conduct demonstration tests in farms, etc., as needed, and to optimize techniques, while referring to the points for each technique described in Chapter 2 and "3-3-1 Adoption of appropriate technique." It is also important to select appropriate areas for dissemination because not all areas can utilize the technique.

Examples of projects

(1) Technical improvements (SLE-02)

TP-R is a technical package for IVS that was established as a result of seven years of technical development combining the "Agricultural Development Project in Kambia District (2006 – 2009 years)" and SLE-01. Since the technique was developed based on a vast amount of basic knowledge and data, no major revision of the technical package has been required for the subsequent dissemination of the technique. However, when the experiment was carried out by changing the seeding rate per unit area of the nursery in the field of the farmhouse organization, it was found that the yield did not change even if the seeding rate was increased to twice of TP-R in the nursery with fertilization. Therefore, it was decided to increase the seeding density and reduce the seedling area by half after the next cropping. In addition, because of the influence of heavy rain during the rainy season, the optimum variety varies depending on the local weather conditions. Hence, it can be seen that even after the technical package has been developed, the effectiveness of the technique may be re-verified by appropriate field tests. It is especially important for productivity improvement to analyze optimum varieties and planting time continuously in rain-fed paddy fields with various cultivation environments.

(2) Need for consideration of target areas for area-wide deployment

In order to apply the technical packages and manuals developed by the project, it is important to select the appropriate target areas for technique dissemination. In many cases in Sub-Saharan Africa, the aging of irrigation facilities is a problem in irrigated areas, not only in rain-fed paddy fields, as described in (1) above. Therefore, the applicability of the technique varies depending on the state of production infrastructure development. In TZA-07, as it took several years for some farmers to adopt the recommended rice cultivation techniques because of inadequate irrigation facilities. Around 250 irrigation districts were surveyed and districts with high training potential were selected. In the future, the technique will be disseminated to selected districts.

Chapter 4 Policy Recommendations

4-1 Achieving CARD Phase 2 Targets

Japan International Cooperation Agency (JICA) has been conducting cooperative interventions for local rice promotion in Africa under the Coalition for African Rice Development (CARD) initiative. By implementing technical cooperation projects, in particular, it has carried out technical transfer of rice-related technology to counterparts (C/Ps) and stakeholders in recipient countries. According to the impact evaluation study, JICA's technical cooperation projects have contributed to achieving the CARD phase 1 target of "doubling rice production within 10 years".

Although there has been an increase in rice production in sub-Saharan Africa, both in terms of area and yield during the CARD phase 1 period, increase of cultivation area is more vital, as indicated in the figures below. According the CARD Secretariat, while cultivation area has increased by 1.70 times, yield has increased by only 1.17 times. During this period, self-sufficiency ratio for rice has not improved, because rice consumption increased more than domestic production.

The phase 2 of CARD, which targets further doubling of rice production during the 2019–2030 period, has now been initiated. Based on expected rice production, cultivation area yield indicated in National Rice Development Strategy (NRDS) phase 2, it is estimated that the total volume of rice production would be doubled if cultivation area is increased by 1.13 times and yield by 1.77 times (Fig 4-1). Since it has become difficult to increase the cultivation area in some countries due to limited areas for expansion and double cropping with irrigation, it is more important to increase yield in phase 2 than in phase 1.

Since conditions and strategies for rice production vary from country to country (e.g., some countries need to increase the cultivation area), each country should implement integrated programs as indicated in NRDS phase 2. To promote local rice production, it is necessary to implement practical and efficient measures in accordance with the technologies and examples described in this manual.

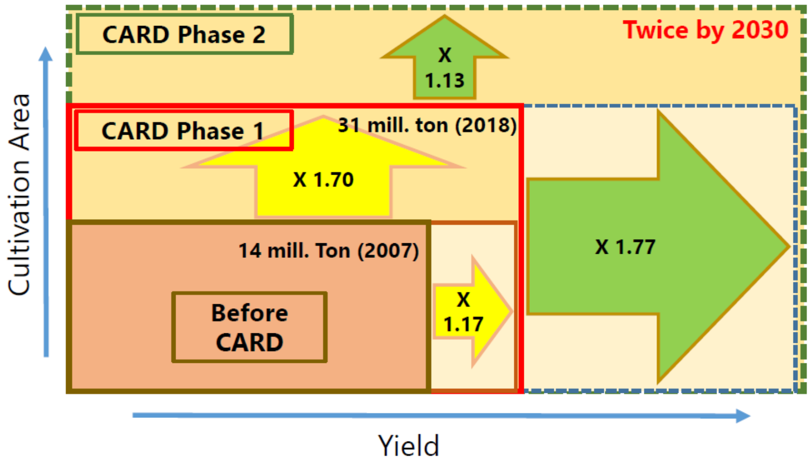


Fig 4-1 Contribution of cultivation area and yield to production increase

Source: Prepared by JICA Study Team based on "CARD Secretariat, a presentation prepared for 16th CARD Steering Committee, September 30, 2020"

During phase 2, JICA is planning to support technical cooperation for the CARD initiative. In order to ensure effective technical cooperation, this manual provides useful technical information using examples from sub-Saharan Africa to illustrate each stage of the rice value chain.

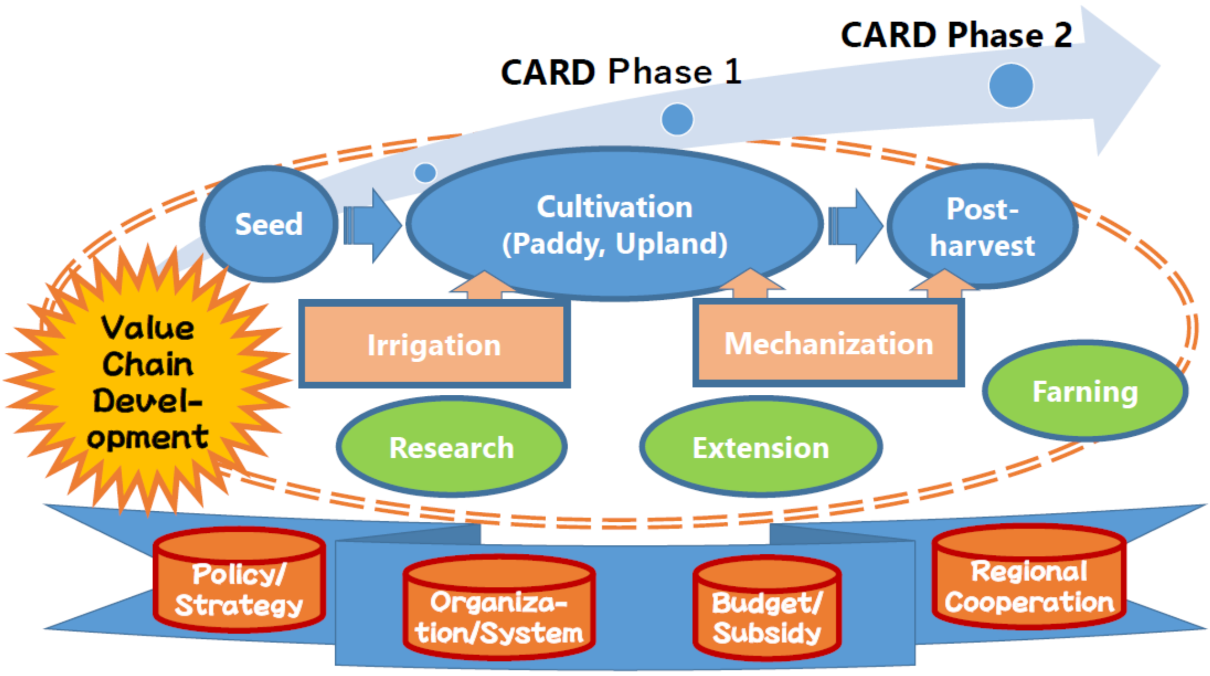


Fig 4-2 Relation of necessary factors for further doubling rice production

As indicated above, production can be doubled by increasing the cultivation area and yield. However, in order to increase yield, which is the main challenge faced in CARD phase 2, the following technical factors need to be taken into account (see Chapters 2 and 3 for further details):

i. Improvement of cultivation techniques (paddy, upland);

ii. Supply of quality seeds

iii. Post-harvest with minimum loss and high quality
iv. Sustainable irrigation;
v. Mechanization at every stage;
vi. Use research-based techniques;
vii. Extension for wide-area expansion; and
viii. Strengthening of factors affecting the rice value chain

As the above-mentioned eight factors are indispensable to strengthen the rice value chain, it is necessary to implement all eight factors in order to improve farmers' motivation on rice production. In this manual, outlines of techniques, processes of utilization, practical challenges, countermeasures, techniques, key mechanisms and case studies on each technical factor are described in detail. Based on this information and the examples provided, readers would be able to select appropriate techniques for application in their countries.The techniques, including root techniques in the field, used by all actors and stakeholders, such as producers, millers, distributors, retailers, input suppliers, financial institutes and service providers, should be improved and information on them disseminated. However, it is not enough to achieve CARD phase 2 targets. In addition to the officials, engineers and extension workers collaborating with the main actors, the government should also carefully examine the following recommendations in order to strengthen the rice value chain:

Chapter 4 is mainly intended for policymakers and project planners. Depending on the specific needs and urgency of each country and region, priorities should be set and a road map drawn up, which should include the achievement of CARD phase 2 targets.

4-2 Value Chain Development to Achieve CARD Targets

Market-oriented Value Chain Development (CIV-01): In order to secure more market shares for local rice than imported rice, it is necessary not only to increase local rice production but also to supply adequate volumes of quality rice adapted to the needs of consumers/markets throughout the year at reasonable market prices. In order to achieve this, both individual efforts to develop techniques and the capacity of each actor, and integrated measures to develop the rice value chain are necessary. At this moment, a limited number of JICA projects such as CIV-01 has attempted to tackle this issue, but all CARD phase 2 projects should make a conscious effort to develop the rice value chain.

4-3 Policies and Strategies for Local Rice Promotion

We recommend that project outputs be included when setting policies and strategies in order to realize long-term policy targets.

4-3-1 Integration of Project Outputs into Policy

1) Contribution of Project Outputs to NRDS (CIV-01, ZMB-02)

In order to conduct rice promotion projects efficiently, it is necessary to exchange information with the NRDS focal point person, its task force members and donor communities in the recipient country, with continuous assessment of the projects and their contribution to NRDS throughout the project period. It is important to present project outputs at the NRDS Working Week during review, and propose action plans for local rice promotion.

2) Passing Laws for Local Rice Promotion (TZA-03/09)

The Comprehensive Guidelines (CGL), which were developed by TZA-03 and TZA-09, were recommended for use in Tanzania to implement irrigation development projects by the National Irrigation Act (2015). It is important to officially validate guidelines and/or manuals developed by the project so that project outputs can be used widely and sustainably.

3) Institutionalization of Project Activities (CIV-01, UGA-03)

In many cases, outputs and activities of technical cooperation projects were stagnant or had been transferred to other projects. In order to sustain these projects, it is important that project activities be institutionalized by assigning these to C/P organizations. In order to solve problems such as limited staff and capacity, it is recommended that qualified C/P staff be involved in project implementation during the second half of the project period so as to achieve both technical and operational knowhow.

4-3-2 Project Implementation in line with Strategy

1) Project Implementation according to Long-term Programs (UGA-01/02)

UGA-01 and UGA-02 were implemented in accordance with "JICA Cooperation Program for Rice Promotion (2008-2017)" which had been agreed between the Government of Uganda and JICA on March 6, 2008. In order to implement projects in line with the national policy, it is useful and effective to conclude a long-term basic agreement among parties and to conduct a series of projects under the agreed strategic program.

2) Monitoring and Examination of Exit Strategy (BFA-02, GHA-04, MOZ-01)

As an exit strategy of a technical cooperation project, it is recommended that a master plan covering 10 years after project completion and/or a short/medium/long-term action plan be developed in cooperation with C/P organization to which project outputs are institutionalized. Practical follow-up activities should be started based on these plans after project completion. It is more important to conduct monitoring and evaluation of project activities by a third party so that the plans are not to stale the plans.

3) Periodical Revision of Guidelines and Manuals (RWA-02, TZA-01)

Since the project guidelines and manuals may become ineffective due to changes in social and natural conditions, these should be revised every 10 years or so. This exercise should be conducted by the C/P organization to which project activities have been institutionalized. It is important for the C/P organization to distribute/advertise the products and to inform the related institutions of the revisions, and provide technical instruction accordingly.

4-4 Infrastructure to Support Local Rice Promotion

Government structure, relations with donor communities and collaboration with the private sector should be strengthened to support local rice promotion and to implement policy.

4-4-1 Government Structure and Relations with Donor Communities

1) Organization in charge and its Role of Coordinator (CIV-01, GHA-01, RWA-01)

In September 2019, the Government of Cote d'Ivoire established a dedicated ministry for rice promotion, which is unusual. In general, many actors are involved in the rice value chain, including seed supply, cultivation, post-harvest, irrigation, mechanization, input, distribution, finance and so forth. Also, governmental involvement may be at the central or local level, and related to production or consumption. Therefore, it is necessary to appoint a core organization/institution in each country, which should be responsible for collecting/sharing all related information among stakeholders and coordinating necessary action to cover all aspects of technical cooperation.

2) Monitoring and Follow-up (BFA-01, GHA-04)

Since training courses are conducted based on guidelines and manuals, the benefits include increased productivity and quality, and reduction of post-harvest losses. However, these effects decrease within a few years after project completion. Therefore, it is important to conduct quantitative evaluation to monitor effects after the project has been completed. It is also essential to carry out effective follow-up by the C/P organization entrusted with the project activities together with the concerned public and private sector entities.

3) Human Resources Development and Management (CIV-01, GHA-02, UGA-03)

Since C/Ps conduct technical transfer activities for 3–5 years together with JICA experts, they have expert information of project implementation. This practical experience is very useful and important for the C/P organization to which the project activities have been institutionalized. However, sometimes C/P personnel are transferred to other departments, or retire from C/P organization after project completion. In order to utilize these human resources for rice promotion in the country, C/P organizations are recommended to consider their secondment to the project for training courses, and to conduct effective personnel management.

4) Inheritance of Technology over Generations (TZA-09)

Technology transfer from the qualified staff to younger staff was ensured in Tanzania due to the retirement of many of the seasoned officials of the National Irrigation Commission and the limited technical capacity of the younger staff. It is important to maintain technology and knowhow, develop a system for technology transfer, and sustain the functioning of the organization not only at the personal level, but also at the institutional level.

5) Coordination and Cooperation among Donor Communities (MOZ-02, NGA-01)

In Nigeria, in cooperation with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and International Fund for Agricultural Development (IFAD), the JICA has promoted the use of false aluminum bottoms made by sand mold casting for parboilers, which improves the quality of parboiled rice. In addition to the project team, the JICA office should inform donor communities not only of project outputs but also of the activities performed to achieve these outputs. This could lead to wider use of project outputs in the projects of other donors, and to significant outcomes.

4-4-2 Infrastructure Development with the Private Sector

1) Cooperation between Water Users and Rice Producers (KEN-01, MOZ-02)

Most farmers belong to several organizations such as water users' organization for irrigation, producers' organization for inputs, cultivation techniques and sales. However, it is necessary to arrange agricultural inputs and irrigation water before rice cultivation starts. Therefore, extension workers should carefully consider collaboration with water users and producers before starting technical instruction in order to optimize performance.

2) Network of Private Sector Organizations (GHA-02, SEN-01)

In many cases, organizations for water users, producers, rice millers exist separately, and information exchange among such organizations is very limited. Even though vertical transmission of knowhow by the national and local governments is encouraged, it is more useful to learn organizational management and/or practical dairy implementation skills through lateral exchange of information. In order to accelerate this collaboration, a national or regional federation should be formed for the exchange of knowhow and technologies within the federation, face common challenges and submit joint requests to the government.

3) Strengthening Service Providers (MOZ-01, CIV-01)

Although the use of agricultural machinery can lead to the increase of efficiency and productivity, it is sometimes difficult for ordinary or small-scale farmers to purchase machinery. Therefore, it is sometimes necessary to take recourse to service providers for tilling, paddling, leveling, harvesting, etc. However, since service providers are not always experienced in many countries, political, financial and technical support should be provided by the government, financial institutions and machine manufacturers.

4) Cooperation and Coordination with Volunteers (UGA-03, ZMB-01)

There has been technology transfer on rice cultivation to volunteers as part of the project in some countries, such as the training courses organized for the Japan Overseas Cooperation Volunteers (JOCV) in Uganda, and for both the JOCV and the US Peace Corps in Zambia. These organizations have closely worked with farmers in the agricultural community and conducted continuous follow-up activities. Collaboration with volunteers should complement activities by the government and projects.

5) Cooperation and Coordination with NGOs (SLE-01, SEN-02)

In Sierra Leone, staff of international NGOs which had been conducting technical support in areas such as rice cultivation, seed production/certification, marshland development, chicken farming, were invited to training. These NGOs introduced training techniques into their own training course. In Senegal, training of local NGOs is a project indicator, since collaboration with NGOs was taken into account. In case of limited human resources for project implementation, such as extension workers, collaboration with international and/or local NGOs should be considered.

4-5 Development of a Technology-based System

The use of technology to improve cultivation techniques, especially the seed supply system, is recommended.

4-5-1 Development of a Seed Supply System

1) Development of a Quality Seed Supply System (GHA-06, MOZ-03, SEN-03)

Rice producers should be able to choose their preferred variety and the volume of rice seed required based on market needs, and to negotiate purchase volumes and prices with seed suppliers. Also, in case of certified seeds, both producers and seed suppliers should have a stable system of supply and demand. The government is requested to provide appropriate information and support for the seed market in order to ensure fair negotiation and cooperation.

2) Practical Support for Quality Seed Production (CIV-01, CMR-02, SEN-02)

In Cameroon, CMR-02 has conducted activities for sustainable quality seed production in order to strengthen capacity of farmers/farmers' groups and to set up a sustainable seed supply system. The government has tried to develop seed production capacity of core farmers and to improve the seed supply network in order to increase rice production. Where a national rice seed supply network does not exist, the above-mentioned practical and simple seed supply system should be established.

3) Provision of a Quality Seed Inspection System (BFA-01)

The number and quality of seed inspectors is limited in CARD member countries. In addition to requesting member countries to provide a sufficient number of inspectors, capacity development of seed inspectors should also be considered. Also, inspection equipment and their operational costs should be provided.

4-5-2 Basic Systems for the support of Local Rice Promotion

1) Development of a Statistic Information System (UGA-02)

One of the biggest challenges faced by many CARD member countries concerns the collection of accurate and useful data on the rice value chain, including the provision and revision of agricultural statistics on production, productivity, distribution, consumption volume and actual conditions of rice stakeholders, for policy formulation and monitoring purposes. Since reliable statistical data are essential for policy making, the development of a better system of collecting/analyzing data on rice value chain should be a long-term aim of the government; this can be done in collaboration with international organizations such as the Food and Agriculture Organization of the United Nations (FAO), International Rice Research Institute (IRRI) and AfricaRice.

2) Introduction of Agricultural Insurance as Resilience Measure (Ethiopia)

Draught and flood risks have recently increased due to climate change. As part of resilience management, the promotion of index-based crop insurance has been studied in Ethiopia for rural resilience enhancement[31]. In addition, AfriceRice has supported sustainable business for rice producers by providing a shared platform[32] and agricultural insurance. Resilience enhancement should be tailored to the specific requirements of each area.

4-6 Financial Support and Subsidies for Policy Implementation

Close collaboration regarding budgetary matters and subsidies between the private and public sectors is recommended for policy implementation.

4-6-1 Government Budgets

1) Evidence-based Budget Proposals (GHA-05, TZA-09)

Despite budgetary restrictions, each country has implemented measures to provide C/P funding for the project in accordance with R/D. However, the recent COVID-19 pandemic has made this more difficult and some countries were not able to provide necessary operational costs for project activities. Therefore, C/P organization should submit realistic budget proposals based not only on international R/D but also on concrete and quantitative evidence indicating increase of rice production and farmers' incomes, indirect contributions to stakeholders, increase in tax revenues,

[31] *"Rural Resilience Enhancement Project" and "Index-based Crop Insurance Promotion Project for Rural Resilience Enhancement."*

[32] *https://www.agcelerant.com/2020/04/29/manobi-africa-and-africa-rice-engage-with-agcelerant-to-transform-rice-value-chain-in-africa/*

decrease in foreign currency required to import rice and reduction of government subsidies. It is also important to secure necessary budget even after project completion.

2) Support for the Purchase of Agricultural Machinery (CIV-01, GHA-06, SEN-01)

Even though some countries offer tax reductions for the import of agricultural machinery, this is not taken advantage of in most case as it involves complicated procedures. In order to promote and modernize rice production activities, machines for cultivation, harvesting, threshing, and milling are required. Integrated support for the purchase of machinery should be considered, including public support such as subsidies/financing, and private support such as credits/loans, in addition to tax reduction.

3) Power Supply for Agricultural Activities (GHA-01)

As mentioned above, gravity irrigation is generally preferred; however, pump irrigation should be adopted if the paddy field is above river level, in which case, power or fuel is necessary. This could be a heavy burden for water users' organizations and/or the government, and reasonable and sustainable solutions such as solar panels should be considered in such cases. In Japan, reasonably priced electricity is provided for agricultural use. In CARD member countries, this should be seriously considered for agricultural activities by water users and/or producer organizations.

4-6-2 Collaboration with the Private Sector

1) Cost Sharing for Irrigation Development (GHA-06, TZA-09)

Operations and Maintenance (O&M) of irrigation facilities designed and constructed for the project site should be ensured in order to distribute irrigation water equally and efficiently. The relevant organizations should be placed in charge to manage depending on the function and size of the structures required to connect water resources to the paddy field. Main facilities are run by the government, while field facilities are maintained by the farmers' organizations. Agreed operation and water management procedures in accordance with regulations should be applied.

2) Provision of Private Financial Products (CIV-01, GHA-06)

Quality seeds and fertilizers, and appropriate pesticides are required for cultivation. However, since many farmers have limited money, the purchase of agricultural inputs in appropriate volume and timing is difficult. In Cote d'Ivoire, the close relationship between the rate of implementing cultivation techniques and provision of agricultural inputs was examined. Also, adequate financing is necessary to recruit service providers for tilling, harvesting and so on. Therefore, the relevant organizations should collaborate with private financial institutions, and develop financial products for farmers, millers and distributors in order to support/accelerate economic activities throughout the rice value chain.

4-7 Research into and Extension of Wide-area Expansion

The development and improvement of research facilities and organizations for the extension of wide-area expansion is recommended.

4-7-1 Development of Specialized Institutions

1) Strengthening Regional Cooperation (TZA-04, UGA-03, CMR-02)

The Kilimanjaro Agricultural Training Centre (KATC) is an example of an institution specializing in technical cooperation; the government of Tanzania and JICA have conducted a series of rice promotion projects for more than 40 years at the center. Many practical training courses have been organized for domestic trainees from the entire country, as well as courses for governmental officials of neighboring countries such as Kenya, Zambia, Malawi, and Uganda. In addition to KATC, the National Crops Resources Research Institute (NaCRRI) in Uganda and the Ministry of Agriculture and Rural Development (MINADER) in Cameroon might be one of possible candidate institutions. Regional activities on technology/information sharing in CARD member countries, including West Africa should be arranged. Various measures concerning regional cooperation such as dispatching staff to other member countries for technical and operational training are also worth consideration.

2) Development of the Extension System (UGA-03)

Although the number of extension workers in Uganda has been reduced and restricted, recruitment of extension workers at the district level has been initiated. Newly appointed staff should be trained through a Training of Trainers (ToT) scheme and/or provided refresher training so that they can acquire basic and practical knowledge/capacity to use the technical package developed by the project. Other countries have recruited officials and introduced a new extension system to supplement limited staff by utilizing Information and Communication Technology (ICT) and others resources despite limited finances.

3) Development of a Research System (KEN-02, UGA-02)

In Uganda, the need to improve research capacity was identified as an urgent issue to ensure project sustainability, and the recruitment of researchers, research assistants and research coordinators, was therefore emphasized. In order to improve the capacity of researchers, research infrastructure/materials have been developed through international joint research programs in Kenya, which is expected to become a regional hub for researchers. Adequate financing is also required for research; "Agricultural Technology and Agribusiness Advisory Service Project" comprising technology development and agricultural research has thus been conducted as a priority national project in Uganda. It is important to provide appropriate institutional, human and financial environment to sustain rice research activities.

4-7-2 Appropriate Extension Methodologies

1) Research and Extension based on Farmers' Needs (ETH-01, MOZ-02, ZMB-02)

In Ethiopia, participatory agricultural research by the Farmer Research Group (FRG) has been conducted to develop appropriate procedures and countermeasures to challenges faced by farmers, and this has produced positive outputs. In Mozambique, collaboration between farmers and research/extension organizations has been carried out in order to study the problems and needs of farmers. In Zambia, the relationship between the research institute and the extension office has been reinforced; the national research institute has been used not only for rice research but also for training courses on rice cultivation. As the promotion of research and collaboration between research and extension are common challenges in CARD member countries, a national coordination body in each country should be established to accelerate responsible collaboration.

2) Dissemination/Utilization of Demonstration Plots (GHA-06)

Verification/training/demonstration plots should use to verify the effects of the project and accelerate extension. In Ghana, demonstration plots have been considered as an extension platform for public-private-partnership, with minimal cost even after project completion as part of the irrigation fee is used for the purpose.

3) Rational Selection of Core Farmers (GHA-06)

JICA experts and C/P have selected key farmers for technical transfer in the field of extension. It is important to select persons with sufficient knowledge and significant influence in the local community who have received training to disseminate knowhow, and not to automatically restrict the choice to community leaders.

4) Increasing Motivation among Farmers (BFA-02)

To ensure good outcomes of extension activities, it is important to motivate farmers to participate in training courses in order to sustain their motivation. Increased production and improved living standards are obvious and clear indicators of good results, and these encourage farmers to participate in the project and to utilize project outputs. Thus, in addition to training, on the field, real-life experience with countable outcomes in demonstration plots, constant practice by farmers at their own field and effective monitoring/follow-up by project staff are important.

Appendix

Appendix1 Project Outline Table

Appendix2 Deliverables List

Appendix1 Project Outline Table

Project code	Country	Title of the Project	Duration of the Project	Type*	Manual availability	Cultivation environment			General	Before planting			After planting									Post-harvest processing					Seed Production	Mechanization	Rice farming				Irrigation	Gender
						Irrigated	Lowland	Upland	Lifecycle of rice	Variety selection	Seed preparation	Land preparation	Nursery preparation	Transplanting	Direct seeding	On-farm water management	Fertilization management	Weed management	Pest and disease managemen	Bird and animal damage management	Harvesting	Drying and processing	Threshing	Storage	Milling	Sorting			Cropping calendar	Account management	Diversification	Marketing		
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	February 2008 - February 2012	TCP(J)	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	●	-	-
BFA-03	Burkina Faso	(English) Project on establishment of the model for fertilizing cultivation promotion using Burkina Faso phosphate rock	May 2017 - May 2022	SATREPS	×	-	○	-	-	○	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d' Ivoire (French) Projet de Promotion du Riz Local en République de Côte d' Ivoire	February 2014 - March 2020	TCP(P)	○	○	○	-	○	○	○	●	●	○	○	○	●	○	○	-	○	○	○	○	●	○	●	●	-	○	-	●	-	-
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	May 2011 - May 2016	TCP(J)	○	-	-	○	●	●	○	●	-	-	●	-	●	○	●	●	●	●	○	●	●	-	●	○	○	-	-	●	-	-
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	June 2016 - June 2021	TCP(J)	○	○	○	○	●	○	○	●	-	-	●	-	○	●	○	○	●	●	●	○	●	-	●	○	○	-	-	●	-	-
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	March 2010 - March 2015	TCP(J)	○	○	○	○	-	○	○	-	-	○	-	○	○	○	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	○
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	November 2015 - November 2020	TCP(J)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	○	○	○	○	-	-	○	○
GHA-01	Ghana	(English) Small-Scale Irrigated Agriculture Promotion Project	August 1997 - July 2004	TCP(J)	○	○	-	-	-	○	-	○	-	○	○	○	○	-	-	-	-	-	-	-	-	-	○	○	○	○	-	-	○	-
GHA-02	Ghana	(English) Farmer Participatory Irrigation Management in Irrigation Projects in Ghana	October 2004 - September 2006	TCP(P)	-	○	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	July 2009 - December 2014	TCP(J)	○	-	○	-	●	-	○	●	●	○	●	●	●	●	●	●	○	●	●	○	○	-	●	○	○	●	-	●	●	-
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	May 2016 - March 2021	TCP(P)	×	-	○	-	-	-	○	●	○	○	●	○	○	○	○	○	○	○	●	○	○	-	○	○	○	○	○	●	-	○
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	January 2016 - January 2021	TCP(J)	○	○	-	-	○	●	●	●	●	○	●	●	●	●	●	○	●	●	○	●	-	○	●	-	○	-	-	○	●	-
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	January 2012 - January 2017	TCP(J)	○	○	-	-	-	-	●	●	●	○	-	●	○	●	○	-	●	-	-	●	-	-	-	●	○	●	●	●	●	-
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	May 2013 - May 2018	SATREPS	×	○	○	○	-	○	-	○	○	○	-	○	○	-	-	-	-	-	-	-	-	-	○	-	○	-	-	-	-	-
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	January 2009 - July 2015	TCP(J)	○	○	-	○	●	●	○	●	●	○	●	○	●	○	●	-	○	○	○	-	●	○	●	●	-	○	○	●	○	-
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	December 2015 - December 2020	TCP(J)	△	○	-	-	○	○	○	○	○	●	-	○	○	○	○	-	○	○	○	-	-	-	-	-	-	○	-	-	-	-
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	May 2017 - May 2022	SATREPS	×	○	○	○	-	○	-	-	○	●	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	March 2007 - March 2010	TCP(P)	○	○	-	-	○	○	○	●	●	○	-	○	●	○	-	-	●	●	○	-	●	-	●	○	○	○	○	●	●	-
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	February 2011 - November 2014	TCP(P)	○	○	-	-	-	○	○	●	●	○	●	●	●	●	-	-	○	○	○	-	●	○	○	●	○	○	○	●	●	-
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria da Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	January 2011 - January 2015	TCP(J)	○	○	-	-	-	○	○	○	●	○	-	○	○	○	-	-	○	●	○	○	○	○	●	○	-	○	-	○	●	-
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province(ProAPA)	November 2016 - November 2021	TCP(P)	×	○	○	○	●	●	○	●	○	●	●	●	●	●	-	-	○	●	●	-	-	-	●	●	-	-	-	-	○	-
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	September 2011 - April 2016	TCP(P)	○	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	●	●	○	●	●	○	-	-	-	○	-	○	-	-
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	November 2010 - October 2013	TCP(P)	○	○	○	-	○	○	●	●	○	●	-	●	○	●	●	○	○	●	●	●	-	-	-	-	○	○	-	-	○	○
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	October 2014 - September 2019	TCP(P)	○	○	-	-	○	○	●	●	●	○	-	●	●	○	●	-	●	○	●	●	-	-	-	-	○	○	-	●	●	●
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	Novermber 2009 - March 2014	TCP(P)	○	○	-	-	○	○	○	●	●	○	●	○	●	●	○	○	●	●	○	○	●	○	-	○	○	○	-	●	○	○
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d' Appui à la Production Durable du Riz Pluvial	August 2014 - July 2018	TCP(P)	○	-	○	○	●	●	●	●	●	○	●	-	●	●	●	-	●	○	○	○	○	-	●	●	○	-	-	-	●	-
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	May 2016 - May 2021	TCP(P)	○	○	-	-	○	●	○	●	○	○	○	○	○	○	○	○	●	●	○	●	●	○	●	●	○	○	●	●	●	○
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	October 2010 - September 2014	TCP(P)	○	-	○	-	●	●	○	●	●	●	-	○	●	○	●	○	●	●	○	●	-	-	○	○	●	-	-	-	-	-
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project(SRPP)	June 2017 - June 2022	TCP(P)	○	-	○	-	○	○	○	○	●	○	-	○	○	○	○	○	○	○	○	○	○	-	○	○	○	-	-	-	-	-
TZA-01	Tanzania	(English) Technical Cooperation for Formulation and Training of the DADP Guidelines on Irrigation Scheme Development	December 2010 - June 2014	TCP(J)	×	○	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	○	-
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	June 2007 - June 2012	TCP(J)	×	○	-	○	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	-	-	○	○
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans(DADPs)	December 2010 - June 2014	TCP(J)	○	○	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-
TZA-04	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project	July 1994 - June 1999	TCP(J)	○	○	-	-	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	○	-	-	-	○	○	○	-	○	○	○
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	October 2001 - September 2006	TCP(J)	×	○	-	-	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	○	-	-	-	○	○	○	-	○	○	○
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	August 2012 - June 2016	TCP(P)	○	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	●	-	-	-	-	-	○	-	●	-	-
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	November 2012 - December 2019	TCP(J)	○	○	○	○	○	●	○	●	●	●	●	●	●	○	●	○	●	●	○	●	○	○	○	○	○	○	-	●	●	○
TZA-08	Tanzania	(English) The Project for Irrigation Human Resource Development by Strengthening the Capacity of Arusha Technical College (AIHRD-Project)	June 2014 - May 2017	TCP(J)	×	○	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	-

Appendix-2

Appendix1 Project Outline Table

Project code	Country	Title of the Project	Duration of the Project	Type*	Manual availability	Cultivation environment			General	Before planting			After planting									Post-harvest processing					Seed Production	Mechanization	Rice farming				Irrigation	Gender
						Irrigated	Lowland	Upland	Lifecycle of rice	Variety selection	Seed preparation	Land preparation	Nursery preparation	Transplanting	Direct seeding	On-farm water management	Fertilization management	Weed management	Pest and disease managemen	Bird and animal damage management	Harvesting	Drying and processing	Threshing	Storage	Milling	Sorting			Cropping calendar	Account management	Diversification	Marketing		
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	August 2015 – August 2019	TCP(J)	×	○	–	–	–	–	–	–	–	–	–	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	●	–
TZA-10	Tanzania	(English) Project on the Revision of National Irrigation Master Plan	October 2016 – October 2018	TCDP	△	○	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	June 2008 – June 2011	TCP(J)	×	○	○	–	○	○	○	○	○	○	–	○	○	○	●	–	○	–	–	–	–	–	–	–	–	–	–	–	○	–
UGA-02	Uganda	(English) NERICA Rice Promotion Project in Uganda	August 2008 June 2011	TCP(J)	×	–	○	○	○	○	○	○	○	○	●	○	○	○	○	–	○	○	○	–	○	–	○	–	–	–	○	–	–	–
UGA-03	Uganda	(English) Promotion of Rice Development Project	November 2011 – March 2019	TCP(J)	○	–	○	○	●	●	○	●	●	●	●	○	●	●	●	–	○	●	○	–	●	○	○	–	–	–	–	–	–	–
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	June 2012 – June 2015	TCP(J)	○	○	–	○	–	●	○	●	●	○	●	–	○	●	–	○	○	●	●	–	–	–	–	○	–	–	–	–	–	–
ZMB-02	Zambia	(English) Rice Dissemination Project	December 2015 – September 2019	TCP(J)	○	–	○	○	–	●	○	●	○	○	●	–	●	○	●	–	○	○	●	○	○	–	○	○	–	–	–	–	–	–

○ indicates the techniques that the project implemented, and ● indicates that the techniques of the project introduced in this manual.

* TCP(P) : Technical Cooperation Project (operated by private companies)
TCP(J) : Technical Cooperation Project (operated by JICA directly)
SATREPS : Science and Technology Research Partnership for Sustainable Development
TCDP : Technical Cooperation for Development Planning

Appendix-4

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
							JP	EN	FR	PR	Others		Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
													2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	01 Manuals	Manuel pour la technologie de production de semences	seed production	data, flipchart			○												
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	01 Manuals	Outils de Gestion pour l'Appui Technique en Renforcement des Capacités a travers la methode FFS	capacity development	data			○												
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	02 Evaluation reports	Joint Terminal Evaluation Report	seed production, quality	report	○					○									
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	02 Evaluation reports	Joint Terminal Evaluation Report (extension phase)	seed production, quality	report	○					○									
BFA-01	Burkina Faso	(English) Project for Dissemination of improved seeds in Burkina Faso (French) Projet de Développment des Semences Améliorées au Burkina Faso	02 Evaluation reports	RAPPORT D'EVALUATION FINALE CONJOINTE DELA PHASE DE PROLONGATION DU PROJET DE DEVELOPPMENT DES SEMENCES AMELIOREES AU BURKINA FASO	seed production, quality	report			○			○									
BFA-02	Burkina Faso	(French) Projet études pour la formulation d’ un programme national de développement de bas-fonds	03 Progress reports / Completion reports	Final Report	irrigation, GIS	report	○					○									
BFA-02	Burkina Faso	(French) Projet études pour la formulation d’ un programme national de développement de bas-fonds	03 Progress reports / Completion reports	Final Report (annex)	irrigation, GIS	ANNEX		○				○									
BFA-03	Burkina Faso	(English) Project on establishment of the model for fertilizing cultivation promotion using Burkina Faso phosphate rock	03 Progress reports / Completion reports	Implementation Report (2016, 2017, 2018, 2019)	fertilization, development	report	○					○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Contrat de production (producteur-transformateur)	platform	contract			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Fiche Technique Plastifie Version 2016 Volume séparé 1-10	cultivation	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Formation OPA Coaching	capacity development	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Presentation de la formation OPA_2016	capacity development	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	SYSTEME DU CREDIT POUR LA FILIERE RIZ LOCAL	material credit	seminar materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Plan final Credit Filre riz VF	credit	seminar materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Guideline of this training	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	La multiplication de la semence de riz	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Morphologie du riz	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Planification pour la multiplication de semence	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	les points cles de la multiplication	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Quelques problemes lies a la multiplication de semence	seed production	training materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Critere Deguestation	survey	survey form			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Portefeuille client _FINAL	product development	survey form			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	LES 4P 4C DU MARKETING	product development	seminar materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Travaux de group_preparation	product development	seminar materials			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Questionnaire_Enquete de preference version corrigee 2019	survey	survey form			○												
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	MANUEL DU STAGIAIRE SUR L’ UTILISATION ET LA GESTION DE LA DECORTIQUEUSE	rice miller, training	training materials			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	FORMATION DES USINIERS DU RIZ MODULE 2: Partie 2 QUALITE, HYGIENE, EMBALLAGE	rice miller, training	training materials			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	FORMATION DES DISTRIBUTEURS DE RIZ LOCAL MODULE1 CARACTERISATION DU RIZ DE COTE D’ IVOIRE	distributor, training	training materials			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	GESTION D’ UNE MICRO ENTREPRISE ET DISTRIBUTION DU RIZ LOCAL : CAS PRATIQUE D’ UNE MICRO-RIZERIE	distributor, training	training materials			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	GESTION D’ UNE MICROENTREPRISE ET DISTRIBUTION DE RIZ LOCAL	distributor, training	training materials			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	01 Manuals	Ligne Directrice de l’ Approche du Projet	extension, monitoring, distribution, training, credit system	guidelines	○		○			○						○			
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	02 Evaluation reports	Joint Mid-Term Review Report	extension, monitoring, sale, preference survey, distribution, training, credit system	report	○					○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	02 Evaluation reports	Joint Terminal Evaluation Report	extension, monitoring, sale, preference survey, distribution, training, credit system	report	○					○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	03 Progress reports / Completion reports	Project Completion Report	extension, monitoring, sale, preference survey, distribution, training, credit system	report	○		○			○								○	
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	03 Progress reports / Completion reports	Project Completion Report (Annex)	extension, monitoring, sale, preference survey, distribution, training, credit system	ANNEX	○					○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	03 Progress reports / Completion reports	Projet de promotion du riz local en République de Côte d’ Ivoire (PRORIL) Rapport d’ achèvement du projet	extension, monitoring, sale, preference survey, distribution, training, credit system	report			○			○									
CIV-01	Cote d'Ivoire	(English) Local Rice Promotion Project in Côte d’ Ivoire (French) Projet de Promotion du Riz Local en République de Côte d’ Ivoire	04 Other	Rapport final d'analyse d'enquête sur la riziculture	extension	survey report			○			○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-5

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	EN	FR	PR	Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques: 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Extension_material	training	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Aperçu du PRODERiP (1): Information de base	project overview	reference material			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Aperçu du PRODERiP (2) : Principales Activités	project overview	reference material			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Vulgarisation et Suivi	extension	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Multiplication de semences	seed production	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Schéma de la Multiplication des semences de pré-base	seed, foundation seed	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	System de production des semences du PRODERiP	seed	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Morphologie du riz	general of rice cultivation	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Technique de la reziculture pluviale de plateaux(1)	sowing, cultivation technique	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Technique de la reziculture pluviale de plateaux(2)	cultivation management, herbicide, fertilization	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Technique de la reziculture pluviale de plateaux(3):Récolte	harvest , post-harvest processing	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Post-Récolte(2) Paddy de qualité pour avoir du bon riz blanchi	post-harvest processing, cracked grain, drying	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Post-Récolte(1)	post-harvest processing, drying	poster			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Caractéristique de la Décortiquese(SB10-D)	rice milling, rice milling machine	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Nettoyage et Révision Journalier dans une Station du Décorticage	rice milling, rice milling machine	training materials			○							○					
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Votre paiment de 50Fcfa/kg soutient votre pointde décorticage!	rice milling, rice milling fee	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	GUIDE for NERICA CULTIVATION	NERICA, upland rice, cultivation	training materials		○					○		○						
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	GUIDE pour la culture du NERICA	NERICA, upland rice, cultivation	training materials			○												
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Seed Multiplication Technology (Foundation Seed) Schéma de la Multiplication des semences de pré base	seed	training materials			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Nettoyage et Révision Journalier dans une Station du Décorticage	agricultural machines	training materials			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Technique - Conservation Post Récolte (3)	rice cultivation technique	training materials			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Manuel 'facile' de production du NERICA	NERICA, upland rice, cultivation	manual			○			○			○						
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Le stage international par pays 2015 《 Stage destiné aux cadres du ministère de l' Agriculture du Cameroun 》	seed production	training materials			○			○					○				

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-6

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
							JP	EN	FR	PR	Others		Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
													2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Poster No.1 Outline PRODERiP	project overview	poster			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Poster No.2 About PRODERiP	extension	poster			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Poster No.3 About PRODERiP	extension	poster			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Formation et suivi Vulgarisation : Formation sur le terrain	training	poster			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	01 Manuals	Vulgarisation : Suivi des producteurs sur le terrain	training	poster			○			○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	02 Evaluation reports	Joint Terminal Evaluation Report	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (1) 25 May 2011 - 24 Nov 2011	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (2) 25 Nov 2011 - 24 May 2012	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (3) 25 May 2012 - 24 Nov 2012	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (3) PDM (Revised edition)	upland rice, extension, seed production	ANNEX		○				○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (4) 25 Nov 2012 - 24 May 2013	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (5) 25 May 2013 - 24 Nov 2013	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (6) 25 Nov 2013 - 24 May 2014	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (7) 25 May 2014 - 24 Nov 2014	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (8) 25 Nov 2014 - 24 May 2015	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (PRODERiP) (9) 25 May 2015 - 25 Nov 2015	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Progress Report (PRODERiP) (10) 26 Nov 2015 - 24 May 2016	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	03 Progress reports / Completion reports	Project Completion Report	upland rice, extension, seed production	report	○					○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	04 Other	Effect of pure line selection of rice in Ndop, Northwest, Cameroon	seed purification	research paper		○				○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	04 Other	Yield characters of different plant-type rice varieties grown with different planting density in Cameroon	cultivation technique	research paper		○				○									
CMR-01	Cameroon	(English) Upland Rice Development Project of the Tropical Forest Zone in Cameroon (French) Projet de Développement de la Riziculture Pluviale de Plateaux en Zone de Forêt à Pluviométrie Bimodale	04 Other	Determination of the Panicle Differentiation Stage by the Visual Observation of Plant Shape of Rice	cultivation technique	research paper		○				○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-7

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Module pour la formation sur le terrain	on-site training	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Explication sur la Boite d'image	extension	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Rôles, Responsabilités des AVZ	role, responsibility	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Calendrier Agricole de la riziculture Module3-1	cultivation calendar, upland rice	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Récolte et Post-récolte du riz(riziculture pluviale de plateaux)	post-harvest processing	training materials			○							○					
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Stade de croissance du riz	upland rice, cultivation management, fertilization	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Rôles du Personneld'encadrement su MINADER dans les activites	project overview	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Rôles des AVZ et des Producteurs-cles	extension, key farmer	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Généralités sur le riz	rice farming	training materials			○				○		○						
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Résultats de l'étude de marché	marketing, market	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Pré-Test de la Formation	upland rice, monitoring	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Formation en techniques d'inspection des semences de riz Yaoundé 2015	seed production	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Shéma de la multiplication des semences de pré-Base	seed production, foundation seed	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Rapport des Activités de Mois de en 2016	monitoring, extension worker	monitoring format			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Fiche de synthése de suivi	monitoring, extension worker	monitoring format			○												
CMR-01	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Maniement de la Décortiquese	post-harvest processing, rice milling	training materials			○												
CMR-01	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	Pièces consommables de la SB10-D décortiqueuse	post-harvest processing, rice milling	training materials			○												
CMR-01	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	La connaissance en base du moteur diesel	post-harvest processing, rice milling	training materials			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	PRODERIP Brochure ENG 2016.12.13	public relations	pamphlet		○													
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	01 Manuals	PRODERIP Depliant FR 2016.12.20	public relations	pamphlet			○												
CMR-02	Cameroon	(English) Project for the Development of Irrigated and Rainfed Rice Cultivation in Cameroon (French) Le Projet Pour le Développement de la Culture du Riz Irrigué et Pluvial au Cameroun	04 Other	The Project for the Development of Irrigated and Rainfed Rice Cultivation (PRODERIP) by JICA expert Sokei Introduction of Project's Activities, 2021	public relations	project overview	○					○				○					
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Guideline to Participatory Agricultural Research through Farmer Research Groups (FRGs) for Agricultural Researchers	participatory research method	guidelines		○													○
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Socioeconomic Characteristics of Smallholder Rice Production in Ethiopia	socio-economic survey	guidelines		○													
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Guideline, Extension Material Develoment for Researchers	extension	guidelines		○													
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Quick Reference Extension Material Development For Researchers And Guideline For improvement of your extension materials Monitoring&Evaluation	M&E	guidelines		○													
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Handbook of FRG approach trainings	training method	guidelines		○													

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	EN	FR	PR	Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	Farmer Research Group Project II (FRG2)	general in agriculture	pamphlet		○													
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	01 Manuals	FRG Research Inventory (2013) final draft	dissemination of rice cultivation, cultivation	inventory survey results		○				○									
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	02 Evaluation reports	Joint Mid-Term Review Report	dissemination of rice cultivation, cultivation	report	○					○									
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	02 Evaluation reports	Joint Terminal Evaluation Report	dissemination of rice cultivation, cultivation	report	○					○									
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	03 Progress reports / Completion reports	Project Completion Report	dissemination of rice cultivation, cultivation	report	○					○									○
ETH-01	Ethiopia	(English) Project for Enhancing Development and Dissemination of Agricultural Innovation through Farmer Research Group (FRG II)	04 Other	Impact Evaluation of Agricultural Technology Developed through Participatory Research—A Case of Technical Cooperation between JICA and Ethiopian Institute of Agricultural Research (EIAR): Project for Enhancing Development and Dissemination of Agricultural Innovations through Farmers Research Group (FRG II project)—	dissemination of rice cultivation, cultivation	abstract of the conference	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	01 Manuals	RICE-Book-PGD Advances in Rice Research and Development in Ethiopia	general	guidelines		○				○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	02 Evaluation reports	Project Assessment sheet	dissemination of rice cultivation, cultivation, capacity development	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	1. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: March 1, 2016 - April 6, 2016	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	2. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: May 25, 2016 - July 6, 2016	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	3. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: August 10, 2016 - September 14, 2016	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	4. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: February 20, 2017 - April 4, 2017	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	5. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: May 23, 2017 - June 21, 2017	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	6. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: August 1, 2017 - September 27, 2017	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	7. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: October 19, 2017 - December 25, 2017	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	8. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: February 20, 2018 - April 5, 2018	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	9. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: February 20, 2018 - April 5, 2018	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	10. Project Completion Report by Expert of JICA Shiratori On-site Dispatch Period: May 19, 2019 - June 21, 2019	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	11. Project Report by Expert of JICA Shiratori On-site Dispatch Period: November 4, 2019 - December 22, 2019	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	03 Progress reports / Completion reports	12. Project Report by Expert of JICA Shiratori On-site Dispatch Period: February 24, 2020 - March 30, 2020	extension	report	○					○									
ETH-02	Ethiopia	(English) Project for Functional Enhancement of the National Rice Research and Training Center	04 Other	Survey Result of Detailed Design	dissemination of rice cultivation, cultivation, capacity development	report	○					○									
GHA-01	Ghana	(English) Small-Scale Irrigated Agriculture Promotion Project	02 Evaluation reports	Joint Terminal Evaluation Report	irrigation	report	○					○									
GHA-02	Ghana	(English) Farmer Participatory Irrigation Management in Irrigation Projects in Ghana	02 Evaluation reports	Joint Terminal Evaluation Report (summary)	irrigation	report	○					○									
GHA-03	Ghana	(English) Upper West Integrated Agricultural Development in the Republic Ghana	03 Progress reports / Completion reports	Final Report (Summary, Japanese)	formulation of master plan	report	○					○									
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Guideline for Extension of Model	dissemination of rice cultivation, cultivation, monitoring, training, calendar	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Outline District Rice Extension Plan	dissemination of rice cultivation	guidelines		○													

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Outline Regional Rice Extension Plan	dissemination of rice cultivation	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Monitoring competition	dissemination of rice cultivation	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	(ASH) AM Database Competition 2013Modified	dissemination of rice cultivation	survey results		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	(ASH NOR) List of MS PS	dissemination of rice cultivation	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	List of Training Group	dissemination of rice cultivation	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Management Training	dissemination of rice cultivation	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Sheet for Field Activities	dissemination of rice cultivation	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	ASH cal1 2013 Calendar	dissemination of rice cultivation	calendar		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	NOR cal3 GROW WHAT YOU EAT & EAT WHAT YOU GROW	dissemination of rice cultivation	calendar		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	2nd Joint Extension	dissemination of rice cultivation	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Planning of Training at District in Ashanti Region	dissemination of rice cultivation	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Farmer Competition 2012 in Project	dissemination of rice cultivation	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	3rd Joint Extension (ASH)	dissemination of rice cultivation	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	In-House Training	dissemination of rice cultivation, marketing, agricultural input material, farmland block, field selection, water management, farmland consolidation, fertilizer, seed quality	training materials		○					○	○							
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	In-House Training (Optional)	baseline survey, rain-fed rice cultivation, irrigation, cultivation environment, water management, topographic map reading , land use, laser rangefinder	training materials		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Onsite Training	farming, farmland consolidation, nursery seedlings, sowing, seed production, water management, post-harvest processing, bird chasing	training materials		○								○		○			
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Format to collect information	marketing, farmland consolidation, water management	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Format for Management	extension, cultivation	format		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Rain-fed Land Development Handbook THE PROJECT FOR SUSTAINABLE DEVLOPMENT OF RAIN-FED LOWLAND RICE PRODUCTION	rain-fed rice cultivation	handbook		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	RC Guide The guideline for the use of agro-chemicals Guidelines for the use of agro-chemicals	cultivation	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	RC IHT 1-6-X Quick Reference Matrix (Frtiliser) Quick Reference Matrix of amount of applied Nitrogen and fertilizer	cultivation	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	RC IHT S-1 Guidance for Certified seed growers	seed	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	RC IHT S-2 Plant and Fertilizer Act 2010	cultivation	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Rice cultivation handbook (NR)	cultivation	handbook		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Rice cultivation handbook	cultivation	handbook		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Rice cropping calendar (ASH)(NOR)	cultivation	calendar		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Farm record keeping book (ASH) (NOR)	cultivation	guidelines		○										○			
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Farm record keeping sheet (ASH)(NOR)+J166	cultivation	guidelines		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	01 Manuals	Promotion sheet (ASH)(NOR) MY RICE IS QUALITY ONE!!How I achieved this quality in the field?	cultivation	poster		○													
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	02 Evaluation reports	Project Assessment sheet	general	report	○					○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-10

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	Languages* EN	Languages* FR	Languages* PR	Languages* Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	02 Evaluation reports	Joint Mid-Term Review Report	general	report	○					○									
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	02 Evaluation reports	Joint Terminal Evaluation Report	general	report	○					○									
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	03 Progress reports / Completion reports	REPORT ON EXIT STRATEGY OF SUSTAINABLE DEVELOPMENT OF RAIN-FED LOWLAND RICE PRODUCTION PROJECT(Tnsui Rice)	rain-fed rice cultivation	report		○				○									
GHA-04	Ghana	(English) Sustainable Development of Rain-fed Lowland Rice Production Project	03 Progress reports / Completion reports	Project Completion Reporting Presentation for JICA Headquarters Project for Sustainalbe Development of Rain-fed Lowland Rice Production in the Republic of Ghana	farming, extension	public relations	○					○									
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	01 Manuals	Rice Extension Guideline_MoFAJICAProject_TENSUI2 Extension Guideline "Model" of Sustainable Development of Rain-fed Lowland Rice Production	rain-fed rice cultivation	guidelines		○				○				○					
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project Progress Report (phase 1)	general	report	○					○									
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project Progress Report (phase 1) (annex)	general	ANNEX	○	○				○									
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project Progress Report (phase 2)	general	report	○					○						○			
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project Progress Report (phase 2) (annex)	general	ANNEX	○					○									
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project for the Sustainable Development of Rain-fed Lowland Rice Production Phase II Annual Progress Report (2nd year)	general	report		○				○									
GHA-05	Ghana	(English) The Project for Sustainable Development of Rain-fed Lowland Rice Production Project Phase 2	03 Progress reports / Completion reports	Project for the Sustainable Development of Rain-fed Lowland Rice Production Phase II Annual Progress Report (2nd year) Annex	general	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Guideline on the process of Water Users Associations establishment with facilitation by Supervising Authority (GIDA)	water management, operation and maintenance, water use organization	guidelines		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Operation and Management Manual for Water Users Association (WUA)	water management, operation and maintenance, water use organization	manual		○				○							○		
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Optimum Input Rice Cultivation Manual for Water Management	irrigation / drainage , water management	manual		○				○							○		
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	What is the role of WUA? (Basic)	water management, operation and maintenance, water use organization	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	The Operation planing by WUA (Basic)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	The Maintenance plan by WUA(Basic)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Water Management for rice production on paddy fields (Basic)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Water Management for rice production on paddy fields (Intermedia)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Water Management in the irrigation scheme(Intermedia)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Report on water management trial in 4 Seasons (Minor 2017, Major and Minor 2018, Major 2019)(Besic)	irrigation / drainage , water management	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Leadership Theory-Leaders and Leadership- by Dr. Shigeoka	water management, operation and maintenance, water use organization	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Leadership Theory-Consensus Building Method- by Dr. Shigeoka	water management, operation and maintenance, water use organization	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Progress Report on Supporting Development of Water Users Association (WUA)in Kpong Irrigation Scheme under MASAPS Project	water management, operation and maintenance, water use organization	report		○				○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-11

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	EN	FR	PR	Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Process of identification and dissemination of appropriate rice cultivation techniques	cultivation / dissemination	public relations	○	○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Brochure for Optimum Input Rice Cultivation	cultivation / farming	pamphlet		○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Optimum Input Rice Cultivation Traning Material	cultivation / farming	training materials		○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Extension of rice cultivation techniques by WUA leaders through satellite demonstrations	dissemination method	training materials		○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Training Material for Certified seed production under Irrigation	seed production	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Guide for Certified Rice Seed production under Irrigation	seed production	guidelines		○				○					○				
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	MASAPS Issues on Rice Seed Production in Ghana Short-Term Expert of JICA Ryoichi Ikeda	seed production	seminar materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Seed Production of Rice in Ghana Short-Term Expert of JICA Ryoichi Ikeda	seed production	seminar materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	MASAPS Technical Workshop Seed production of rice in Ghana (2) Short-Term Expert of JICA Ryoichi Ikeda	seed production	seminar materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Capacity Development Plan	capacity development, training method	planning document (paper)		○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Project Brochure	public relations	pamphlet		○													
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Participatory self assessment	marketing	farming record format		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Rice farm management handbook	farmer management, marketing	training supplementary materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	KPONG IRRIGATION SCHEMEBASELINE SURVEY REPORT	irrigation	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effects of different plant population on three rice varieties in minor season 2017	demonstration test, planting distance	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effects of different plant population on three rice varieties in major season 2018	demonstration test, planting distance	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effects of different plant population on three rice varieties in minor season 2018	demonstration test, planting distance	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of different fertilizer rate on Jasmine 85 rice in minor season 2017 Report on trial on the effects of different fertilizer rates on Jasmine85 rice in minor season 2017	demonstration test, fertilization related	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of different fertilizer rate on Jasmine 85 rice in major season 2018 Report on trial on the effect of different nitrogen fertilizer rate on GBEWAA (Jasmine85) rice in major season 2018	demonstration test, fertilization related	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of different fertilizer rate on Jasmine 85 rice in minor season 2018 Report on trial on the effect of different nitrogen rate on GBEWAA (Jasmine85) rice in minor season 2018	demonstration test, fertilization related	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of nitrogen fertilizer application timing on Jasmine 85 rice in minor season 2018	demonstration test, fertilization related	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	WUA Specific Soil map KIS	demonstration test, fertilization related	soil classification map		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Soil specific fertilizer recommendation KIS NITROGEN, PHOSPHORUS AND POTASSIUM FERTILIZER RECOMMENDATIONS	demonstration test, fertilization related	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	OIRIC fertilization standards	demonstration test, fertilization related	training materials		○				○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of different seed rates under broadcasting for three varieties in major season 2018 Report on trial on the effects of different seed rates under wet direct seeding with broadcasting method for three rice varieties in major season 2018 in KIS 15 November	demonstration test, direct sowing by irrigation	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Effect of different seed rates under broadcasting for three varieties in minor season 2017 Report on trial on the effects of different seed rates under direct wet seeding with broadcasting method for three varieties in minor season 2017 in KIS May	demonstration test, direct sowing by irrigation	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	REPORT ON SATELITE DEMONSTRATION IN C1 and C2 IN MINOR SEASON 2018	dissemination of rice cultivation technique	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Rice Seed Production Practice-for good seed production -by HisashiURAYAMA Short-Term Expert (Rice Cultivation)	seed production	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Report on certified seed production in KIS by seed growers in Major season 2017	seed production	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Seed production of rice	seed production	seminar materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Seed Production of Rice in Ghana	seed production	seminar materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	MASAPS-KIS Outline of seed production	seed production	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Yield and Yield Component -for Good Fertilizer Application and Yield -by HisashiURAYAMA Short-Term Expert (Rice Cultivation)	rice farming	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Irrigated lowland rice cultivationin Japan by HisashiURAYAMA Short-Term Expert (Rice Cultivation) 2017	rice farming	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Rice Cultivation Techniques for Kpong Irrigation Scheme -Tentative-	rice farming	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Rice Cultivation Techniques -Illustrated Manual for Farmers-	rice farming	manual		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Appendix: Life history of rice under the transplanting cultivation system	rice farming	training materials		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Optimum Input Rice Cultivation under Irrigation	rice cultivation technique	training materials		○				○		○							
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	01 Manuals	Guide for Optimum Input Rice Cultivation under Irrigation	rice cultivation technique	guidelines		○				○		○							
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	02 Evaluation reports	Project Assessment sheet	general	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	02 Evaluation reports	Joint Terminal Evaluation Report (draft)	general	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	02 Evaluation reports	Evaluation report (KIS) 1015_Reviewed_GIDA Joint Terminal Evaluation Report For Technical Cooperation Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme	general	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Yamauchi(water use organization) On-site Dispatch Period: February 24, 2016 - March 30, 2018(extension phase)	water use organization	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Monitoring sheet from February to July,2016	water use organization	monitoring sheet		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Output 1: The capacity of GIDA for scheme management oversight in KIS is developed Activity so far from previous JCC to present	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Annex.1 Operation & Maintenance Activities on KIS Irrigation Structures up to Jan, 2018	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	THE OPERATION & MONITORING POINTS OF IRRIGATION STRUCTURE ON KIS	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Service Area: AK/C1	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Water management for rice production(LEVEL: BASIC)	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Water Management in the irrigation scheme(LEVEL: INTERMEDIA)	water use organization	ANNEX		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Guideline on the process of Water Users Associations establishment with facilitation by Supervising Authority(GIDA)	water use organization	guidelines		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Guideline the process of Water Users Associations establishment with supervising Authority (GIDA)	water use organization	guidelines		○				○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	KPONG IRRIGATION SCHEME BASELINE SURVEY REPORT	water use organization	report		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	The Project for Enhancing Market-Based Agriculture by Smallholders and Private sector linkages in KpongIrrigation Scheme (MASAPS-KIS) Project brochure	water use organization	pamphlet		○				○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	The Project for enhancing Market-based Agriculture by Smallholders and Private Sector linkages in Kpong Irrigation Scheme (MASAPS - KIS)	water use organization	pamphlet			○			○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Urayama(rice cultivation) On-site Dispatch Period: January 12, 2017 - February 10, 2017	cultivation	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Toda(program management) On-site Dispatch Period: January 12, 2017 - February 10, 2017	operation	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Chinen(coordination / market oriented) On-site Dispatch Period: January 28, 2016 - April 20, 2018	market oriented	report	○					○									
GHA-06	Ghana	(English) Project for Enhancing Market-Based Agriculture by Smallholders and Private Sector Linkages in Kpong Irrigation Scheme in Ghana (MASAPS)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Ikeda(seed production) On-site Dispatch Period: January 28, 2016 - April 20, 2018	seed production	report	○					○									
GIN-01	Guinea	(English) Research on Sustainable Rural Development in the Central/Upland Guinea	03 Progress reports / Completion reports	Final Report (mail report)	formulation of master plan, capacity development	report	○					○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guidelines of MACHINE HARVESTING OF PADDY RICE for Mwea Irrigation Scheme	post-harvest processing	guidelines		○						○							
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Mechanization Terminal Presentation PROPOSED ALTERNATIVE LAND PREPARATION METHOD	farmland consolidation, agricultural machines	training materials		○						○						○	
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Mechanization Training Material for Harvesting and Threshing	harvest , agricultural machines	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Mechanization Training Material for Land Preparation and Power Weeding	farmland consolidation, herbicide, agricultural machines	training materials		○												○	
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	MECHANIZATION FOR ENHANCED PRODUCTION & POST-HARVEST SYSTEM	farmland consolidation, post-harvest processing, agricultural machines	pamphlet		○												○	
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	COMBINE HARVESTING Reduces grain loss, is fast & efficient	harvest , agricultural machines	pamphlet		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	ALTERNATIVE LAND PREPARATION METHOD	farmland consolidation, agricultural machines	pamphlet		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guideline of Sequential Crop Management in MIS	second cropping	guidelines		○										○			
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	RiceMAPP Training for Unit Leaders on Sequential Crops Production	second cropping	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	GUIDELINE ON HOW TO DISSEMINATE WSRC THROUGH FARMER TO FARMER APPROACH	dissemination between farmers	training materials		○										○			○
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guideline on how to disseminate WSRC through farmer to farmer approach	dissemination between farmers	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guideline on how to disseminate WSRC through farmer to farmer approach (Draft)	dissemination between farmers	guidelines		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Enhancing the Capacity of Irrigation Water Management by Water Management Guideline	water management	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Enhancing the Capacity of Irrigation Water Management by Water Management Guidelines	water management	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	WSRC-INTERMITTENT IRRIGATION	water management	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Water management about ratoon	water management	training materials		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	GUIDELINES ON IRRIGATION WATER MANAGEMENT IN MWEA IRRIGATION SCHEME	water management	guidelines		○											○		
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	MWONGOZO WA MAJI YA UNYUNYIZI KATIKA SKIMU YA MWEA	water management	guidelines					Swahili										
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Outline of Water Management Guideline	water management	pamphlet		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Mukhtasari wa muongozo wa matumizi ya maji	water management	pamphlet					Swahili										

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Appendix-14

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	Languages* EN	Languages* FR	Languages* PR	Languages* Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Cropping calendar on 2015SR	farming plan	calendar		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Doublle cropping calendar on 2016LR	farming plan	calendar		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Cropping calendar on 2016SR	farming plan	calendar		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guideline of WSRC Water Saving Rice Culture For Mwea Irrigation Scheme	water-saving irrigation	guidelines		○						○							
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Guideline of IRaP Improved Ratoon Production For Mwea Irrigation Scheme	ratoon	guidelines		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Improved Ratoon Production - IRaP by Rice based Market oriented Agriculture Promotion Project - RiceMAPP	ratoon	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Water Saving Rice Culture - WSRC	water-saving irrigation	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Healthy Seedling Water Saving Rice Culture - WSRC	water-saving irrigation	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Dapog Seedling	nursery seedlings	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Rice Yellow Mottle Virus	pests	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Available Agricultural loans by Commercial Banks for Rice farmers in Mwea	lending	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Market Oriented Approaches	marketing	poster		○										○			
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	01 Manuals	Findings out of Rice Value Chain Survey in Mwea	rice milling	poster		○													
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	02 Evaluation reports	Joint Mid-Term Review Report	farming, market oriented, irrigated rice cultivation, post-harvest processing	report	○					○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	02 Evaluation reports	Joint Terminal Evaluation Report For Rice-basedand Market-orientedAgriculture Promotion Project	farming, market oriented, irrigated rice cultivation, post-harvest processing	report		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Tasawa(chief advisor / policy support) On-site Dispatch Period: January 18, 2014 - January 30, 2017	policy support, marketing, agricultural machines, farming	report	○					○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 1. RiceMAPP PDM (Version 3.0)	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 2_PO Plan of Operation	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 3_History_Changes_PDM	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 4_Expert List Japanese Expert List	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 5_CP_Training List	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 6_Seminar Training List	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	Annex 7_Provided Equipment List	policy support, marketing, agricultural machines, farming	ANNEX		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	03 Progress reports / Completion reports	THE FINAL REPORT ON RiceMAPP Rice-based and Market-oriented Agriculture Promotion Project	policy support, marketing, agricultural machines, farming	report		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	04 Other	Report on the Verification of Water Saving Rice Culture from the view of farmers' practice	cultivation test	survey report		○				○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	04 Other	Report on the Influence of Seedling Age on Rice Growth and its grain yield from the view of farmers' practice	cultivation test	survey report		○				○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	04 Other	Comparison WSRC (Water Saving Rice Culture) and SRI (System of Rice Intensification)	cultivation technique	survey report material	○					○									
KEN-01	Kenya	(English) Rice-based and Market-oriented Agriculture Promotion Project	04 Other	Research report on changes in income of rice farmers who developed and adopted rice cultivation techniques	cultivation technique, living	survey report	○					○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	01 Manuals	A manual for conducting field trial verification of the improved cultivation technologies (ver1.1)	cultivation technique	manual		○				○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	01 Manuals	A plan for developing rice varieties (ver1.1)	variety	planning document		○				○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	02 Evaluation reports	Joint Mid-Term Review Report	variety development, cultivation technique	report	○					○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	02 Evaluation reports	Joint Terminal Evaluation Report	variety development, cultivation technique	report	○					○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	02 Evaluation reports	THE JOINT TERMINAL EVALUATION REPORT ON JAPANESE TECHNICAL COOPERATION (SATREPS) ON THE PROJECT ON RICE RESEARCH FOR TAILOR-MADE BREEDING AND CULTIVATION TECHNOLOGY DEVELOPMENT IN KENYA	variety development, cultivation technique	report		○				○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	02 Evaluation reports	Joint Terminal Evaluation Report (annex)	variety development, cultivation technique	ANNEX		○				○									
KEN-02	Kenya	(English) The Project on Rice Research for Tailor-Made Breeding and Cultivation Technology Development in Kenya	03 Progress reports / Completion reports	Final Report	variety development, cultivation technique	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Rice Productivity Improvement Project in the Central Highland of Madagascar, Main Activities and Achievements (Revised edition)	general of rice cultivation	manual	○						○	○	○		○			○	
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Yield survey data by Semi-synchronized method	yield	data		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	brochure_donor_french_01-04, project_brochure_french_01-02	general	pamphlet			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	PLANT DE RIZ Le développement du grain Réponses morphologiques envers l' environnement Les variétés	physiology, botany	training materials			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Haitao Teknika manokana ho an'ny voly vary an-drano	cultivation technique	training materials					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Specific rice cultivation technoogie on Sakamaina Paquet Technique pour la riziculture sur sakamaina	cultivation technique	manual		○	○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Plantules "Dapog" sur une pépinière semi-irriguée PAPRiz	cultivation technique	manual			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Ketsa Dapog	cultivation technique	training materials					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Torolalana Fampiasana Zezika ho an'ny vary an-drano	cultivation technique	manual	○				Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Haitao teknika manokana ho an' ny voly vary an-drano Analamanga Ver.2	cultivation technique	training materials					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Paquet technique pour le riz pluvial (VO)	cultivation technique	training materials			○			○			○						
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Technical package for irrigated rice Vakinankaratra Ver.3 Haitao teknika manokana ho an' ny voly vary an-drano Vakinankaratra Ver.3	cultivation technique	training materials		○			Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	MESURE DES COMPOSANTS DE RENDEMENT AVEC LA « METHODE SEMI-SYNCHRONISEE	yield	survey results	○		○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	- Bongolava 2010/11 - Paquet technique unique pour la riziculture de bas-fond Haitao teknika manokana ho an' ny voly vary an-drano - Bongolava 2010/11 -	cultivation technique	training materials			○		Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	ver.1PAQ TECHNIQUE FRANCAIS vergion paysan	cultivation technique	training materials			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Teknika fambolem bary Version 3	cultivation technique	pamphlet					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Fototra 5 hahazoana voka-bary 5 Tonnes / ha	cultivation technique	training materials					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	CATALOGUE NATIONAL DES ESPECES ET VARIETES CULTIVEES	seed	catalog			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Méthode de Sélection de G0	seed	document			○			○									

* JP:Japanese, EN: English, FR: French, PR: Portuguese

Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Why is rice breeding important ?	seed	document		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Points qu'il faudrait faire attention pendant le repiquage et la récolte	seed	document			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Approach to Enhance Rice Productivity	seed	document		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Méthode d' inspection de semences /Méthode d' inspection pour observer tout le champ de semences sur la rive	seed	document			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Condition pour le paysan semencier autorisé et Inspection Par le Dep. De l' Agriculture, des Forêts et de la Pêche dans la Région	seed	document			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Hill selection in G0 for purifier G0 seed production	seed	format		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Agricultural machinery manual	agricultural machines	document		○			Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Agricultural machinery design drawing	agricultural machines	document					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Torolalana momban`ny fomba fanamboarana ny FIKAPOHAM-BARY VOIZINA AN-TONGOTRA	agricultural machines	manual					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Torolalana momban`ny fomba fanamboarana ny FIKAPOHAM-BARY AHODINA MILINA	agricultural machines	manual					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Torolalana momban`ny fanamboarana sy fampiasana ny FIKOROROHANA na (VANNEUSE) (Grain Manual Winower GMW-400)	agricultural machines	manual					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Torolalana momban`ny fomba fanamboarana FIHAVANA V+I358+H347	agricultural machines	manual					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	METHOD OF PADDY LOSSES MEASUREMENT FOR POSTHARVEST IN MADAGASCAR METHODE DE MESURE DES PERTES DE PADDY POUR LA POST RECOLTE A MADAGASCAR	agricultural machines	manual		○	○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	ANALYSIS OF PADDY GRAIN AND RICE QUALITY IN MADAGASCAR ANALYSE DES GRAINS DE PADDY ET DE LA QUALITE DU RIZ A MADAGASCAR	agricultural machines	manual		○	○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Four de fabrication de charbon de balles de riz (Rice husk charcoal furnace manual HBM-100)	agricultural machines	manual			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Test Report of FOFIFA CELA	cultivation technique, variety	report			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Test Report of FOFIFA Kianjasoa	cultivation technique, variety	report			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Test Report of FOFIFA Mahitsy	cultivation technique, variety	report			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Test Report of FOFIFA Antsirabe	cultivation technique, variety	report			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	01 Manuals	Local language teaching materials (technical package, etc.)	cultivation, calendar, agricultural machines, household budget	training materials, pamphlets					Malagasy	○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	02 Evaluation reports	Joint Mid-Term Review Report	general	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	02 Evaluation reports	Joint Terminal Evaluation Report	general	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	02 Evaluation reports	Joint Terminal Evaluation Report (extension phase)	general	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Mr. JOKO Pitoyo FINAL REPORT ON PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT IN CENTRAL HIGHLAND IN THE REPUBLIC OF MADAGASCAR June 2012	agricultural machines	report		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	PAPRiz Project Completion Report by Expert of JICA Shoji(agricultural machinery)	agricultural machines	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	PAPRiz Project Completion Report by Expert of JICA Sugiura(characteristics of paddy rice varieties) On-site Dispatch Period: February 16, 2013 - March 9, 2013	variety	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Mr. Suismono Antsirabe, February, 2013 FINAL REPORT ON PROJECT FOR RICE PRODUCTIVITY IMPROVEMENT IN CENTRAL HIGHLAND IN THE REPUBLIC OF MADAGASCAR September 2013	post-harvest processing	report		○				○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Hoshino (seed production) Research report on seed production in Madagascar May 2012, May 21 2013, May 28 2014	seed production	report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Yamaguchi (soil-analysis) December 17 2012, December 31 2013	soil, fertilization management	report	○					○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Evaluation of Ammonium Sulfate Effect on Rice Production in Madagascar (2012-2013) Evaluation de l' effet du Sulfate d' Ammonium sur la production du riz à Madagascar (2012-2013)	soil, fertilization management	survey report		○	○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Fujimori Rapport de l' expert de gestion des eaux , à court terme période 12.12.2013-07.02.2013 Rapport de l'expert à court terme sur la gestion de l' eau Période de mission 02-11-2013～02-12-2013	water management	report	○		○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	The current status and future maintenance of the main and branch irrigation canals in the PC23 area	water management	survey report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Project Completion Report	general	report	○					○								○	
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Evaluation of soil fertility by pot test - With the result of Pot Trial 1-	soil, fertilization management	survey report	○					○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	03 Progress reports / Completion reports	Gestion de parcelles de prod de semences	seed	manual			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	04 Other	Coût économique de l'apport d'engrais	fertilization	manual			○			○									
MDG-01	Madagascar	(English) Project for Rice Productivity Improvement in Central Highland (French) Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales (PAPRiz)	04 Other	Haitao teknika manokana ho an' ny voly vary an-drano MASOMBOLY	seed	manual					Malagasy	○									
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	Technique Spécifique Pour Riziculture Irriguée	cultivation technique	manual			○					○							
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	AUGMENTEZ VOTRE RENDEMENT RIZICOLE AVEC	dissemination of rice cultivation technique	pamphlet			○												
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	AMPITOMBOY NY VOKA-BARINAO MIARAKA AMIN'NY	dissemination of rice cultivation technique	pamphlet					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	NY VOKATRA NO TSARA	seed production	training poster					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TOROLALANA FAMPIASANA ZEZIKA	fertilizer	training poster					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TANIMBARY AZAHOANA VOKA-BARY 500KG	fertilizer	training poster					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	FILAZANA TANTSAHA MPAMPIOFANA	extension	training poster					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TOROLALANA FAMPIASANA ZEZIKA HO AN'NY VARY AN-DRANO	fertilizer	teaching materials					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	IREO SOKAJIN' NY HAITAO	cultivation technique	teaching materials					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	Voly varin-dRajao	cultivation technique	teaching materials					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	MASOMBOLY VARY ETO MADAGASIKARA AMIN'NY FARITRA IASAN'NY PAPRIZ	seed production	pamphlet					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	Introduction of agricultural machinery (Weeding machine, threshing machine and winnowing machine)	agricultural machines	pamphlet					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	Fivelezam-bary (Batteuse à Pédale)	agricultural machines	manual					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TOROLALANA amin'ny dampiasana ny SARKLEZY an-drano	agricultural machines	manual					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TOROLALANA amin'ny dampiasana ny Fikororohan-bary	agricultural machines	manual					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	CAHIER PAPRIZ Voka-bary tsara!	farming	farming record format					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	Haitao teknika manokana ho an'ny voly vary an-drano	cultivation technique	teaching materials					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	TOPOLALANA PAPRIZ SAC HO AN'NY VOLU VARY AN-DRANO	cultivation technique	teaching materials					Malagasy										

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							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	FITAOVANA ENTI-MAMPIOFANA	cultivation technique	teaching materials					Malagasy										
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	01 Manuals	CATALOGUE NATIONAL DES ESPECES ET VARIETES CULTIVEES	seed	teaching materials			○												
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Sugimoto(agriculture / rural development) On-site Dispatch Period: June 20, 2018 - June 20, 2020	agriculture , rural development	report	○					○									
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Yasuda (coordinator / human resource development) On-site Dispatch Period: April 20, 2018 - July 13, 2020	human resource development	report	○					○									
MDG-02	Madagascar	(English) Project for Rice Productivity Improvement and Management of Watershed and Irrigated Area (PAPRIZ Phase2) (French) Projet D'amélioration de la Productivité Rizicole, de Gestion des Bassins Versants et des Périmètres Irrigué, (PAPRIZ Phase2)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Joho (rice cultivation techniques) On-site Dispatch Period: August 16, 2016 - August 15, 2018	rice cultivation technique	report	○					○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	02 Evaluation reports	Mid-Term Report	breeding, fertilization, materials, P-dipping	report	○					○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	03 Progress reports / Completion reports	Implementation Report (2016, 2017, 2018, 2019)	breeding, fertilization, materials, P-dipping	report	○					○		○							
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	04 Other	Research Result	breeding, fertilization, materials, P-dipping	public relations	○					○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	04 Other	JIRCAS Press Release	breeding, fertilization, materials, P-dipping	public relations	○					○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	04 Other	P-dipping of rice seedlings increases applied P use efficiency	P-dipping	research paper		○				○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	04 Other	Dipping rice seedlings in P-enriched slurry increases grain yield and shortens days to heading on P-deficient lowlands	P-dipping	research paper		○				○									
MDG-03	Madagascar	(English) The Project for Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa	04 Other	Optimizing the Phosphorus Concentration and Duration of Seedling Dipping in Soil Slurry	P-dipping	research paper		○				○									
MDG-04	Madagascar	(English) Agricultural and Rural Development Advisor	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Osuga (agriculture / rural development) On-site Dispatch Period: February 18, 2016 - February 17, 2019	development plan, distribution, value chain	report	○					○									
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Training Material / Extension Resource Transplanting Rice Cultivation Technique	extension	manual		○													
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	#N/A	Material de Treinamento/Recurso para Extensão Técnica de Cultivo De Arroz transplantando	extension	manual				○											
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Irrigation Management and Operation Manual (Revised edition)	irrigation	manual		○											○		
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Manual de Operacao e Gestao de Irrigacao (Edição Revista)	irrigation	manual				○											
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	MANUAL ON RICE CULTIVATION	cultivation technique	manual		○						○							
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	MANUAL DE CULTIVO DE ARROZ	cultivation technique	manual				○											
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Cultivation Technique of Upland Crops	seed	manual		○													
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Manual de Técnica de Produção de Sementes de Alta Qualidade (Edição Corregido)	seed	manual				○											
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Quality Seed Production Technique (Revised Edition)	seed	manual		○													
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Manual on Agricultural Extension (Revised version) ** Group demonstration and farmers group activity **	extension	manual		○													
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Manual de Extensão Agrícola (Edição Revisita) ** Demonstração e apoio a grupo de Productor **	extension	manual				○											
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	01 Manuals	Tecnicas de Cultivo de Culturas de Sequeiro	cultivation technique	manual				○		○									
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	02 Evaluation reports	Ex-post evaluation results sheet	cultivation technique, irrigation, water management, farming	report	○					○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	02 Evaluation reports	Joint Terminal Evaluation Report	cultivation technique, irrigation, water management, farming	report	○					○									
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	02 Evaluation reports	Joint Mid-Term Review Report	cultivation technique, irrigation, water management, farming	report	○					○									
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	03 Progress reports / Completion reports	Project Completion Report	cultivation technique, irrigation, water management, farming	report	○					○					○	○			
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	03 Progress reports / Completion reports	Project Completion Report (phase 4)	cultivation technique, irrigation, water management, farming	report	○					○				○					
MOZ-01	Mozambique	(English) Integrated Agricultural Development Project for Small Scale Farmers in Chokwe Irrigation Scheme	03 Progress reports / Completion reports	Project Progress Report (phase 2, draft)	direct sowing, transplant, farming	report	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	01 Manuals	MANUAL ON RIICE CULTIIVATIION Chokwe Project Rice cultivation Manual (English)	cultivation	training materials		○						○					○		
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	01 Manuals	Rice cultivation Manual (Portuguese) MANUAL SOBRE O CULTIVO DE ARROZ	cultivation	training materials				○											
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	01 Manuals	COMO CULTIVAR MELHOR O ARROZ	cultivation	poster				○											
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	02 Evaluation reports	Project Assessment sheet	cultivation technique, farming, irrigation, training	report	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	02 Evaluation reports	Joint Mid-Term Review Report	cultivation technique, farming, irrigation, training	report	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	02 Evaluation reports	Joint Terminal Evaluation Report	cultivation technique, farming, irrigation, training	report	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	03 Progress reports / Completion reports	Project Completion Report	cultivation technique, farming, irrigation, training	report	○					○						○		○	
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	03 Progress reports / Completion reports	Project completion report ANNEX 6-1 - 6-3	cultivation technique, farming, irrigation, training	ANNEX		○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Model field position map in D4 and D7 Schematic diagram of D4 model field (Status on August 31, 2008)	cultivation test	survey results	○	○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Manual on Rice Cultivation ** Based on survey, experiment and verification trial **	cultivation test	survey results		○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Certificate of Analysis Japanese Attachment 1 June 27, 2008 Detailed report of farm field/pot experiment, farm field demonstration experiment and farm field yield investigation	cultivation test	survey results	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Location of experiments and verification trial field	cultivation test	survey results		○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	D4 Yield (comparison with 2006 -07) English	cultivation test	survey results		○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	D7 Yield (comparison with Nursery Days) 6.06 English	cultivation test	survey results		○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Yield survey result in phase 4 model field (EAC), Yield graph (SDAE)	cultivation test	survey results	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Model Farmer Questionnaire and Interview Survey Results (Japanese)	interview	survey results	○	○				○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Livestock Promotion Group Interview Survey Results (Japanese)	interview	survey results	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Survey Results of Model Farmers and Interview Survey	interview	survey results	○					○									
MOZ-02	Mozambique	(English) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme	04 Other	Microfinance loans and collections Attachment-H 10(2) 2008/09 Model farm microfinance loans and collections by end of August (D7) Unit: MT	microfinance	survey results	○					○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Téｃnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	01 Manuals	MANUAL TÉCNICA DE CULTIVO DE ARROZ	cultivation	training materials				○				○							
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Téｃnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	01 Manuals	MANUAL TÉCNICA DE MANUTENÇÃO, OPERAÇÃO DO SISTEMA DE REGADIO, IRRIGAÇÃO E DRENAGEM PARA O CULTIVO DE ARROZ	water management	training materials				○									○		

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	EN	FR	PR	Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	01 Manuals	MANUAL TECNICA DE CULTIVO DE ARROZ	cultivation technique	manual				○		○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	02 Evaluation reports	Joint Terminal Evaluation Report	cultivation technique, irrigation, farming, capacity development	report	○					○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	03 Progress reports / Completion reports	Field Results Report	cultivation technique, irrigation, seed production, training	report	○					○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	03 Progress reports / Completion reports	Field Results (phase2)	field test, variety, quality	survey results		○				○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	03 Progress reports / Completion reports	Field Results Report (phase3)	field test, variety, quality	report	○					○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	03 Progress reports / Completion reports	Field Results Report (annex)	cultivation technique, irrigation, seed production, training	ANNEX	○					○									
MOZ-03	Mozambique	(English) Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province (Portuguese) Projecto para Melhoria das Técnica para o Aumento da Produtividade da Cultura de Arroz em Nante, Distrito da Maganja da Costa, Provincia da Zambezia (PANA)	03 Progress reports / Completion reports	Project Completion Report (phase 4)	cultivation technique, irrigation, seed production, training	report	○					○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	01 Manuals	Monitoring sheet	general	format		○				○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	02 Evaluation reports	Project Assessment sheet	irrigated rice cultivation, rain-fed rice cultivation, capacity development	report	○					○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	03 Progress reports / Completion reports	Project Progress Report (phase 1)	irrigated rice cultivation, rain-fed rice cultivation, capacity development	report	○					○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	03 Progress reports / Completion reports	Project Progress Report (phase 1) (annex)	irrigated rice cultivation, rain-fed rice cultivation, capacity development	ANNEX		○				○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	03 Progress reports / Completion reports	Baseline Survey Report	baseline survey	report	○					○									
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	03 Progress reports / Completion reports	Project Progress Report (phase 2)	irrigated rice cultivation, rain-fed rice cultivation, capacity development	report	○					○		○						○	
MOZ-04	Mozambique	(English) Project for Improvement of Rice Production in Zambezia Province (ProAPA)	03 Progress reports / Completion reports	Project Progress Report (phase 2) (annex)	irrigated rice cultivation, rain-fed rice cultivation, capacity development	ANNEX		○				○	○			○					
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	OPERATIONS MANUAL FOR BUSINESS OF TRACTOR RENTAL AND PROCESS SERVICES IN TAJIKISTAN	machine / tractor	manual		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Training Manual for ADP Staff	post-harvest processing	course of study		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Guidelines for improved parboiling technology	parboiling technology	training materials	○	○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Dissemination of improved perboiling technology	parboiling technology	training materials	○														
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Dissemination of improved perboiling technology (second report), attached document	parboiling technology	training materials	○														
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Guidelines for improved parboiling technology	parboiling technology	training materials		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Guideline for Low Cost Extension Session (70 min. on site session) of the Improved Parboiling Technology	parboiling technology	guidelines		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Guideline for Training of Trainers for Low Cost Extension Session (70 min. on site session) of the Improved Parboiling Technology	parboiling technology	guidelines		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Use false bottom for more profitable parboiling!	parboiling technology	poster		○													
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	01 Manuals	Number of Trainees and Adopters of Improved Parboiling Technology in Nigeria	parboiling technology	map		○				○									

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	02 Evaluation reports	Joint Terminal Evalution Report RIPMAPP	parboiling technology	report		○				○									
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	02 Evaluation reports	Joint Mid-Term Review Report	parboiling technology	report	○					○									
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	03 Progress reports / Completion reports	Project Completion Report	parboiling technology	report	○					○				○					○
NGA-01	Nigeria	(English) Rice Post-Harvest Processing and Marketing Pilot Project in Nasarawa and Niger States	04 Other	Dissemination of Improved Parboiling Technology in Nigeria", International Cooperation of Agriculture and Forestry	parboiling technology	academic journal	○					○				○					
NGA-02	Nigeria	(English) Policy Advisor to Federal Ministry of Agricultural and Rural Development	01 Manuals	Guideline for Seminar on SON Paddy Grading Standard and FMARD/JICA Simple Paddy Checking Method	paddy quality, extension	guidelines		○													
NGA-02	Nigeria	(English) Policy Advisor to Federal Ministry of Agricultural and Rural Development	01 Manuals	Manual on Paddy grading	paddy quality, extension	manual		○													
NGA-02	Nigeria	(English) Policy Advisor to Federal Ministry of Agricultural and Rural Development	01 Manuals	Manual on Simple Paddy Quality Checking in the fieldsstorages of farmerstraders	paddy quality, extension	manual		○													
NGA-02	Nigeria	(English) Policy Advisor to Federal Ministry of Agricultural and Rural Development	01 Manuals	Dissemination training materials (ToT)	paddy quality, extension	training materials		○													
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	Technical Manual for Rice Cultivation, Water Management and Post-Harvest Practice	cultivation, water management, post-harvest processing	manual		○			Kinyarwanda	○		○		○			○		
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	Manual for Organization Strengthening	farmer organization	manual		○				○									
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	Manual for PiCROPP Horticulture Training	farming, horticultural crop	manual		○			Kinyarwanda	○									
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	PiCROPP Organization Strengthening / Gender Mainstreaming	gender	manual		○				○						○			
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	PiCROPP Kongera ubushobozi /Guteza imbere uburinganire [Imfashanyigisho mu ncamake]	gender	manual					Kinyarwanda	○									
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	01 Manuals	THE PROJECT FOR INCREASING CROP PRODUCTION WITH QUALITY EXTENSION SERVICES IN THE EASTERN PROVINCE IN THE REPUBLIC OF RWANDA COMPLETION REPORT APPENDIX Technical Manual for Rice Cultivation, Water Management and Post-Harvest Practice	cultivation, water management, post-harvest processing	manual		○				○									
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	02 Evaluation reports	Joint Terminal Evaluation Report	rain-fed rice cultivation, horticulture, cultivation technique, farming	report	○					○									
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	03 Progress reports / Completion reports	Project Completion Report	rain-fed rice cultivation, horticulture, cultivation technique, farming	report	○					○									○
RWA-01	Rwanda	(English) Project for Increasing Crop Production with Quality Extension Services in the Eastern Province	03 Progress reports / Completion reports	Project Completion Report (annex)	rain-fed rice cultivation, horticulture, cultivation technique, farming	ANNEX		○				○									
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	01 Manuals	Guidelines for Arrangement of Rice Training Program	cultivation, water management, farmland consolidation, post-harvest processing	guidelines		○													○
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	01 Manuals	Farmer's Textbook for Rice Cultivation,Water Management and Post-Harvest Practice Training	cultivation, water management, farmland consolidation, post-harvest processing	manual		○								○			○		
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	01 Manuals	SMAP Cooperative Management and Gender Mainstreaming Technical Manual	farmer organization, gender	manual		○										○			
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	01 Manuals	Refreshment Training Workshop for FFS Facilitators on Rice	cultivation, water management, farmland consolidation, post-harvest processing	training materials		○						○							
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	01 Manuals	SMAP Rice Cultivation Technical Manual for Improvement of Quality and Productivity	cultivation, water management, farmland consolidation, post-harvest processing	manual		○						○							

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	02 Evaluation reports	(DRAFT) The Terminal Evaluation Report for “The Smallholder Market-Oriented Agriculture Project in Rwanda”	cultivation, water management, farmland consolidation, post-harvest processing	report		○				○									
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	02 Evaluation reports	(DRAFT) The Terminal Evaluation Report for “The Smallholder Market-Oriented Agriculture Project in Rwanda” ANNEX	cultivation, water management, farmland consolidation, post-harvest processing	ANNEX		○				○									
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	03 Progress reports / Completion reports	Project Completion Report (SMAP)	cultivation, water management, farmland consolidation, post-harvest processing	report	○					○									
RWA-02	Rwanda	(English) Smallholder market oriented agriculture project	03 Progress reports / Completion reports	Project Completion Report (annex)	cultivation, water management, farmland consolidation, post-harvest processing	ANNEX	○					○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Participatory Investigation, Survey, Planning and Design for Repair & Improvementof Small-scale Irrigation Scheme	irrigation, small scheme, participatory, survey, plan, design , repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Participatory Implementation of Construction Works for Repair & Improvement of Small-scale Irrigation Scheme	irrigation, small scheme, participatory, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Actions in Operation & Maintenance Stage after Repair & Improvement of Small-scale Irrigation Scheme	irrigation, small scheme, operation and maintenance, repair,	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmer's Manual for Action in Stage of Participatory Investigation, Survey, Planning and Design for Repair & Improvement of Small-scale Irrigation Scheme	irrigation, small scheme, farmer, participatory, plan, design , repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmers' Manual for Participatory Implementation of Construction Works for Repair & Improvement of Small-scale Irrigation Scheme	irrigation, small scheme, farmer, participatory, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmers' Manual for Actions in Operation & Maintenance Stage after Repair & Improvement of Small-scale Irrigation Scheme	irrigation, small scheme, farmer, operation and maintenance, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Investigation, Survey, Planning and Design for Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, survey, plan, design , repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Implementation of Construction Works for Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, operation and maintenance, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	SAED Staff's Manual for Actions in Operation & Maintenance Stage after Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, operation and maintenance, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmers' Manual for Actions in Stage of Investigation, Survey, Planning and Design for Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, survey, repair, plan, design	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmers' Manual for Actions in Stage of Implementation of Construction Works for Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, repair, improvement	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Farmers' Manual for Operation & Maintenance after Repair & Improvement of Large-scale Irrigation Scheme	irrigation, large scheme, operation and maintenance	manual		○													
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide Pratique d'Investigation Participative, de Levé, de Planification et de Conception pour la Réfection, l'entretien et l'Amérioration des petits Périmètres Irrigué s pour le personnel de la SAED	irrigation, small scheme, participatory, plan / operation and maintenance, improvement	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide du personnel de la SAED pour l'Exécution Participative des Travaux de Réfection, d'entretien & d'Amé lioration des Petits Périmètres Irrigués	irrigation, small scheme, repair, operation and maintenance	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide du personnel de la SAED pour les activités d'exploitation et d'entretien aprés réfection et amé lioration des petits Périmètres Irrigués	irrigation, small scheme, development , operation and maintenance, repair	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide des producteurs pour les activités d'Investigation Perticipative, de Levé, de Planification et de Conception pour la Réfection, l'entretien et l'Amélioration des petits périmètres irrigués	irrigation, small scheme, producer, participatory, repair, Maintenance	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide des producteurs pour l'exécution participative des travaux de réfection, d'entretien et d'amélioration des petits périmètres irrigués	irrigation, small scheme, producer, participatory, repair, operation and maintenance	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide des producteurs pour l'exploitation et l'Entretien après Réfection et Amélioration des petits périmètres irrigués	irrigation, small scheme, producer, Maintenance, repair	manual			○												
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Promotion du Riz Sénégalais	rice cultivation promotion	pamphlet			○			○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
							J P	E N	F R	P R	Others		Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
													2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Amérioration des revenus des menages dans les zones de production rizicole	income improvement	pamphlet			○			○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Réhabilitation participative des périmètre irrigués villageois(PIV)de Podor	irrigation, participatory, repair	pamphlet			○			○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Introduction des équipements de calibrage de riz dans les rizeries de la Vallée du Fleuve Sénégal par le PAPRIZ	sorting machine	pamphlet			○			○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	01 Manuals	Guide du Vulgarisation de la Riziculture Irriguée	general	training materials		○	○			○		○							
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	02 Evaluation reports	Joint Terminal Evaluation Report	cultivation technique, irrigation, distribution, marketing	report	○					○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	02 Evaluation reports	Ex-post evaluation results sheet	cultivation technique, irrigation, distribution, marketing	report	○					○									
SEN-01	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal (Frebch) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-Agricoles de la Vallée du Fleuve Sénégal	03 Progress reports / Completion reports	Project Completion Report	cultivation technique, irrigation, distribution, marketing	report	○					○						○			
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	Rainfed lowland rice cultivation technology training materials LE PROJET D’ APPUI A LA PRODUCTION DURABLE DU RIZ PLUVIAL (PRiP) DeuxièmeFormation des ConseillersAgricoles 01~14	general of rice cultivation	training materials			○				○	○	○						
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	MANUEL PRATIQUE DE RIZICULTURE PLUVIALE DANS LE BASSIN ARACHIDIER	general of rice cultivation	manual			○				○		○						
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	MANUEL DE PRODUCTION DE SEMENCES	seed production	manual			○												
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	MANUEL D’AMENAGEMENT DES RIZIERES Manuel d’ Aménagement Secondaire des Bas-fonds	farmland consolidation	manual			○										○		
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	GUIDE DU PRODUCTEUR	general of rice cultivation	manual			○												
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	TÉÉRÉB TEGTAL BU BAYKAT BI	general of rice cultivation	manual					Wolof, Arabic										
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	GUIDE POUR LA PRODUCTION DE SEMENCES	seed production	manual			○												
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	GUIDE DE CONFECTION DE LA LAME DESHERBEUSE KAPRIP	weeder	manual			○											○	
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	01 Manuals	OUTIL D’AMELIORATION DE LA GESTION DES EXPLOITATIONS AGRICOLES DES RIZICULTEURS DU BASSIN ARACHIDIER	farming	manual			○												
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	03 Progress reports / Completion reports	BASELINE SURVEY REPORT	extension, cultivation technique, organization	report		○				○									
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	03 Progress reports / Completion reports	Project Completion Report (phase 1)	extension, cultivation technique, organization	report	○					○									
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	03 Progress reports / Completion reports	Project Completion Report (phase 2)	extension, cultivation technique, organization	report		○				○									
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	03 Progress reports / Completion reports	Project Completion Report	extension, cultivation technique, organization	report	○					○									
SEN-02	Senegal	(English) Project on Supporting Sustainable Production of Rain Fed Rice (French) Projet d’ Appui à la Production Durable du Riz Pluvial	03 Progress reports / Completion reports	Endline Survey Report	extension, cultivation technique, organization	report		○				○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Gérer pour une économie rurale performante	capacity development	manual			○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	MANUEL SUR LA MAINTENANCE MANUEL PRATIQUE DE GESTION DE L’ EAU POUR LA RIZICULTURE	operation and maintenance, water management	manual		○	○			○							○		
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Dissemination monitoring and guidance sheet	extension	monitoring format			○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Manuel pratique sur la technologie post-récolte	post-harvest processing	manual		○	○			○				○					
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d’ Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Practical Manual for Post-harvest Processing	post-harvest processing	manual		○				○									

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	FORMATION SUR LA CONDUITE, L' ENTRETIEN ET LA GESTION DES MACHINES AGRICOLES	mechanization	training materials			○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Guidelines for Arrangement of Rice Training Progra / Manuel sur la Vulgarisation de la Double Culture du Riz	extension	manual		○	○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	01 Manuals	Guidelines for Arrangement of Rice Training Program	extension	manual		○				○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	03 Progress reports / Completion reports	Report on the Survey of Seed Production	seed production	survey report		○	○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	03 Progress reports / Completion reports	Rapport sur l'Enquête sur la production de semences	seed production	survey report			○			○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	03 Progress reports / Completion reports	Project Progress Report (phase 1)	irrigation, irrigated rice cultivation, cultivation technique	report	○					○									
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	03 Progress reports / Completion reports	Project Progress Report (phase 2)	irrigation, irrigated rice cultivation, cultivation technique, agricultural machines	report	○					○						○		○	
SEN-03	Senegal	(English) Project on Improvement of Rice Productivity for Irrigation Schemes in the Valley of Senegal Phase 2 (French) Projet d' Amélioration de la Productivité du Riz dans les Aménagements Hydro-agricoles de la Vallée du Fleuve Sénégal 2	03 Progress reports / Completion reports	Project Progress Report (phase 3)	irrigation, irrigated rice cultivation, cultivation technique	report	○					○		○		○					
SEN-04	Senegal	(English) Agricultural technical advisor	03 Progress reports / Completion reports	Project Completion Report	capacity development	report	○					○									
SEN-05	Senegal	(English) Agricultural Adviser	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Duration of the Project: December, 2012 - November, 2014	capacity development	report	○					○									
SEN-07	Senegal	(English) Agricultural Policy Advisor	01 Manuals	Manual on the dissemination of the False Bottom Technology By Hiroshi Kodama, JICA Expert and Senior Agricultural Advisor f or the Ambassador of Japan in Guinea	parboiling technology	manual		○	○			○				○					
SEN-07	Senegal	(English) Agricultural Policy Advisor	01 Manuals	Manual on the dissemination of the False Bottom Technology Annex1: Chapters 2 and 3 of For High-quality Parboiled Milled Rice by Small-scale Processors A Guideline for RIPMAPP Technology Dissemination	parboiling technology	ANNEX		○	○			○									
SEN-07	Senegal	(English) Agricultural Policy Advisor	01 Manuals	Manual on the dissemination of the False Bottom Technology Annex 2: Experiment on the comparison of JICA improved parboiling technology and traditional method Hiroshi Kodama, Umar Halilu, Bello, and Jumai	parboiling technology	ANNEX		○	○			○									
SEN-07	Senegal	(English) Agricultural Policy Advisor	01 Manuals	Manual on the dissemination of the False Bottom Technology Annex 8: Initial Cost Estimate of the Demonstration in Tounifily	parboiling technology	ANNEX		○	○			○									
SEN-07	Senegal	(English) Agricultural Policy Advisor	01 Manuals	Manual on the dissemination of the False Bottom Technology Annex 18: Li st of the Technical Leaflets	parboiling technology	ANNEX		○	○			○									
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Soil Analysis Manual	soil diagnosis	training materials		○													
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Fertility Evaluation of Soils in Sierra Leone by a Pot Culture	soil diagnosis	training materials		○													
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Technical Package on Rice Production Revised Edition	variety selection, land leveling, sowing, nursery seedlings, transplant, cultivation, herbicide, water management, harvest method, post-harvest processing, farming	guidelines		○													
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Guidelines for the Dissemination of the Technical Package on Rice Production through Farmer Field Schools	Farmer Field School (FFS)	guidelines		○					○	○							
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Extension Material on Technical Package on Rice Production	Farmer Field School (FFS)	guidelines		○					○	○							
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Land preparation	Farmer Field School (FFS)	guidelines		○													
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Uprooting of seedlings and transplanting	Farmer Field School (FFS)	guidelines		○													
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Rodent control and bird scaring	Farmer Field School (FFS)	guidelines		○													

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
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SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Orientation Introduction of TP-R/Extension Guide Training on Rice Production Essence of Technical Package 01~19	soil diagnosis, seed multiplication, sowing, nursery seedlings, cultivation, farmland consolidation, land leveling, fertilization, herbicide, water management, bird damage, animal damage, pest damage, harvest method, post-harvest processing, farming, field test, between farmers dissemination method	training materials		○										○			
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	01 Manuals	Recommended Farming Practces on Rice Production in IVS -A guide to extension workers-	variety selection, land leveling, sowing, nursery seedlings, transplant, cultivation, herbicide, water management, harvest method, post-harvest processing, farming	pamphlet		○				○									
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	02 Evaluation reports	Joint Mid-Term Review Report	rice farming, extension	survey report	○					○									
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	02 Evaluation reports	Joint Terminal Evaluation Report	rice farming, extension	survey report	○					○									
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	02 Evaluation reports	Ex-post evaluation results sheet	rice farming, extension	survey report	○					○									
SLE-01	Sierra Leone	(English) Sustainable Rice Development Project	03 Progress reports / Completion reports	Project Completion Report	rice farming, extension	survey report	○					○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	01 Manuals	Overview of Sustainable Rice Production Project in Sierra Leone (2017-2022)	public relations	pamphlet	○	○													
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	01 Manuals	Newsletter No.1～No.3	activity introduction	letter		○													
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	01 Manuals	Sustainable Rice Production Project(SRPP) Baseline Survey Report	baseline survey	report		○													
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	01 Manuals	Overview of Sustainable Rice Production Project in Sierra Leone	dissemination method	training materials		○													
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	04 Other	Survey using ICT (Sierra Leone)	baseline survey, ICT	photo	○					○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	02 Evaluation reports	Project Assessment sheet	JICA materials	preliminary business evaluation table	○					○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	03 Progress reports / Completion reports	Project Progress Report 1	extension, demonstration farm/plot	survey report	○					○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	03 Progress reports / Completion reports	Project Progress Report 1 (annex)	extension, demonstration farm/plot	ANNEX		○				○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	03 Progress reports / Completion reports	Project Progress Report 2	extension, demonstration farm/plot	survey report	○					○									
SLE-02	Sierra Leone	(English) Sustainable Rice Production Project (SRPP)	03 Progress reports / Completion reports	Project Progress Report 3	extension, demonstration farm/plot, agricultural machines	survey report	○					○		○							
TZA-01	Tanzania	(English) Technical Cooperation for Formulation and Training of the DADP Guidelines on Irrigation Scheme Development	01 Manuals	Informat Sheet of Rice production Related Project in Africa	irrigation	reference material	○	○				○									
TZA-01	Tanzania	(English) Technical Cooperation for Formulation and Training of the DADP Guidelines on Irrigation Scheme Development	02 Evaluation reports	Joint Mid-Term Review Report	irrigation	report	○					○									
TZA-01	Tanzania	(English) Technical Cooperation for Formulation and Training of the DADP Guidelines on Irrigation Scheme Development	02 Evaluation reports	Joint Mid-Term Review Report (annex)	irrigation	ANNEX		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	02 Evaluation reports	Joint Mid-Term Review Report	irrigation	report	○					○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	02 Evaluation reports	Joint Terminal Evaluation Report	irrigation	report	○					○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Oizumi(rice cultivation / farming) On-site Dispatch Period: June 15, 2007 - June 11, 2012	irrigation	report	○					○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (1) Implementation and Achievements of Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture (TC-SDIA / TANRICE) under The Agricultural Sector Development Programme (ASDP) (12 June 2007 - 11 June 2012)	irrigation	report		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (2) 1. Introduction-9. Future Direction	irrigation	report		○				○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (3) APPENDICES	irrigation	ANNEX		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (4) Appendix 7: List of task group members trained in Japan (May 2007 - May 2012)-Appendix 12 Steps of the Standard Training Course of TANRICE	irrigation	ANNEX		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (5) Appendix 13: Brief profiles of 68 irrigation schemes tentatively identified as candidates for TC-SDIA training courses (as of 16 September 2008)-Appendix 21 : Materials and p roducts p roduced by TANRICE (10 May 2012)	irrigation	ANNEX		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (6) Ministry of Agriculture Food Security and Cooperatives (MAFC) Training Division Irrigated Rice Cultivation Guide	irrigation	guidelines		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	03 Progress reports / Completion reports	TANRICE Final Report (7) IRRIGATION SCHEME MANAGEMENT TRAINING FOR IMPROVED AND SUSTAINABLE PRODUCTIVITY OF IRRIGATED CROPS A TANRICE Subject Matter Training Course JULY 2011	irrigation	pamphlet		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Farmer-to-Farmer Extension Facilitated by Agricultural Training Institutions: A Case of NERICA Dissemination in Tanzania	NERICA, agricultural training, training	research paper		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Importance of basic cultivation techniques to increase irrigated rice yields in Tanzania	extension, cultivation technique, irrigated rice cultivation	research paper		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Importance of market-oriented research for rice production in Tanzania. A review	market, distribution	research paper		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Performance of a Number of NERICA Cultivars in Zanzibar, Tanzania: Yield, Yield Components and Grain Quality	NERICA, variety, cultivation test	research paper		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Performance of Four Rice Cultivars Transplanted Monthly over Full Year under Irrigated Conditions in Tanzania	NERICA, planting time, cultivation test	research paper		○				○									
TZA-02	Tanzania	(English) Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	04 Other	Results of the Project for Technical Cooperation in Supporting Service Delivery Systems of Irrigated Agriculture	irrigated rice cultivation, extension, capacity development	report	○					○									
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	The Comprehensive Guidelines for Irrigation Scheme Development under District Agricultural Development Plan	plan / construction / operation and maintenance	guidelines		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	Mwongozo Kabambe wa uendelezaji wa skimu za umwagiliaji chini ya mpango wa maendeleo ya kilimo wa Wilaya	plan / construction / operation and maintenance	guidelines					Swahili										
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	Reference for Training material	plan / construction / operation and maintenance	training materials		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	Compilation of rehabilitation activities - Case study of 10 irrigation schemes -	maintenance / monitoring	training materials		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	PROPOSAL ON O&M TRAINING AND MONITORING FRAMEWORK	maintenance / monitoring	training materials		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	OPERATION AND MAINTENANCE TRAINING MANUAL FOR SCHEME FACILITATORS	operation and maintenance	manual		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	MWONGOZO KABAMBE WA UMWAGILIAJI KATIKA UENDELEZAJI WA SKIMU ZA UMWAGILIAJI CHINI YA MPANGO WA KUENDELEZA KILIMO WA WILAYA (DADPs)	operation and maintenance	training materials					Swahili										
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	Manual for Farmers' Participatory Repair work of irrigation facilities	operation and maintenance	manual		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	Kitini Cha Wakulima Cha Ukarabati Shirikishi Wa Miundombinu Ya Umwagiliaji	operation and maintenance	manual					Swahili										
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	01 Manuals	10 Training Needs Assessment - Field Notebook -	operation and maintenance	manual		○													
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	02 Evaluation reports	THE JOINT TERMINAL EVALUATION REPORT ON THE PROJECT FOR CAPACITY DEVELOPMENT FOR THE PROMOTION OF IRRIGATION SCHEME DEVELOPMENT UNDER THE DISTRICT AGRICULTURE DEVELOPMENT PLANS	irrigation/water management	survey report		○				○									
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	02 Evaluation reports	THE JOINT TERMINAL EVALUATION REPORT ON THE PROJECT FOR CAPACITY DEVELOPMENT FOR THE PROMOTION OF IRRIGATION SCHEME DEVELOPMENT UNDER THE DISTRICT AGRICULTURE DEVELOPMENT PLANS ANNEX	irrigation/water management	ANNEX		○				○									
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	03 Progress reports / Completion reports	Project Completion Report	irrigation/water management	survey report	○					○									
TZA-03	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans (DADPs)	03 Progress reports / Completion reports	Project Completion Report (annext)	irrigation/water management	minutes	○					○									
TZA-04	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project	01 Manuals	Handbook for Outreach Training and Follow-up Guidance Programme Participatory Farmer Training and Extension in Irrigated Rice Farming Areas	extension, training	handbook		○				○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	Languages* EN	Languages* FR	Languages* PR	Languages* Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
TZA-04	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project	02 Evaluation reports	Report by project survey teams	extension, training	survey report	○					○									
TZA-04	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project	02 Evaluation reports	Minutes of The Second Joint Advisory Committee Meeting dor KATC Project	extension, training	ANNEX		○				○									
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	02 Evaluation reports	Joint Mid-Term Review Report	irrigated rice cultivation training	survey report	○					○									
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	02 Evaluation reports	Joint Terminal Evaluation Report	irrigated rice cultivation training	survey report	○					○									
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	02 Evaluation reports	Joint Terminal Evaluation Report (annex)	irrigated rice cultivation training	survey report		○				○									
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	03 Progress reports / Completion reports	Project Completion Report by Expert of JICA Ota	irrigated rice cultivation training	survey report	○					○									
TZA-05	Tanzania	(English) The Kilimanjaro Agricultural Training Center Project Phase II (KATC II)	03 Progress reports / Completion reports	Presentation material for Project Completion Report by Expert of JICA Ota	irrigated rice cultivation training	survey report	○					○									
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Guideline for District Agricultural Development Planning and Implementation (DADP Guideline)	agricultural development plan	guidelines		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Business Plan-	business plan	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Strengthening Farmers' Organizations-	farmer organization	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Local Coordination and Public-Private Partnership (PPP)-	public-private partnership	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Project Management for DADP-	project management	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Warehouse Management-	storage	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Market-oriented Horticulture for DADP Planning and Implementation-	marketing	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	01 Manuals	Technical Supporting Manuals -Coffee Quality Improvement-	value chain	manual		○													
TZA-06	Tanzania	(English) Project for Strengthening the Backstopping Capacities for the DADP Planning and Implementation under the ASDP Phase 2	03 Progress reports / Completion reports	Project Completion Report	general	report	○					○				○		○			
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Format of Baseline Survey	cultivation, gender	baseline survey material					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Teaching materials of Infield Training Kitini cha mafunzo ndani ya skimu	cultivation, water management, farming	training materials					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Implementation Guideline for Subject Matter Training Course on Irrigation Scheme Management (3rd Edition)	farmer organization	guidelines		○			Swahili								○		
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Cultivation Training Course Guide	upland rice cultivation	training materials					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	KUVUNA NA SHUGHULI BAADA YA UVUNAJI	harvest method, post-harvest processing, transportation, insect damage, animal damage	training materials					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	HARVESTING AND POST-HARVEST OPERATION	post-harvest processing	training materials					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	UVUNAJI WA MPUNGA NA KAZI ZINAZOFUATA BAADA YA KUVUNA	post-harvest processing	training materials		○													
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	HARVESTING AND POST-HARVEST OPERATION	post-harvest processing	pamphlet					Swahili										
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	HARVESTING AND POST-HARVEST OPERATION	post-harvest processing	pamphlet		○													
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Group Training Text Chapter1~5	cultivation, farming, water management, extension	training materials		○				○		○							
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	1.Baseline survey report_Njoomlole_Namtumbo_Mtwara REPORT OF BASELINE SURVEY MODIFIED STANDARD TRAINING Namtumbo district,Ruvuma region	training	report		○				○									

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	2.Residnetial training report_Msanjesi _ Njoomlole_Namtumbo_Mtwara REPORT OF RESIDENTIAL TRAINING MODIFIED STANDARD TRAINING MSANJESI NAMTUMBO	training	report		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	3.Infield training report_Njoomlole_Namtumbo_Mtwara REPORT OF INFIELD TRAINING MODIFIED STANDARD TRAINING Njoomlole scheme Namtumbo district,Ruvuma region	training	report		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	4.Monitoring _ Planning report_Njoomlole_Namtumbo_Mtwara REPORT OF MONITORING & PLANNING Njoomlole Scheme Namtumbo district,Ruvuma region	monitoring	report		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	1.Baseline Survey_MST	training	video		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	2.Residential Training_MST	training	video		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	3.Infield Training_MST	training	video		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	4.Monitoing & Planning_MST	training	video		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Training video_Irrigated Rice Farming	training	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA (New Rice for Africa)	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Demo-Plot for NERICA dissemination	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Training Course	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Dissemination for Upland Rice Farmers	upland rice cultivation	pamphlet		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA monitoring	farming	format		○			Swahili	○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Tutors Training Aims & Scopes by Tomitaka	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Promotion in 2010-11 by Sekiya	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Dissemination for Upland Rice Farmers	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NRICA Training Course	upland rice cultivation	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Seed Production	seed production	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	ADDITIONAL SLIDES ON RICE CULTIVATION WITH SOIL AND WATER CONSERVATION	farmland consolidation / water management	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Rice cultivation with soil and water conservation technologies for TOT	farmland consolidation / water management	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	SITE SELECTION FOR NERICA CULTIVATION	farming	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	TOT schedule(modifiedMar2015)	training	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA Cultivation Guide	training	guidelines		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA suitability map (Tsuboi)	upland rice cultivation	map		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	NERICA suitabiltiy map_Average yield_Ouchi Msc paper	upland rice cultivation	map		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Rice farming diary_3 years_Swahili Kumbukumbu za Kilimo cha Mpunga Miaka Mitatu	upland rice cultivation	training materials					Swahili	○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Workbook_Baseline survey_2018 Daftari la upembuzi yakinifu Kwa mafunzo ya kilimo bora cha mpunga	training	training materials					Swahili	○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Workbook_IF&M&P_2018 Daftari la Mafunzo ya Kilimo bora cha Mpunga kwa njia ya Umwagiliaji / Ufuatiliaji na Mpango	training	training materials					Swahili	○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Proseedings of TANRICE2 seminar(Final) PROCEEDINGS OF TANRICE2 SEMINAR	training	training materials		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Implementation Guidelines for Subject Matter Training on Rice Marketing 2018 Version	market research training	guidelines		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	01 Manuals	Guideline for rainfed lowland rice cultivaiton final ver (Mar2019)	rain-fed rice cultivation	guidelines		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Mid-Term Review Report	upland rice cultivation, rain-fed lowland cultivation	survey report	○					○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Mid-Term Review Report	upland rice cultivation, rain-fed lowland cultivation	survey report	○					○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Mid-Term Review Report	upland rice cultivation, rain-fed lowland cultivation	survey report	○					○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Mid-Term Review Report	upland rice cultivation, rain-fed lowland cultivation	survey report	○					○									

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													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Mid-Term Review Report (annex)	upland rice cultivation, rain-fed lowland cultivation	ANNEX		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	02 Evaluation reports	Joint Terminal Evaluation Report	upland rice cultivation, rain-fed lowland cultivation	survey report	○					○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	03 Progress reports / Completion reports	PROGRESS REPORT OF THE PROJECT FOR SUPPORTING RICE INDUSTRY DEVELOPMENT IN TANZANIA (TANRICE2: 16 November, 2012 - 15 November, 2018) and PROCEEDINGS OF TANRICE2 SEMINAR	upland rice cultivation, rain-fed lowland cultivation	report		○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	03 Progress reports / Completion reports	FINAL REPORT OF THE PROJECT FOR SUPPORTING RICE INDUSTRY DEVELOPMENT IN TANZANIA (TANRICE2: 16 November, 2012 - 15 December, 2019)	upland rice cultivation, rain-fed lowland cultivation	report		○				○									○
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	03 Progress reports / Completion reports	Project Completion Report (annex)	upland rice cultivation, rain-fed lowland cultivation	ANNEX	○	○				○									
TZA-07	Tanzania	(English) The Project for Supporting Rice Industry Development in Tanzania	04 Other	Summary of implementation and operation	upland rice cultivation, rain-fed lowland cultivation	summary table	○					○									
TZA-08	Tanzania	(English) The Project for Irrigation Human Resource Development by Strengthening the Capacity of Arusha Technical College (AIHRD-Project)	03 Progress reports / Completion reports	Project Completion Report	capacity development, irrigated paddy field, irrigation	survey report		○				○									
TZA-08	Tanzania	(English) The Project for Irrigation Human Resource Development by Strengthening the Capacity of Arusha Technical College (AIHRD-Project)	03 Progress reports / Completion reports	List of Modules that use JICA supported Facilities	capacity development, irrigated paddy field, irrigation	ANNEX		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Guidelines for Training p1-54, Appendix for Training Guidelines	irrigation, water management, construction, cultivation	guidelines		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	The Comprehensive Guidelines for Irrigation Scheme Development Volume 1 Formulation, Volume 2 Implementation, Volume 3 Operation and Maintenance	irrigation, water management, construction, cultivation	guidelines						○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Sample Design Note of Headworks for Small Scale Irrigation Development Project	design method	manual etc.		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	OPERATION AND MAINTENANCE TRAINING MANUAL FOR SCHEME FACILITATORS	water management, operation and maintenance, water use organization	manual		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	SITE HANDBOOK for Construction Management & Supervision of Small Scale Irrigation Scheme Development Chapter 1~6	cost control in design, contract process, safety management	handbook, original file		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	SITE HANDBOOK for Construction Management & Supervision of Small Scale Irrigation Scheme Development Attachment1~!6	cost control in design, contract process, safety management	ANNEX		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Manual for Rehabilitation Work of Irrigation Facilities (Check Points for Better Design and Construction)(Ver.1.0)	rehabilitation	manual		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Environmental & Social Considerations Handbook for Irrigation Scheme Development	environmental and social considerations	handbook		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Manual for Standard Design of Irrigation Canal(Ver.1.1)	design	manual		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Manual for Water D istribution in I rrigation Schemes (Version 2)	irrigation/water management	manual		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Operation & Maintenance Monitoring Result	irrigation/water management	monitoring sheet		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	01 Manuals	Rehabilitation Guide book(Draft) TANCAID Ⅱ F&I and O&M team	operation and maintenance	guidebook		○				○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	02 Evaluation reports	Joint Terminal Evaluation Report (draft)	irrigation/water management	survey report	○					○									
TZA-09	Tanzania	(English) Technical Cooperation for Capacity Development for the Promotion of Irrigation Scheme Development Under the District Agricultural Development Plans Phase 2	03 Progress reports / Completion reports	Project Completion Report	irrigation/water management	survey report		○				○							○		
TZA-10	Tanzania	(English) Project on the Revision of National Irrigation Master Plan	02 Evaluation reports	Project Assessment sheet	irrigation	report	○					○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
TZA-10	Tanzania	(English) Project on the Revision of National Irrigation Master Plan	03 Progress reports / Completion reports	Final Report	irrigation	report	○					○									
TZA-10	Tanzania	(English) Project on the Revision of National Irrigation Master Plan	03 Progress reports / Completion reports	Final Report (annex)	irrigation	ANNEX		○				○									
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	01 Manuals	LOWLAND RICE CULTIVATION GUIDE	irrigation	training materials		○				○									
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	02 Evaluation reports	Joint Terminal Evaluation Report	irrigation	survey report	○					○									
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	02 Evaluation reports	Joint Mid-Term Review Report	irrigation	survey report	○					○									
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	02 Evaluation reports	Joint Mid-Term Review Report (annex 1)	irrigation	survey report		○				○									
UGA-01	Uganda	(English) Technical Assistance Support to Sustainable Irrigated Agriculture Development Project in Eastern Uganda	02 Evaluation reports	Joint Mid-Term Review Report (annex 2)	irrigation	survey report		○				○									
UGA-02	Uganda	(English) NERICA Rice Promotion Project in Uganda	02 Evaluation reports	Joint Mid-Term Review Report	NERICA, upland rice, cultivation	survey report	○					○									
UGA-02	Uganda	(English) NERICA Rice Promotion Project in Uganda	02 Evaluation reports	Joint Terminal Evaluation Report	NERICA, upland rice, cultivation	survey report	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Dapog Seedling	cultivation	training poster		○						○							
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	How to transplant rice	cultivation	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	How to raise rice seedlings	cultivation	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Seed Mutiplication	cultivation	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Post Harvest Handling	cultivation, post-harvest processing	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Is Weeding important?	herbicide	training poster		○							○						
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Where do you grow lowland rice?	paddy rice	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	How to sow rice seeds	cultivation	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Where do you grow rice?	upland rice	training poster		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Upland Rice Cultivation Guide	upland rice	manual		○							○	○					
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Cultivation Handbook	general	manual		○					○	○	○						
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Lowland Rice Cultivation Guide	farmer, cultivation	manual		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Diseases and Insects	plant disease, pest	manual		○						○							
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Major Rice weeds in Uganda	herbicide	teaching materials		○						○	○						
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Cultivation Training	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Training Workshop on Rice Production Rice Yield	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Training Workshop on Rice Production STANDARD EVALUATION SYSTEM FOR RICE	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Training Workshop on Rice Production Crop Cut Yield Survey	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Guide for Upland Rice (NERICA) Experiments	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Disease and Insects	pests	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Cultivation Training Rice in the world	general of rice cultivation	training materials	○	○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Upland rice cultivation in Uganda	general of rice cultivation	training materials		○							○						
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Yield and Yield components	general of rice cultivation	training materials		○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	LOWLAND RICE CULTIVATION	general of rice cultivation	training materials	○	○													
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	PRiDe Promotion of Pride rice	dissemination of rice cultivation	activity introduction	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	MUSOMESA FIELD SCHOOL (MFS) MODEL	dissemination of rice cultivation	activity introduction		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Explanatory material for Musomesa Field Schoo	dissemination of rice cultivation	activity introduction	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	NAISE center briefing	training center, capacity development	activity introduction		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	NATIONAL AGRICULTURAL INNOVATIONS AND SKILLS ENHANCEMENT CENTER (NAISE) PROJECT Project Concept	training center, capacity development	project overview		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Seed Production in NaCRRI, ZARDIs and NaSARRI PRiDe Project	seed production	training materials		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	TRACTOR HIRING SERVICE MODELS FOR AGRICULTURAL MECHANIZATION IN UGANDA	agricultural machines	report article		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Technical note for The method of selecting suitable area for paddy field and The method of making paddy field(Draft)	irrigation	training materials		○				○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages* JP	EN	FR	PR	Others	Added in this survey	Quoted section: Chapter 2 Rice Cultivation Techniques 2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	Chapter3 Technique Transfer and Extension
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Rice Yellow Mottle Virus (RYMV) La panachure jaune du riz	pathology	training materials		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	01 Manuals	Use of FTA for RYMV Detection	pathology	manual		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	02 Evaluation reports	Terminal evaluation report	general	report		○				○									
UGA-03	Uganda	Promotion of Rice Development Project	02 Evaluation reports	Joint Mid-Term Review Report	general	report	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	02 Evaluation reports	Joint Mid-Term Review Report (annex)	general	report	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	02 Evaluation reports	Joint Terminal Evaluation Report (draft)	general	report	○					○									
UGA-03	Uganda	Promotion of Rice Development Project	03 Progress reports / Completion reports	PRiDe Completion Report (Final)	general	report		○				○									
UGA-04	Uganda	(English) The Project on Irrigation Scheme Development in Central and Eastern Uganda	02 Evaluation reports	Project Assessment sheet	general	report	○					○									
UGA-04	Uganda	(English) The Project on Irrigation Scheme Development in Central and Eastern Uganda	03 Progress reports / Completion reports	Final Report (mail report)	general	report	○					○									
UGA-04	Uganda	(English) The Project on Irrigation Scheme Development in Central and Eastern Uganda	04 Other	Survey Result of Detailed Design	general	report	○					○									
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Upland (Dambo) Rice Cultivation- norah	upland rice	manual		○								○					
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Upland Rice Cultivation (2013)	upland rice	manual		○													
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Lowland Rice Cultivation (2013)	paddy rice	manual		○													
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Lowland Rice Cultivation Manual & Record & Farmers List For Luwingu District 2013	paddy rice	manual		○													
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Upland rice cultivation In Kafue District (2011/2012)Version 1.1	upland rice	manual		○							○						
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	01 Manuals	Simple Farming Tools for Rice Cultivation	machine	manual		○													
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	02 Evaluation reports	Joint Mid-Term Review Report	cropping system, cultivation technique	report	○					○									
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	02 Evaluation reports	Joint Terminal Evaluation Report	cropping system, cultivation technique	report	○					○									
ZMB-01	Zambia	(English) Food Crop Diversification Support Project Focusing on Rice Production (FoDiS R)	03 Progress reports / Completion reports	Final Report for THE FOOD CROP DIVERSIFICATION SUPPORT PROJECT FOCUSING ON RICE PRODUCTION (FoDiS R)	cropping system, cultivation technique	report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	Rice Extension Package CONTENTS OF REP	extension, training, monitoring, cultivation	teaching materials for dissemination and training		○													○
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	Brief Introduction of Rice Extension Package	extension, training, monitoring, cultivation	teaching materials for dissemination and training		○													
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	Rice Extension Package REP Vol.1_Rice Cultivation Manual	cultivation	teaching materials for dissemination and training		○						○	○						
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	REP Vol.2_NERICA 4 Production and Extension Manual	extension	teaching materials for dissemination and training		○							○	○					
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	REP Vol.3_Monitoring Guideline	monitoring, extension worker	teaching materials for dissemination and training		○													
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	RICE CULTIVATION MATERIAL FOR FARMER TRAINING	cultivation, training	teaching materials for dissemination and training		○													
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	REP Vol.5_Rice Variety Catalog	variety	teaching materials for dissemination and training		○													
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	REP Vol.6_Guidelines for Rice Cultivation in Research Stations	cultivation test	teaching materials for dissemination and training		○													
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF CENTRAL PROVINCE SHOWING AREAS WITH POTENTIAL FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF COPPERBELT PROVINCE SHOWING AREAS WITH POTENTIAL FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF EASTERN PROVINCE SHOWING AREAS WITH POTENTIAL FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF MUCHINGA PROVINCE SHOWING AREAS WITH POTENTIAL FOR RICE GROWING	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF NORTHERN PROVINCE SHOWING THE POTENTIAL AREAS FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF SOUTHERN PROVINCE SHOWING AREAS WITH POTENTIAL FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	01 Manuals	MAP OF WESTERN PROVINCE SHOWING AREAS WITH POTENTIAL FOR GROWING RICE	potential map	map		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	02 Evaluation reports	Joint Terminal Evaluation Report	extension, research	report	○					○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Project Completion Report Rice Dissemination Project (RDP)(Draft)	extension, research	report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Project Completion Report Rice Dissemination Project (RDP) ANNEX	extension, research	ANNEX		○				○									

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Project code	Country	Title of the project	Folder name	Title of the deliverable	Keyword	Classification	Languages*					Added in this survey	Quoted section								
													Chapter 2 Rice Cultivation Techniques								Chapter3 Technique Transfer and Extension
							JP	EN	FR	PR	Others		2-1 Overview of Rice Cultivation	2-2 Lowland Rice	2-3 Upland Rice	2-4 Post-harvest Processing	2-5 Seed Production	2-6 Rice Farming Management and Value Chain Development	2-7 Irrigation	2-8 Mechanization of Rice Cultivation	
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Extension Activity Report for the 2018/2019 Planting Season	extension	survey report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Rice Production Potential in Zambia Vol.2	general	survey report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Analysis of Data of Demo-sites of RDP	cultivation	survey report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Rice Cultivation Research Report	research	survey report		○				○									
ZMB-02	Zambia	(English) Rice Dissemination Project	03 Progress reports / Completion reports	Template for District Agricultural Profile	cultivation	format		○				○									

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