

Ministry of Food and Agriculture,
Republic of Ghana

Project for Sustainable Development of Rain-fed Lowland Rice Production Phase II

Project Completion Report

May 2021

Japan International Cooperation Agency

**International Development Center of Japan Inc.
Overseas Agricultural Development Association**

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Exchange Rate

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1 US\$ =108.842000 JPY

1 GHC =18.916500 JPY

(JICA Monthly Exchange Rate)

Abbreviations

Abbreviation	
AAP	Annual Action Plan
AEA	Agricultural Extension Agent
AGRA	Alliance for Green Revolution in Africa
C/WP	Cash and Work Plan
CARD	Coalition for African Rice Development
C/P	Counterpart Personnel
CRI	Crop Research Institute
DACF	District Assembly Common Fund
DAD	District Agricultural Department
DAO	District Agriculture Officer
DBO	District Financial Officer
DCD	District Coordinating Director
DCE	District Chief Executive
DCS	Directorate of Crop Service, MoFA
DDA	District Director for Agriculture
DFO	District Budget Officer
DMTDP	District Medium Term Development Plan
FRI	Food Research Institute
GIDA	Ghana Irrigation Development Authority
GIFMIS	Ghana Integrated Financial Management Information System
GoG	Direct Allocation by Government of Ghana
IGF	Internally Generated Fund
JICA	Japan International Cooperation Agency
JT	Joint Training
LGS	Local Government Secretariat
MAG	Modernising Agriculture in Ghana
MIS	Management Information System
MMDAs	Metropolitan, Municipal, District Assembly
MoF	Ministry of Finance
MoFA	Ministry of Food and Agriculture
MoLGRD	Ministry of Local Government and Rural Development
NRDS	National Rice Development Strategy
OST	On-Site Training
PBB	Programme Based Budget
PCU	Project Co-ordination Unit
PDM	Project Design Matrix
PFJ	Planting for Food and Jobs
PO	Plan of Operation
PPRSD	Plant Protection and Regulatory Service
R/D	Record of Discussions
RAD	Regional Agricultural Department
RCC	Regional Co-ordination Committee

Abbreviation	
RCD	Regional Coordinating Director
RDA	Regional Director of Agriculture
SARI	Savanna Agricultural Research Institute
SC	Steering Committee
SRI	Soil Research Institute
TC	Technical Committee
ToT	Training of Trainers
WIAD	Women In Agriculture Development

Executive Summary

The Sustainable Development of Rain-fed Lowland Rice Production Project Phase II (TENSUI II) was a Bilateral Technical Cooperation Project jointly implemented by Ghana's Ministry of Food and Agriculture (MoFA) and Japan International Cooperation Agency (JICA) from 2016 - 2021.

The Project aimed at disseminating the Rice Extension Guideline developed by the Sustainable Development of Rain-fed Lowland Rice Production Project Phase I in Ashanti, Northern, North East and Savannah Regions as well as mainstreaming it into national rice development policies. Also, the project aimed to build the capacity of Metropolitan, Municipal and District Assemblies (MMDAs) to implement their rice extension activities under the Government of Ghana's Decentralised system.

The project set out the following outputs to be achieved at the end of its implementation period:

Output 1: Target MMDAs increase the capacity to develop their District Rice Extension Plan and to estimate needed budget for its implementation.

Output 2: -Using the Extension Guidelines, the trainings are conducted in target MMDAs.

Output 3: The capacity of Regional Agricultural Department (RAD) and District Agricultural Department (DAD) regarding monitoring and evaluation is increased.

Output 4: The Extension Guideline is fine-tuned.

Output 1: All 41 MMDAs prepared their rice extension plan and composite budget and 26 MMDAs prioritize rice in the District Medium Term Development Plan. This is because all targeted MMDAs have been trained on planning and budgeting for rice extension, tools for budget negotiation have been provided to them and Monitoring and evaluation data collected and utilized for budget justification.

Output 2: The Project Coordinating Unit (PCU) trained 1,780 DAOs and AEAs, 24,819 farmers through 1,587 trainings more than target indicators. This is because most target MMDAs secured budget for the establishment of demonstration plots. Also, the technical packages have been fine-tuned and utilized in the 41 MMDA's targeted.

Output 3: A simplified and user-friendly Monitoring and Evaluation (M&E) tool has been developed and aligned to the existing M&E system being utilized by the Ministry of Food and Agriculture. M&E training has been held 2.8 times in average.

Output 4: Application rate of recommended techniques was increased by 12.2 %. The Guideline has been fine-tuned, validated and approved through a series of validation workshops and Steering Committee.

Project Purpose: Average yield at the demonstration plot were 5.02 ton in Ashanti Region and 3.47 ton/ha in Northern, North East and Savannah regions. Average yield at the farmers field who applied recommended techniques were increased by 116.3% from 1.37 ton/ ha to 2.96 ton/ ha in these regions (Ashanti: from 1.62 in 2016 to 3.60 ton/ ha in 2020, Northern regions: from 1.12 in 2016 to 2.05 ton/ ha in 2020). This is because activities for output 1-4 were successfully implemented as planned.

Based on the above achievements, the following **impact** was confirmed.

- More than 80% of non-target farmers near location of demonstration plots in Ashanti region.
- The farmers who applied the techniques achieved 2.5 times more yield in Ashanti region and 4 times more yield in Northern, North East and Savannah regions than those who did not apply them.

In order to sustainably continue the implementation of Rice extension, it is recommended that the competent human resource developed during the implementation of the project be harnessed by institutionalizing rice extension activities into the activities of the Regional Agriculture Departments (RAD) and the various MMDA's.

The following are recommended for sustainable rice extension activities:

Strengthened Institutional Arrangements for Rice Extension Activities: MoFA as well as Regional Agricultural Departments are recommended to strengthen regional extension structure of rice extension activities for its sustainable expansion.

Letter from Ministry of Food and Agriculture (MoFA)/ Ministry of Local Government and Rural Development (MoLGRD) and continuous backstopping: there is the need for the MoLGRD to recommend to all MMDAs in writing to prioritize rice extension activities.

Frequent involvement of decision makers of MMDAs in rice extension activities: To promote rice extension in districts, involvement of District Chief Executive (DCE)/ District Coordinating Director (DCD) is important. One of the methods is to invite them to field trips for showcasing the results of the rice extension to DCE/ DCD.

Strengthening of Research and Extension Linkage: Extension organisations can take the lead in carrying out simple field adaptation trials. It is recommended that a system is developed to contribute to solving problems through close exchange of ideas and information between extension organizations and research institutes.

Monitoring of rice extension activities by Monitoring and Evaluation (M&E) tools should be continued

MoFA should lead its dissemination in the other regions: The Guideline which has been fine-tuned can be disseminated to other regions.

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1. OUTLINE OF PROJECT

1.1. Background

Rice is one of the important food crops in the Republic of Ghana. In 2013, 644,000 Metric Tons (MT) of milled rice was imported as against 371,000 MT produced. This clearly indicates that Ghana as a nation is not yet self-sufficient in rice production. The situation raises issues of food security. Most of the rice production in the country is rain-fed with low productivity. Many rice farmers are small holders with limited access to inputs, extension services, information, finance, and markets. One of the major challenges is to be overcome increasing their yield.

Ghana's Ministry of Food and Agriculture in cooperation with Japan International Cooperation Agency (JICA) implemented the Project for the Sustainable Development of Rain-fed Lowland Rice Production (Tensui 1) covering 9 pilot Metropolitan, Municipal and District Assemblies (MMDAs) in Ashanti and Northern regions for 2009 - 2014. The Phase 1 project developed an improved technical package and extension methods compiled into a Rice Extension Guideline (the Guideline) approved by MoFA in June 2016. The beneficiary farmers enjoyed an increase of the yield and income.

MoFA in cooperation with JICA launched the Project for the Sustainable Development of Rain-fed Lowland Rice Production (Tensui 2, hereinafter "the Project") aiming at the dissemination of improved cultivation techniques in 35 MMDAs in 2 regions (later 41 MMDAs in 4 regions), contributing to the increase of domestic rice production. It also intends to build capacities of the Regions as well as MMDAs to manage and finance their rice extension activities. Mobilizing districts' own resources for implementing rice extension activities is also one of the biggest challenges in the midst of the ongoing process of decentralization in Ghana. In the face of such challenge, the project sets out to achieve the following goal and outputs:

Table 1 Goal and outputs of the Project

Overall Goal	Domestic rice production is increased.
Project Purpose	The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 Metropolitan, Municipal District Assemblies (MMDAs) of Ashanti and Northern Regions.
Output 1	Target MMDAs increase the capacity to develop their District Rice Extension Plan and to estimate needed budget for its implementation.
Output 2	Using the Extension Guidelines, the trainings are conducted in target MMDAs.
Output 3	The capacity of Regional Agricultural Department (RAD) and District Agricultural Department (DAD) regarding monitoring and evaluation is increased.
Output 4	The Extension Guideline is fine-tuned.

1.2. Outline of the Project

The Project aims at disseminating Rice Extension Guideline in Ashanti and Northern regions as well as mainstreaming it into national rice policies. Overall goal, Project purpose, Outputs and Activities of the Project are summarized below.

The Project Basic Information

Term of Cooperation: Five (5) years (Nov. 2016 – Feb. 2021)

Implementing Organization: Directorate of Crop Service, MoFA

Target Area: Rain-fed Lowland in Northern Region (Now Northern, Savannah and North East) and Ashanti Region

Beneficiary: MMDAs, RAD and DAD staffs (including Crop, Extension and WIAD officers in Project MMDAs), small scale rice farmers in the target area of the Project

PDM: Version 2 (See below.) December 2019

Table 2 Project Design Matrix Version 2 (December 2019)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS (OVI)	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Overall Goal Domestic rice production is increased.	<ul style="list-style-type: none"> 35 MMDAs apply the Extension Guideline for developing the productivity of rice. Rice production in Ghana increases from X tons to X tons 	<ul style="list-style-type: none"> Survey by MoFA/DCS 	
Project Purpose The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 MMDAs of Ashanti and Northern Regions.	<ul style="list-style-type: none"> The yield/ha of farmers who have applied the techniques in the Guideline increase 100% of the yields before the application(*). <i>*: Indicative target yields are 4.0 ton/ha in Ashanti and 3.0 ton/ha in Northern Region (NRDS 2009 average target: 3.5 ton/ha). This target is subject to change according to the review of NRDS targets.</i> 	<ul style="list-style-type: none"> Project Final Report District Rice Extension Plan developed by District Assemblies in project MMDAs 	<ul style="list-style-type: none"> MoFA conducts the implements the extension service delivery, in cooperate with the other District Assemblies.
Outputs of the Project			
1. Target MMDAs increase the capacity to develop their District Rice Extension Plan and to estimate needed budget for its implementation.	<ul style="list-style-type: none"> 1.1 District Rice Extension Plan in respective Project MMDA is developed. 1.2 The extension activity is prioritized in the District Rice Extension Plan. 1.3 Needed expenditure for providing extension services is budgeted. 	<ul style="list-style-type: none"> District Rice Extension Plans developed by District Assemblies in project MMDAs. Budget estimation made by District Assemblies in project MMDAs. 	<ul style="list-style-type: none"> Trained farmers do not migrate. Trained AEAs are not transferred to other regions.
2. Using the extension guidelines, the trainings are conducted in target MMDAs.	<ul style="list-style-type: none"> 2.1 5 times a year per district of the trainings for farmers and concerned stakeholders along with the Extension Guideline are carried out. 2.2 315 of DAO and AEAs are trained. 2.3 3,520 farmers are trained. 	<ul style="list-style-type: none"> Project Annual Report District Rice Extension Plans developed by District Assemblies in project MMDAs. Project Final Report 	<ul style="list-style-type: none"> Price of domestic rice does not decline drastically. Climate does not change sharply.
3. The capacity of RAD and DAD regarding monitoring and evaluation is increased.	<ul style="list-style-type: none"> 3.1 The monitoring and evaluation system is established. 3.2 once a year per region of the trainings about monitoring and evaluation for target RAD and DAD officials are carried out. 	<ul style="list-style-type: none"> Project Annual Report Project Final Report 	
4. The Extension Guideline is fine-tuned.	<ul style="list-style-type: none"> 4.1 Comparing with the Phase 1, the rate of population who apply the techniques in the Extension Guideline is increased by 5%. 	<ul style="list-style-type: none"> Project Annual Report Project Final Report 	
Activities of the Project		Inputs	
<ul style="list-style-type: none"> 1-1 To study the planning process and the decision making done by target MMDAs respectively 1-2 To present the Project Framework and the output produced by Phase 1 to the members of MMDAs and officials (DCD, DDA and other Agriculture Sub-Committee members) 1-3 To conduct trainings of needs analysis, resource analysis, planning, budgeting and monitoring for the member of MMDA and officials (DCD, DDA and other Agriculture Sub-Committee members) 1-4 To support each District Assembly in target MMDAs to make District Rice Extension Plan and a budget estimation 1-5 To strengthen the linkages between MMDAs and Central Government (MoFA and MoLRD) through periodical reporting and meeting 1-6 To review the progress of the plan and financial management 1-7 To renew District Rice Extension Plan and budget estimation based on the performance of the previous year. 2-1 To study natural condition of potential valleys for implementing the Project 2-2 To select target communities and farmers, and then to sensitize and group them 2-3 To set up demonstration plots 2-4 To conduct a baseline survey about land holdings, farm management, market, post-harvest processing, gender and so on 2-5 To conduct trainings for RAD staff, DAD staff and farmers in line with the Extension Guideline 3-1 To conduct monitoring activities of the Extension Guideline, using existing monitoring system via MoFA MIS and/or MoLRD (“monitoring system” means the structure, methodology and data formats) 3-2 To review and assess the effectiveness and efficiency of existing monitoring system and tools 3-3 To improve monitoring/reporting structure from field level to national level 3-4 To improve a set of monitoring/reporting formats (qualitative and quantitative data) and tools 3-5 To conduct trainings of monitoring and evaluation practices for RAD staff and DAD staff 4-1 Through monitoring the extension activities, to identify the techniques that farmers found difficulties to apply 4-2 To assess the reasons why the difficulties occur 4-3 To examine if each skill in Extension Guideline needs to be modified (i.e. for women specification) 4-4 To develop more appropriate skills through learning by doing process 4-5 To revise the Extension Guideline and training materials 4-6 To arrange dissemination workshops and public relation activities for the other MMDAs 4-7 To support MoFA’s effort to mainstreams the Extension Guideline in national rice policies 	<ul style="list-style-type: none"> 1. Ghanaian Side <ul style="list-style-type: none"> a. Human Resources Counterpart personnel b. Physical Input Office spaces for PCU in Ashanti and Northern c. Financial Input Counterpart Fund 2. Japanese Side <ul style="list-style-type: none"> a. Human Resources: JICA will dispatch a professional team to achieve the project purpose. The team will include the following specialties: extension, evaluation and monitoring system, local governance, rice cultivation and others. b. Physical Input Materials, tools and equipment for implementing the Project c. Other Training in the other countries and/or Japan 	<ul style="list-style-type: none"> The mechanism of decentralization is not changed. The District Assembly keeps the delegated authority and responsibility from central <p>Preconditions:</p> <ul style="list-style-type: none"> Security is maintained. Economic situation is not worse sharply. The policy favourable for domestic rice promotion is not changed. 	

List of target districts are show below.

Table 3 List of Target MMDAs

Region	No	District	Remark	Cycle in intervention
ASHANTI REGION				
Ashanti	1	Atwima Mponua		1
	2	Ahafo Ano North		1
	3	Adansi North		1
	4	Adansi Asokwa (Created fromk f Adansi North)	New	1
	5	Adansi South		1
	6	Asante Akim North		1
	7	Sekyere Central		2
	8	Ejura Sekyedumase		2
	9	Offinso North		2
	10	Afigya Kwabre North (Created from r Afigya Kwabre)	New	2
	11	Afigya Kwabre South		2
	12	Amansie West		2
	13	Asante Akim South		2
	14	Mampong Municipal		3
	15	Sekyere East		3
	16	Sekyere South		3
	17	Sekyere Kumawu		3
	18	Sekyere Afram Plains		3
	19	Amansie Central		3
	20	Atwima Nwabiagya Municipall		4
	21	Atwima Nwabiagya North (Created from Atwima Nwabiagya)	New	4
	22	Bosome Freho		4
	23	Bekwai Municipal		4
NORTHERN REGION				
Northern	1	Tamale Metropolitan		1
	2	Sagnerigu Municipal		1
	3	Zabzugu		3
	4	Gushegu Municipal		2
	5	Savelugu Municipal		2
	6	Nanton (Created from Savelugu)	New	2
	7	Mion		1
	8	Kumbungu		2
	9	Tolon		3
	10	Yendi Municipal		2
	11	Karaga		3
North East	12	West Mamprusi Municipal		1
	13	Mamprugu Moagduri (Created from West Mamprusi)	New	1
	14	East Mamprusi Municipal		2
Savanna	15	Chereponi		2
	16	Central Gonja		3
	17	East Gonja Municipal		1
	18	North East Gonja (Created from r East Gonja)	New	1

Location of target MMDAs (Cycle MMDAs) are shown below.

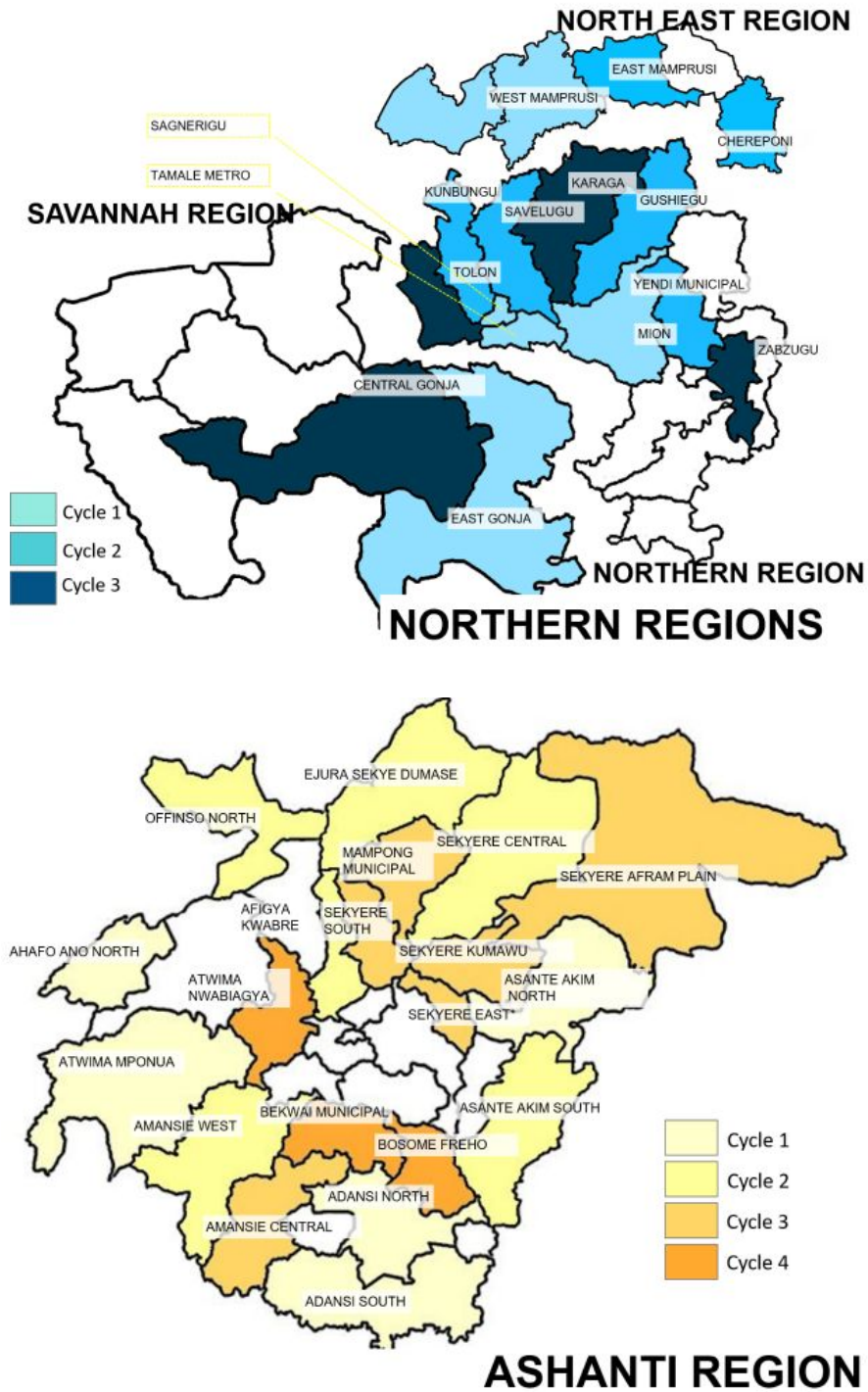


Figure 1 Maps of Target Districts

1.3. Measures Taken for Effective Dissemination of Rice Extension

Comparison of Characteristics between Phase 1 and 2 are show below.

Table 4 Comparison of Phase 1 and Phase 2

	Phase 1	Phase 2
Major objectives	Development of Technical Package of Rice Cultivation and Rice Extension According to Ghanaian Environment	Scaling up Rice Extension Guideline to 35 MMDAs and Building capacity of MMDAs to manage it under its Government System
Target Regions	2 Regions	2 Regions (4 regions later)
Target MMDAs	9 MMDAs	35 MMDAs (41 MMDAs later)

Scaling up Rice Extension Guideline to 35 (later 41 MMDAs) has been a new challenge in Phase 2. To efficiently disseminate the Guideline to 41 MMDAs, they were categorized into 4 groups (Cycles) according to the year in which the Project Coordination Unit (PCU) starts to support implementation in the MMDAs.

Each Cycle MMDAs were supported according to the Government planning process as shown below.

- Year 1 (Planning and Budgeting): PCU facilitated MMDAs’ planning and budgeting for Rice Extension Activities in their composite budgets.
- Year 2 (Implementation): PCUs train DDA, its staff and AEAs and Farmers in ToTs in Region and Districts and Onsite-Training (OST) and facilitate implementation of rice extension activities planned/ budgeted by MMDAs, monitoring and evaluation of the activities and planning and budgeting for next year.
- Year 3 (Follow-up): PCUs make follow-up continuation of MMDAs rice extension activities and provide necessary technical advises through M&E activities.

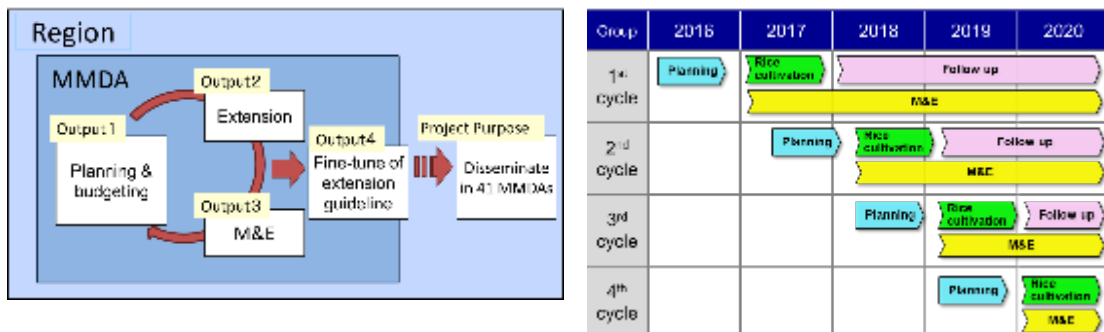
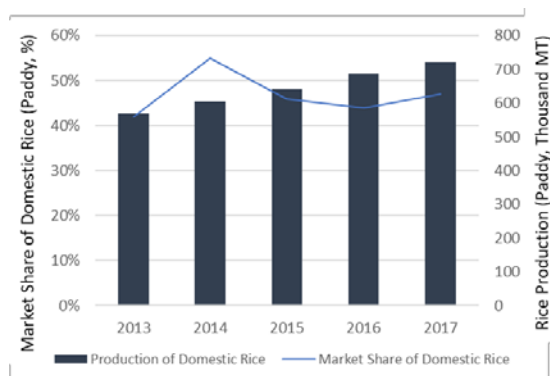


Figure 2 Concept of Effective Dissemination According to the Government System

1.4. Situation after Commencement of Phase 2

Domestic rice production (Paddy)

Domestic rice production has steadily increased. It reached 721,610 MT in 2017. However, importation of rice increased more than the domestic production. This resulted in decreasing share of domestic rice in Ghana from 55% to 47%. Deficit of rice rather increased to 580,300 MT in 2017. The need to increase yield of domestic rice is rather deepening.



Source: MoFA Annual Progress Report 2017

Figure 3 Production and Market Share of Domestic Rice

Government Flagship Programmes

The government of Ghana has established programs that support rice extension activities. These programmes include Planting for Food and Jobs (PFJ), Youth Employment Agency (YEA)¹ as well as other programmes such as “One District One Factory” and “One Village One dam”. In 2019 Nation Builders Corp (NABCO) was deployed to Metropolitan, Municipality and District Assemblies (MMDAs) in place of YEAs.

Creation of New Regions and MMDAs

There has been change of administrative boundaries due to the creation of six (6) MMDAs from target MMDAs in 2017. The Northern Region was divided into 3 different administrative regions namely, Northern, North East and Savannah regions, in February 2019.

The number of the MMDAs increased from 35 to 41. These are Adansi Asokwa, Afigya Kwabre South, and Atwima Nwabiagya North in Ashanti Region (AR); Nanton in Northern Region (NR); Mamprugu Moagduri in North East Region; and North East Gonja in Savannah Region.

Project activities will be implemented in the same area as in the boundary of initial 35 MMDAs since the geography has not been affected. Project Indicators are set based on activities in the initial 35 MMDAs since it will take time for newly created districts and regions to be fully functioning administratively.

¹ YEA is a government initiative to reduce unemployment of young people. It has different modules (extension, sanitation etc.). The extension module is called Youth in Agriculture module. In some District Agriculture Department, the beneficiaries worked as extension officers.

2. ACHIEVEMENT

Achievement of the Project indicators is shown below.

Table 5 Results of Project Indicators

Indicator and Target		Ashanti	Northern, North East and Savannah	Total
Output 1	1.1 Rice Extension Plan Developed (35 MMDAs)	20	15	35
	1.2 DMTDP	11	15	26
	1.3 Budget	20	15	35
Output 2	2.1 No. of trainings conducted (5times/MMDA)	1,057 (20 times/MMDA)	530 (12 times/MMDA)	1,587 (16 times/MMDA)
	ToT in Region	3	3	3
	ToT and OST: Cycle 1	249	163	412
	ToT and OST: Cycle 2	475	265	740
	ToT and OST: Cycle 3	165	102	267
	ToT and OST: Cycle 4	168	-	168
	2.2 No. of DAOs and AEAs trained (490 (net))	1,197	583	1,780
	DAO trained	267	189	456
	AEA trained	930	394	1,324
	2.3 No. of farmers trained (11,700 (gross))	15,853	8,670	24,819
Output 3	3.1 M&E system established	M&E Tool is developed and revised three times.		
	3.2 No. of M&E trainings conducted (1 per region)	3	3	3
Output 4	4.1 Application rate (%) (5% increase from phase 1 (equivalent to 73%))	84 %	71 %	78 % (12.2% increased from phase 1)
Project Purpose	1. Farmer Yield (100% increase * 1)	122.1 %	83.7 %	116.3 %
	Demonstration plot Yield	5.02 ton/ha	3.47 ton /ha	4.24 ton /ha
	Farmer Yield	3.60 ton /ha	2.05 ton /ha	2.96 ton /ha
	Cycle 1	1.62 → 4.35 (169% UP) 1.12 → 2.57 (130% UP)		
	Cycle 2	1.62 → 2.89 (78% UP) 1.12 → 2.06 (84% UP)		
	Cycle 3	1.62 → 2.35 (45% UP) 1.12 → 1.49 (34% UP)		
	Cycle 4	1.62 → 3.08 (90% UP) -		
Average	1.62 → 3.60 (122.1% UP)	1.12 → 2.05 (83.7% UP)	1.37 → 2.96 (116.3% UP)	

Annual Achievement of the project indicators is shown in the table below.

Table 6 Annual Achievement of the Project Indicators

	Indicator	Target	unit	2017			2018			2019			2020			
				Ashanti	Northern	Total	Ashanti	Northern	Total	Ashanti	Northern	Total	Ashanti	Northern	Total	
Output 1	Rice extension plan developed.	Yes	# of district	19	14	33	20	15	35	20	15	35	20	15	35	
	Prioritized.	Yes	# of district							8	14	22	11	15	26	
	Budgeted	Yes	# of district	5	3	8	16	15	31	20	15	35	20	15	35	
Output 2	Number of training conducted.	5/ district/ year	times	22	8.2	15.1	13.9	12.4	13.1	20.4	13.9	17.3	19.4	9.7	18.5	
			times in total	110	41	151	153	136	289	347	208	555	447	145	592	
	Number of DAO and AEA trained.	490	person (net)	95	50	145	124	110	234	485	228	713	493	199	688	
			DAO trained.	person (net)	25	16	41	19	38	57	102	63	165	121	72	193
			AEA trained.	person (net)	70	34	104	105	72	177	383	165	548	372	123	495
	Number of farmers trained.	11,700	person (gross)	242	296	538	3,171	2,626	5,797	5,743	3,665	9,408	6,697	2,379	9,076	
			Male	person (gross)	134	259	393	1,547	1,711	3,258	4,629	2,592	7,221	4,709	1,617	6,326
Female			person (gross)	33	37	70	809	858	1,667	1,760	1,066	2,826	1,900	762	2,662	
Output 3	M&E system established.	Yes		M&E Tools were developed and revised three times.												
	Number of training conducted.	1 /region/ year	times	4	4	4	4	4	4	2	2	2	1	1	1	
Output 4	Application rate (%).	5% up (73%)	Application rate (%)	66.3%	-	66.3%	68.4%	78.3%	74.5%	85.0%	67.7%	75.4%	89.5%	67.0%	88.0%	
			% increase			-4.7%			7.2%			8.5%				
Purpose	Farmer Yield (ton/ha)	100% up	ton/ ha	2.93	2.00	2.93	3.55	2.41	2.82	3.50	2.11	2.80	3.21	1.64	3.14	
	* Average yield of applied farmers.	Compare to baseline survey 2016	%	81.0%	23.4%	114.4%	119.1%	115.9%	105.8%	115.8%	89.1%	104.7%	98.0%	1.2%	129.4%	
			Baseline 2016	ton/ha	1.621	1.116	1.369									

Output 1: The activities about planning and budgeting have achieved their objectives. This can be attributed to the following factors.

- The training of the target MMDAs to improve capacity in planning and budgeting was carried out at early stage of the project.
- PCU also gave MMDAs necessary information and tools for budget negotiation (Unit cost and timing of training (“budget calendar”) and reporting format).
- MMDAs were enabled to access Government source of fund as well as the other source of fund.
- The M&E data have helped DAD to justify the rice extension activities in negotiating budgeting and its release.

Output 2: The activity concerning the rice extension activity achieved the target. There are three main reasons for this achievement.

- MMDAs have secured more demonstration plot budgets than initial expectation and more training has been conducted.
- PCU have kept fine-tuning technical packages against challenges in each field from time to time and have provided appropriate technical guidance to MMDAs.
- The extension method was also appropriately fine-tuned to conduct extension activities for larger number of target MMDAs than phase 1. These technical efforts enabled MMDAs to achieve high yield even in the latter half of the project where 41 MMDAs carried out the rice extension as follows.

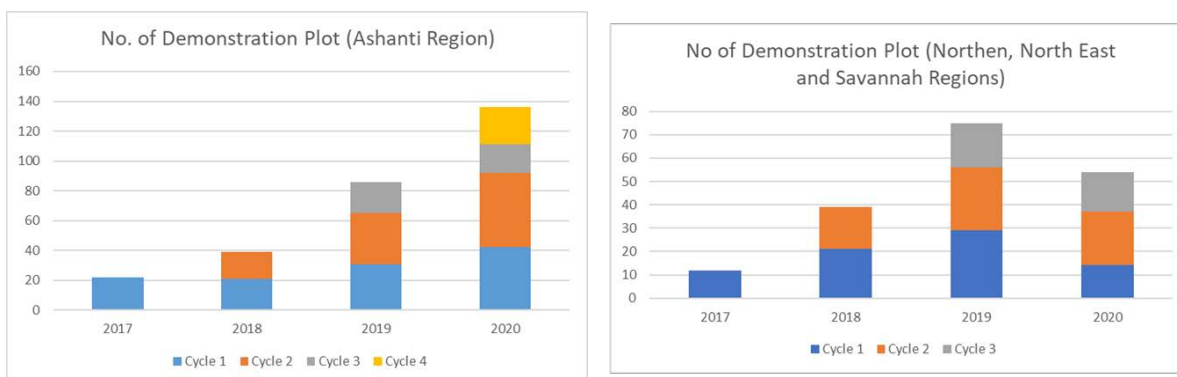


Figure 4 No. of Demonstration Plot Established

(Left: Ashanti. Right: Northern, North East and Savannah Regions)

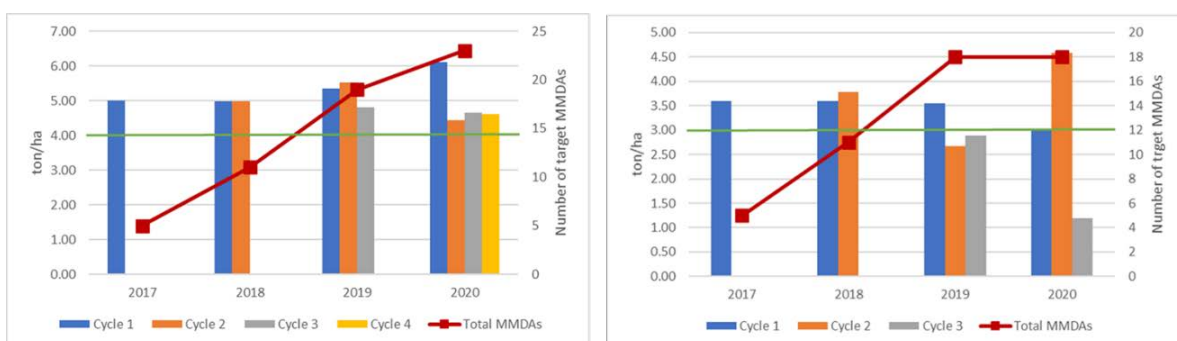


Figure 5 Yield of Demonstration Plot and No. of Target MMDAs

(Left: Ashanti. Right: Northern, North East and Savannah Regions)

Output 3: Indicators of the Output 3 are also achieved. Factors of achievement are as shown below.

- M&E Tool has been developed and introduced before supports at early stage. This is because PCU recognized the importance of establishing monitoring system from the beginning.
- M&E Tool was designed and kept being revised to be aligned to the existing system, as well as simplified and made user-friendly,
- PCU emphasized the importance of M&E and trained MIS officers in each training.

Output 4: The Guideline was approved through validation workshop. Target was achieved, although it needs taking time to achieve the target of the application rate in the indicator since farmers needs three years to adopt the recommended techniques.

Project Purpose: Target was achieved. This is because activities for output 1-4 have been implemented as planned.

Based on such achievements above, following impact were confirmed.

- The data in the M&E tools confirmed that more than 80% non-target farmers near location of demonstration plots in Ashanti region. Farmers who applied the recommended techniques of the Rice Extension Guideline achieved yield twice than non-target farmers who did not apply them. This indicates that knock-on effect through demonstration plots have been confirmed as expected.
- Comparison of the profit per acre between with and without the recommended techniques of the Guideline confirmed that the farmers with the techniques achieved yield 2.5 times in Ashanti region and four times in Northern, North East and Savannah regions than the farmers without them. Rice extension activities of the Guideline contributed to increase income of small-scale farmers.

3. ACTIVITIES

The project period is divided into three as shown in the table below. In the 3rd period, JICA conducted the terminal evaluation during the period from July to October 2021.

Table 7 Project Period and Activities

	Duration	Major Activities
1 st Period	April 2016- February 2017 (10 months)	Preparation period: Baseline survey, Follow-up survey of Phase I farmers, Follow-up training of Phase I farmers in Northern Region, Development of M&E Tool, Selection of Cycle 1 districts.
2 nd Period	March 2017- February 2020 (3 years)	Operation period: Rice extension activities, Revision of training materials and extension methodologies, Revision of guideline based on the experience.
3 rd Period	March 2020 – May 2021 (1 year and 3 months)	Wrap-up period: Extension activities to Cycle 4 district. Drafting and finalizing guideline.

Activities in each year of implementation are described below.

3.1. The First Period (2016)

3.1.1 Activities for Output 1: Planning & Budgeting

(1) Sensitization Workshop

As the first step, a sensitization workshop was organized on 31st May and 2nd June 2016 to brief stakeholders on the structure and framework of Phase II project. The participants were drawn from Directorate of Crop Services (DCS), JICA Headquarters, Project Coordinating Unit (PCU), District Assembly Staff and Farmers representative of phase one.

Reports and achievements of the first phase of the project were presented by the pilot districts and the PCU to participants. Representative from Directorate of Crop Service (DCS) talked on the new role expected from the Local government and funding of rice extension activities in the various districts under the project, Tensui 2. Technical support will still be provided from JICA under the collaboration spelt out in the Record of Discussion.

Participants from the districts welcomed the new arrangements and assured their commitment to fund activities from their budgets for rice extension and production.

(2) Field Trips

Following the sensitization workshop, field trips were organized for Cycle 1 districts in Ashanti and Northern Regions. It was to sensitize the major stakeholders on importance of rice extension activities for securing budget of them. The targeted personnel were the DCE, the DCD, district finance officer, district budget officer, district planning officer and the chairman of agriculture committee/development planning committee in the assemblies.

The field trips were very effective and successful as the invited officers had the opportunity to observe the real activities on the field and interact with the farmers on the ground. The participants were first briefed on the impact of phase one before going to the field and after the field visits, participants were asked to share their opinions on observation made in the fields.

This led to some of the officers making pledges to immediately take charge of the project's activities in their respective assemblies by spearheading the budgeting procedures in order to secure funds for the project.

(3) Training on Planning and Budgeting and its Follow-Up for the Preparation at District

Planning and budgeting workshop was organized in Tamale from 25-26th July 2016 and in Kumasi from 8-9th August 2016 to train participants on how to plan and budget for rice extension activities. It was organized for the department of agriculture staff, district assembly's staff and project coordinating staff.

Some of the content of the workshop included outline of district rice extension plan, budget needs analysis, resource analysis, budget preparation etc. In the workshop phase 1 districts prepared a review of their rice extension plan which was developed in phase 1 while new districts (Mion and Adansi North) prepared a rice extension plan. Also, all districts drafted a rice extension budget for 2017 farming season. After the workshop, PCU provided necessary advice with districts to finalize their budget and to submit to the Assembly as a part of their composite budget. Again, PCU advised MMDAs to prepare procurement plan and cash/ work plan for the Assembly and DAD to secure actual allocation of government funds.

(4) Development of Regional Annual Plan and Budget

PCU in both Northern and Ashanti Regions had a meeting on developing the regional work plan and budget. This was based on the outputs of the project. A comprehensive regional budget has been put together and submitted to DCS, Accra for onward submission to the Ministry of Finance (MoF). The Northern region submitted their budget to RCC on 22nd August 2016. Below is the summary table of the budget for both regions, Northern and Ashanti.

Table 8 Indicative Estimation of Budget for Five Years (000 GHS)

Category	Input	2016	2017	2018	2019	2020	2021
MoFA HQ	Monitoring & Supervision	22.50	90.00	103.50	119.03	136.88	50.00
	Monthly Allowance	6.00	12.00	13.80	15.87	18.25	6.00
MoFA Total		28.50	102.00	117.30	134.90	155.13	56.00
Ashanti	Office Facilities	20.00	42.70	49.10	56.47	64.94	20.00
	Monthly Allowance	34.20	68.40	78.66	90.46	104.03	11.40
	Activities		148.45	170.72	196.33	225.77	
Northern	Office Facilities	20.00	54.04	62.15	71.47	82.19	20.00
	Monthly Allowance	34.20	68.40	78.66	90.46	104.03	11.40
	Activities		108.92	125.26	144.05	165.66	-
Regional Total		108.40	490.91	564.55	649.23	746.61	62.80
	Unit/ district		20.00	23.00	26.45	30.42	
	Cycle 1		200.00				

Category	Input	2016	2017	2018	2019	2020	2021
	Cycle 2			180.00			
	Cycle 3				160.00		
	Cycle 4					243.34	
District Total			200.00	180.00	160.00	243.34	
Grand Total	Annual	136.90	792.91	861.85	944.12	1,145.08	118.80
GoG	Five years						3,999.67

3.1.2 Activities for Output 2: Extension

(1) Extension

New adjoining communities to the old communities where demonstrations were conducted in Phase I were selected for extension activities. Two communities each from the old districts were used to lay out demonstration for learning purposes. Out of the eight (8) established, six (6) were successful. The two were affected by flood.

Table 9 Results of Demonstration Plot

DISTRICT	COMMUNITY	YIELD (MT/Ha)	REMARKS
West Mamprusi	Gaagbin ni	3.3	
Sagnarigu	Galizegu	3.2	
Sagnarigu	Kpawumo	2.2	Poor germination due to flooding
Tamale Metro	Gbabshei	3.1	
Tamale Metro	Pagazaa	2.4	Poor germination due to flooding
East Gonja	Chekosi-kakosi	2.0	Birds fed on grains

(2) Baseline Survey

IDCJ contacted JMK Consulting on 8th September to conduct the baseline survey on the Tensui rice project phase II in thirty five (35) target MMDAs of Ashanti and Northern regions and submitted final report on 20th December.

The purpose of the survey was to identify the status of rice production and marketing in the region with consideration to gender aspect and also collect data on project indicators to help assessment of project impact.

For Ashanti, the survey was carried out in twenty (20) target MMDAs on three stakeholders that consisted of 40 rice farmers, 154 rice value chain actors and 40 district agricultural officers.

For Northern Region, the survey was carried out in fifteen (15) target MMDAs on three stakeholders that consisted of 306 rice farmers, 152 rice value chain actors and 40 district agricultural officers.

Eighteen (18) enumerators (agricultural extension agents) and two (2) supervisors trained to conduct the survey.

On the 19th September 2016, the contractor submitted Inception report. On the 25 September 2016, PCU held meeting with the contractor to discuss the methodology of the survey and details of the questionnaires. On 27th of September, the inception report was finalized.

On the 10th November 2016, PCU received draft final report from JMK consulting. The Ashanti and Northern counterparts met with JMK Consulting on the 17th November at Tamale to comment on and fine tune the report.

On the 23rd November 2016, PCU members of two regions invited JMK consulting to Kumasi and carried out second round of comment on the draft final report. On the 20th December 2016. JMK submitted the finalized report to the Project. The survey report shown that the average yield of farmer respondents in the target MMDAs was 1,621 kg/ha in Ashanti Region and 1,116 kg/ ha in Northern Region. The low yield can be attributed to low adoption of improved technologies and some other factors.

Table 10 Rice production in the MMDAs in 2015

Ashanti Region		Northern Region	
District	Yield (kg/ha)	District	Yield (kg/ha)
Adansi North	842	Central Gonja	1,058
Adansi South	2,073	Chereponi	1,055
Afigya Kwabre	2,304	East Gonja	1,268
Ahafo Ano North	969	East Mamprusi	1,582
Amansie Central	1,239	Gushegu	941
Amansie West	1,487	Karaga	1,301
Asante Akim North	2,364	Kumbugu	885
Asante Akim South	1,504	Mion	1,237
Atwima Mponua	1,381	Sagnarigu	1,327
Atwima Nwabiagya	2,957	Sevelugu	1,251
Bekwai Municipal	1,958	Tamale Metropolitan	649
Busome Freho	1,182	Tolon	989
Ejura/Sekyeredumasi	1,327	West Mamprusi	1,435
Kumasi Metropolitan	1,920	Yendi Municipal	1,630
Mampong Municipality	2,411	Zabzugu	1,017
Offinso North	840	Total	1,116
Sekyere Afram Plains	1,140		
Sekyere Central	2,149		
Sekyere Kumawu	1,654		
Sekyere South	828		
Total	1,621	Total	1,116

Source: Baseline Report

The baseline survey indicated that rice production is the major contributor to household income to the farmers as compared to other income generating sources. This implies that, farmers need to practice improved technologies for higher production and earn better income.

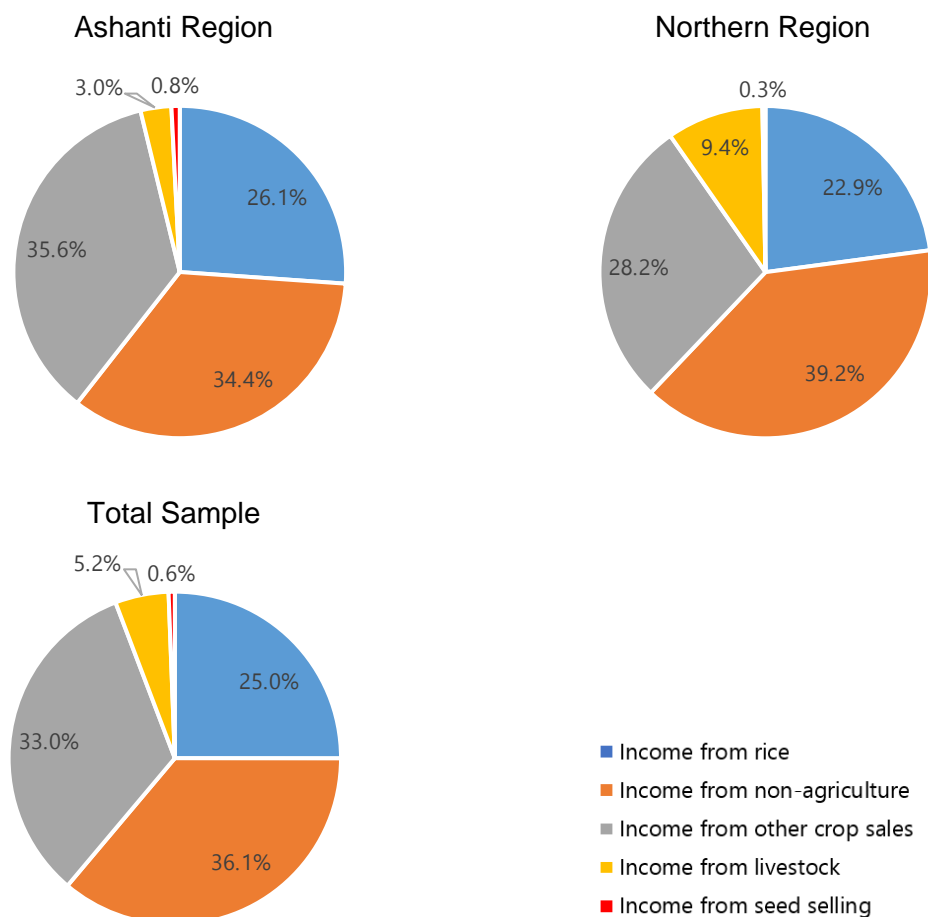


Figure 6 Source of Income of Sample Household in Ashanti and Northern regions

3.1.3 Activities for Output 3: M&E

(1) Review of Existing M&E System

The existing monitoring and evaluation (M&E) system was reviewed based on the interview with regional agricultural officers and field visit to the districts. The existing institutional setup and system for M&E is summarized as follows.

1) Institutional Setup for M&E at districts

The extension area in a district is divided into usually 4 Zones. Each Zone is divided into 5 Operational Areas depending on the number of Agricultural Extension Agents (AEAs). Each operational area has 8 and more Communities.

District Agricultural Department (DAD) has 4 - 8 District Agricultural Officers (DAO) those are in charge of respective Zones. Under the supervision of DAO, 3 and more AEAs are assigned to provide

extension services to farmers in several Operational Areas. The structure is shown in the figures below, taking Asante Akim North district in Ashanti region as an example.

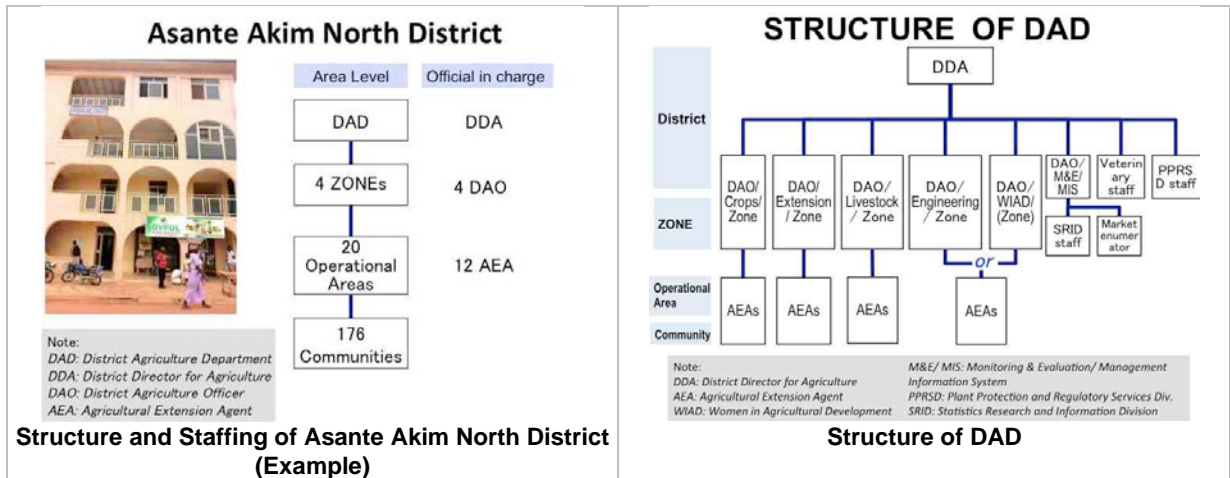


Figure 7 Structure of District

2) M&E System

The monitoring system is uniform over the nation. Ministry of Food and Agriculture (MOFA) introduced uniform formats for M&E. According to the direction by MOA, regions and districts prepare their annual plans. Progress of the annual plan is monitored periodically. Monitoring report describes progress and challenges in line with the annual plan. The monitoring report at ground level is sent to higher entities vertically and horizontally, as shown in the figures below.

At district level, AEAs submit monitoring report to respective DAO. District M&E/MIS officer compiles DAO's monitoring reports and submit to District Director of Agriculture (DDA). DDA reports to District Coordinating Director (DCD) of MMDAs and copies to Regional Agricultural Department.

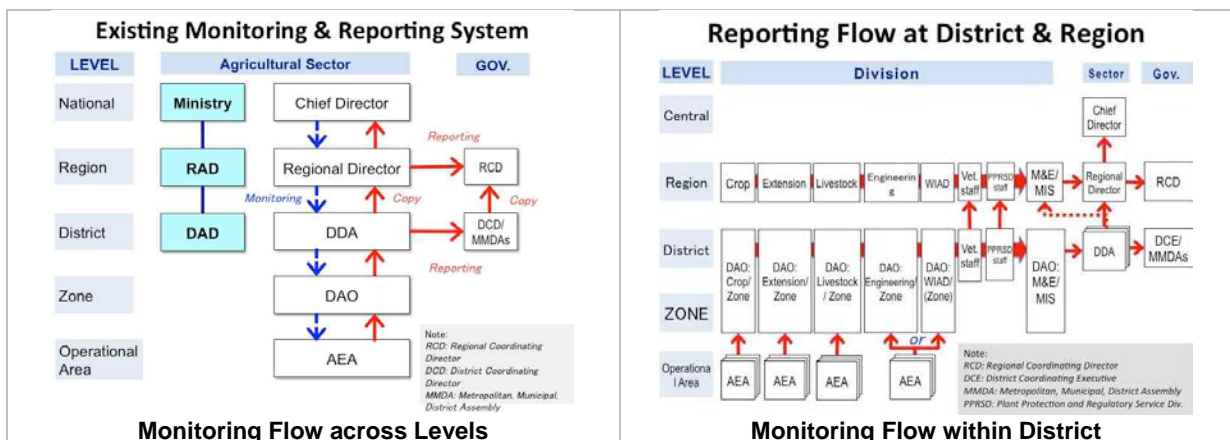


Figure 8 Existing Monitoring & Reporting System

Types and frequencies of those monitoring and its reporting are shown in the table below. The information included in the existing periodical monitoring report on rice production is area planted (ha), area harvested (ha), land intensification status, production (metric ton), and average wholesale price of local rice.

Table 11 Types and their Frequency of Monitoring Reports

	Annual Plan	Monitoring frequency	Reporting				Evaluation (Project/program base)
			Monthly Report	Quarterly Report	Annual Report	Situational Report	
Ministry	✓	2 times a year					✓
Regional Director	✓	Quarterly		✓	✓	✓	✓
DDA (District)	✓	Fortnightly		✓	✓	✓	✓
DAO (Zone)		Weekly		✓	✓	✓	
AEA (Operational Area)		4 times a week	✓	✓	✓	✓	

Source: PCU, Tensui 2 Project

Main Content of AEA Quarterly Report (Example)

1. Food Security and Emergency Preparedness
 2. Increased Growth in Income
 3. Increased Competitiveness and Enhanced Integration into Domestic and International Markets
 4. Sustainable Management of Land and Environment
 5. Science and Technology Applied in Food and Agriculture Development
 6. Improved Institutional Coordination
- Constraints
 Lessons Learned during the Quarter
 Other Projects

Source: PCU, Tensui 2 Project based on the information of Ahafo North District

(2) M&E proposed in Guidelines

Monitoring framework of Model developed in Tensui Rice Project Phase I (Tensui 1) described in Guideline is reviewed. Rice Extension Plans are prepared at District level. Progress of activities and achievement of target set in plans are monitored. The targets are: 1) Number of target communities, 2) Average yield in target communities, 3) Number of target farmers, and 4) Application rate of technologies. It is comprehensive monitoring system utilizing 15 types of information capturing formats.

(3) Actual Practice of M&E during and after Tensui Rice Project Phase I

During Tensui Rice Project Phase I

M&E practices during Tensui Rice 1 were in the following way.

- PCU with MMDAs directly monitored activities such as training, model site establishment and farmer level competition to check technical application of techniques.
- Evaluation is conducted based on Baseline Survey 2009 and Impact Survey in 2013. PCU directly undertook these surveys.

After Termination of Tensui 1

The monitoring activities have been done within the existing M&E framework. However, limited monitoring activities have been practiced. One of the major constraints is limited budget. DAOs and AEAs those are stationed at district capital have limited access to the target community due to the limited resource for extension work.

(4) Issues and Challenges

Based on the review of M&E above, the following three challenges were identified.

- As reviewed above, the existing M&E system is well organized and can provide some information to project monitoring, however, the information is limited.
- On the other hand, the project monitoring of Tensui Rice Project Phase II (Tensui 2) could provide the information to the existing monitoring system. It could generate synergy effects.
- Monitoring framework proposed in Guideline by Tensui 1 is comprehensive and complex. It requires a lot of cost and efforts of districts and region to cover 35 districts. It is necessary to figure out efficient but effective project M&E system utilizing experience and Model developed in the Project.

(5) Direction to Address Challenges: Potential Action

Direction to address challenges and potential actions are shown below.

Developing simplified and user-friendly monitoring system

Monitoring framework proposed in Guideline by Tensui 1 is comprehensive and complex. It requires a lot of cost and efforts of districts and region. Tensui 2 has to cover 35 districts. It is necessary to figure out efficient but effective project M&E system utilizing experience and Model developed in Tensui 1. Simplified and user-friendly monitoring system should be developed.

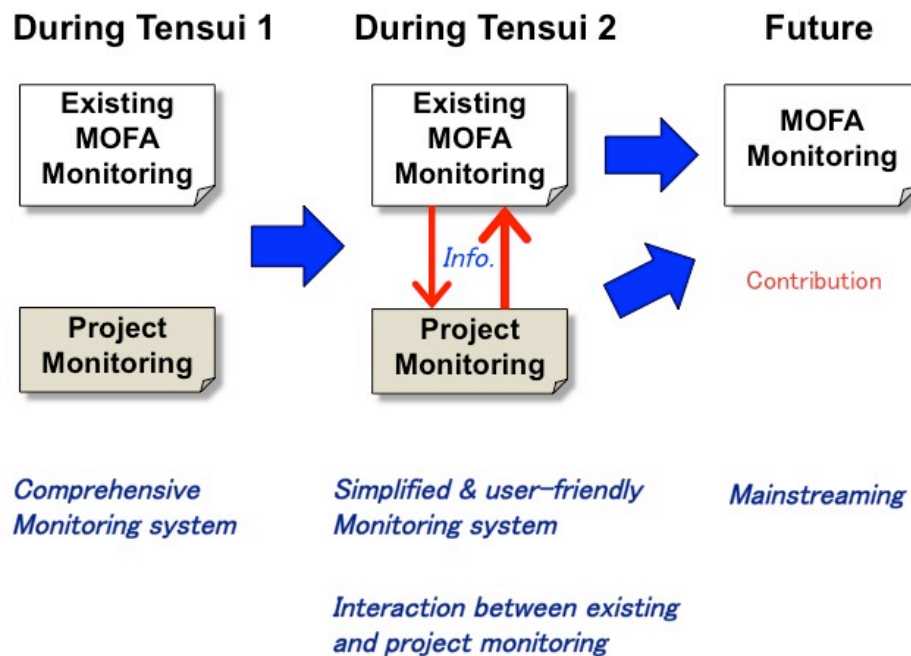
More interaction between existing and project monitoring systems

Project monitoring system and existing M&E system should be more synchronized which generates synergy effect. These two M&E systems should be co-related to each other.

- The information obtained by project monitoring can be utilized for existing monitoring. Results and outputs of project rice extension activities are to be incorporated into the existing monitoring system and reported to district and regional reports. It could appeal the project results and output to decision makers and stakeholders in districts, which enhance awareness of stakeholders on rice extension activities. It could also facilitate budgeting on rice extension activities.
- The information obtained by existing monitoring system can be also utilized for project monitoring.

Internalizing the project monitoring system into existing monitoring system in the future

After the termination of Tensui 2, the developed M&E system shall be incorporated and internalized into the existing M&E system in the future.



Source: PCU, Tensui 2 Project

Figure 9

M&E: Challenges and Future

3.1.4 Activities for Output 4: Guideline

(1) Technical Adoption Survey

1) Overview

To understand current situations and constraints on technical adoption by target farmers in phase 1, there was the need to conduct a technical Adoption survey and to use the results of the survey to revise the rice extension guideline in phase 2 in both regions.

Questionnaire development started in mid-August 2016 and pre-tested at Bedabour in the Atwima Mponua district of Ashanti region and Sanga community in the Sagnarigu district of the Northern region. Four (4) districts were chosen from phase one for the survey in both regions, totally eight. The districts were: Tamale Metro, Sagnarigu, West Mamprusi and East Gonja in the Northern region.

Communities in the survey districts were randomly selected as well as farmers. A total of 12 communities were selected, and 120 farmers were interviewed, comprising 10 farmers per community. A total of 11 communities were also selected from the Northern region and 12 groups with a membership of 10 each per group totally 120 farmers per region.

A total of 24 AEA's were chosen from both regions, with 12 AEAs per region to interview farmers who participated in the phase I project and also cropped in the 2015 cropping season. One (1) day training was organized in each district by PCU to explain the questionnaire to AEAs before administration.

The actual conduction of the survey began in middle September and ended close of the month. Submission and data entry started in October. Data entry and analysis has been completed. The tables below provide the details of the communities and farmers interviewed.

Table 12 Districts and Communities Selected for Technical Adoption Survey (Northern Region)

DISTRICTS	COMMUNITIES	FARMERS INTERVIEWED	
		MALE	FEMALE
<i>WEST MAMPRUSI</i>	Boakudow	18	6
	Yama/Chere		
	Kata/Banawa		
<i>EAST GONJA</i>	GBUNG	27	3
	MANKANGO 1		
	MANKANGO 2		
<i>SAGNARIGU</i>	KUKPEHI	30	0
	KULYEVILLAH		
	SANGA		
<i>TAMALE METRO</i>	WULANYILI	25	3
	VETTING YEPALA		
	NACHIMBIYA		

Table 13 Districts and Communities Selected for Technical Adoption Survey (Ashanti Region)

DISTRICTS	COMMUNITIES	FARMERS INTERVIEWED	
		MALE	FEMALE
<i>ATWIMA MPONUA</i>	BEDABOUR	25	3
	AGYEKUM AKURAA		
	MOFRA AND NKRUMAH		
<i>AHAFO ANO NORTH</i>	ASENKYEM	21	9
	NKYENSEDAHO		
	MANFO		
<i>ASANTE AKIM NORTH</i>	JUANSA	28	2
	WURAPONSO		
	AKUTUASE		
<i>ADANSI SOUTH</i>	TWEAPEASE	20	10
	KOJO YENTUMI		
	TONKUASE		

2) Key Findings

Ashanti Region

- Self-evaluation of technical adoption: Rates for “good” or “fair” are much higher than “none” or “poor” in most of the questions.

Which have got the lowest rating was “line drawer”, followed by “water management for direct sowing”. The survey result shows line drawers have not widely used by rice farmers. In Ashanti Region, direct sowing is practiced instead of transplanting when a large amount of water is not available for transplanting at the early stage of the cropping season. Therefore, water shortage could be a persistent problem for those who practice direct sowing.

“Puddling”, “levelling of ploughed field”, and “way of row sowing in direct sowing” received low evaluation grade. “Tools/machinery” and “labour” were major limiting factors for those three techniques.

- Continuation Rates of Rice Cultivation: 99.2%

The continuation rates of rice cultivation by farmers who joined rice training in the Phase 1 Project are extremely high.

- Method of Planting Rice: Transplanting: 54.3%, Direct sowing: 45.7%

The transplanting method of rice culture is practiced predominantly compared with direct sowing. However, rates for direct sowing were unexpectedly high.

- Land Ownership: Owner Farmer: 19.0%, Tenant Farmer: 81.0%

The majority of rice farmers grow rice as tenant farmers. Farmers might not show a positive attitude towards land development such as bunds and water channels building and improved soil fertility because they could be anxious about continuity of tenancy.

- Average Planted Area per Rice Household: First Crop: 0.7 ha, Second Crop: 0.5ha

Approximately 20% of agricultural land is used to grow rice. The average planted areas are relatively large as farming systems which most farmers do not have access to tractors and animal traction.

- Average Yield per hectare at farmers' fields: 2.5 tons/ha

The average yield per hectare at farmers' field is relatively low compared with the yield per hectare achieved in some of Trials and Demonstration Plots in the Phase 1 Project. There is room to increase yield. However, please note the farmers used their own resources, namely seed, fertilizer, and other chemicals to achieve this yield level.

- Rice Varieties Planted: Agra 62.6%, Jasmine85 36.6%

The two improved varieties accounted for nearly 100% in the total rice planted area.

- Issues Raised: water, fertilizer, labour, and pest & disease account for approximately 20%, respectively.

Few respondents raised postharvest processing and marketing as problems they faced.

- Access to a tractor or power tiller: no access 96.5%

Ploughing and harrowing are done by hand. However, zero tillage and breaking up the soil by digging stick seem to be popular practices in the investigated areas.

Northern Region

- Self-evaluation of technical adoption: Generally, very high, rates for “good” or “fair” are much higher than “none” and “poor” in almost all questions.

The lowest rating was “water management for direct sowing”. Although most rice farmers practice direct sowing in Northern Region, water would be scarce for quite some time from a very early stage after sowing.

“Seed selection”, “line drawer”, and “bird-scaring” also received low evaluation grade. Individual farmers might have difficulties preparing tools and inputs, namely large buckets and some amount of salt for seed selection, line drawer for drawing lines in their rice fields and bird nets to protect paddies from birds.

- Continuation Rates of Rice Cultivation: 99.2%

The continuation rates of rice cultivation by farmers who joined rice training in the Phase 1 Project are extremely high.

- Method of Planting Rice: Transplanting: 0.9%, Direct sowing: 99.1%

Almost all rice farmers practice direct sowing as a method of planting rice.

- Land Ownership: Owner Farmer: 80.6%, Tenant Farmer: 14.8%
More than 80% of rice farmers grow rice as owner farmers in contrast to Ashanti Region, where about 80% of rice farmers are tenants.
- Average Planted Area per Rice Household: First Crop: 1.8 ha (only one crop season in a year)
The average planted area per rice household is 1.8ha, which is more than double of that of Ashanti Region.
- Average Yield per hectare at farmers' fields: 1.4 tons/ha
The average yield per hectare is about half of that of the Ashanti Region (56%). Water availability could be the main reason for the lower average yield.
- Rice Varieties Planted: Agra 28.0%, Jasmine85 58.9%
The two improved varieties accounted for about 87% in total rice planted area. The rate of Jasmine 85 is relatively high, and the expansion of Agra is still under way. Spread of rice blast is anticipated in the near future for the weakness of Jasmine 85 against rice blast.
- Issues Raised: fertilizer 30%, water and marketing 20% respectively.
As issues, the rates for fertilizer and marketing are higher compared with Ashanti Region. In contrast, the rates for pest & disease are extremely low.
- Access to a tractor or power tiller: access 75.7%
Ploughing is mainly done by a tractor. However, about 1/4 of respondents cultivate rice fields by hand.

(2) Dissemination Workshops and Public Relations

1) Farmers Day

The project participated fully in the 32nd National Farmers' Day Celebration.

The PCU displayed some simple tools designed by the project such as Bambam box, Push-weeder, Leveler, Sickles and Tarpaulin. PCU explained to participants the importance of these to produce quality rice. Other training materials such as rice cropping Calendars and leaflets on how to produce good quality rice were distributed to Farmers who visited the stand and some award winners.

The project exhibited both straight-milled and parboiled rice² for participants at the display as a value addition for entrepreneurs and other stakeholders to take it up. Ashanti PCU visited Agro-chemical dealers to interact with them and see how they can collaborate with the project.

² Parboiled rice was Northern Region only.

2) Press Tour

The project organised a press tour to the East Gonja district to expose the activities and achievement of the project to media outlets. More than five (5) different media were present. The Japanese country resident representative and other top officials from the JICA Ghana office were present. The press tour was highly successful; the visiting team were first briefed about the Tensui two project at the conference hall of the Regional MoFA office. They were later taken to Kpalbe community in the East Gonja district, where they interacted with farmers who have adopted and are practicing some of the rice cultivation technologies disseminated in the first phase of the project. At the time of the press tour, the farmer's rice was still available in the field for the media to physically observe by themselves.

3.1.5 Other Activity

Rice Festival in Accra organized by Ghana Rice Inter-professional Bodies

The Project participated in a two-day rice festival on the 7th and 8th of October 2016 at Efua Sutherland Park, Accra. The occasion was organized by the Ghana Rice Inter-professional body and the Ghana Rice Advocacy Council. This festival aimed at promoting local rice with the theme "Eat quality rice for a healthy life".

TENSUI II was represented by the schedule officers in Ashanti and Northern regions, experts on rice cultivation, extension and local governance. On display at the festival were a lot of rice varieties grown in Ghana, especially from the Volta, Eastern and Great Accra regions. Various dishes of rice were prepared and saved freely to participants to have a test of the quality of the local rice.

Companies and suppliers of machinery and agro-equipment for rice production also participated and displayed their products for sale and educating participants.

Ashanti PCU exchanged contacts with most of these groups for further collaboration in the future. Among them were the Competitive Africa Rice Initiative (CARI), John Agyekum Kufour Foundation (JAK), Ghana Rice Inter-professional Body (GRIB) and Technoserve.

3.2. The Second Period (2017-2019)

3.2.1 Activities for Output 1: Planning & Budgeting

(1) Supporting MMDA's Planning and Budgeting

Methodologies for supporting MMDAs' planning and budgeting process have been improved during the second period.

Table 14 Challenges and Improvement about planning and budgeting issues

Year	Challenges	Improvement in the following year
2017	<ul style="list-style-type: none"> District budget was released partially with delay after the middle of the fiscal year. 	<ul style="list-style-type: none"> Communication with decision-makers is to be improved through briefing them with materials, sharing experiences of accessing other fund sources and better communication with them.
2018	<ul style="list-style-type: none"> Though DCE/DCD committed, some MMDAs were unwilling to allocate funds timely. 	<ul style="list-style-type: none"> All MMDAs were able to establish additional demonstration plots by their available sources.
2019	<ul style="list-style-type: none"> Some MMDAs still rely on a source of donor fund. 	<ul style="list-style-type: none"> All MMDAs prepared composite budgets, and they were able to explain rice extension activities this year. They have also budgeted the other sources in their composite budget 2021.

Support for MMDA's planning and budgeting of rice extension plan was undertaken in line with the existing annual and mid-term planning and budgeting cycle. It starts with sensitizing stakeholders of MMDAs by sensitizing workshop, field trip, and visiting decision-makers of MMDA such as DCEs and DCDs. Following these, training on planning and budgeting for next year as well as mid-term are conducted inviting district officers. After training, district officers go back to their district and prepare a plan and budget for the next year as well as a mid-term plan. In the next year after the training, follow-up support is made to materialize the prepared rice extension and budget plan.

(2) Results of Financing District

One of the crucial results of support for planning and budget is budgeting performance. The following tables show the budgeting status in each year.

Table 15 Budgeting Status in 2017

	Budgeted	Total Released (GoG & Other Source)	(%)	Government source			Other source	
				Subtotal	DACF	GoG	PFJ	Subtotal
Adansi North	13,972	14,242	102%	270	0	0	270	13,972
Adansi South	12,000	3,577	30%	3,000	3,000	0	0	577
Ahafo Ano North	55,119	4,800	9%	1,800	0	1,800	0	3,000
Asante Akim North	42,243	4,850	11%	500	0	500	0	4,350
Atwima Mponua	43,830	7,007	16%	720	0	720	0	6,287
Ashanti	167,164	34,476	21%	6,290	3,000	3,020	270	28,186
(%)				18%	9%	9%	1%	82%
East Gonja	26,630	5,420	20%	3,000	3,000	0	0	2,420
Mion	0	961		161	0	0	161	800
Sagnerigu	44,640	3,500	8%	0	0	0	0	3,500
Tamale Metro	0	2,599		0	0	0	0	2,599
West Mamprusi	20,000	500	3%	0	0	0	0	500
Northern	91,270	12,980	14%	3,161	3,000	0	161	9,819
(%)				24%	23%	0%	1%	76%
TOTAL 2 regions	258,434	47,456	18%	9,451	6,000	3,020	431	38,005
(%)				20%	13%	6%	1%	80%

Table 16 Budgeting Status in 2018

	Grand Total			Government Source (Regular)					Other Sources					
	Total Budgeted	Total Expended	%	Expenditure					Expenditure					
				Total	% in Total Expended	GoG	DACF	IGF	Total	% in Total Expended	Donor	PFJ	Input Dealer	
ASHANTI														
AFIGYA KWABRE	17,764	5,900	33.2%	5,000	84.7%	-	5,000	-	900	15.3%	900			
AMANSIE WEST	170,878 ^P	95,100 ^P	55.7%	4,200	4.4%	-	4,200	-	90,900 ^P	95.6%	90,900 ^P			
ASANTE AKIM SOUTH	600	600	100.0%	-	0.0%	-	-	-	600	100.0%	600			
EJURA SEKYEDUMASE	808,554 ^P	2,833	0.4%	-	0.0%	-	-	-	2,833	100.0%	2,405	427.5		
OFFINSO NORTH	27,985	1,500	5.4%	1,500	100.0%	-	-	1,500	-	0.0%	-			
SEKYERE CENTRL	40,000	25,000	62.5%	5,000	20.0%	5,000	-	-	20,000	80.0%	20,000			
ASHANTI REGION	1,065,781^P	130,933^P	12.3%	15,700^P	12.0%	5,000	9,200	1,500	115,233^P	88.0%	114,805^P	427.5		
NORTHERN														
CHEREONI	14,815	14,815	100.0%	-	0.0%	-	-	-	14,815	100.0%	14,815	-	-	
EAST MAMPRUSI	12,021	5,498	45.7%	-	0.0%	-	-	-	5,498	100.0%	5,498	-	-	
GUSHEGU	184,734 ^P	5,572	3.0%	650	11.7%	650	-	-	4,922	88.3%	4,922	-	-	
KUMBUNGU	34,691	1,400	4.0%	-	0.0%	-	-	-	1,400	100.0%	1,400	-	-	
SAVELUGU	13,170	6,585	50.0%	-	0.0%	-	-	-	6,585	100.0%	6,585	-	-	
YENDI	1,370	1,370	100.0%	-	0.0%	-	-	-	1,370	100.0%	1,370	-	-	
NORTHERN REGION	260,801^P	35,240	13.5%	650	1.8%	650	-	-	34,590	98.2%	34,590	-	-	

Table 17 Budgeting Status in 2019

MMDAs	Grand Total			Government Source (Regular)					Other Sources					
	Total Budgeted	Total Expended	%	Expenditure					Expenditure					
				Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer	
ASHANTI														
AMANSIE CENTRAL	15,185	10,950	72	6,210	56.7	0	6,210	0	4,720	43.3	4,740	0	0	
MAMPONG	25,808	1,480	5.7	0	0	0	0	0	1,480	100	1,480	0	0	
SEKYERE AFRAM PLAINS	17,000	3,700	21.8	2,700	72.9	2000	700	0	1000	27.1	1000	0	0	
SEKYERE EAST	12,935	12,935	100	12,935	100	12,935	0	0	0	100	0	0	0	
SEKYERE KUMAWU	0	5,202	0	4205	80.8	0	0	4,205	1000	19.2	1000	0	0	
SEKYERE SOUTH	356,606	73,000	0	0	0	0	0	0	73,000	100	73,000	0	0	
Cycle 3 Average	61,076	15,323	28.5	4,3417	51.73	2,489	1,151	700	13,533	64.93	13,536	0	0	
NORHTERN														
KARAGA	32,362	320	1.0	32,043	100	320	0	0	0	0	0	0	0	
CENTRAL GONJA	39,640	2,250	0	0	0	0	0	0	0	100	2,250	0	0	
TOLON	71,100	1,668	0	0	0	0	0	0	1,668	100	1,668	0	0	
ZABZGU	13,770	7,390	54	0	0	0	0	0	7,390	100	7,390	0	0	
Cycle 3 Average	31,374	2,325	11	8,010	25	80	0	0	2,264	75	2,832	0	0	

3.2.2 Activities for Output 2: Extension

(1) Improving Training and Extension Methodologies

Following the Guideline, ToT was conducted to train selected DAOs to be trainers. Joint Training at district level (Later renamed to District ToT) was held to train the other DAOs and Agricultural Extension Agents (AEAs). The training is followed by Onsite Training (OST) at established demonstration plots to train AEAs and Group Farmers who are expected to apply the techniques learnt on their individual fields. Monitoring visits were made to monitor the progress and status and advise

districts officers when problems arose.

Throughout the practicing process for three years, training and extension methodologies as well as materials are improved year by year. The following table shows the process of the improvement.

Table 18 Challenges and Improvement of Extension Methodology

Year	Challenges	Improvement in the following year
2017	<ul style="list-style-type: none"> • Late start of 1st ToT in Ashanti due to limited fund availability. • Newly involve DAO/AEAs have challenges in acquiring techniques in their demonstration plots. • Some demonstration plots establishment untimely were affected by erratic rainfall. 	<ul style="list-style-type: none"> • A training plot was introduced in each district to serve as the learning centre.
2018	<ul style="list-style-type: none"> • Late preparation of action plan in some districts in Ashanti. • Some demonstration plots were affected by excessive rainfall, which caused a low germination rate in the Northern region. 	<ul style="list-style-type: none"> • MMDAs tried to establish additional demonstration plots with funds allocated. • Demonstration plots were timely established. • Extension serves were delivered effectively by introducing the improved Guidebook and OST flipchart. • Many demonstration plots were managed to result in good yield in spite of drought in July.
2019	<ul style="list-style-type: none"> • Some MMDAs experienced rice diseases and buds. 	<ul style="list-style-type: none"> • PCU made follow-up visits to target MMDAs and provided necessary advice on rice cultivation and extension.

(2) Extension and Training Practice

Followings are the training and extension methodologies practiced in the year 2017-2019.

PCU organized three (3) ToT for DDAs and selected DAOs and AEAs from target MMDAs to equip them with land development techniques, rice cultivation techniques, farming support system and extension activities. This was to enable them to obtain knowledge and transfer it to their colleagues at the district level and the farmers in the communities.

The training was conducted three times based on the kind of farming activities to be carried out on the farm. Two days are used per each training, except the 3rd ToT, which was organized in a day. The MMDAs then organize JT, which involve the rest of DADs staff. This is then followed by OST on the training plot established by MoFA/ JICA and the other demonstration plots established by MMDAs.

One of the challenges to transfer skills in the cascade approach is how ToT enables trainees to become trainers effectively. During the training, participants practiced skills by group work as well as mock presentations in the case of the Northern Region. This was aimed at improving their ability to teach what they had learnt in the JT.

In the ToTs of the two regions, pre and post-training evaluation tests were conducted to evaluate the levels of understanding of the training content. During the second ToT, MIS officers from Cycle 1, 2 and 3 MMDAs were also invited to attend the second-day session, which focused on reporting and M&E.

1) 1st ToT

The first ToT was conducted on land development, rice cultivation, farm management and support systems, and extension. In the land development session, participants were trained onsite selection, land demarcation, area measurements (using Heron's Formula), bund construction, ploughing, land levelling and puddling (harrowing in NR), water usage and management.

In the rice cultivation session, participants were trained on seeds selection, hot water treatment, seed preparation, nursery preparation and sowing, transplanting methods, direct sowing, fertilizer management, disease and weed control. With respect to farm management and support systems, participants were trained on the preparation of action plans, cropping calendar, record keeping and marketing support. The extension session was focused on general extension delivery activities, and M&E tools.

2) 2nd ToT

The second ToT was conducted on land development, rice cultivation, farm management and support systems and extension. Topics treated under land development for the participants are water management, valley expansion, bunds management and repairs, and canal construction.

The rice cultivation training session included fertilizer management, observation of young panicles, heading dates, estimation of harvesting time, chemical control, disease, and pest management, weed control and quality seed production. The farm management and support systems session focused on reiterating the need for good record keeping and marketing support. Reporting and revised end-line surveys were added to the general extension training needs under extension for participants.

3) 3rd ToT

Finally, the third ToT was also conducted on land development, rice cultivation, extension and farm management and support system. The land development training session focused on bund construction/maintenance, land levelling, timeliness of land development and water control for minor cropping season. Rice cultivation training was focused on achieving better postharvest results. Thus, the training session was on moisture content measurement, bird scaring and timing of harvesting, yield components, harvesting and postharvest activities. The training session on farm management and support systems aimed at equipping participants with the necessary rudimentary skills on good field practices and cost saving. The extension training session equipped participants with the know-how to review activities of the preceding cropping season and to also budget for the succeeding cropping season.

In addition to rice cultivation and extension techniques, planning and budgeting issues were discussed in each ToT. Participants were also entreated to include their District rice extension budgets into their Districts Composite Budgets. At the end of the training, participants indicated an increase in their depth of knowledge on rice production.

After ToTs, MMDAs also conducted JT and OST at established demonstration plots. PCU monitored and backstopped the MMDAs training. PCU assisted each Cycle 2-3 MMDAs to establish a training plot. This training plot served as the learning centre for the MMDA. After the training, PCU monitored these training plots and other demonstration plots established by the MMDAs to backstop MMDAs activities.

4) Joint Training (ToT in MMDA)

PCU also developed a recommended timetable and points to be emphasized in presentations for MMDAs in Cycle 2 and 3 to follow during JTs. This helped the MMDAs to effectively plan and execute their JTs very well. Again, PCU also developed a comprehensive but concise JT material for the MMDAs. PCU observed that this helped the MMDAs to reduce the long hours that they used to have for JTs. Again, the comprehensive and concise material helped the officers being trained to comprehend what their trainers were teaching them.

PCU backstpped JTs of Cycle 1-3 MMDAs. At the training, AEAs were the participants. Trained DAOs served as resource personnel that carried out theoretical and practical training. In the first JT, seed selection by use of salt water and hot water seed treatment were demonstrated to the participants. At Sekyere South District, DDA invited the Agric. Master and two (2) students from Agona Senior High School to the training.

With second JT, observation of young panicles, which determine the time for third fertilizer application was taught and practiced at training. PCU intervened where DAOs could not facilitate very well in some topics. For instance, fertilizer calculation, Heron's formula, and Action plan preparation.

5) Site Selection

Site selection is a detailed process that involves assessing potential demonstration plot sites by PCU, DAD staff and farmers. During site selection, a checklist was used to interview the farmers in order to acquire information about the history and characteristics of the valley.

PCU joined target MMDAs to verify and confirm the selection of candidate valleys. Some criteria used in selecting valleys include but not limited to location, valley accessibility, availability of existing farmer group, level of group cohesion and nearness to the community. Again, relevant previous knowledge on rice cultivation by the group, women participation, valley flatness and water availability were considered.

6) On-site Training

On-Site Training is primarily meant to afford farmers and AEAs practical hands-on knowledge and skills. It is usually characterized by the presentation of pictorial flipchart training materials by DAD staff and PCU, followed by practical implementation of activities like bund construction, row planting with line drawer, moisture content determination, and many more. OST materials enable target and non-target farmers present to understand the activity and purpose of doing it.

At Kyeremfaso in Mampong municipal and Abrakaso in Sekyere South district, MCE, DCE and some Assembly staffs participated in the training respectively to have a firsthand practical feel and to encourage the participants. The presence of these officials boosted the working morale of the groups. PCU also observed that skills in the guideline such as hot water treatment, seed selection, row planting and timely fertilizer application are skills that farmers easily apply. Farmers, however, find it difficult to practice land development skills such as bunding and levelling due to its drudgery nature.

7) Baseline and end-line survey

AEAs during JT at their respective MMDAs were trained on the compilation of baseline and end-line using the M&E tools. PCU noticed lots of delays in the compilation and submission of both baseline and end-line information from the beneficiary MMDAs.

All AEAs were trained on how to fill the baseline and end-line Survey forms. During the JTs, a practical session for AEAs to try to complete the forms was done. All AEAs were to submit the completed forms to DAO at the end of the first quarter. The baseline survey would assist in understanding the situation of farmers before the intervention or introduction to the technology. The end-line survey would also help PCU understand the farmer situation after the technology was introduced.

(2) Demonstration plot

Demonstration plots are established and utilized for on-site training for farmers. The yield of demonstration plots every year is shown below.

Table 19 Demonstration plot Performance in Ashanti

Year	Cycle	District	Community	Variety	Yield (t/ha)
2017	1	Atwima Mponua	Kwankyeabo	Agra	4.2
			Nyameyehene	Agra	5.3
			Manukrom	Jasmine 85	4.3
		Ahafo-Ano North	Asuhyiae	Agra	4.7
			Nkyensedaho	Agra	6.3
			Mmeredane	Agra	5.4
		Adansi South	Obonsu	Agra	4.8
			Kramokrom	Agra	4.0
			Feneye	Agra	5.0
		Adansi North	Fumso	Agra	6.1
			Kusa	Agra	2.7
			Pipiiso	Agra	6.0
		Asante Akim North	Bresaa	Agra	5.1
			Nyamebikyere	Agra	5.8
			Agyarho	Agra	6.0
Nhyiaeso	Agra		3.2		
2018	2	Afigya Kwabre	Tetrem	Agra	4.3
			Pampatia	Agra	3.6
		Amansie West	Nanhini	Agra	6.0
			Antoakrom	Agra	5.3
		Asante Akim South	Kokoado	Agra	5.7
			Bankame	Agra	4.4
		Ejura Sekyedumase	Miminaso	Agra	5.7
			Kwaseakan	Agra	4.5
			Asumen	Agra	3.6
			Samari Nkwanta	Agra	3.8
		Offinso North	Kobreso	Agra	6.3
			Asuoso	Agra	5.9
			Asempaneye	Agra	4.2
		Sekyere Central	Aframso	Agra	6.0

Year	Cycle	District	Community	Variety	Yield (t/ha)
2019	3	Amansie Central	Amoamang	Agra	2.4
			Kente	Agra	5.88
			Esaase	Agra	3.36
		Mampong	Kyeremfaso	Agra	6.22
			Woraso	Agra	3.91
			Bunuso	Agra	6.43
		Sekyere Afram Plains	Boffosur	Agra	4.43
			Dorobonso	Agra	9.60
		Sekyere East	Ntonkumso	Agra	4.00
			Sanigya	Agra	4.20
			Brofoyedru	Agra	3.78
			Attakrom	Agra	2.10
		Sekyere Kumawu	Dadease	Agra	7.20
			Sekyere	Agra	3.60
			Banko	Agra	8.40
		Sekyere South	Abakaso	Agra	4.21
			Wiamoase	Agra	1.68
Tano Odumase	Agra		3.36		
Akrafonso	Agra		2.52		
Agona	Agra		2.52		
Afamanaso	Agra		1.68		

Table 20 Performance of Demonstration Plots in Northern

Year	Cycle	District	Community	Variety	Yield (t/ha)
2017	1	East Gonja	Chito-N'kwanta	Jasmin 85	3.2
			Mion	Sanzhee	AGRA
		Sagnerigu	Kukpehi	AGRA	1.7
			Garizegu	AGRA	2.1
			Sishawu	AGRA	2.3
			Damabkoyili	AGRA	2.1
		West Mamprusi	Tinguri	AGRA	6.8
2018	2	Kumbungu	Gbulung	AGRA	1.4
			Kpegu	AGRA	2.5
			Kumbung-Kukuo	AGRA	3.4
		Chereponi	Nyangbadi	AGRA	3.8
			Mayamam	AGRA	5.0
			AndoKajura	AGRA	2.9
		Savelugu	Duko	AGRA	4.6
			Boggu	AGRA	5.5
			Dingoni	AGRA	3.4
		East mamprusi	Wundua	AGRA	5.7
			Tunni	AGRA	5.9
		Gushiegu	Kpatili	AGRA	3.4
			Nayilifong	AGRA	4.6
			Boggu	AGRA	2.5
			Zinindo	AGRA	4.1
			Sampebga	AGRA	3.7
		Yendi	Zang	AGRA	5.0
Zakoli	AGRA		4.6		
2019	3	Central Gonja	Wambong	AGRA	2.73
			Alipe	AGRA	2.10
			Torope	AGRA	1.68
			Chanpe	AGRA	1.26
			Sankunpe	AGRA	2.04

Year	Cycle	District	Community	Variety	Yield (t/ha)
		Karaga	Kpataribogu	AGRA	3.99
			Namburugu	AGRA	3.15
			Malgunayili	AGRA	5.04
			Shellilanyili	AGRA	3.99
		Tolon	Tibogunayili	AGRA	5.46
			Kasulyili	AGRA	2.21
			Yipelgu	AGRA	1.58
		Zabzugu	Nakohugu-fong Zabzugu	AGRA	3.57
			Sabare No. 2	AGRA	3.99
			Mogneigu	AGRA	3.36
			Kukpalgu	AGRA	2.52

(3) Other Activities

1) Rapid Value Chain Survey in 2017

A short-term expert conducted a rapid survey on the rice value chain, gender and nutrition between 2-12 and 13-26th August 2017 in Ashanti Region and Northern region, respectively. The purpose was to identify the actual living conditions, gender and nutrition of the target farmers in Ashanti and Northern regions. It was also to identify the actual condition of the local rice value chain in the project areas and extract the issues, and finally to find out the activities related to the value chain, gender and nutrition that can be introduced in the project's activities.

Some of the possible actions to be taken by the project to address some of the outcomes include improvement in TOT training for better farm management that is appropriate to farmers' capacities. Below are the outcomes of the rapid survey.

Table 21 Outcome of the Rapid Survey

Key Indicator	Outcome	Direction of project activity
Gender	<ul style="list-style-type: none"> Male family members manage a household budget. Female farmers also rent and manage rice field or farmland. Male and Female farmers are helping farming work each other. Without distinction of gender, the person who has a right to farmland management has all the responsibilities and rights regarding to cultivation and sale. Much of wife's income is used for household management such as daily meals and education for their children. 	<ul style="list-style-type: none"> Further participation of women with land ownership in training.
Nutrition	<ul style="list-style-type: none"> Farmers have basic knowledge of nutrition since health center and hospitals educate them. However, Meals at the community level are mainly lipids and carbohydrates. Not enough intake of vegetables, animal protein, iron and calcium. However, farmers are possible to eat three times a day throughout the year, not particularly serious situation. 	<ul style="list-style-type: none"> There is no particular plan of the activities for improving nutrition in Ashanti region.

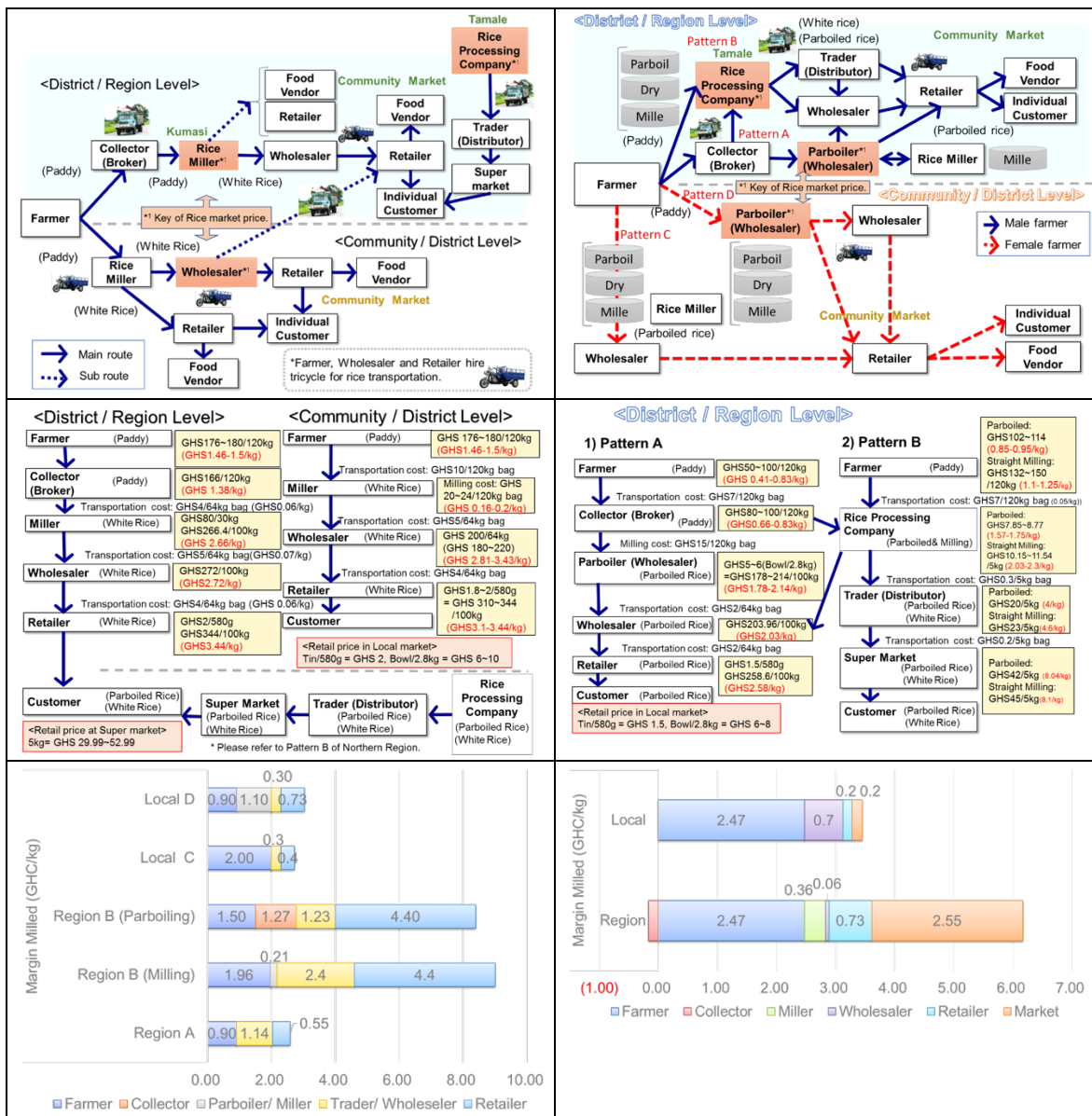


Figure 10 Findings: Supply Chain, Value Chain and Profit Margin

Ashanti (left) and Northern (right)

(2) Nutrition Survey in 2019

Verification survey on the effect of introducing parboiled rice dishes for nutrition improvement in the Northern region was carried out from October to December 2019. Details as follows.

Table 22 Nutrition Survey

Title	Nutrition Survey
Area	Mion, Yendi, North-East Gonja MMDAs
Community	Total of 9 communities (3 communities per MMDA)
Target	Total of 90 female farmers (10 female farmers per community)
Method	1. Demonstration of rice recipes (parboiled rice porridge and parboiled rice TZ) 2. Questionnaire survey on consumption of parboiled rice (baseline) 3. Monitoring 4. Questionnaire survey on consumption of parboiled rice (end-line)

1) Demonstration of rice recipes (parboiled rice porridge and parboiled rice TZ)

Recipes of parboiled rice porridge and parboiled rice TZ were introduced and demonstrated to female farmers in the target communities.

2) Consumption of parboiled rice (baseline, monitoring and end-line)

A questionnaire survey was conducted to capture the changes in rice consumption after the rice recipes demonstration. Rice consumption has increased and been diversified by introducing rice flour porridge and rice TZ as a regular menu.

3) Nutritional analysis

Nutritional contents of main staple foods (porridge (parboiled rice flour, parboiled rice flour with soy, corn dough), TZ (parboiled rice flour, maize, and boiled yam) were analyzed.

Table 23 Nutrition Analyzed

Target nutrients	Remarks
Thiamin (Vitamin B ₁)	Effective to prevent beriberi
Niacin (Vitamin B ₃)	Effective to prevent pellagra
Folate (Vitamin B ₉)	Effective to prevent fetal growth restriction
Iron	Effective to prevent anemia
Copper	Effective to prevent anemia
Protein	Insufficient in rural areas of whole Ghana

As shown in the figure below, parboiled rice dishes include more nutrients than maize dishes. It is implied that parboiled rice dishes can be alternatives to maize dishes with sufficient nutrients.

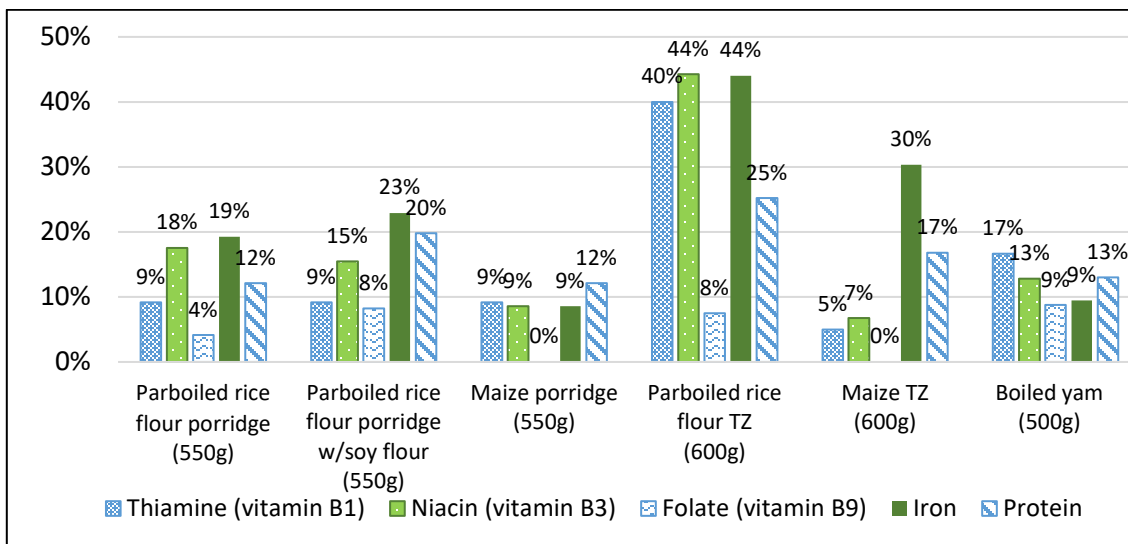


Figure 11 Results of Nutritional Analysis

3.2.3 Activities for Output 3: M&E

(1) M&E Workshop and follow-up training on TOT

M&E workshop was held to fine-tune the M&E tools drafted so far and to synchronize it with existing MoFA M&E system and to facilitate the M&E activities of the district rice extension plan for DAOs, AEAs, and Regional Agriculture Officers (RAOs). Simplified and user-friendly M&E tools were proposed.

Each of the Cycle 1 districts went through all proposed form of M&E tools such as planning, implementation, monitoring and evaluation. The M&E tools introduced can expedite the implementation and achievement of the targets set in the district rice extension plan, which can contribute to the better livelihood of rice farmers in the districts.

The District Agriculture Department compiles the report as AEA submits to DAO. The DAO verify the reports for onward submission to MIS officer for compilation and submission to DDA. The DDA submits the report to the District Assembly with a copy submitted to the region.

In the M&E workshop, participants were taken through the outline of the rice extension plan, outline of existing M&E and project monitoring and proposed M&E tools. Participants were also put into groups to brainstorm on how to introduce project monitoring into actual practice on the field. Their inputs were incorporated into the draft document. Based on their inputs, PCU developed M&E Tool version 1. The main monitoring items are shown in the table below. M&E activities were undertaken with M&E Tool version 4.

Table 24 Contents of M&E tools

Format	Contents
Format 1: District Extension Plan	Extension planning
Format 2: District Quarterly Report	Progress of budgeting and activities.
Format 3: AEA Report	Progress of activities in communities
Format 4: Demo-Plot Action Plan and Monitoring	Demonstration plot planning and progress
Format 5: Farmer Monitoring	Farmers' baseline and end-line data.
Format 6: Annual Report	Annual reporting

(2) Monitoring Activities

M&E activities were conducted in 2017, 2018 and 2019 with utilizing M&E revised based on the experience of the previous year. District officers utilized the data collected with M&E Tool for reporting to MMDA and MoFA.

Table 25 Overview of M&E Activities

Year	M&E Activities	District
2017	M&E in line with M&E Tool ver.1	Capacity building of 10 districts in Cycle 1
2018	M&E in line with M&E Tool ver. 2	Capacity building of 12 districts in Cycle 2 Follow up of 10 districts in Cycle 1
2019	M&E in line with M&E Tool ver. 3	Capacity building of 10 districts in Cycle 3 Follow up of 22 districts in Cycle 1 & 2

(3) Review of M&E Tool, Improve M&E Tool

M&E Tool was revised every year through learning from the experience in the previous year. With improved M&E Tool, M&E training was conducted.

Table 26 Overview of M&E Training

Year	Output	Challenges	Improvement
2017	<ul style="list-style-type: none"> The capacity of M&E for district officers are improved. Utilizing M&E results, district officers reported to MMDA and MoFA. 	<ul style="list-style-type: none"> Submission of Quarterly report. Data collection of individual farmers. M&E Format of MoFA followed MAG (Modernization of Agriculture in Ghana) formats. 	<ul style="list-style-type: none"> Submission of quarterly report at technical committee. Alignment to MAG format. But differentiate from it by focusing on farmers' outcome such as yield increase. Further simplification to 4 formats.
2018	<ul style="list-style-type: none"> Quarterly report submission is improved. Farmer level information is collected. 	<ul style="list-style-type: none"> Collection of farmer level information for follow-up districts is challenge. Many mistakes are found. 	<ul style="list-style-type: none"> To reduce mistakes, auto-processing system is developed. M&E workshop with utilizing PC for capacity building of M&E .
2019	<ul style="list-style-type: none"> Collection of farmer level information was improved for follow-up districts. 	<ul style="list-style-type: none"> Challenges in conducting end-line survey, delay of submission, and data keeping mistakes. 	<ul style="list-style-type: none"> Further simplification of farmer monitoring sheet. Improvement of auto-processing formats.

Monitoring flow with revised M&E Tool is as shown in the figure below.

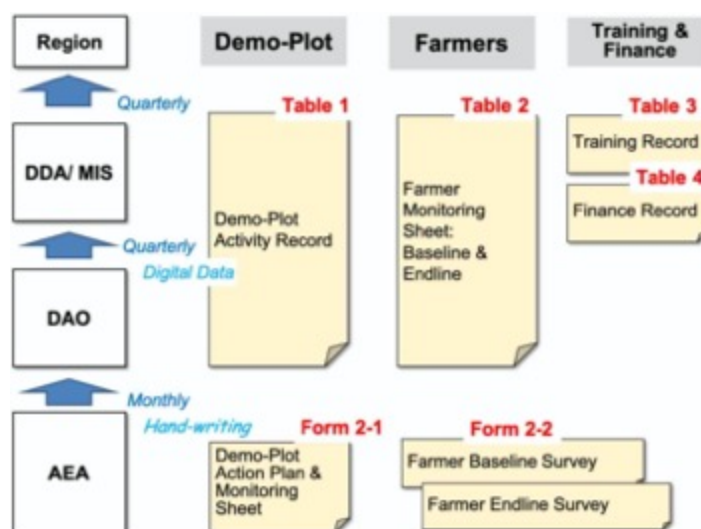


Figure 12 Monitoring Flow with M&E Tool

3.2.4 Activities for Output 4: Guideline

(1) Revision of Materials: Introduction of Rice Cultivation New Technologies

The following four new rice cultivation technologies were proposed and approved by the Technical Committee and the Steering Committee. They and were demonstrated and taught during the direct guidance in the cycle support target MMDAs.

Table 27 List of New Technologies Introduced in the Project Phase 2

Introduced technology	Year	Outlines
Hot Water Seed Treatment	2017	Introduce to eliminate rice blast and other seed-borne pathogens. A sustainable technology that leads to reduced use of pesticides is safe for human health and the environment, and is economical.
Split Fertilizer Application (number of fertilizer application, young panicle observation)	2017	The fourth fertilizer application is very small and difficult to spread evenly, so very few farmers actually apply it. The timing of the third application is determined by observation of the young panicles.
Determining of harvesting date by cumulative average temperature	2017	One of the criteria for determining the harvesting date was the date when the cumulative average temperature reached 950°C after panicle emergence. This is more objective than judging by the colour of the paddy and eliminates the need for a moisture meter, which is necessary for judging the moisture content of the paddy.
Application of rice husk charcoal to seedling beds	2019	Rice husk charcoal is used in place of the soil covering at the time of sowing to make a seedling bed for transplant cultivation. The soil is softened, and the rooting process is improved, resulting in strong, better quality seedlings.

(2) Revision of Materials on Farm Management System Support

Farm management and support systems materials are revised and added such as what is marketing, connecting farmers to buyers and good practices to increase profit. Also, PCU has introduced value chain questionnaires to enable DAOs and AEAs to confirm the situation about farmers' farm management, sales of rice and challenges on VC easily. Training materials on enhancing MMDAs awareness of the value chain was also revised. For the northern region, flip chart slides were prepared for good practices of tractor access improvement.

(3) Nutrition Improvement Activities

New technology was introduced in improved parboiling method and utilization of parboiled rice for nutritious dishes in collaboration with WIAD.

In the area of improved parboiling, the FMSS unit compared false bottom to a conventional method. PCU hypothesized that by ensuring that paddy rice is not submerged in water during the steaming process, more nutrients could be retained in the rice grain. At the end of the experiment, rice grain was analysed at a laboratory in Japan. Parboiled rice has higher nutritional contents than non-parboiled rice. However, no significant difference was found in the area of nutritional components of the rice grain from the two parboiling methods.



Figure 13 Improved Method of Parboiling Rice

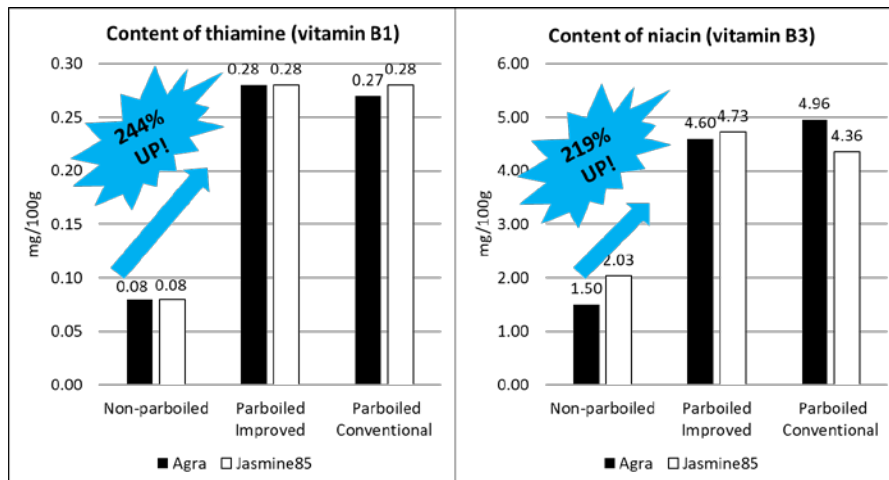


Figure 14 Comparison of Nutrients in Parboiled and Non-Parboiled Rice

On the introduction of nutritious rice dishes, meals like rice T.Z., rice “yama”, rice porridge, “farmers’ rice” and many more were prepared and served to farmers at Duko community for tasting and assessment in 2018. At the end of the event, the majority of participants were much impressed with the rice porridge and that recipe was adjudged the best for that day.

In 2019, the project conducted a nutrition survey with the aim of assessing the consumption of locally produced parboiled rice as well as establishing the general dietary behaviour of some respondents in the three MMDAs in the Northern region. In addition to the survey, two rice recipes (parboiled rice T.Z and parboiled rice porridge) were introduced to 9 communities within the MMDAs. Considering the level of success of this pilot rice recipe demonstration and the result of nutrition analysis of parboiled rice dishes, Japanese experts recommended the inclusion of the rice recipes in the rice extension guideline and/or training materials.

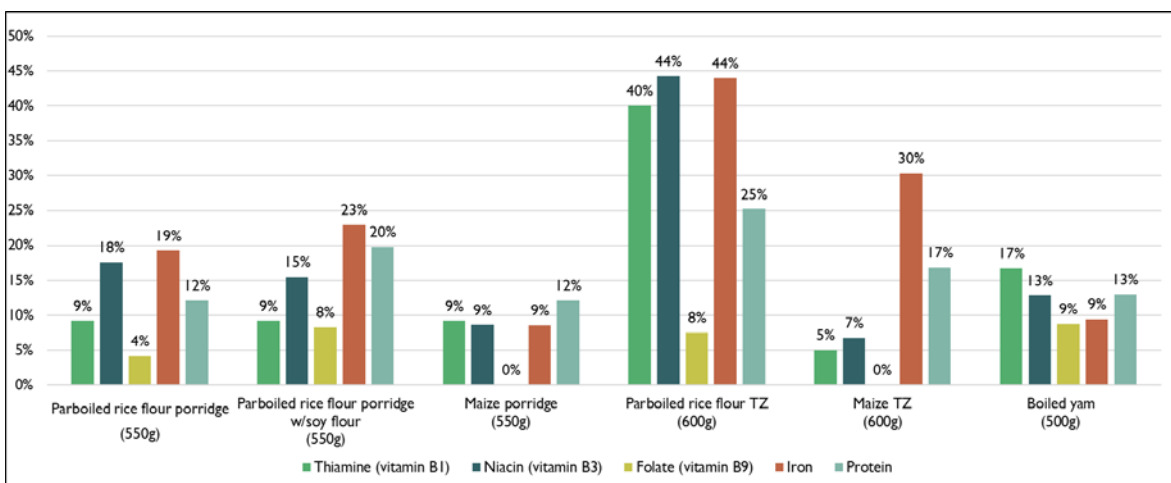


Figure 15 Comparison of Nutrient in Parboiled Rice Flour and Maize Porridge and TZ

(4) Preparing Technical Handbook

Rice Cultivation Handbook was developed in March 2019 and distributed to all AEAs in Cycle 3 MMDAs. The handbook aims at AEAs as main users and is being compiled as pictorial materials for OST into one booklet so that AEA can refer to the handbook anytime he/she trains rice farmers.

(5) Fine-tuning Guideline

Based on the learning from the previous experience, training materials had been revised every year. Additional techniques such as hot water treatment, accumulated temperature and young panicle observation were introduced. Supplemental materials such as Extension Handbook and flipchart were also developed. Through the experience, fine-tuned Guideline was drafted and presented at Technical Committee and Steering Committee in early 2020.

3.2.5 Other Activities

(1) Farmers Day

The project joined the Regional stand at the national farmers' day Regional focus exhibition event every year. In 2019 it was hosted in Ho at the Jubilee Park, Volta region. All four Regions that the project covers had PCU representation for the regional focus event. Freshly harvested paddy rice of optimum moisture level was purchased from the demonstration plots in the various MMDAs and processed into straight-milled and parboiled rice for exhibitions. The PCU displayed a pull-up banner with information on how to produce rice with improved rice production technologies.

The quality of milled rice exhibited attracted a lot of participants to the stand. A new technology: the use of Biochar was also demonstrated at the event. The PCU branded T-shirts were also distributed to the various MMDAs and departments for the farmers' day celebrations.

(2) Japanese Ambassador's Visit in 2017

The Japanese Ambassador to Ghana visited the Northern Regional project office on 30th January 2017. His Excellency was briefed on the project activities for phase one and phase two. He was then sent to Sagnarigu district in Sanga community, where he interacted with farmers and moved to the field to observe the field condition. The media team which came with the ambassador interviewed the schedule officer and the rice cultivation counterpart.

(3) ODA Reporters' Visit in 2017

Japanese reporters who were also ordinary citizens visited the project office in Kumasi on the 24th of October 2017. The ten (10) member team was accompanied by three (3) staff of the JICA Ghana office. After a brief meeting with the Regional Director of Agriculture on the status of the Tensui project in the Ashanti Region, PCU led the team to Ahafo Ano North district and to Mmeredane demonstration plot and interacted with group farmers on the project. And also, to discuss how farmers are practicing the techniques learnt from the project as well as the challenges faced by farmers. Farmers expressed satisfaction with the project activities and positive impact on their social life.

(4) JICA Country Representative's Visit in 2017

The JICA country representative visited the project office in Northern Region on 6th November 2017.

He was taking to the project demo at Shishagu community under Sagnarigu district. Later he was briefed by the schedule officer of the project on activities of phase one and two.

(5) Visit of Liberian Mission in 2019

A team from Liberia visited the PCU office in Ashanti and Northern regions to acquaint themselves with the technologies disseminated to farmers under the Tensui 2 project. The Liberian team was led by the staff of FAO and supported by the staff of DCS. PCU presented ecological and geographical similarities between Ghana and Liberia in terms of rice production. It also covered project approach and achievements, project technologies, success stories, extension guideline, sustainability, to mention but a few. The Liberian team was very impressed with the MoFA/ JICA's achievements and a lot of discussions was done after the presentation. On the following day, the Liberian team was taken on a field visit to Kpataribougu Training Plot in Karaga district, then to SARI Office and finally to SARI's seed trial fields at the Golinga Irrigation Scheme.

(6) Collaboration with AGRA funded Rice Project

PCU collaborated with the Agra PFJ project on public-private partnership (Rice chapter) to train DAD that is not part of the target MMDAs of the project. 12 MMDAs that are not part of the target MMDAs of the project was trained with the rice production guidebook.

3.3. The Third Period (2020-2021)

3.3.1 Activities for Output 1: Planning & Budgeting

(1) Support planning & budget release for Cycle 4 and newly established MMDAs for Budgeting

From the beginning of the Tensui 2 Project, PCU identified a difficulty by most DADs to access funds. As a result of this, PCU has made various efforts to support DADs in their quest towards securing funds. As part of these efforts, PCU in Ashanti and Northern regions visited MMDCEs/ MMDCDs and Assembly staff (District Planning Officers (DPOs), Budget Officers (DBOs) and Finance Officers (DFOs)) in Cycle 4 MMDAs. PCUs also made necessary follow-up and advice to Cycle 4 MMDAs and newly established MMDAs during a technical committee meeting and quarterly review meetings for all cycle districts to discuss planning and budget releases issues. It was important for the DADs to access funds to conduct ToT in district and OSTs in the demonstration plots using their allocated funds in order to ensure the sustainability of their rice extension activities.

PCU has taken the following actions to address the challenges.

- Less interaction by DDA with DCD/DCE: PCU is providing support to DDA to explain the importance of supporting Rice extension to DAD. Also, sensitization of DDA to use alternative means of explaining rice extension to DCE's; e.g. visiting DCE at less busy times, including weekends etc.
- Too big amount of Memo delays release: TIPS or advice on how DDAs should work in DA for budget release (e.g. in setting budget ceilings at the beginning of the year and preparing Memo for a budget release.)

- GIFMIS system requirements delay release: DDAs full understanding of the system would facilitate in timing of submitting Memos.
- DCE/DCD do not want to give government funds in addition to MAG sometimes: DDAs need to fully explain the unsustainability of donor funding and rather rely of more sustainable means of supporting rice extension activities.

(2) Follow-up Services of all Cycle and newly established MMDAs for Budgeting

The follow-up activity is to check on the progress of implementation and outputs systematically. Agricultural activities are time-bound, so it is important for the timely and early release of funds to conduct ToT in MMDAs and OSTs and the setting up of demonstrations plots by MMDA's.

Due to the Covid-19 pandemic, most funds of the District assemblies were channelled to the Health sector of the district. However, DAD's made efforts to obtain funding for rice extension activities. Since all districts had planned on the needed budget for their activities, memos were submitted to the Assemblies timely. Also, some districts tried to source funding from alternative sources like input dealers or PFJ to start rice extension activities.

Result of Accessing funds

As a result of the activities to support planning and budget release, most of the MMDAs managed to access several sources of funds for rice extension. It should be noted as well that four MMDAs secured the government source of the fund even under severer financial constraints. The districts were Afigya Kwabre North district (Cycle 2), Bekwai municipality (Cycle 4) Nanton and Savelugu.

Table 28 Result of Access to Funds (Cycle 1 and 2 MMDAs, Ashanti Region in 2020)

MMDAs	Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)					
				Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer	
Cycle 1 MMDAs	ADANSI NORTH	10,700	10,700	100%	0	0%	0	0	0	10,700	100%	0	0	10,700
	ADANSI SOUTH	7,000	7,000	100%	0	0%	0	0	0	7,000	100%	0	0	7,000
	ADANSI ASOKWA	15,610	15,610	100%	0	0%	0	0	0	15,610	100%	15,610	0	0
	AHAFO ANO NORTH	0	8,550	-	0	0%	0	0	0	8,550	100%	8,550	0	0
	ASANTE AKIM NORTH	1,000	1,000	100%	0	0%	0	0	0	1,000	100%	1,000	0	0
	ATWIMA MPONUA	7,180	7,180	100%	5,000	100%	5,000	0	0	2,180	30.4%	2,000	180	0
	Cycle 1 Average	6,915	8,340	100%	833	0	833	0	0	7,507	88.4%	4,527	30	2,950

Note: DACF: District Assembly Common Fund, IGF: Internally Generated Fund, PFJ: Planting for Food and Jobs

MMDAs		Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
					Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
Cycle 2 MMDAs	AFIGYA KWABRE SOUTH	700	700	100%	0	0%	0	0	0	700	100%	700	0	0
	AFIGYA KWABRE NORTH	5,000	5,000	100%	5,000	100%	0	5,000	0	0	0%	0	0	0
	AMANSIE WEST	6,000	6,000	100%	0	0%	0	0	0	6,000	100%	5,000	1,000	0
	ASANTE AKIM SOUTH	7,971	7,971	100%	0	0%	0	0	0	7,971	100%	7,971	0	0
	EJURA SEKYEDUMASE	7,220	3,000	41.6%	0	0%	0	0	0	3,000	100%	0	0	3,000
	OFFINSO NORTH	4,700	4,700	100%	0	0%	0	0	0	4,700	100%	4,700	0	0
	SEKYERE CENTRAL	9,912	0	0%	0	0%	0	0	0	0	0%	0	0	0
	Cycle 2 Average	6,801	4,445	73.6%	833	16.7%	0	833	0	3,612	66.7%	2,945	167	500

MMDAs		Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
					Total	% Total Expended	GoG	DAC F	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
Cycle 3 MMDAs	AMANSIE CENTRAL	7,215	5,029	69.7%	0	0%	0	0	0	4,574	100%	0	0	4,574
	MAMPONG	3,400	3,400	100%	0	0%	0	0	0	3,400	100%	0	0	3,400
	SEKYERE AFRAM PLAINS	31,000	3,000	9.7%	0	0%	0	0	0	3,000	100%	0	0	3,000
	SEKYERE EAST	2,000	1,850	92.5%	0	0%	0	0	0	1,850	100%	1,850	0	0
	SEKYERE KUMAWU	1,500	1,500	100%	0	0%	0	0	0	1,500	100%	1,500	0	0
	SEKYERE SOUTH	6,359	6,359	100%	0	0%	0	0	0	6,359	100%	0	0	6,359
	Cycle 3 Average	8,579	3,523	79%	0	0%	0	0	0	3,447	100%	558	0	2,889

Table 29 Result of Access to Funds (Cycle 1, 2 and 3 MMDAs, Northern, North East and Savannah Regions in 2020)

MMDAs		Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
					Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
Cycle 1	EAST GONJA	8,596	2,596	30%	0	0%	0	0	0	2,596	100%	2,000	596	0
	MAMPRUGU MOADURI	203,479	4,500	2%	0	0%	0	0	0	4,500	100%	4,500	0	0

MMDAs	Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
				Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
MION	203,696	2,000	1%	0	0%	0	0	0	2,000	100%	2,000	0	0
NORTH EAST GONJA	5260	5,260	100%	0	0%	0	0	0	5,260	100%	5,260	0	0
SAGNERIGU	183,000	21,250	12%	16,250	76%	3,250	12,000	1,000	5,000	24%	5,000	0	0
TAMALE	1,792	1,792	100%	0	0%	0	0	0	1,792	100%	1,792	0	0
WEST MAMPRUSI	9,538	1,488	16%	0	0%	0	0	0	1,488	100%	1,488	0	0
Cycle 1 Average	87,909	5,555	0	2,321	11%	464	1,714	143	3,234	1	3,149	85	0

MMDAs	Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
				Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
CHEREPONI	5,059	5,059	100%	0	0%	0	0	0	5,059	100%	5,059	0	0
EAST MAMPRUSI	183,093	3,830	2%	0	0%	0	0	0	3,830	100%	3,830	0	0
GUSHEGU	13,450	162	1%	0	0%	0	0	0	162	100%	3,450	0	162
KUMBUNGU	2,564	1,014	40%	0	0%	0	0	0	1,014	100%	1,014	0	0
NANTON	180,498	3,597	2%	0	0%	1194	0	0	3,597	100%	3,061	0	536
SAVELUGU	6,365	6,365	100%	0	0%	0	0	0	6,365	100%	6,365	0	0
YENDI	80	80	100%	0	0%	0	0	0	80	100%	80	0	0
Cycle 2 Average (NR)	55,873	2,872	0	0	0	171	0	0	2,872	1	3,266	0	100

MMDAs	Grand Total Budgeted	Grand Total Expended	%	Expenditure (Government Source)					Expenditure (Other Source)				
				Total	% Total Expended	GoG	DACF	IGF	Total	% Total Expended	Donor	PFJ	Input Dealer
KARAGA	1,216	1,216	100%	0	0	0	0	0	1,216	100%	1,216	0	0
CENTRAL GONJA	2,200	2,200	100%	0	0	0	0	0	2,200	100%	2,200	0	0
TOLON	6156	6,156	100%	0	0	0	0	0	6156	100%	6156	0	0
ZABZGU	159,361	7,500	4.7%	0	0%	0	0	0	7,500	100%	7,500	0	0
Cycle 3 Average (NR)	42,233	4,268	76.2%	0	0	0	0	0	4,268	1	4,268	0	0

Results of demonstration plots establishment

As a result of such efforts in output 1, 181 demonstration plots were established in target MMDAs.

Table 30 Number of Demonstration Plots Established (Cycle 1, 2, 3 and 4 Ashanti Region in 2020)

Cycle 1	MMDAs	Adansi North	Adansi South	Asante Akim North	Atwima Mponua	Ahafo Ano North	Adansi Asokwa		Total
	No. of Demonstration Plots	4	14	4	9	9	2		42
Cycle 2	District	Afigya Kwabre South	Amansie West	Asante Akim South	Ejura Sekyedumase	Offinso North	Sekyere Central	Afigya Kwabre North	Total
	No. of Demonstration Plots	2	5	12	4	10	5	12	50
Cycle 3	District	Amansie Central	Mampong	Sekyere Afram Plains	Sekyere East	Sekyere Kumawu	Sekyere South		Total
	No. of Demonstration Plots	3	3	4	3	1	5		19
Cycle 4	District	Atwima Nwabiyaga Muni.	Atwima Nwabiyaga North	Bekwai	Bosome Freho				Total
	No. of Demonstration Plots	4	5	12	4				25
Grand Total									136

Table 31 Number of Demonstration Plots Established (Cycle 1, 2 and 3 Northern, North East and Savannah Regions in 2020)

Cycle 1	MMDAs	East Gonja	Mion	Sagnerigu	Tamale	West Mamprusi	Mamprugu Moaduri		Total
	No. of Demonstration Plots	3	2	4	1	1	3		14
Cycle 2	District	Chereponi	East Mamprusi	Gushegu	Kumbungu	Savelugu	Yendi	Nanton	Total
	No. of Demonstration Plots	5	3	6	1	4	1	3	23
Cycle 3	District	Karaga	Central Gonja	Tolon	Zabzugu				Total
	No. of Demonstration Plots	4	3	2	8				17
Grand Total									54

3.3.2 Activities for Output 2: Extension

(1) Training of Trainers

According to the rice extension guideline, ToT in a region was held. The summary is shown below.

Table 32 Training of Trainers (Ashanti Region and Northern Region)

Title		1st ToT	2nd ToT	3rd ToT
Date	Ashanti	Voice PPT (distributed in May 2020)	7 th -8 th June 2020	8 th - 9 th September 2020
	Northern	Voice PPT (distributed in May)	Follow-up visits to MMDAs	Follow-up visits to MMDAs
Purpose		<p>To provide a training of trainers for DDAs, DAOs and AEAs of Cycle 4 MMDAs (AR only) and newly established MMDAs for the major season, and to improve their problem-solving capacity on the challenges they are encountering.</p> <p>To review the progress of activities in the 1st and 2nd ToTs as well as how to use M&E tools</p>		
Participants		RAO (Crops, Extension, M&E, PPRSD, Engineering, WIAD), DDAs, DAO-Crop, DAO-Extension, MIS, AEAs		

The training of trainers in the region was organized for selected DAOs from Cycle 4 municipals/districts to equip them with land development techniques, rice cultivation techniques, farming support system and extension activities. This was to enable them to have knowledge and transfer it to their colleagues at the district level and the farmers in the communities.

The training was conducted on three different phases based on the kind of farming activities to be carried out on the farm. The 1st TOT was in the form of Virtual training for the Cycle 4 MMDAs This was a result of COVID-19 protocols, which restricted social gathering like meetings, workshops seminars within the period.

PCU organized second and third ToTs at the regional office for cycle 4 MMDAs while observing COVID-19 safety protocols. The training was conducted in two days, and 2 MMDAS were invited at the first day and the other 2 MMDAs on the second days to observed social distancing. Also, PCU made available PPEs for the participants at the training. At the training, relevant topics related to second and third ToTs were treated. PCU advised MMDAs to conduct district ToTs in order to train other staffs who could not benefit from the regional ToT.

(2) Support Training of Trainers (ex-Joint Training) and On-Site Training in MMDAs

The districts organize the Training of Trainers in the district (ex-joint training), which trains the rest of DADs staff. This is then followed by on-site training (OST) on the training plot established by MoFA/ JICA and the other demonstration plots established by MMDAs where Agricultural Extension Agents (AEAs) and key farmers are grouped for practical trainings. Under the severe restriction of movement and contact under the pandemic, PCU decided to concentrate its support and follow-up on OST.

On-Site Trainings

Amidst of the restriction and impact by the pandemic to some extent, training was delayed. However, PCU managed to establish training plots in cycle 4 MMDAs and trained DAOs, AEAs and group farmers.

To avoid infection of the disease, the PCU considered necessary measures at each on-site training.

The group farmers separated into two groups for each plot to reduce the number of participating farmers and keep social distancing and spent two days for each separated group in some OST instead.

For example, the OST 1 needs labour for land development generally. Therefore, instead of reducing the number of participants, the PCU separated group farmers into two and train each of them in two days and develop lands in two days. In such heavy work, it is difficult for participants to mind the social distance. Therefore, PCU ask participants to stretch their arms for social distance. On the other hand, PCU completed OST 2 for transplanting in one day by training in two batches on the same day, while transplanting practice was done with a smaller number of people and social distance. Harvesting, hauling and threshing were done in two days, using the two separate staff and group farmers. This time, the postharvest loss was minimized as a result of both PCU and MMDAs providing bigger size tarpaulins for harvesting activities.

Members were provided with nose masks, veronica buckets with water, liquid soap and tissues were made available for handwashing protocol at the training ground. A summary of measures taken for each OST is shown below.

Table 33 Measures Taken for OST under COVID-19 Pandemic

OST	No of days	Measures taken
OST1 (Seed Selection and Nursery Bed Preparation)	2	PCU trained two separate staff and group farmers in two days. On first day, group one trained on Seed preparation and hot water treatment. On nursery bed preparation, first group worked on one and half beds of the three beds demarcated with area dimension of 1.5m width by 8m length. On day two, the second group were taken through same training.
OST2 (Land Development)	2	PCU trained two separate staff and group farmers in two days. On the first day PCU measured 25m by 40m as the training plot dimension. Plot further divided into two equal sizes. First group trained on manual and mechanical ploughing, bund construction, puddling and levelling on a portion. The second group received same training on the following day.
OST3 (Transplanting)	2	PCU trained two separate staff and group farmers in two days. First group trained on seedlings uprooting, washing of basal soil and transplanting of seedlings. The group transplanted seedlings with planting distance of 30cm by 10cm on the half plot. On day two, second batch received same training and carried same activities.
OST4 (1 st Fertilizer Application)	1	PCU trained two separate staff and group farmers in measurement and application of fertilizer (20kg NPK). Each group took their turn to apply 10kg quantity of the fertilizer in batches.

OST	No of days	Measures taken
OST5 (Harvesting)	2	PCU trained two separate staff and group farmers in two days. PCU demonstrated to the group farmers on removal of Bed scaring net, cutting of rice straws by use of Sickles, fixing of Bambam box and threshing with the box. Group one carried out these activities on first day while group two farmers participated on the second day. PCU provided additional Sickles, Bambam box and Tarpaulin to support the groups in the harvesting.
All OST	-	Preventive measures against infection (provision of nose masks, veronica buckets with water, liquid soap and tissues, keep social distance by stretching arms)

PCU encountered some challenges due to COVID 19 restriction. These challenges include PCU unable to visit MMDAs to backstop the first districts ToT in seed preparation and action plan preparation that was crucial to have a good start of the training plots. Again, the timing of the second and third ToTs were delayed because of the pandemic. Third ToT was so close to harvesting in the MMDAs. One training plot faced a challenge of low yield as a result of insect attack and improper usage of a sprayer by a farmer.

PCU trained AEAs to conduct a baseline survey for group members. PCU provided necessary advice on rice cultivation techniques and how to extend these techniques to their individual farms. Again, PCU advised the cycle 4 MMDAs to establish additional demonstration plots.

Establishment of Demonstration Plots (Cycle 4)

With assistance from PCU, one (1) training plot was established in each Cycle 4 MMDAs. These MMDAs also established a total of twenty-one (21) additional demonstration plots. This brings the total of training and demonstration plots established to twenty-two (25). Bekwai Municipality and Atwima Nwabiagya North established five (5) demonstrations in addition to the training plot, respectively. Atwima Nwabiagya Municipal and Bosome Freho Districts established four (4) demonstrations each in addition to the training plots.

PCU observed that skills in the guideline such as hot water treatment, seed selection, row planting and timely fertilizer application are skills that farmers quickly adapt. Farmers, however, find it difficult to practice land development skills such as ploughing, puddling, land levelling and bunding. The difficulty as observed is due to the drudgery nature of those land development processes.

In Bekwai Municipal, one (1) training plot and eleven (11) demonstration plots were established and harvested with an average yield of 3.63 ton/ha. Target farmers were enthused with rice production technology and the resulting yields from all the plots. One of their major challenges was a threat of initial diseases infestation and off-farm water management.

In Atwima Nwabiagya North, one (1) training plot and four (4) demonstration plots were established and harvested with an average yield of 4.36 tons/ha. They were successful because the group farmers were hardworking and had good group cohesion. This had significantly affected the activities of the training plot establishment. However, on-farm water management was a challenge since the water source to the training plot was dried up.

Bosome Freho established one (1) training plot and three (3) demonstration plots. An average yield was 7.58 tons/ha, one of the highest records in the region. It was achieved due to high group cohesion among the few farmers who were committed to learning the technology. The group members were enthused with the rice production techniques. Hence they immediately expanded their training plot size. The key farmer has virtually developed the paddy field around the training plot using the project techniques.

Atwima Nwabiagya Municipal harvested one (1) training plot and three (3) demonstration plots with an average yield of 2.89 tons/ha. The training plot yield was poor as a result of insect and pest infestation. In controlling the insect attack, herbicide was contaminated with insecticide when farmers sprayed.

Site Selection

PCU visited the Cycle 4 MDAs to embarked on a site verification visit to candidate valleys for training plot and demonstration plots. PCU conducted these visits to have first-hand information on valleys that have been earmarked for rice demonstrations. Again, PCU also used that opportunity to select the valley/site that will be used as a training plot. Selection and verification of candidate valleys were based on accessibility, group cohesion of existing farmers working in the valley, rice cropping systems practiced, water holding capacity, proximity, gender balance and relevant previous knowledge in rice production.

Baseline and end-line survey

AEAs and DAOs in the Ashanti region were trained on the compilation of baseline and end-line using project templates during ToT 2. Additionally, PCU during the M&E visits to MMDAs also trained officers on data compilation and utilization. PCU noticed lots of compilation delays on the part of AEAs, which directly affected report submission to RAD.

Table 34 Results of Training Plots and Demonstration Plots (Yield)

NUMBER	MMDAs	COMMUNITY	YIELD TON/HA
1	Atwima Nwabiagya Municipal	Nkawie Kuma	2.89
2	Atwima Nwabiagya North	Adagya	4.36
3	Bekwai	Asanso	3.63
4	Bosom Freho	Anyanso	7.58
Overall average			4.61

(2) Northern, North East and Savannah Regions

For the 2020 season, PCU in Northern Region had mainly follow-up and monitoring roles. Hence PCU N/R had little participation in OSTs. Instead, PCU N/R supported all DADs in their demonstration plot activities by providing necessary advice during monitoring visits and backstopping ToT in some new MMDAs.

Site Selection

Three newly established MMDAs from Cycle 1-3 were visited by PCU to support DAD staff in the selection of suitable sites for 2020 demonstrations. The three MMDAs are North East Gonja, Mamprugu Moaduri and Nanton. All other MMDAs of Cycle 1, 2 and 3 selected their new sites by themselves, using the experienced they had already gained from the previous years.

ToT in the district (Joint Training)

PCU distributed audio materials for 1st ToT to the newly established MMDAs because of the restriction of the COVID-19 pandemic. PCU of Northern Region assisted three new MMDAs in conducting the 2nd ToT and 3rd ToT. The remaining MMDAs of Cycle 1, 2 and 3 also carried out district level training. But PCU did not participate in those since the PCU in the Northern region decided to prioritize its activities to follow-up visits to demonstration plots in newly established MMDAs.

On-Site Training

All DADs conducted their OSTs by themselves. Due to COVID-19 restrictions, PCU N/R could not visit OST, but visited their demonstration plots and advised DAOs, AEAs and farmers for better practice.

Table 35 Results of Training Plots and Demonstration Plots (Yield)

NUMBER	MMDAs	COMMUNITY	YIELD TON/HA
1.	Mamprugu-Moagduri	Soo	3.15
2.	Mamprugu-Moagduri	Kubugu	3.57
3.	Mamprugu-Moagduri	Jadema	3.15
4.	Nanton	Dingoni	3.15
5.	Nanton	Dohi	1.89
6.	Nanton	Kpano	2.52
7.	North-East Gonja	Nyamaliga	3.36
8.	North-East Gonja	Fuu	1.68
9.	North-East Gonja	Kpalgini	3.78
Overall average			3.04

3.3.3 Activities for Output 3: M&E

(1) Revising M&E Tool

M&E Tool was revised to version 4 based on the experience of the past years.

(2) M&E Training

On-line training was conducted for C/P in Ashanti and Northern provinces. C/P, in turn, conducted training for district MIS officers.

District training was conducted with preventive measures against COVID-19 such as dividing into two groups, keeping social distance, and facing face mask.

(3) Conducting M&E

M&E activities were implemented in line with M&E Tool version 4. Although regional C/Ps had difficulties in visiting districts because of the COVID-19 pandemic, PCU members conducted monitoring using ICT methods.

(4) Clarification of M&E Data

Clarification of M&E data was made for the whole project period. Farmer level data collection was significant challenges in 2017. However, data collection has been improved year by year.

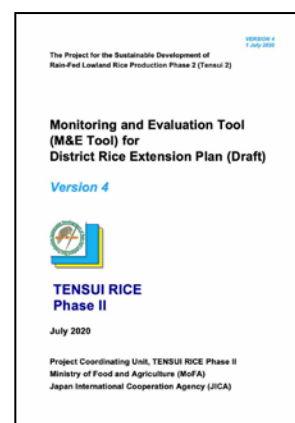


Figure 16 M&E Tool Version 4

Table 36 Status of Collection of Farmer Level Information (Unit: Districts)

	Number of District to be Monitored		Monitoring Status for Individual Household							
			2017		2018		2019		2020	
	2017-2018	2019-2020	Number of District to be Monitored	Number of Deta Collected District	Number of District to be Monitored	Number of Deta Collected District	Number of District to be Monitored	Number of Deta Collected District	Number of District to be Monitored	Number of Deta Collected District
Ashanti	20	23	5	4	11	11	19	19	23	23
Cycle 1	5	6	5	4	5	5	6	6	6	6
Cycle 2	6	7			6	6	7	7	7	7
Cycle 3	6	6					6	6	6	6
Cycle 4	3	4							4	4
Northern	15	18	5	0	11	9	18	15	18	14
Cycle 1	5	7	5	0	5	4	7	5	7	4
Cycle 2	6	7			6	5	7	6	7	6
Cycle 3	4	4					4	4	4	4
Cycle 4	0	0								
Total	35	41	10	4	22	20	37	34	41	37
Cycle 1	10	13	10	4	10	9	13	11	13	10
Cycle 2	12	14			12	11	14	13	14	13
Cycle 3	10	10					10	10	10	10
Cycle 4	3	4								4

The number of farmers whose information was collected is shown in the table below. In 2017 only 100 data was collected. However, 700 in 2018, 1,800 in 2019 and 2,500 in 2020. They are beyond initial expectation.

Table 37 Number of Farmers Information Collected

	Number of Farmers (a)					Number of Farmers at Baseline (b)					Number of Farmers at End-line (c)				
	2017	2018	2019	2020	Total	2017	2018	2019	2020	Total	2017	2018	2019	2020	Total
Ashanti	114	274	793	1,731	2,912	79	252	784	1,026	2,141	80	225	698	905	1,908
Cycle 1	114	109	251	471	945	79	100	251	259	689	80	94	245	258	677
Cycle 2	0	165	384	732	1,281	0	152	377	375	904	0	131	319	365	815
Cycle 3	0	0	158	255	413	0	0	156	157	313	0	0	134	88	222

	Number of Farmers (a)					Number of Farmers at Baseline (b)					Number of Farmers at End-line (c)				
	2017	2018	2019	2020	Total	2017	2018	2019	2020	Total	2017	2018	2019	2020	Total
Cycle 4	0	0	158	273	431	0	0	156	235	391	0	0	134	194	328
Northern	0	467	984	999	2,450	0	396	896	478	1,770	0	351	874	52	1,277
Cycle 1	0	125	184	308	617	0	85	156	93	334	0	94	88	2	184
Cycle 2	0	342	505	392	1,239	0	311	445	334	1,090	0	257	503	25	785
Cycle 3	0	0	295	299	594	0	0	295	51	346	0	0	283	25	308
Grand Total	114	741	1,777	2,730	5,362	79	648	1,680	1,504	3,911	80	576	1,572	957	3,185

(5) Data Processing for Project Indicators

The data collected by monitoring up to 2019 was processed and utilized for the JICA terminal evaluation. Also, data collected up to 2020 was processed and used for calculating project indicators. The project output chain is as shown in the figure below.

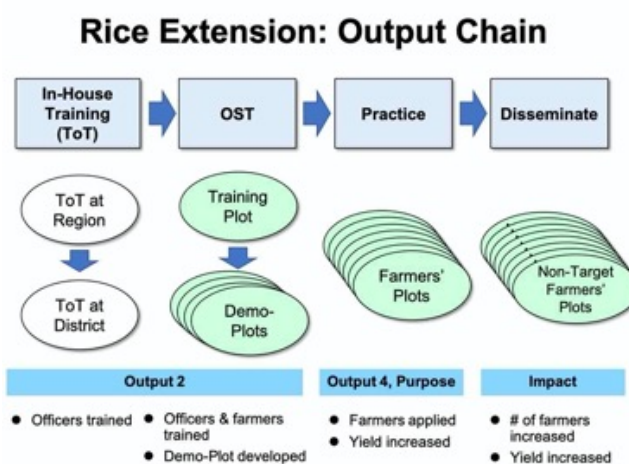


Figure 17 Project Output Chain

- District officers trained -> Demonstration plots established -> Farmers trained -> Farmers' practice in own fields -> Neighbouring farmers practice in their field.

Project indicators are calculated with data collected as follows.

1) Data related to Output 2: Extension

The number of demonstration plots was developed beyond the initial expectations, as shown in the table below. 441 demonstration plots were established in total up to 2020.

Table 38 Number of Demonstration Plots Established

	# of Demonstration plot				
	2017	2018	2019	2020	Total
Ashanti	22	39	92	136	274
Cycle 1	22	21	31	42	108
Cycle 2		18	34	50	101
Cycle 3			21	19	40

	# of Demonstration plot				
	2017	2018	2019	2020	Total
Cycle 4				25	25
Northern	12	39	62	54	167
Cycle 1	12	21	16	14	63
Cycle 2		18	27	23	68
Cycle 3			19	17	36
TOTAL	34	78	154	190	441

The number of training, trained officers and farmers were also increased beyond the initial expectations. More than 20,000 farmers have been trained.

Table 39 Number of Trainings Conducted

	# of Training				
	2017	2018	2019	2020	All
Ashanti	110	153	347	447	1,057
1	110	31	60	48	249
2		122	186	167	475
3			101	64	165
4				168	168
Northern	41	136	208	145	530
1	41	43	44	35	163
2		93	96	76	265
3			68	34	102
Total	151	289	555	592	1,587

Table 40 Number of Officers Trained (Gross)

		# of Officer Trained				
		2017	2018	2019	2020	All
Ashanti	Total	199	371	1,002	2,971	12,089
	DAO	140	249	684	897	4,543
	AEA	59	122	318	2,074	7,546
1	Total	199	103	86	584	3,157
	DAO	140	72	54	184	972
	AEA	59	31	32	400	2,185
2	Total	0	268	528	867	3,466
	DAO		177	343	295	1,663
	AEA		91	185	572	1,803
3	Total	0	0	388	567	2,435
	DAO			287	141	955
	AEA			101	426	1,480
4	Total	0	0	0	953	3,031
	DAO				277	953
	AEA				676	2,078
Northern	Total	95	408	584	315	8,925
	DAO	25	285	388	111	1,402
	AEA	70	123	196	204	7,523
1	Total	95	98	88	136	1,325
	DAO	25	63	53	45	417
	AEA	70	35	35	91	908
2	Total	0	310	242	125	1,250
	DAO		222	146	44	677
	AEA		88	96	81	573
3	Total	0	0	254	54	6,350
	DAO			189	22	308

		# of Officer Trained				
		2017	2018	2019	2020	All
	AEA			65	32	6,042
Total	Total	294	779	1,586	3,286	21,014
	DAO	165	534	1,072	1,008	5,945
	AEA	129	245	514	2,278	15,069

Note: Number of Northern in 2017 is net number. Others are gross number.

Table 41 Number of Farmers Trained

	# of Farmer				Total # of Farmer
	2017	2018	2019	2020	All
Ashanti	242	3,171	5,743	6,697	15,853
1	242	862	1,378	953	3,435
2		2,309	2,987	3,122	8,418
3			1,378	995	2,373
4				1,627	1,627
Northern	296	2,626	3,665	1,221	8,966
1	296	894	676	384	2,250
2		1,732	1,859	1,337	4,928
3			1,130	658	1,788
Grand Total	242	5,797	9,408	7,918	24,819

2) Data related to Output 2: Guideline

The share of farmers who apply the improved techniques introduced by the project is the indicator. The following table shows the results. These are also beyond the target.

Table 42 Rate of Farmers Applying the Recommended Techniques

	% of Applied (# of applied / #of farmers at end-line)				
	2017	2018	2019	2020	Total
Ashanti	66%	68%	85%	89%	84%
Cycle 1	66%	84%	90%	94%	88%
Cycle 2		57%	83%	91%	82%
Cycle 3			81%	71%	77%
Cycle 4				88%	88%
Northern		78%	68%	67%	71%
Cycle 1		69%	47%	100%	59%
Cycle 2		82%	83%	36%	81%
Cycle 3			48%	96%	52%
Grand Total	66%	74%	75%	88%	78%

3) Data related to Project Purpose

The yields of farmers who applied the techniques in the Guideline is shown below.

Table 43 Yield of Farmers Applying the Techniques in Guideline

	Applied Farmer: Average Yield (ton/ha) at End-line				
	2017	2018	2019	2020	Average
Ashanti	4.15	3.55	3.50	3.21	3.60
Cycle 1	4.15	3.90	4.93	4.43	4.05
Cycle 2		3.18	2.77	2.71	2.89
Cycle 3			2.40	2.29	2.35
Cycle 4				3.08	3.08
Northern	2.00	2.41	2.11	1.64	2.05
Cycle 1	2.00	2.12	2.06	4.10	2.76
Cycle 2		2.50	2.34	1.33	2.06
Cycle 3			1.42	1.56	1.49
Grand Total	3.08	2.82	2.80	3.14	2.96

Note: Data in 2019 is based on technical committee documents.

4) Data related to Impact

Some of the impacts available are the increased income of farmers and dissemination to non-target farmers. In 2020, as the last year of the project, PCU guided the district MIS officers to include non-target farmers in the end-line survey. The results are as follows.

Impacts on Non-Target Farmers

The table below shows the results of the survey comparing target and non-target farmers. The application rate of non-target farmers is impressive. It can be said that the recommended techniques have been disseminated to non-target farmers, which is one of the impacts.

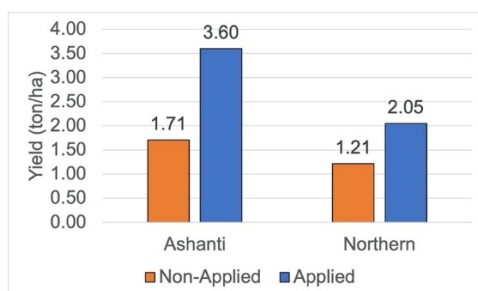
Table 44 Application Rate: Target vs Non-Target Farmers

	Farmer at Baseline			Farmer at End-line			Applied			Application Rate (%)		
	Total	Target	Non-Target	Total	Target	Non-Target	Total	Target	Non-Target	Total	Target	Non-Target
Ashanti	1,026	852	172	905	789	114	803	706	95	88.7%	89.5%	83.3%
Cycle 1	259	200	59	258	199	59	245	188	57	95.0%	94.5%	96.6%
Cycle 2	375	354	21	365	345	20	329	315	14	90.1%	91.3%	70.0%
Cycle 3	157	89	68	88	77	11	64	55	9	72.7%	71.4%	81.8%
Cycle 4	235	209	24	194	168	24	165	148	15	85.1%	88.1%	62.5%
Northern	478	530	14	52	52	0	35	35	0	67.3%	67.3%	
Cycle 1	93	93	0	2	2	0	2	2	0	100.0%	100.0%	
Cycle 2	334	334	0	25	25	0	9	9	0	36.0%	36.0%	
Cycle 3	51	103	14	25	25	0	24	24	0	96.0%	96.0%	
All	1,504	1,382	186	957	841	114	838	741	95	87.6%	88.1%	83.3%

The following table and figure show the yield comparing target and non-target farmers. It is impressive that non-target farmers in Ashanti have a higher yield than that of the target farmers. It is said that some motivated non-target farmers have the willingness to introduce the techniques as a farmer to farmer extension.

Table 45 Yields: Target vs Non-Target Farmers

	Applied			Non-Applied		
	All	Target	Non-Target	All	Target	Non-Target
Ashanti	3.27	3.21	3.71	1.71	2.30	1.93
Cycle 1	4.39	4.43	4.23	0.81	2.80	2.40
Cycle 2	2.71	2.71	2.83	1.72	1.80	1.29
Cycle 3	2.40	2.29	3.05	2.63	2.52	3.90
Cycle 4	3.06	3.08	2.95	2.30	2.52	1.81
Northern	1.64	1.64		1.21	1.21	
Cycle 1	4.10	4.10				
Cycle 2	1.33	1.33		1.21	1.21	
Cycle 3	1.56	1.56		1.26	1.26	
All	3.20	3.14	3.71	1.48	2.12	1.93



Note: Data for applied is average of the whole project period.

Figure 18 Yield Compared: Applied and Non-Applied Farmers

Farmers applying the techniques enjoy higher profit, which is the expected impact by the project, as shown in the figure below.

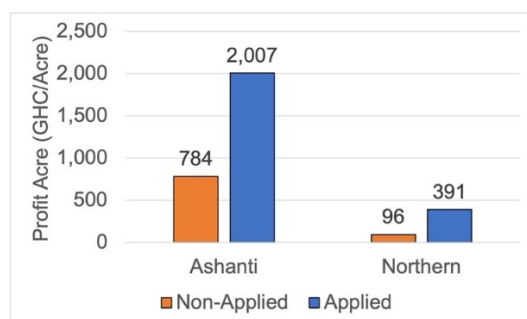


Figure 19 Profit Compared: Applied and Non-Applied Farmers

5) Results and Challenges

The Introduction of the M&E tool brought about the following results.

i) M&E capacity development for district and regional officers

Capacities of M&E for district and regional officers are strengthened, contributing to their improved reporting capacities.

ii) Contribution to the timely management of the rice extension activities

Data collected by M&E Tool contributed to the improvement of the rice extension activities management throughout the planning cycle, i.e., plan-do -see cycle.

iii) Outcome management and contribution to the strengthening of accountability

Under the existing M&E system, input indicators such as the number of training and output indicators such as the number of farmers trained are monitored. Through the project, outcome indicators such as yields of farmers' fields are monitored. This is done by monitoring of individual farmer level. The outcome data is utilized effectively for reporting to MMDA as well as MoFA to mobilize resources to rice extension, which contributed to the strengthening of the accountability of DAD.

However, the following challenges are identified from the experience of practising M&E.

i) Difficulties of data collection, especially for farmers level data

The range and number of data become too large, which becomes beyond the capacities of district MIS officers to collect and process.

Data to be collected covers planning, every activity and farmers outcome. Data range should be focused on outcome data related farmers.

In addition, as the project proceeds, the number of data became more than 100 households per district, and the number of farmers data was more than 3,000 households in the project. This is because collecting all group farmers' data precisely. The number of farmers should be reduced by sampling, and the range of data should be focused on the crucial data.

ii) Many errors in the process of data collection, transferring and processing

Method to collect and process data is conventionally using EXCEL in the way of transferring data between districts and regions. This was effective for the training of MIS officers. However, this conventional method is one of the factors causing many errors in data processing.

3.3.4 Activities for Output 4: Guideline

(1) Nutrition Improvement

1) Demonstration of rice recipes

In collaboration with the Regional WIAD officer, PCU organized a one-day training programme for district WIAD officers on Nutrition and Rice Recipe Demonstrations. This programme involved practical food preparation of rice T.Z and rice-soybean weanimix porridge in Northern region and unpolished rice banku and unpolished rice porridge for Ashanti region. A total of 20 participants attended the training (5 male and 15 female). Of the 20 participants, two (2) were Regional WIAD officers from Savanna and North-East Regions, with the remaining 18 being district WIAD officers. The Nutrition and Rice Recipe Demonstration was replicated at three communities Kpatili, Kubugu and Zieng in three MMDAs Gushegu, Mamprugu Moagduri and Nanton, respectively. In the three communities, participants were pleased and impressed with the parboiled rice T.Z and rice-soya weanimix porridge. At Kubugu community, the PCU team was privileged to visit the Chief Palace to interact with the community Chief before commencing the training. The Chief was very impressed with the Tensui Project's activities. He, however, made a passionate appeal to PCU staff by saying that the neighbourhood of Kubugu, Kubori and Yagaba are in dire need of a rice milling facility/machine. Even though they produce a lot of rice, they usually have to sell their rice in paddy form or rely on corn mill-type machines for dehusking and polishing of their paddy rice.

2) Preparation of ToT materials and PR materials

PCU and Japanese counterparts prepared training materials on nutrition and rice recipe demonstration for WIAD officers and women farmers. ToT material explains the background of nutrition activity and verification survey/demonstrations. OST material, on the other hand, employs pictures to explain to farmers the benefits of parboiled rice; and also contains a recipe for practical food preparation.

3) Simple survey on the effect of demonstration of parboiled rice recipes for nutrition improvement (Northern)

The survey was conducted on ten women each per community before and after the demonstration of the parboiled rice recipes. The amount and frequency of rice consumed by different households can vary based on many factors, like seasonality. The survey was thus aimed to assess the rice consumption patterns of the various households prior to and after the introduction of the parboiled rice T.Z. and rice-soya weanimix porridge.

70% of respondent answered that they cooked parboiled rice dishes at home after the demonstration. As of them, 90% used rice-soya weanimix for cooking porridge. The amount of eating rice increased and the frequency of eating rice increased after the demonstration.

4) Simple marketing survey on Consumption Trends and Potential for Consumption Promotion (at National Farmers Day)

Rice recipes (T.Z, banku and porridge) were prepared at National Farmers' Day grounds and served to visitors who came to the Project's stand as a part of a promotion of rice recipes. The food tasting was immediately followed by a questionnaire administered to the visitors. The results of this survey indicate that 86% of respondents prefer to eat rice for reasons like ease of cooking, taste and others. It also showed that the parboiled rice flour recipes have great potential of becoming popular dishes but require a lot of promotion.

Table 46 Detail of Marketing Survey

Title	Simple Marketing Survey on Consumption Trends and Potential for Consumption Promotion to General Consumers in Ghana
Purpose	To identify Consumption Trends and Potential for Consumption Promotion to General Consumer
Period	2-3 Nov. 2020: Parboiled rice dishes, 4-5 Nov 2020: Unpolished rice dishes
Location	Methodist Park, Techiman
Target	Total of 140 male and female farmers
Method	1. Demonstration of rice recipes (parboiled rice porridge and parboiled rice TZ) 2. Questionnaire survey on consumption of parboiled rice

(2) Validation of Rice extension Guideline

Northern

In the Northern Region, Guideline Validation Workshop was held on 17th November 2020. PCU made presentations to explain the Rice Extension Guideline to participants before breaking them up into groups for discussions. The groups were strategically formed according to the professional expertise of participants to ensure optimum input in the various sections of the guideline. Inputs from the groups were compiled into one document and forwarded to PCU Ashanti for another validation workshop in their region.

Ashanti

The Regional Workshop for Validating the rice extension guideline was held at Ceetakel Hotel in Kumasi.

Participants were grouped into five with each group working on output within the rice extension guideline. Technical changes were made, and each group presented the changes made to the document. Other inputs from participants were also incorporated into the document. The final document was accepted as a regional rice extension guideline to be finalized at the national level.

National

The National Workshop to validate the Rice extension guideline was held on 26th November 2020.

Participants were grouped into six groups for technical review of the Guideline Document.

Technical changes were made, and each group presented the changes made to the document. Other inputs from participants were also incorporated into the document. The final document was accepted as a National rice extension guideline to be submitted to the Steering committee for approval.

4. INPUTS

4.1. Japanese Experts

Japanese experts were dispatched as shown in tables below.

(1) 1st Project Year (April 2016 – February 2017)

1. Assignment in Ghana

Name Title		No. of Trip	1st Year										Total Days	Total MM		
			2016												2017	
			4	5	6	7	8	9	10	11	12	1			2	
Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan	4			(14)		(14)			(32)		(42)		102	3.40	
	Actual	4			6/27 7/9 (13)		8/22 9/4 (14)			11/15 (32)		12/16 (43)	1/9 2/20	102	3.40	
Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan	3					(95)			(70)		(45)		210	7.00	
	Actual	3			6/22				9/24	10/12		12/22 (43)	1/9 2/20	210	7.00	
Tatsuo FUJITA (Rice cultivation 1)	Plan	3		(46)					(113)			(48)		207	6.90	
	Actual	3		5/15 (46)	6/29	7/21				11/15		1/9 2/20 (43)		207	6.90	
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan	3				(104)				(86)		(35)		225	7.50	
	Actual	3		5/15				8/26	9/11			12/5 (35)	1/10 2/13	225	7.50	
Total Assignment in Ghana											Plan	744	24.80			
											Actual	744	24.80			

2. Assignment in Japan

Name Title		No. of Trip	4	5	6	7	8	9	10	11	12	1	2	Total Days	Total MM
Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan			(6)										6	0.30
	Actual			5/1, 9-10 (3)	6/15-16, 18 (3)									6	0.30
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan			(6)										6	0.30
	Actual			4/25-28 (4)	5/9-10 (2)									6	0.30
Total Assignment in Japan													Plan	12	0.60
													Actual	12	0.60

Grand Total	Plan	25.40
	Actual	25.40

(2) 2nd Project Year (April 2017- February 2020) (1)

1. Assignment in Ghana

Name (Title)	No. of Trip	2nd Project year (1)																																		
		2017												2018																						
		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12														
Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan																																			
	Actual	5/1 (60)	6/23 (60)				8/25 (37)	9/30 (37)	11/8 (31)	12/8 (31)	2/1 (34)	3/6 (34)				5/14 (37)	6/19 (37)				9/1 (22)	9/22 (22)	11/18 (28)	12/15 (28)												
Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan																																			
	Actual	5/1 (48)	6/17 (34)	7/23 (29)	8/20 (60)	10/22 (40)	11/30 (40)	1/23 (40)	3/3 (40)	4/11 (40)	5/20 (40)	7/18 (58)	9/13 (58)	11/12 (20)	12/1 (20)																					
Tatsuo FUJITA (Rice cultivation 1)	Plan																																			
	Actual	4/30 (60)	6/28 (60)	7/17 (34)	8/19 (60)	9/26 (62)	11/26 (62)				4/7 (30)	5/6 (30)	6/10 (96)	9/13 (96)	10/28 (24)	11/20 (24)																				
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan																																			
	Actual	4/30 (60)	6/28 (60)	7/15 (36)	8/19 (60)	9/25 (63)	11/26 (63)				3/1 (45)	4/14 (45)	6/10 (60)	8/8 (60)	10/30 (35)	12/3 (35)																				
Eiri KAKU (Rice Cultivation 2 / Nutrition Improvement 1)	Plan																																			
	Actual													10/1 (30)	3/0 (30)				4/7 (18)	4/24 (18)				9/22 (42)	11/2 (42)											
Yasuko YAGI (Extension 2 / Nutrition Improvement 2)	Plan																																			
	Actual													7/23 (45)	9/5 (45)																					

2. Assignment in Japan

Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan																								
	Actual	4/26-28 □ (3)												12/17-20, 25-28 □ □ (8)											
Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan																								
	Actual													10/1-10/4 □ (4)											
Tatsuo FUJITA (Rice cultivation 1)	Plan																								
	Actual	8/28-31, 9/1, 8 □ □ (6)												10/1-5, 10/8-12 □ □ □ (10)											
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan																								
	Actual	9/4-7 □ (4)																							

*Grand total is described in the next figure.

(3) 2nd Project Year (April 2017- February 2020) (2)

1. Assignment in Ghana

Name (Title)	No. of Trip	2nd Project year (2)														Total Days	Total MM			
		2019												2020						
		1	2	3	4	5	6	7	8	9	10	11	12	1	2					
Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan	12																	467	15.57
	Actual	12	(20)	2/3	2/28		5/13	5/30		8/28		(40)	10/19	11/8	12/15	1/10	2/7	(20)	413	13.77
Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan	12	(20)				(34)			(60)			(30)				(15)	433	14.43	
	Actual	12	1/20	2/16		4/10	5/10		6/27	8/20			11/7	12/3		1/18	2/10	(21)	433	14.43
Tatsuo FUJITA (Rice cultivation 1)	Plan	9					(60)			(60)			(45)					495	16.50	
	Actual	9			3/24	4/28		6/6	8/4			10/2	11/24					(36)	456	15.20
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan	11	(20)				(60)			(60)			(30)				(15)	489	16.30	
	Actual	11	1/12	2/5	3/17	4/13	5/13		7/21	8/21	9/8	10/23	11/22		1/14-30			(25)	489	16.30
Eiri KAKU (Rice Cultivation 2/ Nutrition Improvement 1)	Plan	4											(24)					114	3.80	
	Actual	4										10/11	11/3					(24)	114	3.80
Yasuko YAGI (Extension 2/ Nutrition Improvement 2)	Plan	3											(21)					111	3.70	
	Actual	3											11/29	12/19				(21)	111	3.70
														Assignment in Ghana	Plan	2109	70.30			
															Actual	2016	67.20			

2. Assignment in Japan

Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan	/																	4	0.20
	Actual	/	1/7, 10, 11, 15, 17, 28, 29, 31							8/23, 26-27		10/29-30	11/1, 5-7	12/16-26	1/6-9			(8)	40	2.00
Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan	/							(4)										8	0.40
	Actual	/								8/28-30	9/2							(4)	8	0.40
Tatsuo FUJITA (Rice cultivation 1)	Plan	/																		
	Actual	/								8/28-30	9/2-6, 9-10							(10)	26	1.30
Kyoko AKASAKA (Local governance 2 / Extension 1)	Plan	/																	4	0.20
	Actual	/																	4	0.20
														Assignment in Japan	Plan	16	0.80			
															Actual	78	3.90			

Grand Total	Plan	71.10
	Actual	71.10

(4) 3rd Project Year (March 2020 – May 2021)

1. Assignment in Ghana

No.	Name (Title)	No of Trip	3rd Project Year															Total Days	Total MM				
			2020										2021										
			3	4	5	6	7	8	9	10	11	12	1	2	3	4	5						
1.	Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan	0																		0	0.00	
		Actual	0																			0	0.00
2.	Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan	1																			21	0.70
		Actual	1																				21
3.	Tatsuo FUJITA (Rice cultivation 1)	Plan	0																			0	0.00
		Actual	0																			0	0.00
4.	Kyoko AKASAKA (Local governance 2 / Extension 1/ Nutrition Improvement 3)	Plan	1																			21	0.70
		Actual	1																				21
5.	Eiri KAKU (Rice Cultivation 2/ Nutrition Improvement 1)	Plan	0																			0	0.00
		Actual	0																			0	0.00
6.	Yasuko YAGI (Extension 2/ Nutrition Improvement 2)	Plan	0																			0	0.00
		Actual	0																			0	0.00
																						42	1.40
																						42	1.40

2. Assignment in Japan

1.	Hiroshi YOSHIMURA (Chief advisor/ Monitoring and evaluation)	Plan																						131	6.55		
		Actual		4/6-10, 13-17	5/11-15, 25-29	6/15-19, 22-26, 29-30	7/1-3, 6-10, 14-17, 21, 27-29	8/3-7, 11-14, 17-21, 24-28, 31	9/1-4, 7-10, 11, 23-25, 12-16	10/1, 2, 5, 11, 4, 9, 16, 17, 19, 20, 24, 26	11/6, 11, 12, 1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	12/1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	1/6-8, 12-15, 19, 21, 22, 25, 27	2/4, 10, 11, 12, 14, 22, 25, 27	3/9, 23, 30, 31	4/1, 2, 5-9, 19-23, 26, 27											131
2.	Takafumi NAKASE (Deputy advisor / Local governance 1)	Plan																								114	5.70
		Actual		3/25-27, 30-31	4/6-9, 13-14, 20-24	5/11, 18, 25-29	6/1-3, 10, 15-17, 23-30	7/1-3, 6-10, 13-17, 20-21, 27-31	8/3-7, 11-14, 17-20, 24-27	9/1-4, 7-10, 11, 14, 15, 18, 23, 24, 29	10/1, 2, 5, 11, 4, 9, 16, 17, 19, 20, 24, 26	11/6, 11, 12, 1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	12/1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	1/6-8, 12-15, 19, 21, 22, 25, 27	2/4, 10, 11, 12, 14, 22, 25, 27	3/9, 23, 30, 31	4/1, 2, 5-9, 19-23, 26, 27										
3.	Tatsuo FUJITA (Rice cultivation 1)	Plan																								142	7.10
		Actual		3/25-27, 30-31	4/6-10, 13-17	5/11-15, 18-19, 23	6/1-3, 10, 15-17, 23-30	7/1-3, 6-10, 13-17, 20-21, 27-31	8/3-7, 11-14, 17-20, 24-27	9/1-4, 7-10, 11, 14, 15, 18, 23, 24, 29	10/1, 2, 5, 11, 4, 9, 16, 17, 19, 20, 24, 26	11/6, 11, 12, 1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	12/1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	1/6-8, 12-15, 19, 21, 22, 25, 27	2/4, 10, 11, 12, 14, 22, 25, 27	3/9, 23, 30, 31	4/1, 2, 5-9, 19-23, 26, 27										
4.	Kyoko AKASAKA (Local governance 2 / Extension 1/ Nutrition Improvement 3)	Plan																								130	6.50
		Actual		3/25-27, 30-31	4/1-2, 7, 13-14, 20, 22	5/4, 8, 11-12, 14, 18, 19	6/2, 8-12, 17, 24-26, 29-30	7/1, 6, 9-13, 17, 20-22, 28-31	8/3, 6, 6, 10, 14-15, 17-21, 25-28	9/1, 2, 7, 8, 10, 11, 16, 18, 23, 24, 28-31	10/1, 5, 7, 9-12, 16, 17, 19, 20, 24, 26, 27	11/6, 11, 12, 1, 2, 8, 17, 6-8, 12-15, 19, 21, 22, 25, 27	12/1, 2, 3, 8, 14, 21, 13, 18, 15, 26	1/5, 8, 12, 12/1-3, 13, 18, 15, 26	2/4, 10, 11, 12, 14, 22, 25, 27	3/1, 4, 9, 12, 17, 30, 31	4/1, 2, 5-9, 19-23, 26, 27										
5.	Eiri KAKU (Rice Cultivation 2/ Nutrition Improvement 1)	Plan																								30	1.50
		Actual																									30
6.	Yasuko YAGI (Extension 2/ Nutrition Improvement 2)	Plan																								30	1.50
		Actual																									30
																										577	28.85
																										577	28.85
																										619	30.25
																										619	30.25

4.2. Regional Counterparts

Regional counterparts in Ashanti and Northern regions are shown in the tables below.

Table 47 List of Counterparts in Ashanti Region

Name	Title	History
Current Member		
Ms. Yaa Pokuaa	Schedule Officer	June 2018- present Previous: PCU Extension since Phase 1
Mr. Kingsley Abedi-Addae	Land Development	Since September 2016 - present Previous: Ashanti Regional Agricultural Engineering officer
Mr. Charles Ofori	Farm Management and Support System	Since September 2016 - present Previous: Adansi South District Crop officer
Mr. Obed Opoku Mensah	Extension/ M&E	November 2018 - present Previous: Ashanti Regional M&E officer
Members Retired or Transferred		
Mr. Micheal Kofi Anokye	Rice Cultivation	January 2019 – March 2020 (Retired) Current: Ghana Cocoa Board
Mr. Sammuel Kofi Tekpor	Schedule Officer	From Phase 1 – April 2018 Current: Oforikrom Municipal Director of Agriculture
Mr. Maxwell Adu-poku	Rice Cultivation	From Phase 1 – April 2018 Current: Atwima Nwabiagya North District Director of Agriculture
Mr. Eliasu Mumuni	Land Development	From Phase 1 – November 2016 Current: University for Development Studies
Mr. Raphael Sorkpor	Farm Management and Support System	From Phase 1 – August 2016 Current: Sekyere East District Director of Agriculture

Table 48 List of Counterparts in Northern Region

Name	Title	History
Current Member		
Mr. Dauda A. Salaam	Schedule Officer	June 2018- present Previous: PCU Rice Cultivation since Phase 1
Mr. Solomon Selasi Djre	Land Development	May 2018 - present Previous; Northern Region Agricultural Engineering officer
Mr. Baba Abdulai	Farm Management and Support System / M&E	Since Phase 1
Mr. Silvester De Clerk	Extension	May 2020 - present Previous: Northern Regional Extension Officer
Mr. Christopher Akai	Farm Management and Support System	May 2020 - present Previous: Northern Regional Plant Protection and Regulatory Service (PPRSD) Officer
Members Retired or Transferred		
Mr. Yussuf Ahmed Tijani	Schedule Officer	Since Phase 1. Retired in June 2018.

4.3. List of Training and Workshop

Table 49 List of Training and Workshop

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
Sensitization Workshop	2016/5/31 (AR) 2016/6/2 (NR)	80 (40 each in AR and NR)	To brief stakeholders on the structure and framework of Phase II project.
Training on Planning and Budgeting for Cycle 1 MMDAs	2016/7/25-26 (AR) 2016/8/8-9 (NR)	68 (34 each in AR and NR)	To explain outline of Rice Extension Guideline and work on budget needs analysis, resource analysis, review of rice extension plan, budget preparation
Field Trip	2016/10/12, 13, 18,19 (AR) 2016/10/17,18,19,20 (NR)	16 (AR) 29 (NR)	To sensitize the major stakeholders (DCE, DCD, finance officer, budget officer, planning officer and the chairman of agriculture committee) through observation of demonstration plot and interaction with benefit farmers.
M&E Workshop	2017/2/2 (NR) 2017/2/8 (AR)	34 (17 each in AR and)	To propose M&E framework for rice extension plan and exchange the opinions among stakeholders.
Training on Planning and Budgeting for Cycle 2-4 MMDAs	2017/6/5-6 (AR) 2017/6/13-14 (NR)	127 (AR) 90 (NR)	To sensitize DCE to incorporate rice extension plan to DMTDP and encourage the budget allocation for rice extension activities. To work on budget needs analysis, resource analysis, then prepare budget and rice extension plan.
1 st ToT for Cycle 1 MMDAs	2017/5/18-19 (AR) 2017/6/7-8, 15-16 (NR)	25 (AR) 24 (NR)	To train selected district officers conversant with technical package of Rice Extension Guideline and in turn become trainers at the district.
2 nd ToT for Cycle 1 MMDAs	2017/8/1-2 (AR) 2017/8/14-15 (NR)	26 (AR) 26 (NR)	To train the technical package for reproductive stage of rice growth.
3 rd ToT for Cycle 1 MMDAs	2017/10/10-11 (AR) 2017/10/24-25 (NR)	26 (AR) 26 (NR)	To train the technical package for harvesting season.
ToT at district level (Joint Training) for Cycle 1 MMDAs	[Ashanti Region] Adansi North 6/12,9/19 Adansi South 5/31 Ahafo Ano North 5/23, 8/3	AR F: 167 D: 25 A: 70	In-house training provided by the trained district officers to AEA's. All topics of ToT are covered.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
	Asante Akim North 6/8 Atwima Mponua 6/22, 9/13 [Northern Region] East Gonja 7/24-25, 10/5 Mion in September Sagnerigu 10/19 West Mamprusi 7/5-6	NR F: 296 D: 16 A: 34	
On-Site Training for Cycle 1 MMDAs	[Ashanti Region] Kusa 6/27, 10/31, Fumso(TP) 6/20, Pipiso 6/27, 10/3, 10/27, Obonsu 9/30, Fenaye 9/28, Kramokrom 9/28 Asushyiae(TP) 5/31, 7/5, 8/12, Nkyensedanho(TP)5/30, 6/13,21, 8/28, 9/1, Mmeredane 6/23, 8/22, 9/05 Bresaa(TP)6/10, 6/29-30, 8/5. Agyaaho 6/15, 7/8, 8/7, Nyamebekyere 6/2, 7/5-9, 8/4. Nhyiaeso 7/7, 8/7, 29. Nyame Ye Hene 7/11, 9/22. Manukrom 8/24, 9/10, 9/22. Kwankyeabo(TP) 6/7, 8/2, 9/5 [Northern Region] Masaka 8/10, 10/11, Kalande 8/12, 10/13. Chito-N'kwanta 8/17, 10/14, 11/10. Sanzei 7/15, 7/21, 7,27, Kukpehi 7/9, 8/15, 9/16, Garziegu 7/8, 8/19 Nagba-Yapala 7/28, 8/16, 9/1. Sishawu 6/19, 7/26, Damakuyilui 6/19, 7/10, 8/7		Practical training for farmers at demonstration plot.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
	Zaayuri 7/14, 8/2,3, Nabari 7/10, 18, 25 Tinguri 7/8, 13, 21		
Field Trip	2017/11/6-7 (NR)	82 (NR)	To sensitize all DCEs, DCDs of the next cycle MMDAs by bring them to the best demonstration plot of the year and encourage them to disburse budget for rice extension activities on time.
1st ToT for cycle 2 MMDAs	2018/3/21 – 22 (AR) 2018/5/2-3 (NR)	37 (AR) 37 (NR)	To train selected district officers conversant with technical package of Rice Extension Guideline and in turn become trainers at the district.
2 nd ToT for cycle 2 MMDAs	2018/7/18-19 (AR) 2018/8/1-2 (NR)	30 (AR) 30 (NR)	To train the technical package for reproductive stage of rice growth.
3 rd ToT for cycle 2 MMDAs	2018/8/30 (AR) 2018/9/10 (NR)	30 (AR) 30 (NR)	To train the technical package for harvesting season.
ToT at district level (Joint Training) for Cycle 2 MMDAs	[Ashanti Region] Ejura Sekyedumase 5/11, 6/29,9/5 Sekyere Central 4/12, 8/1, 9/11 Asante Akim South 4/13, 8/2,9/26 Afigya Kwabre 4/27,8/7,9/13 Amansie West 5/3, 11, 8/16, 9/20 Offinso North 5/30,8/14, 9/19 [Northern Region] Savelugu 5/14-15, 8/29, 9/18 East Mamprusi 5/15-16, 8/14, 10/1 Gushegu 5/18-19, 8/7-8, 9/20 Chereponi 5/20-21, 8/17, 10/11 Yendi 5/22-23, 9/26, Kumbungu 5/24-25, 8/16, 10/2	AR F: 1,618 D: 177 A: 693 NR F: 1,665 D: 213 A: 378	In-house training provided by the trained district officers to AEAs. All topics of ToT are covered.
On-Site Training for Cycle 2 MMDAs	[Ashanti Region] Tetrem (TP) 5/11, 15, 29, 6/12, 9/18. Pampatia 5/17, 6/5, 22, 7/24, 9/23. Nanhini (TP) 6/2,5,25,7/11, 9/10, 10/17. Antoakrom 7/3,18, 8/7, 11/1.		Establish training plot to train all AEAs in the district. Trained AEAs in turn provide practical training for farmers at demonstration plot.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
	<p>Kokoado (TP) 6/11,20,27, 7/12, 8/29,10/17. Bankame 9/15, 10/3, 5, 22, 11/19. Amoamang (TP) 5/21, 30, 6/6,20, 8/8,9/25. Aframso 7/29, 8/20, 9/3, 10/8, 11/18. Miminaso (TP) 6/14, 28, 7/5, 23, 8/25, 11/7. Kwaseakan 8/13, 27, 9/3,17,10/23, 12/21. Asumen 8/17, 7/27, 9/7, 10/26, 12/28. Samari Nkwanta 8/23, 21, 9/14, 10/30, 12/19. Kobreso (TP) 7/4, 28, 24, 8/8, 9/17, 11/12. Asuoso 8/11, 31, 9/15, 10/21,11/12. Asemaneye 8/4, 24, 9/8, 10/17. [Northern Region] Nyangbandi 6/10, 18, 7/12, 8/30, 10/23. Adokajura 6/19, 28, 7/21, 9/7, 10/29. Mayamam 6/17, 22, 7/18, 9/5, 10/26. Wumdua 6/7, 8, 7/5, 8/18, 10/23. Tunni 7/5, 7, 28, 8/25, 11/8. Kpatili 6/3, 11, 7/4, 8/25, 10/18, Nayili-Fong 6/15,20,7/12, 8/29, 10/20. Zenidow 7/5, 9, 28, 8/21, 11/9. Bogu 7/3, 21, 8/7,23, 9/3,27,11/10 Sampebega 6/16, 7/26, 8/11, 9/11, 11/8. Gbulung 6/13, 14, 7/6, 8/24, 10/19. Kpegu 6/18, 21, 7/23, 9/5, 11/4. Kumbungu Koku 6/19, 22, 7/20, 9/7, 10/26. Duko 6/5, 10, 7/3, 8/23, 10/18. Bogu 6/15, 17, 22, 7/21, 9/5, 10/20. Dingoni 6/10, 7/1, 22, 9/6, 10/27. Zang 7/9, 12, 8/4, 9/7, 11/10. Zakoli 7/5, 11, 8/8, 9/8, 11/8</p>		
On Site Training in Cycle1 MMDAs	Omit details due to a lot of data	AR F: 819 D: 64 A: 119	Cycle 1 MMDAs conducted On Site Training by their own budget.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
		NR F: 904 D: 63 A: 77	
Field Trip for Cycle 3 MMDAs	2018/10/9 (NR) 2018/11/21 (AR)	30 (NR) 30 (AR)	To sensitize all DCEs, DCDs of the next cycle MMDAs by bring them to the best demonstration plot of the year and encourage them to disburse budget for rice extension activities on time..
Experience Sharing Workshop	2019/1/23 (AR) 2019/1/29 (NR)	60 (AR) 45 (NR)	To share the experiences of implementation of Rice Extension Guideline to non-target regions and MMDAs
1st ToT for cycle 3 MMDAs	2019/3/26,27 (AR) 2019/4/23,24 (NR)	34 (AR) 27 (NR)	To train selected district officers conversant with technical package of Rice Extension Guideline and in turn become trainers at the district.
2 nd ToT for cycle 3 MMDAs	2019/6/13 (AR) 2019/7/17 (NR)	30 (AR) 25 (NR)	To train the technical package for reproductive stage of rice growth.
3 rd ToT for cycle 3 MMDAs	2019/7/31 (AR) 2019/9/19 (NR)	30 (AR) 25 (NR)	To train the technical package for harvesting season.
2 nd quarterly review for cycle 3 MMDAs	2019/6/12 (AR) 2019/7/16 (NR)	20 (AR) 16 (NR)	To report the 2 nd quarter progress on the rice extension activities.
ToT at district level (Joint Training) for Cycle 3 MMDAs	[Ashanti Region] Amansie Central 4/16 Mampong 4/8 Sekyere Arfam Plains 4/18 Sekyere East 4/17, 8/6 Sekyere Kumawu 4/11, 7/2, 8/27 Sekyere South 4/3, 7/2, 8/19 [Northern Region] Central Gonja 5/15, 10/3 Karaga 5/21, 7/28, 10/30 Tolon 5/14 Zabzugu 5/20, 9/18, 10/9	AR F: 1,374 D: 270 A: 1,153 NR F: 1,105 D: 189 A: 415	In-house training provided by the trained district officers to AEAs. All topics of ToT are covered.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
On-Site Training for Cycle 3 MMDAs	<p>Ashanti Region</p> <p>Kente (TP) 4/27,29, 5/14,28, 7/10, 8/29.</p> <p>Esaase 7/3,26, 8/7,9/12, 11/18.</p> <p>Kyeremfaso (TP) 4/29, 5/7,16,30, 7/9, 9/3.</p> <p>Woraso 6/21, 7/12,26, 9/6, 10/30.</p> <p>Bunuso 7/9,23, 8/6, 9/17, 10/10.</p> <p>Boffosur (TP) 5/13,15,29, 6/14, 9/18.</p> <p>Dorobonso 8/1, 9/6,20, 10/22, 12/18.</p> <p>Ntonkumso (TP) 4/8,23, 5/8, 8/7.</p> <p>Sanigya 4/15, 5/7,21, 6/24, 8/24.</p> <p>Brofoyedru 4/29, 5/17,31, 7/12, 9/3.</p> <p>Attakrom 5/8, 31, 6/15, 8/5, 9/19.</p> <p>Naama 6/7,28, 8/4, 9/23,</p> <p>Dadease (TP) 4/19,24, 5/10,24, 8/25.</p> <p>Sekyere 7/3,24, 8/9, 9/20, 11/11.</p> <p>Banko 8/18, 9/12,25,</p> <p>Abrakaso (TP) 4/10,17, 5/2,16, 6/26, 8/14.</p> <p>Wiamoase 5/6,29, 6/14, 7/31,</p> <p>Tano Odumase 5/1,22, 6/6, 7/30, 9/13.</p> <p>Akrafonso 5/10, 6/3,14, 6/19, 8/20.</p> <p>Agona 5/11, 6/3, 7/8, 8/12, 10/14.</p> <p>Afamanaso 4/15, 5/9, 28, 7/3, 8/28.</p> <p>[Northern Region]</p> <p>Wambung (TP) 6/13, 7/4, 8/22, 10/12.</p> <p>Alipe 7/8, 8/2,</p> <p>Torope 8/25,17,</p> <p>Chanpe 7/5, 29,</p> <p>Sankunpe 7/8, 30, 11/3.</p> <p>Kpataribogu (TP) 6/6,26, 8/19, 10/15.</p> <p>Malgunayili 6/27, 7/18, 9/5, 1/1.</p> <p>Namburugu 7/10, 7/31.</p> <p>Shellilanyili 7/11, 31, 9/18, 11/15.</p> <p>Tiboagnaayili (TP) 6/14, 7/5, 8/22, 10/31.</p> <p>Kasulyili 6/18,7/17, 8/19, 11/11.</p>		<p>Establish training plot to train all AEAs in the district.</p> <p>Trained AEAs in turn provide practical training for farmers at demonstration plot.</p>

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
	W. Kamonayili 6/29, 7/21, 9/6, 11/14. Yipelgu 7/1, 20, 9/14, 11/22. Nakohugu 7/7, 7/30, 9/6, 11/6. Sabari No.1 (TP) 6/11, 7/9, 9/10, 10/18. Sabare No.2 7/2,29, 10/16, 11/3. Mognegu 7/27, 8/22, 10/15, 11/20. Kukpalgu 8/1, 15, 10/10, 12/3.		
On Site Training in Cycle1 & 2 MMDAs	Omit details due to a lot of data	AR F: 4,395 D: 460 A:1,196 NR F: 2,553 D: 206 A: 396	Cycle 1 & 2 MMDAs conducted On Site Training by their own budget.
1st ToT for cycle 4 MMDAs	2020/5/6,7,14 (AR) 2020/6 (NR, F/U)	34 (AR)	To train selected district officers conversant with technical package of Rice Extension Guideline and in turn become trainers at the district. Distributed voice recorded training materials for 1 st ToT due to COVID-19 protocols.
2 nd ToT for cycle 4 MMDAs	2020/7/7,8 (AR) 2020/8 (NR, F/U)	25 (AR)	To train the technical package for reproductive stage of rice growth.
3 rd ToT for cycle 4 MMDAs	2020/9/8-9 (AR) 2020/10 (NR, F/U)	25 (AR)	To train the technical package for harvesting season.
ToT for WIAD officers	2020/10/13 (NR) 2020/10/28 (AR)	21 (NR) 24 (AR)	To train WIAD officers on nutrition value of parboiled rice and unpolished rice and equip them how to cook the rice recipes.
On Site Training for cycle 4 MMDAs	[Ashanti Region] Nkawie Kuma (TP) 5/21,26,6/8, 6/22, 8/5,9/28. Ntabaanu 6/1, 19, 7/3, 8/18, 8/15 Apuayem 9/30,10/14,28, Fankomawe 10/4, 16, 10/30, 12/3, Adagya (TP) 5/22, 27, 6 /10,24, 8/6, 9/30. Abira 5/8,15, 6/5, 19, 7/28, 9/21.	AR F: 1,627 D: 277 A: 676	Establish training plot to train all AEAs in the district. Trained AEAs in turn provide practical training for farmers at demonstration plot.

Training / Workshop	Period and Place	No. of participants	Overview of Training / Workshop
	Kokoben 7/1,22, 8/10,24, 9/7, 12/2. Esaase 6/2,12,16,30, 10/20. Maaban 9/18, 10/1,9,26,12/16, Asanso (TP) 5/25, 6/4, 15,26, 8/13, 9/29. Dominase 6/5,18,19, 7/3, 8/11, 10/1. Boagyaa Besease 6/3,8,17, 7/1, 10/8. Korkyirekrom 5/28, 6/8,22, 7/6,9/1, 10/13. Bogyawe 6/2, 8, 29, 7/13, 10/27. Bekwai 5/5, 7/1,20. 11/19. Anyanso 1 (TP) 5/25, 6/2,12,29, 8/13,10/6.		
On Site Training in cycle 1-3 MMDAs	Omit details due to a lot of data	AR F: 5,070 D: 620 A:1,398 NR F: 2,355 D: 115 A: 207	Cycle 1-3 MMDAs conducted On Site Training by their own budget.
Extension Workshop	2021/4/23 (AR) 2021/4/27 (NR)	65 (AR) 65 (NR)	To distribute the fine-tuned Rice Extension Guideline to non-target MMDAs, other regions and rice sector stakeholders.
Project Completion Workshop	2021/5/4		To report the project outcome to rice sector stakeholders.

4.4. Training in Japan

Table 50 List of Training in Japan

No.	Period	Participants	Institutions visited	Outline of the training
1	2017/8/27-9/9	MoFA-DCS: 1 PCU: 2 (1 each from Northern and Ashanti) Cycle 1 MMDA: 10 Total 13	Ibaraki University, JICA Tsukuba Center, Tsukuba Agriculture Research Hall, NARO Genetic Resources Center, Tsukuba University Plant Innovation Research Centre, Tochigi Agricultural Experiment Station, Donkame Co. Ltd., Kohnan Shokuryo Co. Ltd., Hyogo Prefectural Government, Shikata-higasi Agricultural Producer's Corporation and JA Rice Center, Satake Corporation	<p>[Purpose]</p> <ul style="list-style-type: none"> • To improve rice extension in Ghana by learning how Local Government, Research Institute/Station and Extension Center in Japan collaborate each other on dissemination of the improved rice cultivation technology. • To learn roles and functions of Local Government and Private Sector on stable rice production, quality improvement and sales promotion of rice. <p>[Training Topics]</p> <ul style="list-style-type: none"> • Good quality seed production and extension, and rice breeding by using useful genetic resources, • Effective rice extension activities towards yield increase and quality improvement based on the District Rice Extension Plan, • Transition of agricultural tools improvement and Land development technology, • 4) Improved rice milling technology and Rice distribution based on consumer's needs
2	2018/10/1-13	MoFA-DCS: 1 PCU: 2 (1 each from Northern and Ashanti) Cycle 2 MMDA: 12 Total 15	Fukushima University, Fukushima Prefectural Government, Rice Seed Centre JA Sakura Fukushima Branch, Fukushima Agricultural Technology Centre, JA Pearl-line Fukushima Corp., International Agricultural Development Co. Ltd/Ashigara	

No.	Period	Participants	Institutions visited	Outline of the training
			Agricultural Club, Tsukuba Agriculture Research Hall, JICA Tsukuba Center, NARO Genetic Resources Center, Tsukuba University Plant Innovation Research Centre, JIRCAS	
3	2019/8/27-9/11	MoFA-DCS: 1 PCU: 2 (1 each from Northern and Ashanti) Cycle 3 MMDA: 10 Total 13	NARO Genetic Resources Center, JICA Tsukuba Center, Tigar-Kawashima Co. Ltd., Hosokawa Works Co. Ltd., Niigata Agricultural Research Institute, Niigata Agricultural Technology Extension Center, JA Zennoh Perl Rice, JIRCAS	
4 (Virtual)	2020/10/26-11/10	MoFA-DCS: 6 PCU: 2 (1 each from Northern and Ashanti) Cycle 4 MMDA: 4 Newly created MMDA: 5 Total 17	Online lectures were provided by Fukushima University, JICA Tsukuba Center, NARO Genetic Resources Center, Open University of Japan, JIRCAS	

4.5. Machinery and Equipment Procured

Machinery and Equipment procured are shown in the table below.

Table 51 List of Machinery and Equipment

Equipment	Quantity	Procured to	Current Status of Utilization (3/2/1+Reason of no utilization)
Photocopier	2	Ashanti PCU : 1 Northern PCU : 1	3
Desktop Computer	12	Ashanti PCU : 6 Northern PCU : 6	2 (A PC is broken and not repairable)
Projector	1	Northern PCU : 1	3
Manual Planter	6	Ashanti PCU : Manual Planter (one row) 1, Manual Planter (two rows) 1, Transplanter 1 Northern PCU : Manual Planter (one row) 1, Manual Planter (two rows) 2	1 In order to improve effectiveness, they were introduced in trial. However, they were not applied well since many soil masses in demonstration plot enabled them to plant seeds well.
Satellite cell-phone	1	For security purpose, Japanese experts use it in the Northern region.	It will be back to JICA Ghana Office after project completion.

Note: 3: utilized without problem. 2: utilized but with problem. 1: not utilized.

4.6. Local Cost

Local cost expended during the project period was 89,926,116 yen (equivalent to GHS 4,180,324) in total. Detail is shown below.

Table 52 Local Cost by Project

Items	Amount (JPY)	Remarks
Car operation cost	20,912,264	Fuel and maintenance costs for two Project cars and four regional cars
Consumables and Equipments	5,265,654	Purchase of tonner, laptop computers, air-conditioners, modem etc. and maintenance costs for equipment
Demonstration Plot	5,556,992	Seed, fertilizer, agrichemicals, tools, and moisture mater, etc.
C/P DSA, transportation cost	18,657,099	
Trainee DSA, transportation cost	20,412,267	
Training Material	6,651,670	Printing materials
Training Cost	7,418,383	Venue, Food and Stationery
Office Maintenance	3,940,835	Including furniture, utility charges, communication cost (phone, internet), and repair of office items
PR	1,110,952	Farmers Day
Total	89,926,116	

5. EFFORTS MADE FOR EFFECTIVE MANAGEMENT OF THE PROJECT

5.1. Budget Constraint

This was one of the new challenges in phase 2 of the project. All target MMDAs needed to continue rice extension activities by themselves after direct support from PCU. However, it was obvious that Region & MMDAs had faced budget constraint in implementing their activities. The constraint generated the tendency of stakeholders' behavior to rely on donor funding.

Based on such understanding, PCU had intensive discussion to encourage MMDAs to take necessary actions to obtain several sources of funding. PCU had heard several views from several stakeholders such as RADU, DCE/ DCD and DDA.

Based on such exchanges, PCU considered necessary actions to be taken.

- A “budget calendar”: DDAs were informed when OSTs should be done and how much a training unit costs. The information enabled DADs to plan the timing of their fund requests, the amount to request and from which source.
- Facilitation of budgeting rice extension activities: This is a prerequisite to enhance the budget release of government funding. Follow up visits and discussions on the timely release of rice extension budget highlighting the benefits of proper implementation of the extension plan.
- Facilitation for utilizing M&E results and pictures: MMDAs will need to justify the activities that they plan and budget for in order to secure funds. PCU facilitated utilization of M&E results and pictures of training to justify rice extension activities in reporting and negotiating budgeting and timely release for rice extension activities with DCE/DCD.
- Facilitation of Accessing other sources of funds: The government source is not the only source. The source will fill the gap in case the release of government source from the central government is delayed.
- Counterpart funding from the regional budget was not released.

5.2. Rice Extension and Cultivation

1) Mutual learning process between Ghanaian counterpart personnel's and Japanese Experts

There was much staff who had experience from phase 1 in PCU members. In that sense, Japanese experts were new to the Guideline. Therefore, Japanese experts learnt rice extension guideline from them first. Then, Japanese experts and Ghanaian regional counterparts brainstormed together on how they can address new challenges in phase 2.

2) Establishing Training Plot serving as a training centre in District

There was the need to approach the implementation of the cascade model in all 41 MMDAs in an effective manner considering the new challenges of human resource development in DADs (staff number and experience). Also, there was the need to improve the technical package through experience in 41 target MMDAs.

The project trained all AEA, YEA, NABCO, NSS through ToT in MMDAs (Joint training) and OST at Training Plot so that any of them can become trainers at demonstration plot established by MMDA. In order to train them to become capable AEAs of improved technical package, the project established one Training Plot in Cycles 1, 2, 3 and 4 MMDAs and provided practical training to them throughout the rice cultivation period. After each OSTs in the Training Plot, the AEAs could try and teach learnt techniques in the other demonstration plots of MMDAs.

3) Group cohesion works effectively.

Farmer groups were organized as beneficiary groups of the training, and this approach worked effectively. Especially group cohesion (farmers to unite.) LD is tedious, according to them. In that sense, it was a challenge how PCU could involve in the LD activity. ToT materials were improved for farmers to form the group for rice extension activities better.

4) Frequent visit to MMDA and farmers.

PCU made efforts to visit MMDA and farmers. These efforts contributed to the effective extension of technology to MMDAs and farmers.

5) Technical improvement on Rice Cultivation

The aim of the project was to establish a stable and sustainable production system by improving yields, making use of the resources available at the local level, introducing improved cultural practices and increasing the precision of their work while controlling the level of chemical fertiliser and pesticide inputs.

i) Control of the amount of fertilizer to avoid rice blast

The first strategy to improve rice yield is to increase the amount of fertilizer applied, especially of nitrogen, depending on the variety of characteristics and environmental conditions. However, in some of the project areas, before the start of Phase 2, there were cases of rice blast outbreaks that devastated entire fields and resulted in no harvest. Under these circumstances, increasing the use of nitrogen fertilizer could have led to a widespread intensification of blast damage as the rice culture spread. On the other hand, at the start of Phase 2, MoFA had started to promote a high yielding and disease resistant IR variety (Agra rice) to add to the commonly grown aromatic rice variety (Jasmine 85). Agra rice has some blast resistance, but it is susceptible to blast under certain conditions. Therefore, our policy was to reduce the risk of the blast by reducing the amount of nitrogen applied to about two-thirds of that recommended by the research institutes.

ii) New techniques applied in Phase 2

Hot water seed treatment

At the seed treatment stage before sowing, hot water seed treatment was newly introduced to ensure thorough seed disinfection, in addition to the saltwater selection of seeds introduced in Phase 1. It is widely acknowledged that hot water seed treatment, in addition to the removal of pathogenic immature seeds by the saltwater selection, has considerably reduced the incidence of the blast. Other preventive measures include avoiding gaps and other overcrowded and poorly ventilated areas, not leaving surplus seedlings after transplanting and avoiding fields prone to drought. At the same time, it was emphasized that such preventive measures were far more important than symptomatic measures such as the application of pesticides at the time of the disease outbreak.

As mentioned above, there were some concerns that the reduced amount of nitrogen applied would not result in the expected increase in yield, but this was addressed by dividing the fertilizer application into three well-timed sessions according to the growth stage of the rice. In particular, farmers were instructed to observe the formation of young panicles (just before panicle emergence) and apply fertilizer at that time with high accuracy. As a result, PCU was able to demonstrate that, despite being established under rainfed conditions, the demonstration plots and others could produce yields of 5-6 tonnes/ha, equivalent to irrigated rice fields. In order to improve the quality of the rice, it is important to harvest the crop at the right time. For this reason, PCU set the expected harvest date based on the average accumulated temperature after panicle emergence, which enabled PCU to plan the work in advance.

5.3. M&E

M&E Tool is developed and introduced to develop capacities of MIS officers in districts and regions. M&E Tool was designed to be aligned to the existing system, as well as simplified and made user-friendly. The M&E Tool covers the whole process of rice extension activities, and this makes it possible to monitor the whole cycle of the district rice extension activities.

Through the introduction and practice, the M&E capacities of districts as well as regions were strengthened. Districts can utilize the visualized outputs and outcomes of rice extension activities. In doing so, districts can strengthen their managerial capacities of rice extension activities. Districts also utilize the outcome such as farmers' yield increase for reporting and applying to MMDAs for funds. This contributed to the strengthening of the accountability of DAD.

6. LESSONS LEARNT

The terminal evaluation recognized the following lessons learnt from the project.

Table 53 Lessons Learnt (Terminal Evaluation, October 2020)

	Lessons learnt	Detail
1.	Promotion of agricultural projects not relying on the budget of development partners	Project made good effort to ensure sustainability of implementing capacity on budgeting and extension activities. It is expected that knowledge and experience of Tensui 2 project will be utilized on this issue for further dissemination to other regions.
2.	Development of the Extension Guideline aiming at national expansion	The Guideline is fine-tuned for its application to the other regions (Ashanti for use in the Southern part, and Northern for use in the North part of Ghana).
3.	M&E tool	The tool worked properly to inform MMDA of the situation in the fields.
4.	Market-oriented rice cultivation	Farmers' experiences of increasing income together with appropriate technology are crucial for the promotion of extension activities.
5.	Effective use of demonstration plots	The Project's demonstration plots had a large promotional effect on technology dissemination because farmers who saw increased rice production at the demonstration plots were motivated to apply the same technology at their lands.
6.	Introduction of a machine and small-scale land development	Support to introduce machinery for trained farmers to expand their cultivation. To realize this, farmers' needs for machinery have become stronger.

Through dissemination practice of the Guideline to all 41 MMDAs, PCU has learnt lessons, as shown below. As recognized in the terminal evaluation, the experience of working under the Government planning cycle will contribute to MMDAs continuing rice extension. In addition to it, there are more detailed and practical lessons learnt.

6.1. Output 1: Planning and budgeting

Lessons learnt for planning and budgeting are as follows.

- Efforts to access several sources of funds, including government source and the other sources of funds in
- Involvement of district assemblies by Inviting DCE/DCD/ MMDAs to demonstration plot facilitated the earlier release of funds.
- A Budget calendar enabled MMDAs to take actions to obtain budget release by providing ideas on how much each training cost and when each release will be difficult if the amount requested for an activity on a "Memo" is too large. MMDAs may not release because budget allocation to the district assembly is always limited. Several departments are competing for the limited resources.

6.2. Output 2: Rice Extension

(1) Rice Cultivation Techniques

While many of the demonstration plots achieved high yields even under rainfed conditions, and good practices were reported that significantly increased yields at the individual farmer level, there were also farmers who did not achieve the expected results due to bottlenecks in natural environmental conditions. This happened even if they understood the usefulness of the project's recommended technologies and were willing to expand their paddy rice cultivation.

As the technology practice survey revealed, although there was a high degree of acceptance of the basic technology recommendations, many farmers cited water availability as well as drudgery involved with some activities as a problem they faced. This challenge of water availability was particularly the case in the Northern Region at the time of the survey, where only a few plots could be kept waterlogged after sowing, and many could barely keep the soil waterlogged when trying to use the recommended water management practices. When selecting plots, it is recommended that they be located in low lying areas in valleys where surface water can be obtained during rainfall, but unless a certain amount of rainfall per hour is obtained, surface water will not be generated. In addition, although efforts have been made to build bunds around the perimeter of the fields to retain the water, many of the fields were newly cultivated and the land that had not been used for many years, so the plough bed that forms in the ground of a field that has been cultivated for many years has not yet been formed, and this made it difficult to maintain waterlogged conditions.

As the demonstration plots in this project were managed by local communities at the village level, the identification of catchment areas, which would involve surveying, was beyond the capacity of the project. However, with the recent development of drone-based surveying technology and the increasing availability of low-cost, labour-saving surveying methods, it may be worth considering the use of such technology to capture water from off-field water harvesting structures. In fields with high vertical water infiltration, it may be necessary to test the effectiveness of compaction by using a roller towed by a tractor.

In the Ashanti Region, the use of tractors and power tillers for ploughing paddy fields is almost non-existent, and this is a major factor limiting the area of paddy cultivated per household. One of the reasons for the lack of progress in the use of agricultural machinery is that the region is blessed with relatively high rainfall and has an undulating topography, which means that the valleys are marshy and difficult to be penetrated by tractors. In order to promote mechanisation in the future, it will be necessary to excavate simple drainage channels to make the fields dry, and to improve farm roads. To increase rice production, it is necessary to develop the infrastructure in a phased manner that is appropriate to the size of the local community to cope with climate change due to global warming.

(2) Extension activities

Lessons learnt for extension activities are as follows.

- Practical work through exercise during the in-house training was encouraged to increase

participants' understanding of new technologies such as area calculation by heron's formula, fertilizer calculation, seed selection by salt-water, hot water seed treatment, young panicle observation, use of moisture meter etc.

- Hands-on training for all AEAs at Training Plot enhanced their capacity development.
- The use of pictorial illustrations in training materials enabled farmers to easily understand messages of AEAs.
- Small equipment for rice cultivation. (e.g. power tillers will reduce the time of LD. Thresher will reduce the time of threshing.) can be introduced if MMDAs afford it.

6.3. Output 3: M&E

For MIS officers of MMDAs, one of the biggest challenges was M&E capacities. To facilitate M&E and strengthen their capacities, an excel M&E Tool was introduced. These M&E tools were aligned to the existing MoFA M&E system as well as simplified and made user-friendly. The M&E Tools facilitated them to compile results and report what has been achieved. Through practising M&E, the capacities of District and Regional MIS officers are strengthened as well. The M&E Tool worked very effectively in showing an outcome of the extension, especially, the increase in rice yield of farmers. The significant impacts on non-target farmers can be observed as well.

However, there are some challenges identified. The following are some lessons learnt.

1) The range and the number of data to be limited.

The data to be collected by MIS officers appears to be too many and also had very wide range beyond their capabilities. Moving forward, the range and number of data should be limited appropriately in consideration of the capacities of officers.

2) Easier data collection method to be considered

The conventional M&E method employed in the project by transferring data in EXCEL files causes many mistakes and complications. Easier, smarter and updated method can be considered.

7. REVISING PDM

Setting target indicators for project purpose, goal and each output and the other revision of the PDM was consulted and approved through Steering Committee meetings in February 2018 and 2019. The Record of Discussion was revised officially in December 2019. A revision was made mainly for the following issues.

- Addition of newly established MMDAs (Added during the consultation process for revising R/D after the SC meeting in 2019.)
- Description of Overall Goal and Project Purpose (revised at the SC meeting in 2019)

- Description of Objectively Verified Indicators (OVI) for Output 1 and 2 (revised at the SC meeting in 2019)
- Setting all target indicators (approved at the SC meeting in 2018 and updated upwards in the SC meeting in 2019)

Details are shown below.

(1) About Newly Established Regions/ MMDAs and Description and Target Indicators of Overall Goal and Project Purpose

Table 54 Detail of Amendment (Outline of the Project and Overall Goal)

Outline of the Project	
Before	Amended Version
<p>II. OUTLINE OF THE PROJECT (page 2 of Appendix 1).</p> <p>< 3. Project Purpose: page 3 of Appendix 1 ></p> <ul style="list-style-type: none"> ▪ The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 Metropolitan, Municipal, District Assemblies (MMDAs) of Ashanti and Northern Regions. <p><7. Project Site(s) and Beneficiaries: Page 6 of Appendix 1.></p> <ul style="list-style-type: none"> ▪ Project Activities will be implemented in 35 MMDAs in Ashanti and Northern Regions. A list of candidates MMDs for the Project site is in the Annex 5. 	<ul style="list-style-type: none"> ▪ The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in <u>41</u> Metropolitan, Municipal, District Assemblies (MMDAs) of <u>Ashanti and Northern, North East, and Savannah Regions.</u> ▪ Project Activities will be implemented in <u>41</u> MMDAs <u>which covers the same geographical areas as those of initial 35 MMDAs of Ashanti and Northern Regions stipulated in R/D. A list of candidates MMDAs for the Project site is in the revised Annex 5 of Appendix 1. Indicators are set based on activities in the initial 35 MMDAs.</u>
Overall Goal	
Before	Amended Version
<p>< Objectively verifiable indicators ></p> <ul style="list-style-type: none"> ▪ <u>XX MMDAs</u> apply the Extension Guideline for developing the productivity of rice. ▪ Rice production in Ghana increases from <u>X tons to X tons.</u> 	<ul style="list-style-type: none"> ▪ <u>35 MMDAs</u> apply the Extension Guideline for developing the productivity of rice. ▪ Rice production <u>in rain-fed lowland</u> increases from <u>33,000 tons to 89,000 tons in Ashanti region and 191,000 ton to 507,000 tons in Northern region from 2016 to 2023.</u>

Project Purpose	
Before	Amended Version
<p><Narrative></p> <p>The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 MMDAs of Ashanti <u>and Northern</u> Regions</p> <p>< Objectively verifiable indicators ></p> <ul style="list-style-type: none"> The yield/ha of farmers who have applied the techniques in the Guideline increase <u>XXX %</u> of the yields before the application. 	<p>The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 MMDAs of Ashanti, <u>Northern, North East, and Savannah</u> Regions</p> <ul style="list-style-type: none"> The yield/ha of farmers who have applied the techniques in the Guideline increase by <u>100%</u> of the yields before the application^{*1}. <p><u>*1: Indicative target yields are 4.0 ton/ha in Ashanti and 3.0 ton/ha in Northern, North East, and Savannah (NRDS average target: 3.5 ton/ha) respectively. This targets are subject to change according to the review of NRDS targets.</u></p>

Note: Underlined texts are ones revised.

(2) Target indicators of All Outputs and OVI of Output 1 and 2

Table 55 List of Amendment (OVI of Output 1-2 and Target indicators of Output 1-4)

Output 1	
Before	Amended Version
<p>< Objectively verifiable indicators ></p> <ul style="list-style-type: none"> District Rice Extension Plan in respective Project MMDA is developed. The extension activity is prioritized in the District Rice Extension Plan. Needed expenditure for providing extension services is budgeted. 	<p>1.1: District Rice Extension Plan in respective Project MMDA is developed.</p> <p>1.2: <u>Districts are sensitized to incorporate rice extension plan into District Medium-Term Development Plan (DMTDP).</u></p> <p>1.3: Needed expenditure for providing extension services is budgeted.</p>
Output 2	
Before	Amended Version
<p>< Objectively verifiable indicators ></p> <ul style="list-style-type: none"> XX (frequency) of the trainings for farmers and concerned stakeholders along with the Extension Guideline are carried out. XX (number) of DAO and AEAs are trained. XXX farmers are trained. 	<p>2.1: <u>5 times a year per district</u> of the trainings for farmers and concerned stakeholders along with the Extension Guideline are carried out.</p> <p>2.2: <u>490</u> of DAO and AEAs are trained. <u>11,700</u> farmers are trained.</p>

Output 1	
Before	Amended Version
Output 3	
Before	Amended Version
< Objectively verifiable indicators >	
<ul style="list-style-type: none"> ▪ The monitoring and evaluation system is established. ▪ <u>XX (frequency)</u> of the trainings about monitoring and evaluation for target RAD and DAD officials are carried out. 	3.1: The monitoring and evaluation system is established. 3.2 <u>1 time a year per region</u> of the trainings about monitoring and evaluation for target RAD and DAD officials are carried out.
Output 4	
Before	Amended Version
< Objectively verifiable indicators >	
<ul style="list-style-type: none"> • Comparing with the Phase 1, the rate of population who apply the technics in the Extension Guideline is increased by <u>XX</u> %. 	4.1: Comparing with the Phase 1, the rate of population who apply the techniques in the Extension Guideline is increased by <u>5</u> %.

Note: Underlined texts are ones revised.

8. STEERING COMMITTEE AND TECHNICAL COMMITTEE

8.1. Steering Committee Meetings

A Steering Committee meeting was held six times. The detail of the meetings is summarised in the table below.

Table 56 List of the Steering Committee Meetings

	Date	Participants	Agenda
1.	2016/9/1	MoFA (Chief Director, Directors of DCS and Extension), Ministry of Finance, Ashanti/Northern Regional Agriculture Directors and Crop officers, JICA office (Resident Representatives)	<ul style="list-style-type: none"> • Review of Result of Phase 1 • 5 year Workplan, annual action and budget 2017 • Monitoring Sheets ver. 1
2.	2017/8/17	Director and deputy director of Crop Service, National Rice Desk Officer DCS, MLGRD, RDAs and PCU schedule officers in Ashanti and Northern regions, JICA country representative and officers	<ul style="list-style-type: none"> • Rescheduling of SC/TC • Cycle districts selection process

	Date	Participants	Agenda
3.	2018/2/22	Director and deputy director of Crop Service, National Rice Desk Officer DCS, MLGRD, RDAs and PCU in Ashanti and Northern regions, Japanese Experts, JICA country representative and officers	<ul style="list-style-type: none"> Progress and outcomes as well as 2018 plans and budget PDM indicators and target
4.	2019/2/14	Director and deputy Director of Crop Services, National Rice Desk Officer DCS, MLGRD, RDA and PCU in Ashanti and Northern regions, Japanese Experts, JICA country representative and officers	<ul style="list-style-type: none"> Progress and outcomes of 2018, as well as 2019 plans and budget PDM indicators and target
5.	2020/2/4	Director and deputy Director of Crop Services, National Rice Desk Officer DCS, MLGRD, Ministry of Finance, RCC, RDA and PCU in Ashanti and Northern regions, Japanese Experts, JICA country representative and officers	<ul style="list-style-type: none"> Progress and outcomes of 2018, as well as 2019 plans and budget Revision of the Rice Extension Guideline
6.	2021/4/20	Director and deputy Director of Crop Services, National Rice Desk Officer DCS, MLGRD, Ministry of Finance, RCC, RDA and PCU in Ashanti and Northern regions, Japanese Experts, JICA country representative and officers	<ul style="list-style-type: none"> Review of activities in 2020 Completion Report of Project (5 years results) Approval of the revised Guideline.

8.2. Technical Committee Meetings

A Technical Committee meeting was held 10 times in the Ashanti and Northern regions, respectively. The detail of the meetings is summarised in the table below.

Table 57 List of the Technical Committee Meetings

	Date	Participants	Agenda
1.	2016/7/12 (AR) 2016/7/14 (NR)	MoFA (DCS and Department of Extension Service), Region (RDA, RAO (Crop, M&E and WIAD etc.), District (DCD and DDA), Research Institute (CRI, SRI and SARI)	5 years Workplan of the Project , Annual Workplan 2016 and Monitoring Sheet Ver. 1
2.	2017/1/24 (AR) 2017/1/27 (NR)	DAD/DAO from cycle 1 MMDAs, Region (RDA, RAO (Crop, M&E and WIAD etc.), PCU, CRI, SRI, SARI, JICA Ghana office, DCS, GIDA, Agricultural Extension Services	Report and review project field activities in 2016 and plans for 2017 (PCU and MMDAs), baseline Survey overview and proposal of project indicators and targets.

	Date	Participants	Agenda
3.	2017/11/14 (AR) 2017/11/21 (NR)	DAD/DAO from cycle 1 MMDAs, Region (RDA, RAO (Crop, M&E and WIAD etc.), PCU, CRI, SRI, SARI, JICA Ghana office, DCS, GIDA, Agricultural Extension Services	Report and review project field activities in 2017 and plans for 2018 (PCU and MMDAs)
4.	2018/2/27 (AR) 2018/3/1 (NR)	DAD/DAO from cycle 2 MMDAs, Region (RDA, RAO (Crop, M&E and WIAD etc.), PCU, CRI, SRI, SARI, JICA Ghana office, DCS, GIDA, Agricultural Extension Services	<ul style="list-style-type: none"> • Report and review project field activities in 2017 and plans for 2018 (PCU and MMDAs) • Sharing good practices of accessing funds for DCDs • PDM targets and indicators
5.	2018/11/20 (AR) 2018/11/27 (NR)	National Rice Desk Officer DCS, Staff from DAES, RDAs, DADs, DCDs from Cycle 2 MMDAs, GIDA, CRI, SRI SARI and PCU Ashanti officers	<ul style="list-style-type: none"> • Reviewed activities of 2018 and next year 2019 plan and budget (PCU and MMDAs)
6.	2019/1/24 (AR) 2019/1/30 (NR)	National Rice Desk Officer DCS, DAES, RDA, DADs, DCDs from Cycle 3 MMDAs, GIDA, CRI, SRI, SARI and PCU	<ul style="list-style-type: none"> • Review cycle 3 MMDAs rice extension plan for 2019 • Sharing good practices of accessing funds for DCDs
7.	2019/11/13 (AR) 2019/11/26 (NR)	National Rice Desk Officer DCS, Head of Food crop Unit DCS, Staff from DAES, RDAs, DADs, DCDs from Cycle 3 MMDAs, GIDA, CRI, SRI, SARI and PCU	<ul style="list-style-type: none"> • Review cycle 3 district rice extension in 2019 and plan of the activities in 2020.
8.	2020/1/28 (NR) 2020/1/30 (AR)	National Rice Desk Officer DCS, Head of Food crop Unit DCS, DAES, RDAs, DADs, DCDs from Cycle 4 and newly established MMDAs, GIDA, CRI, SRI, SARI and PCU	<ul style="list-style-type: none"> • Review cycle 4 and newly established MMDAs rice extension plan for 2020 • Sharing good practices of accessing funds for DCDs • Sharing experience from parent MMDAs and newly established MMDAs
9.	2020/11/16 (NR) 2020/11/19 (AR)	National Rice Desk Officer DCS, Head of Food crop Unit DCS, DAES, WIAD, SRID, PPRSD, RDAs, DADs, DCDs from Cycle 4 and newly established MMDAs, GIDA, CRI, SRI, SARI and PCU, MIS officer from North East Region	<ul style="list-style-type: none"> • Review activities in 2020 rice extension plan for 2021 about cycle 4 and newly established MMDAs
10.	2020/2/16(NR) 2020/3/9 (AR)	National Rice Desk Officer DCS, Head of Food crop Unit DCS, DAES, WIAD, SRID, PPRSD, RDAs, DADs from all cycle MMDAs, GIDA, CRI, SRI, SARI and PCU, MIS officer from North East Region Online participation: DCDs	<ul style="list-style-type: none"> • Review of 4 year results and rice extension plan for coming 4 years (for future input to DMTDP).

9. RECOMMENDATIONS

9.1. Issues to be Addressed

As positively reported by Terminal Evaluation Team in October 2020, the Tensui II project has achieved the project objectives by overcoming several constraints faced in the following ways.

- **Good results motivated MMDA.** PCU has proved that the technical package of rice cultivation and extension in Guideline successfully worked to disseminate to MMDAs. Many of the target MMDAs could improve yield through training on improved techniques as described in the Guideline, which motivated MMDA to continue the activities.
- **Fine-tuned Guideline validated.** The Rice Extension Guideline was revised based on the experience in the 41 MMDAs. Thus, the Guideline does fit more for scaling up to the other regions. It was validated by several rice stakeholders through the validation workshops in Accra, Kumasi and Tamale.
- **Aside technical capabilities, managerial capabilities of MMDAs for rice extension activities were strengthened.** Target MMDAs have got experience of managing rice extension activities in line with the Guideline under the Government system in the following ways:
 - ✓ Tools and information about budgeting enabled MMDAs to access Government source of fund as well as the other source of fund.
 - ✓ They have experienced alternative option to access resources. That is to access the other source funds. They include donor funds and contribution from input dealers etc.
 - ✓ The region and MMDAs are now able to collect and compile result data of rice extension to show the results for justifying and considering rice extension activities in planning and budgeting.

One of the important recommendations made by the Terminal Evaluation Team in October 2020 is about the “*sustainability*”. They positively reported the achievement of the objectives by overcoming various constraints and the development of competent human resources. However, one of the reasons for concern over the sustainability is the uncertain institutional arrangement of rice extension activities in the region in the future. Important recommendations made by Terminal Evaluation Team are summarized in the table below. Technical, organizational and financial aspects are discussed for the sustainability.

Table 58 Summary of Recommendation by the Terminal Evaluation

	Issues in Sustainability	Recommendations
Policies & laws (Institutional)	Favorable policies for rice extension.	
Organizational	PCU dissolved.	To develop extension structure.
Technical	Expected to be spread out.	MoFA: Continue dissemination of the Guideline.
Financial	MMDA: key for continuation. RAD: too small budget.	MoFA and RAD: Secure Budget for monitoring and providing technical assistance for DAD. MoF to clarify cause of delay in transfer to MMDAs and develop solution.

During the ten years of Tensui project Phase I and II, competent human resources have been developed. This is the most valuable “assets” and strongest points of the regions as well as MoFA for future rice extension activities. Individual capacities at RAD and MMDAs has been strengthened through the above exercises of the project, which will give foundations for technical and organizational sustainability. However, the current organizational structure “PCU” is just a unit for project management. In that sense, this uncertainty of organizational structure for the continuation of rice extension activities in Ashanti, Northern, North East and Savannah regions might undermine the strong individual capacities in the regions and MMDAs, which will be a serious loss to MoFA extension activities as well. This is the most serious weakness of the region as well as rice extension activities in the future. For disseminating the Guideline to the other regions, MoFA has to fully utilize the competent human resources as valuable assets. In this regard, a continuation of rice extension activities in these regions and their MMDAs is also crucial.

Looking at the external conditions of rice extension activities and regions, there is a favourable environment for rice extension. There are huge opportunities to expand rice extension activities in these regions. Therefore, it is rather high time for MoFA and target regions and MMDAs to maximize their benefit by fully utilizing outputs/ outcomes from the Project.

- The Government policy and programmes support rice.
- JICA is willing to support further dissemination to the other regions in a sustainable manner.
- Other DPs are also supporting the rice sector.

In this regard, for the “**Sustainable Expansion**” of rice extension activities, it is necessary *i) to strengthen the regional extension structure of rice extension to eliminate the uncertainty of institutional arrangements, ii) to fully utilize the strength of competent human resources, district, and guideline in order to capture the benefits from these opportunities.*

9.2. Recommendations

(1) Institutional Arrangements for Rice Extension Activities for the Sustainable Expansion

MoFA as well as Regional Agricultural Departments are recommended to strengthen the regional extension structure of rice extension activities for its sustainable expansion. It makes it possible to fully utilize the strength of competent human resources as valuable assets developed through the

project in order to capture the opportunities to promote rice extension, which can be strategic action for the “Sustainable Expansion” of rice extension activities discussed in the previous section.

(2) Relating to Planning & Budgeting

As discussed, once a project ends, MMDAs tend to look for another source and discard what they learnt. To avoid that, a letter from MoFA and/ or MoLGRD to direct MMDAs to allocate and release funds timely for rice extension will assist DDAs to negotiate with the Assembly for that purpose. Also, continuous backstopping from the Regions on the extent of resource allocation to DAD for rice extension is crucial for sustainable continuous implementation. This will also be a strong message from the Ministries to regions and MMDAs to continue rice extension activities under the Guideline.

(3) Relating to Extension

1) Frequent involvement of decision-makers of MMDAs to rice extension activities

To promote rice extension in districts, frequent involvement of stakeholders of MMDAs, especially decision-makers, is important. This includes explaining to DCE/DCD and field trip for showcasing the results of the rice extension to them. By observing the outcomes of rice extension activities, decision-makers of MMDAs can be encouraged to promote rice extension activities.

2) Strengthening of Research and Extension Linkage

The extension guidelines are based on the experience of this project and cover basic rice cultivation techniques applicable in Ghana. However, they do not include detailed information on what varieties should be selected in different environments or on fertilizer application, planting density, etc. for future extension processes. Extension organisations can take the lead in carrying out simple field adaptation trials, but farmers' plots are generally too small and not uniform in terms of soil fertility, water and sunlight conditions to allow for scientific data. In addition, many extension staff are not familiar with yield survey and statistical processing of data. In this sense, there is a strong need for collaboration with research institutions in order to solve technical problems. In Ghana, the research institutions in the agricultural sector are not affiliated to MoFA but to the Council for Scientific and Industrial Research (CSIR), which makes it difficult for the needs of the agricultural extension field to be reflected in research and experiment. In the medium to long term, it is recommended to reorganize and bring the research institutes under the umbrella of MoFA, but in the short term, it is recommended to develop a system that contributes to solving problems through close exchange of ideas and information.

(4) Issues related to M&E

M&E Tool worked very effectively for showing outcomes of the extension, especially, the increase of farmer production. For future sustainability, the following are to be considered.

1) Continuous monitoring of farmers outcome by DAD

Monitoring of rice extension activities should be continued, especially farmer level monitoring to capture the outcome to show the outcome of rice extension activities.

2) Continuous utilization of the M&E tool for rice extension and reporting.

Too many and too wide range of data to be collected and reported beyond the capacities of District

MIS Officers. The following points are to be considered.

i) Range of data should be focused to those related to farmers' outcome.

ii) Number of farmer level data should be reduced. Sampling size should be considered e. g. selecting around 5 samples per demonstration plot. The number of data items should be focused on important data showing farmers' outcome, such as production, area, and sales. Other detailed data such as production cost of each farmer can be collected by ad hoc survey, if necessary.

iii) Utilizing the updated and smarter method for collection under the COVID-19 conditions. For example, utilizing data collection software by tablet or smartphone should be considered, which makes it easy to collect, send and process a large amount of data.

(5) Issues related to Guideline

The Guideline was fine-tuned for extension activities in the other regions. MoFA should lead its dissemination in the other regions.

(6) Logistics

Tablet was distributed to 41 MMDAs and 4 regions. It contains the Guideline and training materials for continuing rice extension activities in the Guideline. It should remain in the MMDAs for that purpose.

Regional Vehicles were intensively used during the pandemic in 2020. Therefore, the two project cars in the project phase 2 should be handed over one each to Ashanti and Northern Regions.

Pictures

Sensitization Workshop and Training on Planning and Budgeting (2016-2017)



Picture 1 Sensitization Workshop in Ashanti region



Picture 2 Group work in the training on planning and budgeting in Northern region

Visits to DCE/DCD (2016-2020)



Picture 3 Visit to Cycle 1 MMDAs (Sagnarigu DCD)



Picture 4 Visit to Cycle 2 MMDAs (Ejura Sekyedumase DCD)



Picture 5 Visit to Cycle 3 MMDAs (Tolon DCE)



Picture 6 Visit to Cycle 4 Meeting With DCE/DCD, Atwima Nwabiagya MMDAs

Technicak Committee (2016-2020)



Picture 7 Ashanti RAD speeches (2018)



Picture 8 PCU reporting activities of year 2018

Steering Committee (2016-2020)



Picture 9 Presentation on PDM indicators



Picture 10 PCU reporting activities of year 2019

Site selection for demo plots (2016-2020)



Picture 11 PCU visited the valley in Sekyere Afram Plain district



Picture 12 PCU visited the valley in Karaga district

TOT at regional level (2017-2020)



Picture 13 1st TOT (Hot water seed treatment)



Picture 14 1st TOT (Practice how to measure the land area)



Picture 15 2nd TOT (PCU explains how to use the OST materials)



Picture 16 2nd TOT (Young panicle observation)



Picture 17 3rd TOT (Japanese counterpart explains yield component)



Picture 18 3rd TOT (Practices by participants how to use the moisture meter)

ToT at district level (2017-2020)



Picture 19 Lecture by DAO-Crop (Sekyere Afram Plain)



Picture 20 Group work on M&E tool(Sekyere South)



Picture 21 Area calculation by using Heron's formula (Sekyere Kumawu)



Picture 22 Practice on salt-water seed selection (Tolon)

On-Site Training (2017-2020)



Picture 23 Land development (Amansie Central)



Picture 24 Ploughing by tractor (Central Gonja)



Picture 25 Nursery bed (Afigya Kwabre)



Picture 26 Bund Construction (Central Gonja)



Picture 27 Land levelling (Sekyere Kumawu)



Picture 28 Direct sowing (Tolon)



Picture 29 Transplanting (Sekyere East)



Picture 30 Fertilizer application (Karaga)



Picture 31 Weeding (Sekyere South)



Picture 32 PCU trains how to observe young panicle (Zabzugu)



Picture 33 Bird scaring Net (Offinso North)



Picture 34 PCU explains how to use the moisture meter (Mampong)



Picture 35 harvesting (Amansie West)



Picture 36 Threshing (Tolon)

Field Trip (2016-2019)



Picture 37 AEA explains about the demo plot activities (West Mamprusi, 2017)



Picture 38 Key Farmer explains about the training plot activities (Savelugu, Duko community, 2018)

M&E Training and follow-up activities (2017-2020)



Picture 39 Data entry exercise in Ashanti region training



Picture 40 Data entry exercise in Northern region training



Picture 41 Visit to Sekyere Central DAD



Picture 42 PCU supervises data entry status in Afigya Kwabre North

Experience Sharing Workshop (2019)



Picture 43 Workshop in Ashanti region



Picture 44 Workshop in Northern region

Validation Workshop on Rice Extension Guideline (2020)



Picture 45 Group work in Ashanti workshop



Picture 46 Group work in Northern workshop

Nutrition Improvement Activities (2018-2020)



Picture 47 Baseline survey to female farmers (Mion)



Picture 48 WIAD officer explains on parboiled rice flour (Yendi)



Picture 49 TOT for WIAD officers (Northern region)



Picture 50 Cooking demonstration to WIAD officers in Northern region

Farmers Day (2016-2030)



Picture 51 Project exhibition in 2018



Picture 52 Tasting for parboiled rice TZ in 2020

Guests Visit



Picture 53 News gathering by TV program (East Gnja, 2016)



Picture 54 Visit by Japanese ambassador (Northern region, 2017)



Picture 55 JICA international cooperation reporters visited in Ashanti regions, 2017



Picture 56 Liberian visited the demo plot in Northern region, 2019

Training in Japan (2017-2020)



Picture 57 NARO Gene Bank (2017)



Picture 58 Color sorter of Satake Corporation (2017)



Picture 59 Fukushima Agricultural Technology Centre (2018)



Picture 60 Harvesting and drying rice (2018)



Picture 61 Interview to rice farmer in Niigata prefecture (2019)



Picture 62 Destoner of Hosokawa Works Co. Ltd.(2019)

Appendix

Appendix 1: Rice Extension Guideline

Appendix 2: Rice Production Handbook

Appendix 3: M&E Tools

Appendix 4: ToT Materials (soft copy only)

Appendix 5: OST Materials (soft copy only)

Appendix 6: Presentation Materials for Dissemination Workshop

Appendix 7: PR Materials



RICE *Produce More, Earn More and Be Happier!*

Extension Guideline

for Sustainable Rain-Fed Lowland Rice Production in Ghana

TENSUI RICE Phase II



April 2021

The Project for the Sustainable Development of Rain-Fed
Lowland Rice Production Phase 2 (Tensui Rice 2)



Ministry of Food and
Agriculture (MoFA)

Japan International Cooperation
Agency (JICA)



Extension Guideline

for Sustainable Rain-Fed Lowland Rice Production in Ghana

TENSUI RICE Phase II



April 2021

The Project for the Sustainable Development of Rain-Fed
Lowland Rice Production Phase 2 (Tensui Rice 2)



Ministry of Food and
Agriculture (MoFA)

Japan International Cooperation
Agency (JICA)



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¹ Tensui is Japanese word and has a meaning of rain-fed.

FOREWORD

Rice has become a staple food in Ghana and there is the need to increase domestic production. Out of the three ecologies that rice thrives very well, rain fed rice production occupies about 90% of the total area being recommended for its cultivation. Although rice consumption keeps increasing, domestic production is limited with the identifiable gap being filled with imported rice. It is interesting to note that, majority of rice farmers under the rain-fed lowland areas are smallholders cultivating rice with limited access to technical information. Increasing farmers yield is one of the biggest challenges facing rice production in rain-fed lowland conditions. Therefore, the Government of Ghana with support from some of the Development Partners is making all the frantic efforts to increase domestic rice production.

This Guideline is one of the outputs of the Project under the Sustainable Development of Rain-fed lowland Rice Production Phase 2 (Tensui 2) implemented by the Ministry of Food and Agriculture (MoFA) in collaboration with the Japan International Cooperation Agency (JICA) from April 2016 to May 2021. The Tensui 2 aims at disseminating technologies of the Guideline with the object of increasing yield in rice production in 41 MMDAs in Ashanti, Northern, North East and Savannah regions respectively. Prior to the implementation of Tensui 2, Phase 1, of the Project (2009 - 2014) had developed a technical package to increase yields and farmers' income and compiled it into rice extension guideline which was approved MoFA. The Guideline developed in Phase I had been revised and fine-tuned to suit the local conditions as well as the decentralized the implementation of MMDAs, during the implementation of Tensui 2.

In addition, this Guideline describes the technologies to increase rice production in a profitable manner in the rain-fed lowland areas of smallholder farmers. The Guideline also describes how Agricultural Officers in the MMDAs must plan and manage their rice extension activities in order to disseminate technologies in their annual and mid-term planning frameworks. It is known that, better plan and management of rice extension activities contribute to increased rice production.

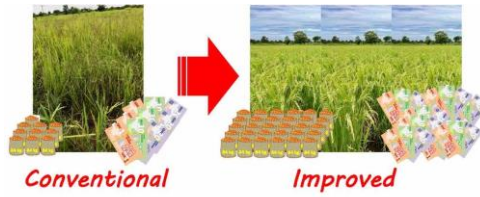
Therefore, the purpose of this Guideline is to help build the capacities of Agricultural Officers who are providing extension services to rice farmers in the MMDAs and any other stakeholder(s) in the rice value chain. The capacities being built by the use of this guideline include managerial capacities to plan and manage extension activities, monitoring and evaluation. Others include technical competencies to provide training and extension services, farm management and technical knowledge and skills to cultivate paddy rice.

Finally, this Guideline also emphasizes on extension delivery, standardization and improvement of effective extension aim at improving rice cultivation techniques to be transferred to framers. It serves to support rain-fed lowland rice production in general, and useful guide to Agricultural Officers, resource persons and other users.

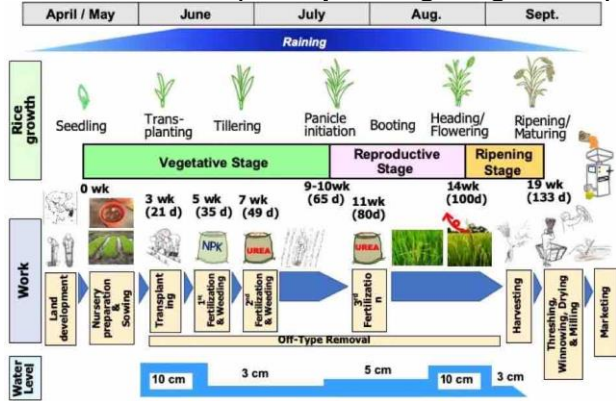


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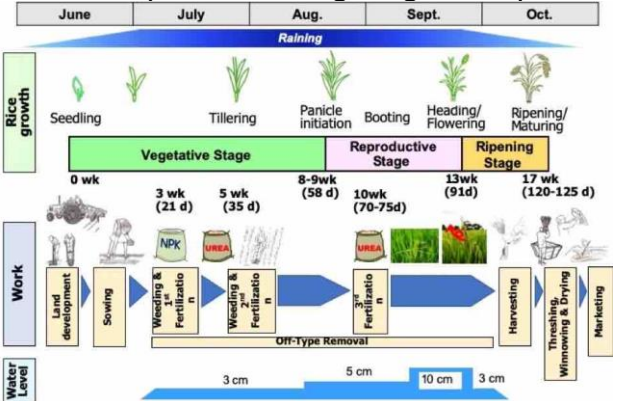
QUICK GUIDE



Cropping Calendar for Forest Savannah Transition Zone (Transplanting – Agra Rice)



Cropping Calendar for Guinea Savannah Zone (Direct Sowing – Agra Rice)



1. Bund construction, Ploughing, Pudding and Land Levelling



2. Salt Water Seed Selection and Hot Water Seed Treatment



1. Bund construction, Ploughing, Pudding and Land Levelling



2. Salt Water Seed Selection and Hot Water Seed Treatment



3. Row Planting –Transplanting-



4. Water Management



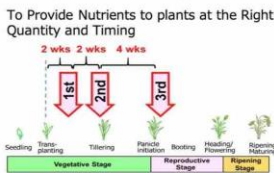
3. Row Planting –Direct Sowing-



4. Water Management



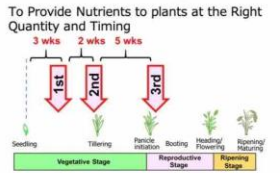
5. Split Fertilizer Application



6. On Time Harvest and Thresh On Tarpaulin



5. Split Fertilizer Application



6. On Time Harvest and Thresh On Tarpaulin



7. Farm Record Keeping and Marketing Support



7. Farm Record Keeping and Marketing Support



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ACRONYMS

AAP	Annual Action Plan
AEA	Agriculture Extension Agent
AGRA	Alliance for a Green Revolution in Africa
DAD	District Agriculture Department
DAO	District Agriculture Officer
DBO	District Budget Officer
DCD	District Coordinating Director
DCE	District Chief Executive
DDA	District Director of Agriculture
DFO	District Financial Officer
DMTDP	District Medium Term Development Plan
DPO	District Financial Officer
JICA	Japan International Cooperation Agency
KF	Key Farmer
M&E	Monitoring and Evaluation
MIS	Monitoring and Information System (Officer)
MMDA	Metropolitan, Municipal and District Assembly
MoFA	Ministry of Food and Agriculture
PCU	Project Coordinating Unit
PoA	Programme of Action
PPRSD	Plant Protection and Regulatory Service Division
RAD	Regional Agriculture Department
RAO	Regional Agriculture Officer
RDA	Regional Director of Agriculture
ToT	Training of Trainers
WIAD	Women in Agricultural Development Directorate

INTRODUCTION

Background

Rice has become one of the most important staple crops in Ghana. In 2019, domestic consumption reached about 1.4 million metric tons (MT) due to population growth, urbanization and change in dietary habits (MoFA 2019). However, domestic production is limited, with the balance between consumption and domestic production filled by imports. This situation raises concerns on food security and current account balance. In this regard, the Government of Ghana is trying to increase production of rice, especially making effort to increase productivity in the rain-fed lowland areas.

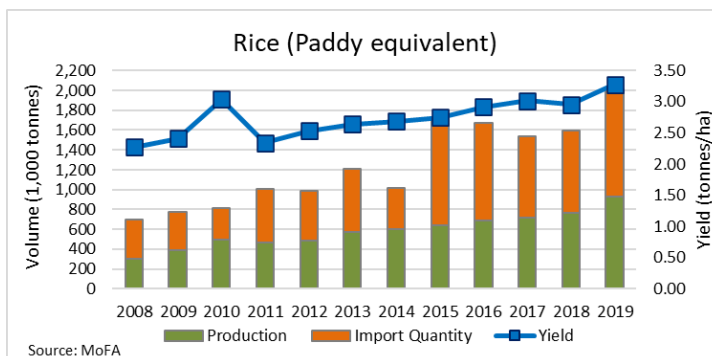


Figure 1: Rice Production and Import

In Ghana the bulk of local rice is produced in the rain-fed lowland areas with low productivity. The majority of farmers are smallholders with limited access to technical information, inputs, extension services, finance and markets. One of the challenges is how to increase their yield.

The Project for Sustainable Development of Rain-Fed Lowland Rice Production, Phase 2 was implemented in Ashanti and Northern, North East and Savannah regions where most of the rice production is done in the rain-fed lowland areas. These areas are located in different ecological zones namely; *Semi-Deciduous Rainforest, Forest-Savannah Transition and Guinea (Interior) Savannah Zones*. The technologies in this Guideline can be applied in these zones.

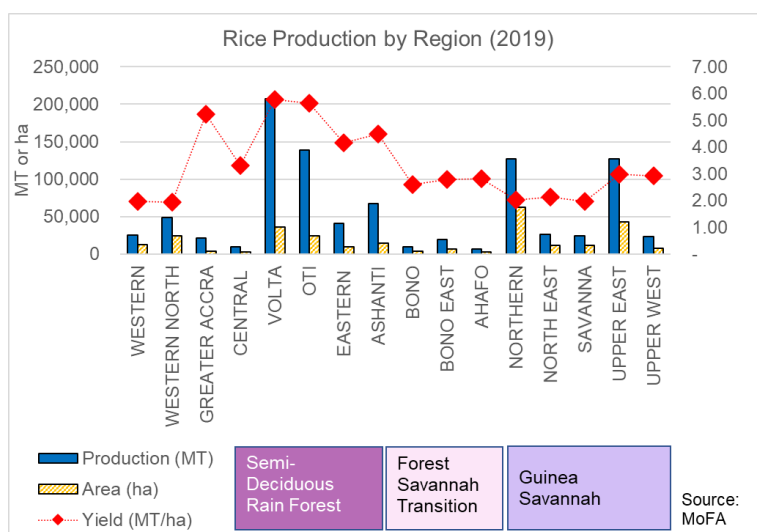


Figure 2: Rice Production by Region (2019)

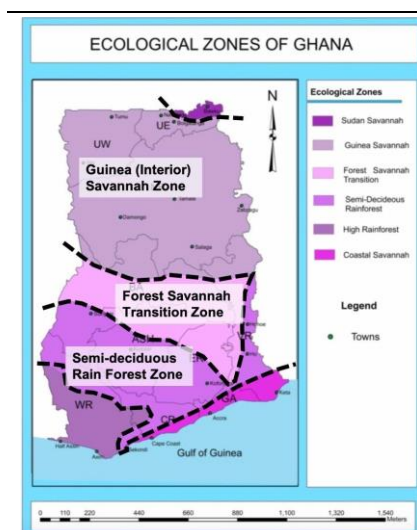


Figure 3: Ecological Zone

Consequently, the project aims at disseminating the technical packages to 41 MMDAs in both regions with the following components:

- i) capacity development of DAD staff in planning and budgeting,
- ii) training and extension,
- iii) capacity development in monitoring and evaluation (M&E), and
- iv) fine-tuning the Guideline.

The Guideline shows not only technological package but also management of the rice extension activities. In this regard, the various MMDAs have to i) prepare their own rice extension plans, ii) mobilize resources to implement them, iii) implementing extension activities, and iv) manage them with “*Plan-Do-See*” cycle to make their rice extension activities more effective.

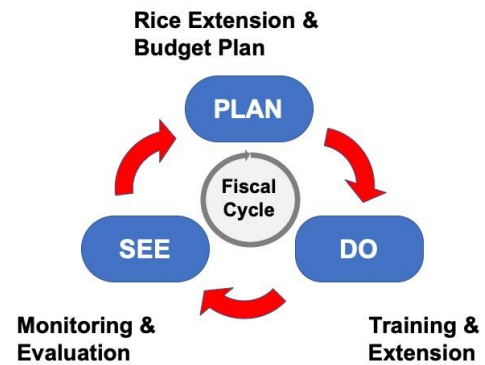


Figure 4: Rice Extension Activities in “Plan-Do-See” Cycle

This Guideline consists of the following chapters:

- Chapter 1: Extension Methodologies
- Chapter 2: Technical Package
- Chapter 3: Implementation of the Guide

CHAPTER 1 EXTENSION METHODOLOGIES

The extension methodologies adopted in this guideline consists of a set of practical field training of farmers at demonstration plot, and a series of cascade trainings which makes it possible to train farmers in widely spread area, efficiently.

Demonstration plot (Demo-Plot) is set up as a frontline of extension in a community. Demo-Plot is a venue for practical training of group of farmers (Group Farmers) on improved techniques. A series of cascade trainings from in-house Training of Trainers (ToT) to onsite training at Demo-Plots is conducted. Beneficiaries of those trainings in turn become trainers in the next stage of cascade training. Agricultural Extension Agents (AEAs) are expected to be trainers at Demo-Plots.

1.1 Extension Approach at the Field Level

A set of Demonstration plots (**Demo-Plots**) and group of farmers (**Group Farmers**) in communities are core components of rice extension at the field.

Demo-Plot and Direct Beneficiaries

Demo-Plots are established in the communities to demonstrate the improved rice cultivation technical packages. Group Farmers are identified and formed into a demo plot group. The group farmers are then considered as target farmers (Target Farmers). They are direct beneficiaries trained during Onsite Training. Group Farmers are expected to: 1) learn the rice cultivation techniques at Demo-Plots, 2) manage the Demo-Plots, 3) evaluate results of demo-plots and 4) apply the techniques to their farms.

Indirect Beneficiaries

Farmers nearby Demo-Plots are non-target farmers (Non-Target Farmers) and are therefore seen as indirect beneficiaries. They are expected to see and/or observe what goes on in the Demo-Plot and to copy/apply the techniques to their own fields. Field day is a tool to disseminate technical packages to Non-Target Farmers.

Replication of Demo-Plot and Group Farmers

A core component (Demo-Plot and Group Farmers) is replicated in other places to disseminate the improved rice cultivation techniques to be expanded into other areas.

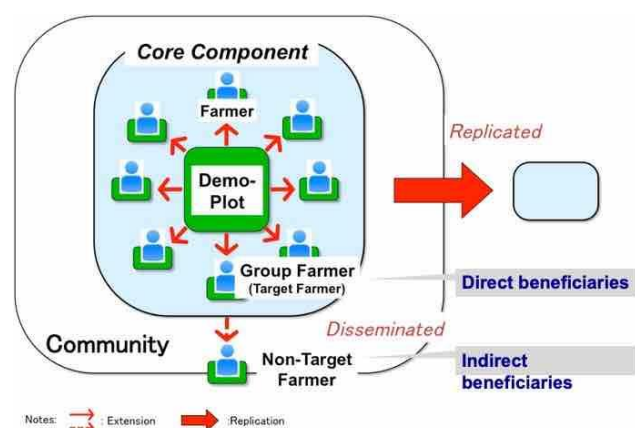


Figure 5: Demo-Plot and Group Farmer

1.2 Cascade Training

To introduce the field level extension, series of cascade trainings are rolled out. Beneficiaries of the trainings are expected to become trainers in the next step of training. The goal is that trained farmers are expected to adapt and practice the technologies in their individual fields.

The cascade training model consists of three levels of training: 1) **Training of Trainers** (ToT: theoretical in-House Training), 2) **Onsite Training** (OST: Practical Training), and 3) Demonstration & Observation to share the results to others (Field trips and field days).

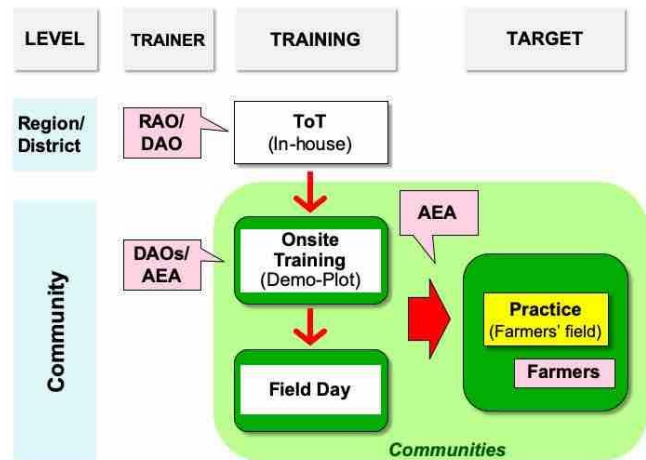


Figure 6: Cascade Training

Training of trainers (ToT) is a theoretical in-house training at the district level (with the regional level version being optional), and Onsite Training is a practical training at the communities.

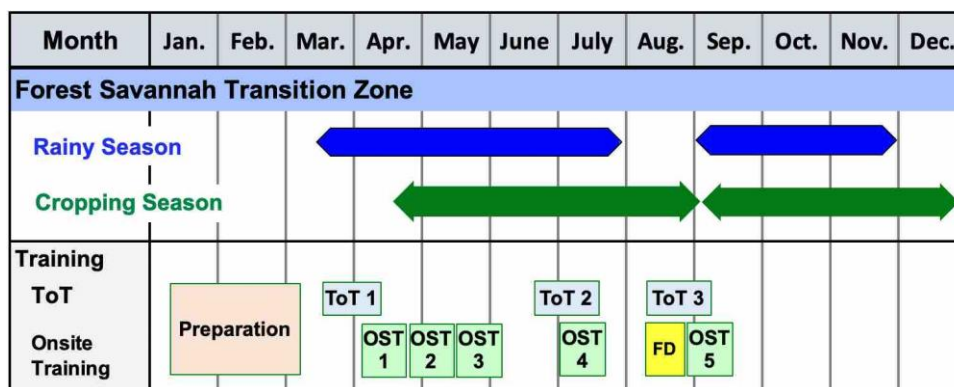
Onsite Training is the key training at the field level to train Group Farmers (Target Farmers) at Demo-Plots. After learning the technical package at Demo-Plot, Target Farmers are expected to practice on their own field and adopt the improved techniques.

Field Trip gives opportunities to stakeholders for mutual learning experiences by observing the progressive cases on the demo fields. **Field Day** is organized to show improved rice cultivation techniques to Non-Target Farmers.

Annual Schedule of the Extension

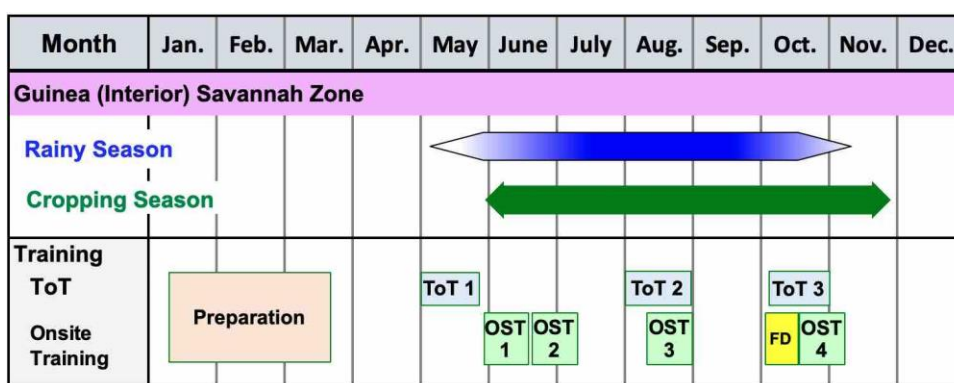
These trainings are planned according to rice growing calendar. Trainings are planned before the expected actual field work so that farmers can know what to do in advance. Important trainings such as ToT and Onsite Training are divided into several sections. The proposed calendar of each activity by geographical zones are shown on figure 7 below:

Yearly Activity Calendar for Forest Savannah Transition Zone



Note: ToT: Training of trainers; OST: Onsite Training; FD: Field Day; FT: Field Trip

Yearly Activity Calendar for Guinea Savannah Zone



Note: ToT: Training of trainers; OST: Onsite Training; FD: Field Day; FT: Field Trip

Figure 7: Annual Calendar by Zones

NB: Timing of activities in calendars may change due to environmental factors.

1.3 Implementation

For effective implementation of Rice Extension Activities, the following are crucial focal points to consider. The details of these points are described in Chapter 3.

1. Preparing District Rice Extension Plan
2. Group Formation & Community Facilitation
3. Action Plan for Demo-Plot prepared by AEA
4. Conducting Training
5. Monitoring and Evaluation (M&E)
6. Sharing Results

CHAPTER 2 TECHNICAL PACKAGE

2.1 Overview

Rice production start with land development and preparation, followed by Cultivation and Harvesting. Techniques of rice cultivation is divided into two categories depending on water availability of the location.

These are: (i) **Transplanting** method applicable to areas with relatively high availability of water, and (ii) **Direct Sowing** method for water scarce areas depending on the climate conditions. Both methods are developed for rain-fed lowland conditions. Technical package consists of land development/preparation techniques and rice cultivation techniques in consideration of:

1. Proper land and water management to enable the full and efficient utilization of limited resources under rain-fed condition, and
2. Introduction of low cost and simple rice production techniques that enhance smallholder farmers' field practices.

Expected benefit of the improved technical package is an increase in yield and an improvement in rice quality. Based on experience, the introduction of this improved technical package can help farmers to harvest rice twice as compared with conventional method.

	Transplanting (Ashanti region)		Direct Sowing (Northern, North East and Savannah regions)	
	Conventional methods	Improved package	Conventional methods	Improved package
Bags harvested (84kg/acre)	8 – 10 bags	15 – 30 bags	6 – 8 bags	12 – 16 bags
Yield (ton/ha)	1.6 – 2.0 ton/ha	3.0 – 6.0 ton/ha	1.2 – 1.6 ton/ha	2.4 – 3.2 ton/ha

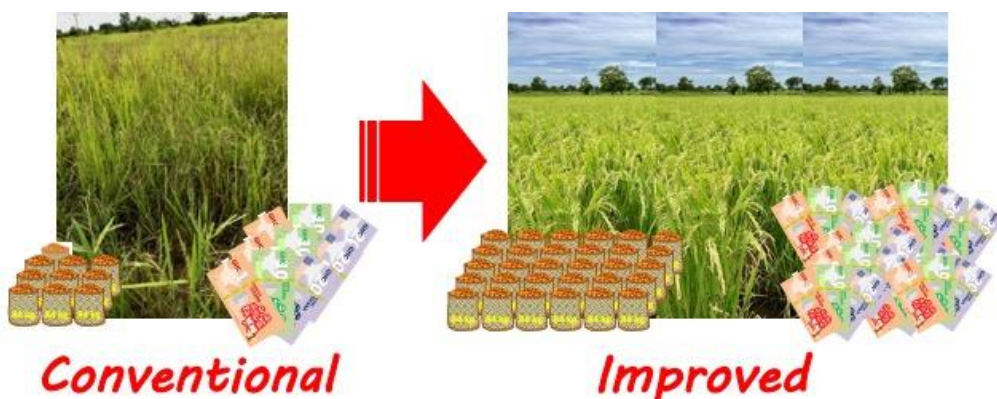


Figure 8: Expected Benefit

Transplanting method is applicable in rain-fed lowland areas, where water sources is relatively available. Improved techniques of land development and preparation are (i) bund construction to store water, (ii) land levelling for uniform water depth, and (iii) appropriate water management, depending on the growth stage of rice plant.

Improved rice cultivation techniques are (i) seed selection for better germination and seed treatment for disease control, (ii) transplant seedlings in row, (iii) split fertilizer application and weed control, (iv) frequent off-type removal and (v) timely harvest. Introduction of improved post-harvest techniques such as threshing on tarpaulin and drying paddy to appropriate moisture content are also important enable farmers sell good quality rice which meets consumer needs such as stone free, clean and white etc.

Standard rice cropping calendar of transplanting method is shown below:

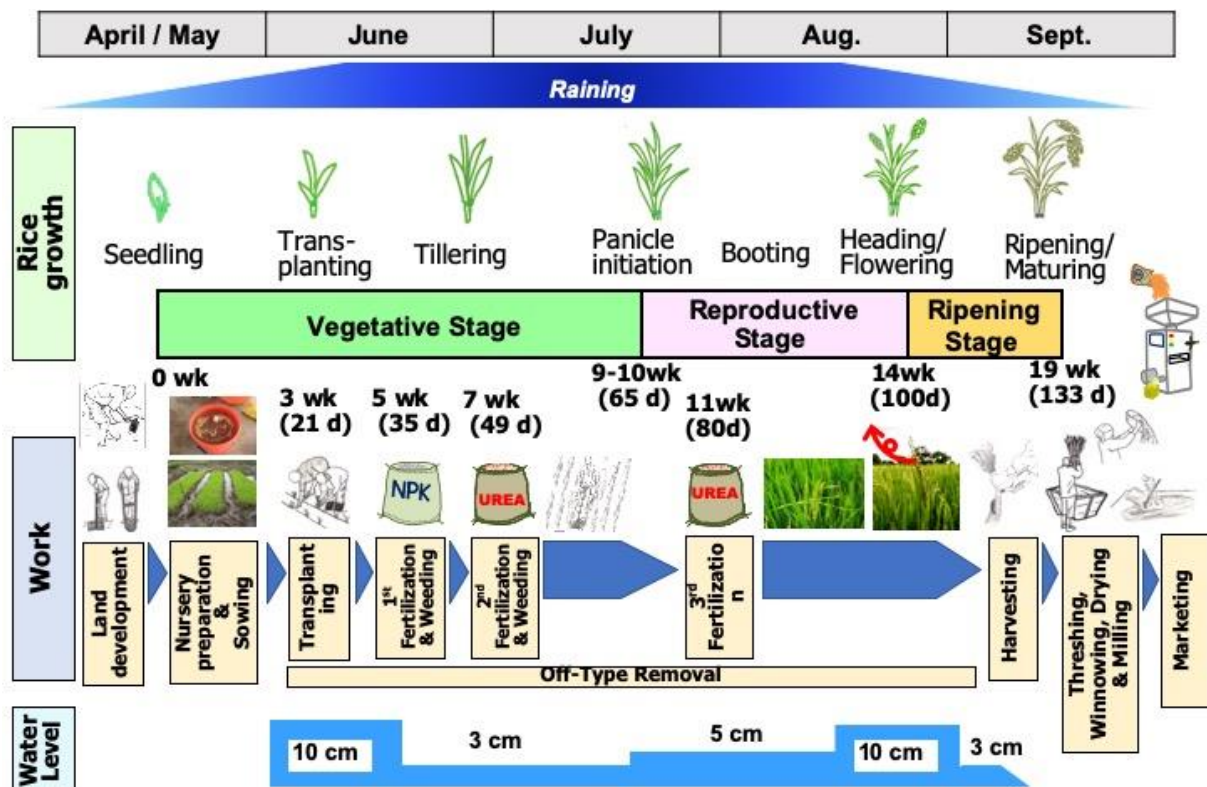


Figure 9: Standard Cropping Calendar (Transplanting – AGRA Rice) in Ashanti Region

Direct sowing method is applicable in rain-fed lowland areas where water sources are relatively limited. Improved techniques of land development/preparation are (i) bund construction to catch run-off water and (ii) land levelling to minimize undulation of land. Improvement of tractor access is also important.

The only difference in improved rice cultivation techniques between transplanting and direct sowing methods are; transplanting seedlings in row and drilling or dibbling respectively. Seed selection and seed treatment, split fertilizer application and weed control, frequent off-type removal and timely harvest apply.

Standard rice cropping calendar of direct sowing method is shown below.

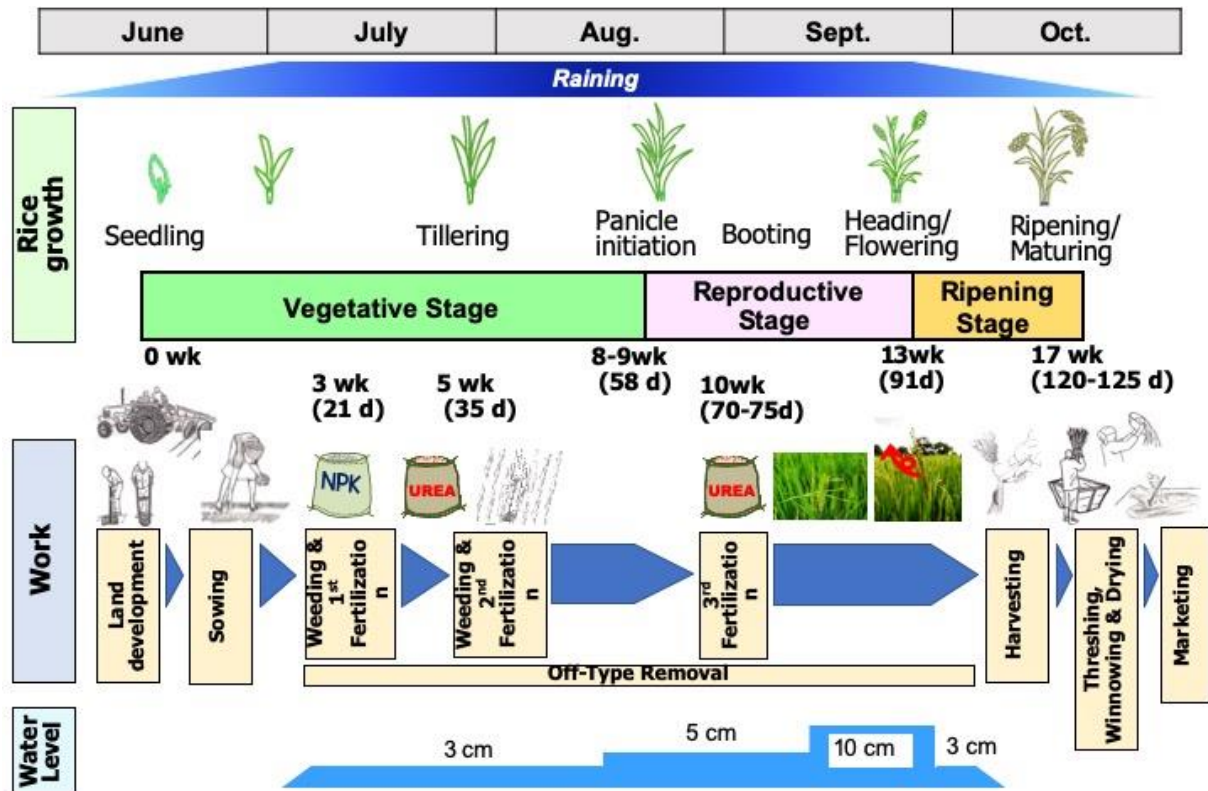


Figure 10: Standard Cropping Calendar (Direct Sowing – AGRA Rice) in Northern, North East and Savannah Regions

2.2 Land Development and Preparation

The success of rice cultivation is partly dependent on proper land development and preparation. The land development activity for rice cultivation is an integrated process involving good valley/site selection, stumping for virgin lands, drainage systems and bund construction. After land development, land preparation should be done. This includes ploughing, puddling, levelling, water harvesting and management.

2.2.1 Land Development

(1) Valley/Site Selection

The success of rice farming depends to a large extent on proper selection of the land/valley to be developed. The area selected can influence the cost of the land development and preparation activities.

Some factors to consider in valley/site selection are:

[Technical aspect]

Good source of water (temporary and permanent, but permanent preferred)

It is necessary to ensure that the valley or field under consideration has a good source of water, whether temporal or permanent. A perennial water source is always preferred.

Slope of the Valley

A fairly flat plain is recommended. This is to help minimize farmers' effort needed to level the field since a well levelled field is a necessity for equitable distribution of water and efficient weed and fertilizer management. High undulating fields/valleys will demand more efforts from farmers to level them. This can be costly and time consuming as well.

Flood water level.

History of flood levels is very key in selecting a valley for rice production. This is because these valleys are developed on smallholder farmer basis, thus, does not include flood protective embankment to take care of flood waters. Therefore, it is important to select a valley whose flood level history is not above the knee level of the farmer and also has a maximum of three (3) days recession period.

Preferred Soil Type

Select soils with higher clay loamy content. Also, avoid sandy soils and stones.

Vegetation Cover

Vegetation cover such as Gamba grass, Acheampong weed, Elephant grass, Oil palm, Nut Grass (*Cyperus Esculentus*) and other local grasses gives an indication of a good valley soil for rice cultivation.

Contaminated water or soils

Avoid areas where either soil or water has been contaminated [Galamsey operated areas].

[Social aspect]

Valley ownership / Custodian [Chief, family head, Individual]

Consideration should be given to the ownership of the valley or field to be developed. Avoid non-cooperative land owners to prevent future land disputes. Land users are encouraged to enter into a longer-term land tenancy agreement. e.g. 5 years or more.

Farmers are encouraged to leave a buffer zone of 5 – 30 meters depending on land availability when cultivating close to water bodies. The buffer should be kept under vegetative cover to protect the water bodies from silting and prevent the washing away of top soil that are close to the valley.

Accessibility to the valley

Valleys or fields earmarked for demonstrations and future developments should be accessible to stakeholders. Such valleys should have access tracks/roads to enable farmers to cart their produce to towns and market centres without difficulty.

Number of farmers working in a Group

For demonstration purposes, the number of farmers working in a group should not be more than ten [10] for a quarter acre in Ashanti Region. In the Northern, North East and Savannah Regions, the number of farmers should be between 10 – 15 for one [1] acre field. This is very important because of the drudgery involved in the land development activities, efficiency of the work and also help in the man-management of the farmers.

On the other hand, there are some things that should be avoided when selecting valleys for rice cultivation. One should avoid:

Reserved or protected/totem areas should be avoided.

These areas are usually reserved for traditional purposes. Such areas should be avoided since they have traditional or customary implications.

Contaminated water or soils

Avoid areas where either soil or water has been contaminated [Galamsey operated areas].

Below are some examples of vegetation cover to look out for during valley selection.



Photo 1: Gamba grass



Photo 2: Elephant grass



Photo 3: Cyperus Esculentus



Photo 4: A fairly flat valley / Valley with a gentle slope

(2) Drainage Systems

Construction of an effective drainage system is a requirement of land development for rice production. [Desilt existing water courses to enhance effective field drainage]

(3) Field Bunds

Bunds are small earth embankments used to contain or manage water within basins for agricultural purposes. The height of bunds is determined by the water depth. The width of bunds should be such that it will be stable and leakage free. There are two main types of bunds constructed for the purposes of this Technical Package. These are the peripheral and interlocking bunds.

The peripheral bunds are mainly used to demarcate the basins. They are higher in height and wider in width than the interlocking bunds. They are the main bunds constructed around the field.

The interlocking bunds are created within basins to avoid deep water deposit in the field. Thus, created to separate places of higher elevations from lower elevations.

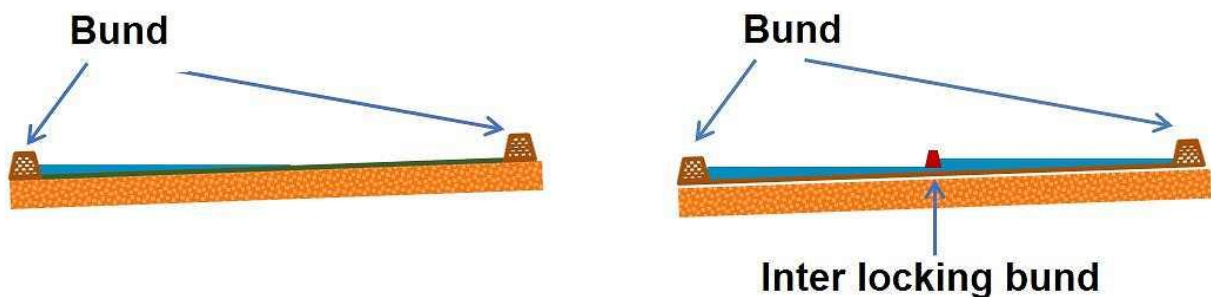


Figure 11: Peripheral and interlocking Bunds

Function of bunds: Bunds are constructed to help conserve water on the field for rice plants. They are also to direct water in and out of the basins for water management purposes. They serve as flood control structures, walkways and field boundaries. Without the field bunds, water cannot be harvested and stored on the field. Fields without bunds will experience erosion and frequent flooding. Lastly, without bunds, fertilizer applied is likely to be lost especially in the unlikely event of rainfall hours or a day after fertilizer application.

Steps to follow in bund construction:

1. Peg the bund alignment using a rope in straight lines.
2. Clear the bund alignment and scoop the top soil aside
3. Scoop the sub-soil from both sides of the alignment.
4. Compact the heaped sub-soil in thin layers using the flat wooden compacter.
5. Continue the heaping and compaction process until the required height of 30 cm – 50 cm (main/peripheral bund) is achieved. With respect to the interlocking bunds, the height should be 10-15cm.
6. The top width should be such that it can be used as a walkway.

NB: Avoid the use of top soil to form bunds as these contain organic matter and therefore are loose and cannot be compacted well. This can easily be washed away.

Pond the field to determine higher portions and lower portions by observing the flow of water and make inter-locking bund between both portions. After making inter-locking bund, both portions are levelled respectively.

Regularly maintain field bunds to avoid leakages and loss of nutrients. During cropping season, minor repairs such as hilling up the soil, reshaping and clearing of weeds on the bund should be done to maintain the function of bunds. During off-cropping season, clear the weeds, re-compact and reshape bunds should be done. In addition, reinforcement of weak bunds using sand bags could be done.



Photo 5: Bund



Photo 6: Compaction

2.2.2 Land Preparation

(1) Land Clearing, Ploughing/ Harrowing, Puddling and Levelling

Valleys selected should be cleared and free of existing vegetation and stones.

a. Ploughing

Ploughing is the process of turning up the soil or the process of cutting, breaking and inverting the soil partially or completely to make it suitable for sowing rice. Some tools used in ploughing the soil are hoe, power tiller and tractor mounted ploughs.

Points to note during Ploughing

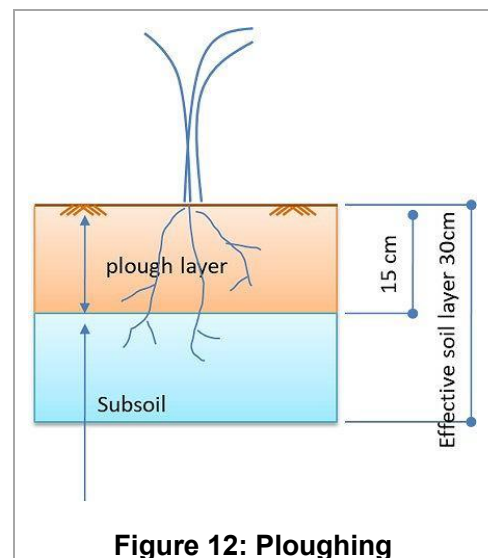
1. Land should be cleared before ploughing
2. Soil should be relatively moist
3. Plough across the slope
4. Avoid deep ploughing to prevent turning of subsoil
5. Ploughing depth should be uniform
6. Lump soils should be broken down
7. Remove debris and tree stumps.

The ploughing layer should not be more than 15cm. Effective soil layer should also not be more than 30cm including the ploughed layer of 15 cm.

b. Puddling (for transplanting)

Under waterlogged conditions, puddling involves breaking down of the ploughed soil lumps with the feet, hoes or power tiller to make it soft structure less mud.

Puddling softens the soil and assists both manual and mechanized transplanting of rice seedling, minimizes water use through reduced percolation losses and effective weed control.



Over time, soil puddling also creates a compacted layer below the puddled zone which further reduces percolation losses. It is advisable that one wears the field boots before manual puddling.

c. Harrowing

Harrowing involves working the ploughed soil to break up and smoothen out the surface of the soil especially for direct sowing. This helps levelling by closing up soil gaps left after ploughing and to ensure even distribution of water.

d. Land Levelling

Land levelling is a process of modifying the soil surface by grading and smoothing to a planned

level or grade required to facilitate or improve uniform water distribution. It involves modifying existing slopes or undulations, thus, reducing the field undulations. It is also a process of making the ploughed field level. It enhances even water distribution and drainage of surface water. It also enhances uniform growth of rice, and effective fertilizer and herbicide utilization. Without levelling, water will be unevenly distributed, and farmers will have difficulty controlling water on the field.

Land levelling is done using a wooden land leveller. The user of the leveller pulls or pushes the ploughed soil from places of higher heights to places of lower height to enable even water distribution.

It should be noted that water lodging in the field tells where land is high and low. Such places should be marked for levels to be corrected either using the land leveller or interlocking bunds. Also, continuous land levelling year by year is a key factor for good yield.

Some simple tools for land levelling include:

- Manual land leveller,
- Flat leveller tied with a rope,
- Ladder tied with a rope,
- Sack for 2 people to hold, and
- Sack with a rope.
- Power tiller can also be used for levelling



Photo 7: Puddling



Photo 8: Levelling

(2) Water Use & Management

This involves the introduction of useful structures such as bunds, weirs, canals, pond, seepage water collection ditches and drains to harvest, manage and help in the distribution of harvested water. Water management entails the optimum use of available water resources by the rice plant and other water users. It is mainly to secure water for the rice plant for non-continuous rainy days with a water harvesting or storage facility.

Water used for rice cultivation should not be obtained from sources where the environment is risk to contamination with any harmful substance and its quality is suitable for cultivation. It shall not be waste water from either domestic or industrial activities or others that may cause hazardous contamination.

Water management techniques are integrated processes that uses (details can be found in the Appendixes: Rice Cultivation Handbook):

1. Peripheral and Interlocking bunds
2. Drainage system,
3. Canal,
4. Dug outs, weirs, and
5. Sand bags

The construction of bunds [both peripheral and interlocking], channels and drains to move water to and from basins greatly improves the control of water by rice farmers. These structures allow water to be delivered to the individual basins for the use by the rice plant in a timely manner and the farmer is able to retain water (especially after applying fertilizer so nutrients are not lost) or drain the field for harvest.

Examples of canals used in small scale inland valleys include the divided canal type and the dual purpose type as shown in figures 9 & 10 below.

With respect to divided canal type, diversion weir/dug out is constructed to gather and raise water level at upstream for gravity flow. Diversion canals are constructed around the field. Existing river is developed as a drainage canal through the middle of the field.

For the dual purpose canal, original water way is developed with a weir constructed. This weir helps to raise the level of the water into the basins. Water within these basins are used and the excess is also impounded by another weir downstream. This second weir helps to channel water to the plots downstream.

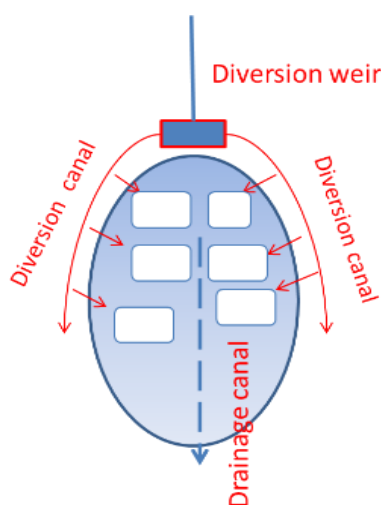


Figure 13: Divided Canal

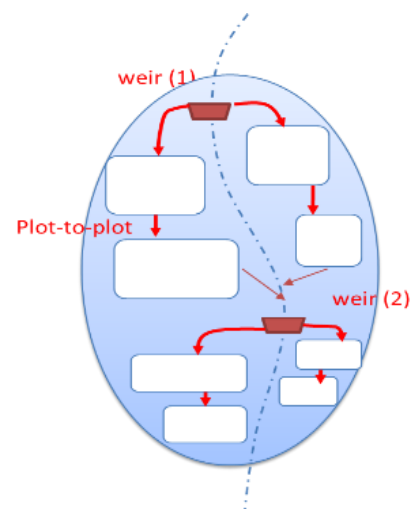


Figure 14: Dual Purpose Canal

2.3 Rice Cultivation

2.3.1 Choice of Variety

(1) Variety Selection Criteria

When a rice variety is chosen for planting, the variety should have both the genetic and physical attribute to enhance productivity. Some of these attributes include high yield potential, resistance/ tolerance to major pests and diseases, good grain quality, consumer preference for higher market demand, adaptable to local climatic conditions etc.

High Yield Potential

A High Yielding Variety (HYV) should be the first choice when a rice variety is planted. HYVs are responsive to fertilizer, especially nitrogen fertilizer, and have erect leaves to receive sufficient sunlight for growth. This enables HYVs to produce more photosynthetic products efficiently and as a result, produce more paddy than conventional (Traditional) rice varieties. The potential yields of HYVs could reach as high as 9 tons/ha compared with conventional (Traditional) varieties with yields ranging from around 1-2 tons/ha.

Duration

Growth duration of the variety should be considered depending on environmental factors such as period of water availability and risks of flooding. Short maturing varieties mature early and should be harvested early. The advantage of using early maturing varieties would be to avoid harsh weather conditions, disease escape, etc. However, their yield level is often lower than medium and long maturing varieties because of limited time of growth. In contrast, late maturing varieties need more time to produce panicles and thus longer maturity period. Sometimes, such long maturing varieties are planted to avoid flood damage at harvest. Generally, traditional varieties are late maturing and low yielding.

Resistance/ Tolerance to Disease

How to minimize yield loss by disease is an important issue in rice cultivation. One of the most cost-effective ways would be planting disease-resistant/ tolerant varieties. Some varieties show resistance to particular kinds of pathogens, namely some strains of fungi and bacteria. This means that different varieties have different resistant capacities to certain diseases. However, even if a rice variety has resistant capacity to certain strains of pathogen, the resistant capacity could be broken by the pathogen in several years. This phenomenon occurs especially in the case that the resistant variety has been planted continuously for several years in the same plot. It is recommended to rotate some varieties for diverse resistance to diseases in the same area.

Good Palatability and Aroma

The planted variety should have good palatability and possibly good aroma as well. Rice with good aroma is preferred in the Ghanaian rice market, not only for straight mill rice, but also for parboiled rice.

(2) Major Varieties in Ghana

CRI-AGRA Rice

Currently, a medium maturing HYV called “AGRA Rice” is recommended for planting in diverse agro-ecological zones of Ghana. AGRA Rice was originally created by International Rice Research Institute (IRRI) in the Philippines as one of IR varieties (IR841) and adopted to Ghana. This variety is responsive to inorganic fertilizers especially nitrogen and high yield could be attained by good cultural practices. The highest yield record of AGRA Rice is 6.8 tons/ha in Northern, North East and Savannah Regions in the Project. It shows reasonably good resistance to Rice Blast which is a major threat to rice cultivation especially in Ashanti Region. In terms of palatability, it tastes good with excellent aroma and widely accepted by aggregators, rice millers, and sellers, as well as consumers. Typical growth duration is between 120 and 135 days in Ashanti and the average duration is approximately 130 days in Northern, North East and Savannah Regions. The growth duration is affected by planting season.

GBEWAA Rice (Jasmine 85)

Before AGRA Rice was introduced to Ghana, GBEWAA Rice (Jasmine 85) was promoted and commonly planted in the Project areas. The registered name of Jasmine 85 is GBEWAA Rice in Ghana. Although this variety is still commonly planted and popular for good aroma of milled rice, it is not resistant to Rice Blast. Once Rice Blast occurs in a rice field of Jasmine 85, it tends to widely spread, especially when the rice plants are under stress such as drought. Therefore, it is strongly recommended for planting when moisture is assured. The growth duration of this variety is approximately 110 – 115 days.

List of Major Rice Varieties Released in Ghana (Update table to current catalogue)

Major rice varieties released in Ghana are shown in the table below:

Table 1 Major Varieties of Rice for Lowland Ecology Released in Ghana

Variety	Year of Release	Maturity (days)	Yield Potential (MT/Ha)	Main Value for Cultivation	Grain Quality
CRI-Dartey	2019	125	9.0	Disease tolerant (rice blast, rice yellow mottle virus) and tolerant cooking quality	Tolerant cooking quality and slightly aromatic
CRI-Katinka	2019	125	8.5	Potential yield of 8.5 t/ha. And physiological maturity of 125 days	Non-aromatic
CRI- Obofo	2019	135	8.5	Good cooking and processing quality (baby food), it also has a yield potential of 8.5	Non-Aromatic but good cooking and processing quality
CRI-Emopa	2019	130	8.0	It has a potential yield of 8.0t/ha and a long physiological maturity day of 130	Slightly aromatic
CRI-Mpuntuo	2019	120	8.0	Long days to physiological maturity of 120 days and has good cooking and processing ability	Slightly Aromatic and also good cooking and processing quality (baby food)
CRI-Enapa	2019	120	9.5	Good cooking and processing ability (baby food)	Slightly Aromatic, good cooking and processing ability
Legon rice 1	2019		9.0	Tolerant to rice yellow mottle virus and resistant to blast disease	excellent cooking quality and aromatic

Variety	Year of Release	Maturity (days)	Yield Potential (MT/Ha)	Main Value for Cultivation	Grain Quality
CRI-Agra Rice	2013	120-135 (*1)	8.5 (*2)	Tolerant resistance to blast, moderate resistance to iron toxicity.	Good cooking quality
CRI-Bodia (mpuntuo)	2010	120-125	8.0	Tolerant resistance to blast	Good cooking quality & aromatic.
CRI-Sakai (Enapa)	2010	135-140	8.0	Tolerant resistance to blast	Good cooking quality & non-aromatic.
CRI-Amankwatia	2010	115-120	11.6	Tolerant resistance to blast	Good cooking quality, aromatic.
CRI-Wakatsuki (Emopa)	2010	125-130	8.0	Tolerant resistance to blast	Good cooking quality & non-aromatic.
Sakai	2010	135-140	8.0	Resistant to blast and resistant to lodging	Good cooking quality and aroma is absent
Jasmine 85/ Gbewaa	2009	110-115	5.0 - 6.0	Good resistance to common pests and diseases	Excellent cooking quality & aromatic.
NABOGO RICE	2009	120-130	6.0 - 7.0	Very good cooking quality, high consumer acceptability and good resistance common pest and diseases	Good cooking quality and non- aromatic
KATANGA RICE	2009	130-140	6.0 - 8.0	Excellent cooking quality, high consumer acceptability and good resistance to common pest and diseases	Good cooking quality and aromatic
NERICA 1	2009	90-95	3.0 - 4.0	Average consumer acceptability and drought tolerant	Aromatic
NERICA 2	2009	95-100	3.0 - 4.0	Average consumer acceptability and drought tolerant	Non-aromatic
Mmo tea	2009	110-115	4.8	Resistance to blast, resistant to lodging and good cooking quality	Good cooking quality
Otoo mmo	2009	115-120	5.6	Resistance to blast, good resistance to lodging	Good cooking quality and absent of aroma
Digang	2003	115	4.8	Good resistance to common pests and diseases	Acceptable cooking quality & non-aromatic.
SIKAMO	1997	120-125	6.0	Resistant to blast, lodging and high nitrogen use efficiency	Good cooking quality, non-sticky and high expansion ratio
GR 19	1986	125	5.5	High consumer acceptability and good resistance to common pest and diseases	Good cooking quality and non-aromatic
GR 20	1986	125	4.5	High consumer acceptability and good resistance to common pest and diseases	Good cooking quality and non-aromatic
GR 21	1986	125	4.5	Acceptable cooking quality especially and good resistance to common pest diseases	Acceptable cooking quality and non-aromatic
GR 18	1983	132	6.5	Good resistance to common pests and diseases	Good cooking quality & non-aromatic.
FARO 15	1980	145-150	5.0	Good resistance to common pest and diseases and deep valley	Good cooking quality and non-aromatic

Source: MoFA, Catalogue of Crop Varieties Released and Registered in Ghana, 2019.

2.3.2 Seed Preparation

(1) Acquisition of Good Quality Seed

Good quality seed should be used for rice production for increased yield and quality grain. The seed must be genetically pure, fully filled and disease free for vigorous growth after sowing. Ideally, seed used should be certified seed that was produced in seed production plots with official certification. When certified seed is not available, good quality viable seed should be obtained from reliable supplier.

(2) Salt Water Seed Selection

Salt water seed selection is strongly recommended to select healthy and viable seed. By soaking seed in salt water of specific gravity of 1.10 and removing floating chaffs, well fulfilled seed is obtained. The procedure is as follows:

Procedure of Salt Water Seed Selection:

1. Measure ten (10) liters of water and two (2) kg of salt.
2. Mix salt and water then stir well.
3. Put at least 2 fresh (uncooked) eggs in the solution. If the eggs float above the water, the solution is ready for seed selection
4. Remove the eggs and pour seeds into the salt water.
5. Remove the floating seeds after proper stirring.
6. Wash the remaining seeds with fresh water 5 times (to avoid germination inhibition) of seed.

Please note that seeds should be fully submerged into the salt solution. The salt solution can be used repeatedly for seed selection for several times while ensuring that the egg continues to float.



Photo 9: Mix 2kg of salt and 10 liters of water and stir well



Photo 10: Put an egg into salt water to check if the salt water is ready for seed selection



Photo 11: Remove the egg and pour seed paddy into salt water



Photo 12: Remove chaffs



Photo 13: Drain salt water and wash seed in fresh water 5 times



Photo 14: Drain water and dry seed in the shade

(3) Hot Water Seed Treatment

Hot Water Seed Treatment is one of the counter measures to prevent diseases and is as effective as seed dressing. It can remove pathogen causing diseases which can be on or in seed, seed-borne pathogens including fungi causing Rice Blast. Hot Water Seed Treatment is also environmental friendly and cost-saving.

Diseases Controlled by Hot Water Seed Treatment: Rice Blast, Bakanae (foolish seedling, is a seed-borne disease of rice where infected plants yield empty panicles. The disease occurs most frequently when contaminated seeds are used), Bacterial Grain Rot, Bacterial Seedling Blight, rice nematodes, etc.

Procedure of Hot Water Seed Treatment

1. Heat up clean water.
2. Keep water temperature at 60°C, observing the water temperature by using thermometer².
3. Put selected seeds in a net bag and soak it into hot water of exactly 60°C for 10 minutes. Gently shake the seed bag from time to time.
4. Take out the seed bag from hot water after 10 minutes. Put the seed bag into cold water quickly and stir it for cooling down.

² Thermometer is available at GH¢50 at the market (as of 2020)

5. Allow the water to drain. Do not place the seed directly on the ground.
6. For transplanting, the Project recommends soaking & incubation right after this hot water seed treatment.



Photo 15: Heat up water



Photo 16: Keep water temperature at 60°C.



Photo 17: Put seed in a net bag and soak it into hot water of exactly 60°C for 10 minutes.



Photo 18: After 10 minutes, put the seed bag into cold water quickly and stir it for cooling down.



Photo 19: Allow the water to drain



Photo 20: Pre-treated seeds ready for soaking for transplanting or direct sowing

(4) Seed Soaking

Soak seeds in clean water for 2 – 3 days. In case seeds are soaked in water in a bucket or a container, change water every 12 hours (twice a day) during soaking. Alternatively, seeds can be soaked in a stream when placed in a sack. If sprouting is excessive, roots and sprouts of

grains are damaged at the time of sowing.

Process of Seed Soaking

1. Put seeds in adequate amount of fresh water.
2. Change the water every twelve (12) hours.
3. Check the condition of seed daily.
4. After 2 - 3 days, remove seed from water and dry the seed for half day under a shade.



Photo 21: Put seeds in adequate amount of fresh water



Figure 15: Change the water twelve (12) hours interval for 2-3 days

2.3.3 Transplanting Method

(1) Advantages of Transplanting

In rice cultivation, transplanting method has some advantages compared with direct sowing method. The advantages are:

- It is easy to establish planned number of hills per unit area and eventually to attain expected number of panicles.
- Strong and healthy seedlings can be selected.
- Transplanted seedlings grow faster and compete well with weeds.
- In row planting, weeding can be easier especially when push weeder is used.
- Right amount of seed is used to reduce production cost.
- Growing period can be shorter compared to direct sowing.

(2) Preparing nursery and sowing

Nursery Location and Set-up Procedures

A nursery is established to raise seedlings before transplanting. The location of nursery should be a flat area where there is reliable water source, and irrigation and drainage are easy. The Project recommends establishing wet-bed nursery to secure soil moisture necessary for seedlings to grow. After selecting appropriate location for nursery, the land should be ploughed two weeks before sowing and puddling and setting up of nursery beds should be taken place a day before sowing.



Photo 22: Select a suitable location for nursery and plough the land in advance



Photo 23: Raise up the soil 10 - 15cm height and level the soil surface



Photo 24: Broadcast pre-treated seeds



Photo 25: Cover the seeds with soil

Size of Nursery

Width: 1.5m. Length 8-10 m x 4 beds. Height: 10 – 15 cm above ground level.
Intervals between beds: 50 cm.

Quantity of Seed:

Prepare pre-treated seeds. (See 3.2 Seed Preparation part)
5 kg per 1/4acre (20 kg per acre, 50 kg / ha) or more.

Sowing Rate: 100g / m²

Sowing:

1. Broadcast seeds evenly on the nursery bed.
2. Cover seeds with soil well by hand.
3. Cover nursery beds with palm leaves or other materials to prevent bird damage.

Water Management

At the sowing: Water level must be 2-3 cm lower than the bed surface.
After germination: The bed surface should be covered by 2-3 cm of water.

Nursery Period: 14 - 21 days

Growth of seedling:

1. 5 days after sowing, Seedlings emerge.

2. Although from 14 days after sowing, seedlings can be transplanted, optimum transplanting time is within 14 to 21 days after sowing.
 - Seedlings are planted in row along the guide rope.
 - Row Distance: 30 cm,
 - Hill Distance: 10 cm
 - # In case of Certified Seed Production, row distance is 30 cm and hill distance is 15 cm.

Planting depth: Plant the seedlings 2 - 3 cm deep in soil.

Advantages of Row Planting:

1. Crop management after transplanting is easier.
 - i. Weeding
 - ii. Pest management
 - iii. Fertilizer application
2. Optimum planting density could be attained, and sufficient panicle number assured.

(3) Transplanting

Time of Transplanting

Transplanting could begin when the seedlings develop three leaves and the fourth leaf starts to come out, approximately 14 – 21 days after sowing. Since the first leaf is a small incomplete leaf, the three leaf stage seedlings look like having two leaves. This growth stage is a right time for transplanting because the seeds consumed nutrients in endosperm and it is the time to develop new roots.

Uprooting seedlings

When seedlings are uprooted from the nursery, it is necessary to take care not to cut roots of seedlings as much as possible. Each seedling should have roots at least 3 cm long at the time of transplanting. If length of remaining roots is less than 1 cm, serious transplanting damage will occur, and the damaged roots adversely affect tillering and overall growth of rice plants. Uprooting of seedlings would be difficult when the nursery has excessive clay soil.

Soil texture could be amended by adding organic matter before sowing. Alternatively, it is recommended to apply **rice husk biochar** to soften the soil because of this positive effect and the easy availability of rice husks as charcoal material in rice growing areas. Rice husk biochar could be applied as substitute for cover soil as well as materials to soften hard soil.

Experimental trial of rice husk biochar application showed the positive results. Firstly, it makes easier to uproot seedlings with softened soil. Secondly, the seedlings with biochar application are taller in height with longer roots, heavier in weight and looking healthier with thick green color. The table, figure and photo below show the results of biochar application trial experiment.

Table 2: Results of Experimental Trial

	Biochar Applied	Small amount of Biochar Applied	Not Applied
Height (cm)	26.5	23.5	22.2
Weight (g)	0.95	0.65	0.24










	Biochar Applied	Small amount of Biochar Applied	Not Applied
At the sowing (April 29)			
One week after the sowing (May 7)			
At the transplanting (May 16)			

Photo 26: Results of Experimental Trail of Biochar



Photo 27: Seedlings Compared No biochar (left), With little biochar (middle), With biochar (right)



Photo 28: Seedlings Compared by Farmer and AEA

Plant Density

The Project adopts a planting density of 33.3 hills/m² (row distance 30cm, hill distance 10cm) for ordinary paddy production and 22.2 hills/m² (row distance 30cm, hill distance 15cm) for seed production based on past experience. Row distance should be 30 cm because push weeder could be used easily with this row distance. If quality of seedlings is improved, recommended planting density could be 25.0 hills/m² (row distance 30cm, hill distance 13.3cm) or less for ordinary paddy production to avoid overgrowth.

Transplanting by hand

2-3 seedlings should be transplanted per hill at 1.5cm depth.



Photo 29: Nursery



Photo 30: Uprooting seedlings



Photo 31: Bunches of seedlings



Photo 32: Transplanting

2.3.5 Direct Sowing Method

Drilling and dibbling

Make seed furrows along the guide rope and sow seeds in furrows. If the line drawer is used, working time is reduced. Put a weight on the drawer as shown Photo 35 for easier drawing. When the drawer is used, soil surface should be evenly levelled by harrowing. After sowing,

cover with soil. The soil depth should be 2-3 cm. If seeds are exposed, seeds suffer feeding damage by birds.

Precaution:

1. Sowing time: At the beginning of rainy season. Avoid delayed sowing. Standing water in the field inhibits germination.
2. In case water is standing in the field, soak seed in water for two days to acquire higher germination ratio. Change water every 12 hours during soaking.



Photo 33: Mark edges of planting rows by using pegs at 30cm intervals and use a rope as a planting guide



Photo 34: Alternatively, use a drawer to make furrows



Photo 35: Sow seeds by hand



Photo 36: Cover seeds with soil

2.3.6 Field Water Management

Transplanting

1. Maintain 10 cm depth of water at puddling and drain water during planting.
2. Maintain 10 cm depth of water again up to the first fertilizer application stage in order to protect the seedlings from wilting.
3. Reduce and maintain 3 cm depth of water up to panicle initiation stage (at 3rd fertilizer application time).
4. Maintain 5 cm depth of water between panicle initiation stage and heading time.
5. After heading time increase to 10 cm depth of water for 2 weeks.
6. Finally, maintain 3cm depth of water for 1 week and drain 7 or 10 days before harvesting.

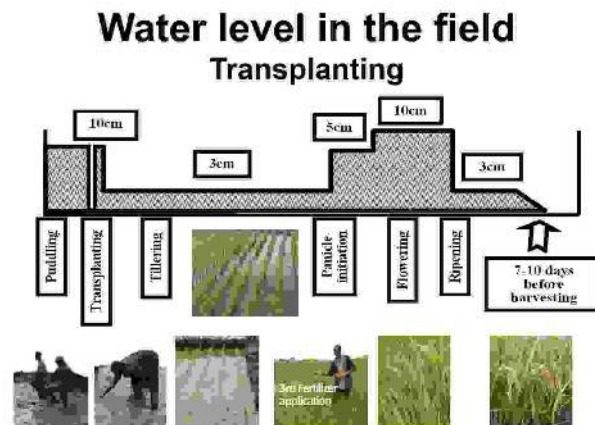


Figure 16: Water Level (Transplanting)

Direct Sowing

1. In direct sowing cultivation, on-farm water management is more difficult than that in transplanting cultivation.
2. However, it is important to understand an ideal way of on-farm water management and to drain standing water in the field as much as possible for maintaining good growth condition.
3. Increase water level gradually after germination.
4. Keep 3 – 5 cm depth up to panicle initiation stage (at 3rd fertilizer application time).
5. Keep 5 cm depth between panicle initiation stage and heading time.
6. After heading time keep 10 cm depth for 2 weeks.
7. Then keep 3cm for 1 week and drain 1 week or 10 days before harvesting.

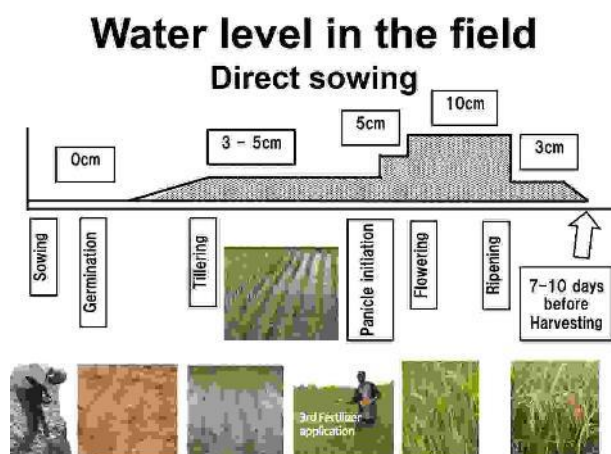


Figure 17: Water Level (Direct Sowing)

2.3.7 Fertilizer Management

Fertilizers are plant food which contain important mineral nutrients. The major nutrients in fertilizers are Nitrogen (N), Phosphorus (P) and Potassium (K). The function of Nitrogen is to enable the rice plant increase photosynthesis and tillering. Phosphorous encourages tillering, early flowering and ripening. Potassium makes plants vigorous. Fertilizers are of two types: 1) organic, such as farmyard manure, and 2) inorganic, such as urea. Apply fertilizers when the soil fertility is insufficient (by soil test if possible) to ensure good plant growth. Timely and appropriate amount of application is necessary.

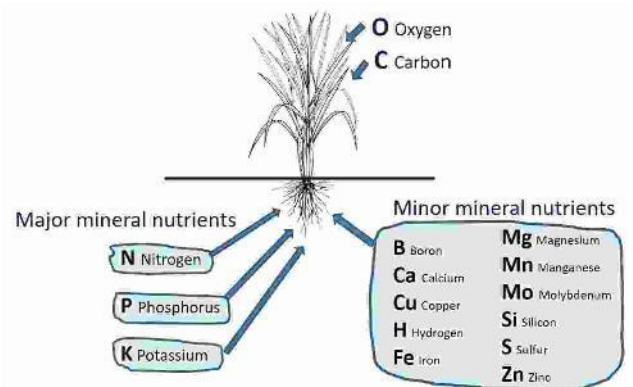


Figure 18: Plant Nutrients

Application Stages

It is necessary to apply fertilizer at the right growth stage. Fertilizer is normally applied 3 times at particular times according to growth stage. These 3 periods are important in determining yield respectively. Especially, timing of 3rd fertilizer application is important for efficient panicle formation and grain filling. Too early application causes lodging, and too late application makes it ineffective.

Timing of the 3rd fertilizer application should be determined by young panicle observation. Approximately 33 days before heading, panicle initiation begins at the uppermost node of the stem. Initially, the young panicle is so small and not visible to the bare eye. A week later, the panicle grows to 1 mm in length. The recommended timing for the 3rd fertilizer application is 20 days before heading when the young panicle is 10 mm long.

Table 3: Fertilizer Application Time

	1 st	2 nd	3 rd
Stage	Rooting stage	Tillering stage	Panicle formation stage (20 days before heading)
Effect	Helping root establishment and increasing the number of tillers	Increasing the number of tillers and leaf areas.	Increase grain number per panicle

How to estimate Heading Date

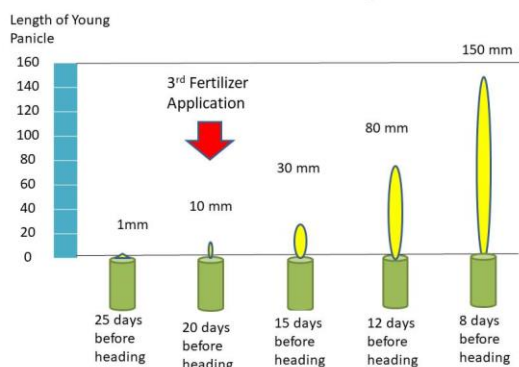


Figure 19: Estimating Heading Date



Photo 37: Young panicle observation

Fertilizer Application Rate

Recommended amount of nutrition is 60 kg of Nitrogen (N), 30 kg of Phosphorous (P), and 30 kg (Potassium) for 1 ha (10,000m²) split in three times. 1st application is N-P-K (e.g. 15-15-15). 2nd and 3rd applications are either Urea (46% of nitrogen) or Sulphate of Ammonia (SOA: 21 % of nitrogen).

Table 4: Application Rates of Fertilizer in Three Splits

		1st	2nd	3rd	Total
Rate of Nutrient to be Applied (kg/ha)	N	30 kg/ha	15 kg/ha	15 kg/ha	60 kg/ha
	P ₂ O ₅	30 kg/ha			30 kg/ha
	K ₂ O	30 kg/ha			30 kg/ha
Amount of Fertilizer to be applied for 1 acre (4,000 m ²)		80 kg of N-P-K (15-15-15)	13 kg of Urea or 29 kg of SOA	13 kg of Urea or 29 kg of SOA	

2.3.8 Weed Control

Controlling weed is crucial since the yield declines significantly with presence of weeds in the field.

Timely Weed Control

Weeding must be done at least twice. It is desirable to carry out 1st and 2nd weeding at the same time as fertilizer application. Weeding must be done as and when necessary besides what is mentioned above.

Weeding by Push Weeder

Adjust the depth of standing water to a few centimeters and push the weeder ahead moving it back and forth.

Under the condition without standing water, carry out weeding using the weeding hoe. If the soil is too wet to weed, consider the application of selective herbicide.

Herbicide application

In applying a herbicide, the recommended rate must be adhered to by paying attention to instructions on the label.

When herbicide is used;

- The timing of application is very crucial.
- Concentration of the herbicide must be proper.
- Adequate volume of spray must be ensured.

2.3.9 Disease Control

(1) Integrated Pest Management (IPM) Principles

Integrated Pest Management (IPM) principles is desirable in controlling pests and diseases.

IPM is an eco-friendly and mostly cost saving approach for pest management that uses combined biological, physical and chemical measures. In IPM, pesticides are used only when it is economically justified and risks to human health and environment are minimized.

(2) Major Rice Diseases

1) Rice Blast

Rice Blast is a fungal disease that causes serious damage on the growth and yield of rice. Adopt the following measures to prevent and minimize damages by Rice Blast:



Photo 38: Rice Blast

Site Selection and Land Preparation

- **Site Selection for Better Ventilation**

Securing better ventilation is important to prevent the occurrence of rice blast. Avoid poorly ventilated narrow valley and hollow spot, especially a location surrounded by trees and shrubs.

- **Reliable Water Source**

Select a site that has a reliable water source to avoid dry soil conditions.

- **Avoid Elevated Location**

Avoid elevated location where surface water does not easily come in.

Variety and Seed (including Seed Treatment)

- **Use of Resistant/tolerant Rice Varieties**

As explained in 2.3.1, blast resistant variety should be planted to manage rice blast. At the moment, AGRA Rice is most recommended variety because it shows partial resistance to blast and also has good market demand.

- **Use Rice Varieties with Desirable Plant Type**

Use rice varieties with straight and erect leaves to reduce dew period.

- **Disease-Free Seed from Reliable Supplier**

Rice Blast is both seed borne and air borne disease. Obtain disease free seed from reliable seed supplier.

- **Salt Water Seed Selection**

Practice salt water seed selection as indicated in 2.3.2 above.

- **Hot Water Seed Treatment**

Practice hot water seed treatment as indicated in 2.3.2 above.

Fertilizer Management

- **Avoid Excessive Nitrogen Application**

Avoid excessive nitrogen application as rice blast tends to occur severely at high nitrogen levels.

- **Split Fertilizer Application**

Split fertilizer application is recommended not to increase leaf nitrogen content more than desirable level. When rice blast occurs just before panicle initiation stage, reduce the amount of the third fertilizer to be applied at panicle formation stage.

Other Cultural Practices

- **Grow Healthy Seedlings**

Grow healthy seedlings in well managed nursery, when transplanting method is applied. Consider application of bio-char.

- **Dispose Left over Seedlings**

Dispose left over seedlings in nursery after transplanting as they could be source of rice blast. Burning or burying is recommended as a means of disposal. In case of direct seeding, seedlings for missing hills should be replanted when they develop 2-3 leaves. Dispose extra left over seedlings as practiced in transplanting method.

- **Avoid High Plant Density**

Avoid high plant density for better ventilation. Apply plant density of 25 hills/m² or lower in a field with blast infection history.

- **Clear Weeds in and around Rice Field**

For better ventilation and lowered relative humidity, clear weeds in and around rice field.

- **Avoid Low Soil Moisture**

Lowland rice varieties such as AGRA Rice require soil enough moisture throughout their growth period except for a few weeks before harvesting. Avoid exposing rice under stress by growing under dry soil conditions that could encourage rice blast.

- **Minimize Dew Period**

High relative humidity is favorable for fungi of rice blast in terms of spore germination and lesion formation. Dew period should be shorter by growing rice plants with straight and erect leaves. Chose rice varieties that have such plant type and do not apply too much fertilizer, especially nitrogen not to develop drooping leaves.

- **Avoid Continuous Cropping throughout the Year**

Continuous cropping throughout the year is not recommended because the host crop is provided for pathogen to comfortably survive.

Community Approach

A single rice farmer cannot prevent rice blast when fungi of blast spread extensively in several farmlands of different owners. They need to take measures to prevent rice blast at the same time. Community approach is necessary to minimize occurrence of blast.

Chemical Control

- **Apply Fungicide**

Apply fungicide from early stage of leaf blast development. In order to prevent panicle blast, apply fungicide at late booting and full heading stages. Fungicide application is recommended especially when leaf nitrogen content is high; rice plants have dark leaf

color. Remember fungicide application is last resort to control blast.

- **Avoid continuous use of same type of fungicide**

Avoid continuous application of same type of fungicide as this could develop fungicide resistance by fungus.

2) **Brown Spot**

Brown Spot is a fungal disease that affects leaf, leaf sheath, and spikelets of rice. Leaf lesions of brown spot are circular and often produced on old leaves. The Project recommends following counter measures to prevent brown spot.

- Use resistant/tolerant rice varieties
- Use disease free seed from reliable supplier
- Practice salt water seed selection
- Practice seed disinfection by using fungicide. Please note hot water seed treatment is not effective against brown spot.
- Remove infected residue in nurseries and main fields.
- Maintain soil fertility through proper soil management.



Photo 39: Brown Spot

3) **Yellow Mottle**

Rice Yellow Mottle Disease is caused by virus which is transmitted by some species of beetles and grasshoppers. Ratoon crops growing between cropping seasons help the virus survive in rice fields. Rice Yellow Mottle Virus (RYMV) symptoms appear as mottles on young leaves and later develop yellow or orange streaks. Plough infected residue, volunteer crop, and ratoons to control the disease. Roguing is the easiest way to eliminate the disease when infected population is low.



Photo 40: Yellow Mottle

(Source: presentation by CRI at 9th Technical committee)

4) **False Smut**

False Smut is a fungal disease which causes velvety spores and chalkiness of rice grains. The infection of this disease takes place at booting stage. The disease occurs especially when rain continues and sunshine is insufficient in heading time. The fungal spores are spread by wind. Infected grains should be removed by hand as soon as they are found. Hot water seed treatment is useful to eliminate the pathogen. Avoid excessive use of Nitrogen fertilizer, especially later growing stage of rice.



Photo 41: False Smut

2.3.10 Bird Scaring

To reduce losses through birds, field bird netting should start a week after heading at milky stage. Not only top face, but also side of the field should be covered fully with the net to prevent the entry of birds. Net should not be too close to rice grain. Try bird scares such as balloons and wind mills.



Photo 42: Bird Scaring Net

2.3.11 Harvesting

Proper moisture content at harvesting is very crucial since it can adversely affect grain quality at milling if the moisture content is too high or too low.

Right time for harvesting is when 80 - 85% of a panicle turned out yellow and the rest is still green. That is approximately 35 – 40 days after heading and grain moisture content is about 20 – 25%. Start panicle observation from 25 - 30 days after heading.

In addition, harvesting time can be judged by using cumulative daily mean temperature after heading. In a simplified method, daily mean temperature is determined as the average of maximum and minimum temperatures of the day. When a cumulative daily temperature reaches 950°C, the right harvesting time has come. This practice is reasonable as far as the limited observation is concerned. This can be practiced by District Agriculture Department or AEAs. Based on the information obtained, DAD or AEA can advise farmers on the appropriate harvesting time. On average, it took 36 days after heading in Ashanti Region. In Northern, North East and Savannah Regions, average duration seems to be approximately 35 days after heading. However, experience suggests it could be as short as 29 days depending on temperature and field conditions. The lengths of days can be assessed by further trial of the practice.

2.4 Post-Harvest

Post-harvest techniques include threshing, winnowing, cleaning, drying, storage and preparation before milling.

Threshing: In this process, the grain is separated from the panicle. Harvested rice should not be kept on the field long before threshing. It should be threshed the same day or a day after harvest to preserve its good quality. The use of a threshing box (Bambam box), pedal thresher and threshing machine are recommended to minimize grain loss.



Photo 43: Threshing (1)



Photo 44: Threshing (2)



Photo 45: Threshing (3)

Drying is a process that reduces grain moisture to a safe level for storage. It is the most critical operation after harvesting. Harvested grain has a moisture content of 20%- 25% which needs to be reduced to approximately 14% for storage and milling. Delay in drying, incomplete drying or ineffective drying reduces grain quality and results in grain loss. Properly dried grains give good milling quality and taste.



Photo 46: Drying (1)



Photo 47: Drying (2)

Winnowing is the process of separating immature grains and impurities from harvested grain by use of wind power (traditional method and winnowing machine). Winnowing produces uniform quality grains. This process should be accomplished on a tarpaulin (plastic sheet) to prevent incorporation of ground soil and dust.



Photo 48: Winnowing (1)



Photo 49: Winnowing (2)

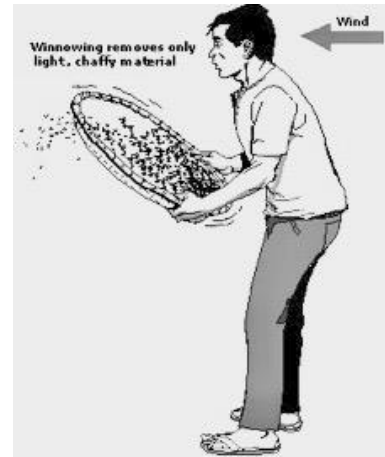


Figure 20: Winnowing (3)

Storage: Paddy and milled grain should be stored in separated bags in cool dark places and in separate storage facilities. Bag containing grain should be place on pallets for better ventilation and prevention of pests and decay. Moisture content determines the storage periods and use. Grain with a moisture content of 14% (determined by means of a moisture meter) can be stored for several months. The purpose of grain storage is to provide safe condition for the grain in order to prevent grain loss caused by adverse weather, moisture, rodents, insects and micro-organisms like fungi. The bags should be well packed on a pallet in the storage facility.

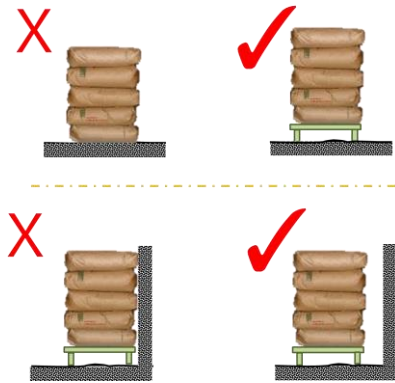


Figure 21: Storage

2.5 Farm Management and Support System

2.5.1 Managing Farm

Farming is a kind of business. “*Farming as business*” is achieved by good farm management. Farm management involves good decision making resulting in judicious use of limited resources and high returns on investment. It helps rice farmers: 1) to analyze records taken at the previous season (cost benefit analysis), 2) to plan for the future; 3) to organize individual/group input acquisition; 4) to strictly follow their action plans and 5) to monitor and evaluate. Above all, good farm management increases profit of farmers in rice production.

Rice farmers need to learn the “*Plan-Do-See*” cycle for good farm management.

Plan: AEAs should assist farmers to acquire all needed information to set target and make a plan including estimation of cost for rice production. AEAs also facilitate farmers to reduce production cost through group work. Detail steps are shown in the Rice Production Guidebook.



Figure 22: Farm Management Cycle

Do: Record keeping is thus fundamental for good farm management. AEAs instruct rice farmers, at 1st/2nd OST, how to keep records and support farmers throughout the cultivation season. Farmers are requested to record all expenditure including purchased inputs, services and hired labor as well as sales information after harvesting.

See: At the end of the cultivation season, AEAs should assist farmers to analyze the decision taken during the cultivation season, calculate total costs and total sales to check whether they get profit or loss. AEAs instruct farmers, at the last OST, on how to analyze the record and how to utilize results of the analysis to plan for the next season to increase profit.

2.5.2 Marketing Support

The aim of marketing is to know and understand the “Customer’s Needs and Wants.” Once farmers know which types of rice are demanded by customers, what farmers can do is only to produce rice that meets the required quality and to sell it to the target customers.

Marketing is also one of the processes of the **Plan-Do-See cycle** explained in Section 2.5.1 above. Before making plan, farmers collect market information such as variety (aromatic, grain size), type (paddy or milled rice), quality (stone free, cleanliness), storage, price, buyers (processor including miller or parboiler, retailer, food vender, market women, contracted customer, etc.) and timing of sale. These market information help farmers to decide which variety to grow and motivate farmers to apply the improved rice cultivation technologies shown

in this guideline.

AEAs introduce good practices of rice marketing to farmers at 3rd/4th OST. Good practices are compiled into the Rice Cultivation Handbook and the training material “*Good Practices of Farm Management (Flipcharts for the 2nd OST)*”.

2.5.3 Other Related Issues

(1) Gender Considerations

It is important to encourage women as well as men to participate in the trainings, since rice cultivation is often supported by female family members. By identifying roles and responsibilities between men and women in household chores, childcare, participation in farming or community activities, and decision making in household economy, it is possible to clarify how women are involved in rice cultivation and how they contribute to it. If there are women-specific problems in rice cultivation, AEAs should consult Women in Agricultural Development Directorate (WIAD) officers to consider measures to resolve them as much as possible.

Key factors in gender perspective are:

- Land ownership in most parts of Ghana is usually male-dominated. There are however cases in which rights to the farmland management are transferred from husbands to wives, and the wives have all the responsibilities and rights regarding cultivation and sale.
- Some female farmers, such as widows, rent and manage rice fields and farmland by themselves, but the majority of them are suffering from poverty and facing the challenge of insufficient initial investment for farming.
- Basically, male family members manage household budget, however most wives income is used for household management such as daily meals and education for their children.
- Most women are busy with household chores and childcare. They are less likely to participate in training than men. With this, opportunities for participation in training should be given equally. Therefore, the training is conducted in consideration of the time and place where it is easy for women to participate. AEAs can include extension methods such as home visits to cater for the women who may not be able to attend OST due to their household engagements.
- The illiteracy rate of women is higher than men. Training materials should be easy to understand even for illiterates. This ensures that male family members can share training contents with female family members, even if female family members are unable to attend the training.

(2) Nutrition Improvement

Ghana's country strategy for nutrition improvement recognizes that, "Micronutrient deficiencies, particularly of iron, vitamin A, and iodine, are of serious concern, undermining health and development of many Ghanaians age groups. Iron deficiency coupled with the high malaria burden contributes to very high prevalence of iron deficiency anaemia, especially among women and children in Ghana"³. Another regional issue is that vitamin B complex is more likely to be deficient in areas such as the Northern, North East and Savannah Regions, where maize is the major staple food throughout the year. Rice contains a relatively large amount of vitamin B complex than maize such as vitamin B1 "*thiamine*", vitamin B2, vitamin B3 "*niacin*", vitamin B6, pantothenic acid, biotin and folic acid. Furthermore, vitamin E, minerals (potassium, calcium, magnesium, phosphorus, manganese, iron, copper, zinc, selenium, molybdenum), and dietary fiber are also contained. For this reason, diversification of diets through consumption of rice dishes is recommended to complement nutritional needs and good health of consumers.

Table 5: Major nutrients in Rice and its effectiveness

Nutrients	Expected effectiveness
Thiamine (Vitamin B1)	To prevent beriberi
Niacin (Vitamin B3)	To prevent pellagra
Folic acid	To prevent fetal growth restriction
Iron	To prevent anaemia

In general, brown rice (un-polished rice or de-husked rice) is well known to be more nutritious than white rice (straight milled rice) since the grain contains a larger portion of vitamins and minerals in its bran and germ, which are usually removed during the process of milling. Figures below show the result of nutrition analysis of white rice (straight milled rice) and un-polished rice.

It is also known that the presence of phytates in the un-polished rice has a negative effect on mineral uptake. However, it is also reported that food preparation/processing techniques e.g. soaking, cooking and fermentation reduce phytate content⁴. Cooking process of rice banku and porridge includes these preventive processes against the negative effect. Therefore, recommended rice dishes such as rice banku and rice porridge have less risk of inefficient absorption of iron.

³ National Development Planning Commission (2019). Ghana's Country Strategy for Action Under the Initiative for Food and Nutrition Security in Africa (IFNA), Accra, Ghana.

⁴ Dietary roles of phytate and phytase in human nutrition: A review (Vikas Kumar, Amit K. Sinha, Harinder P.S. Makkar, Klaus Becker), Food Chemistry 120 (2010) 945-959

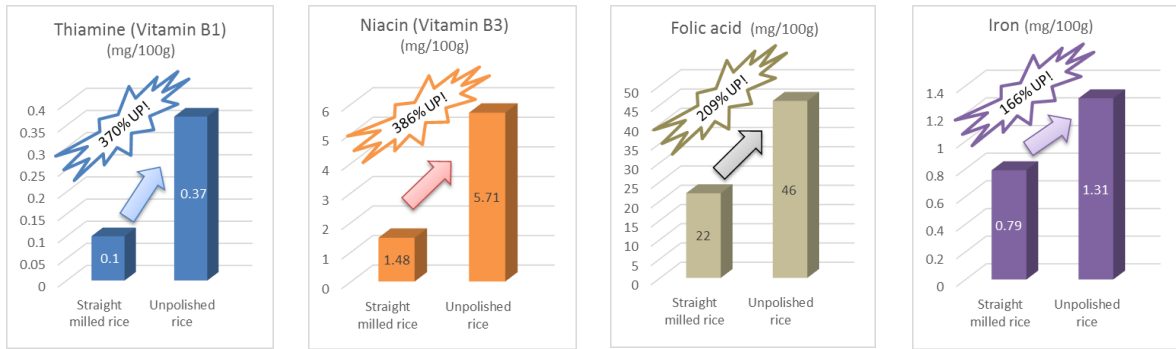


Figure 23: Comparison of nutrients between straight milled rice and un-polished rice

Source: TENSUI2 Project (analysed in Japan Food Research Laboratories)

Also, the parboiling process reduces loss of nutritive value of white rice due to the movement of micro nutrients such as Thiamine and Niacin from bran to endosperm. Therefore, parboiled rice is more nutritious than straight milled (non-parboiled) rice. Figures below show the result of nutrition analysis of un-polished rice and parboiled rice.

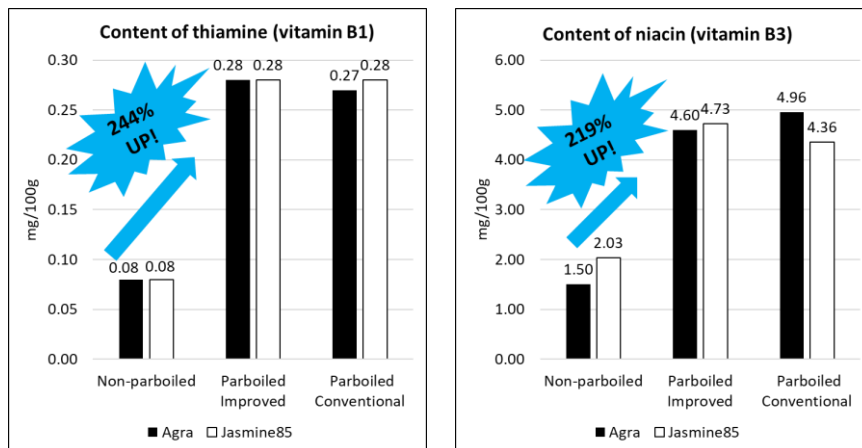


Figure 24: Comparison of nutrients between parboiled rice and non-parboiled rice

Source: TENSUI2 Project (analysed in Japan Food Research Laboratories)

From the above data, It is then expected that promotion of consumption of both un-polished rice and parboiled rice can contribute to nutrition improvement in rural areas. To promote the consumption of both un-polished rice and parboiled rice in rural area, rice flour dishes⁵ such as Porridge, Banku and TZ etc. can be introduced as alternatives of traditional maize flour dishes, since rice farmers can easily access to rice.

⁵ Recipe of rice flour dishes refers to NERICA Rice recipe booklet, NERICA Rice Dissemination Project and the Women In Agricultural Development Directorate, MoFA, November 2011

Table 6: General Rule to Evaluate Percent Daily Value of Food

% DV	Evaluation
20% ≤	A nutrient per serving is high, rich source of a nutrient, etc.
10% - 19%	A nutrient per serving is moderate, good source of a nutrient, etc.
≤ 5%	A nutrient per serving is low

Source: Code of Federal Regulations, Title 21, Chapter I, Subchapter B, Part 101, Subpart D, Section 101.54 (US Food and Drug Administration. April 1, 2017. Retrieved August 25, 2018)

Based on the general rule to evaluate percent daily value of food, the difference in nutritional value between the maize dishes and the rice dishes are summarized in the figures below:

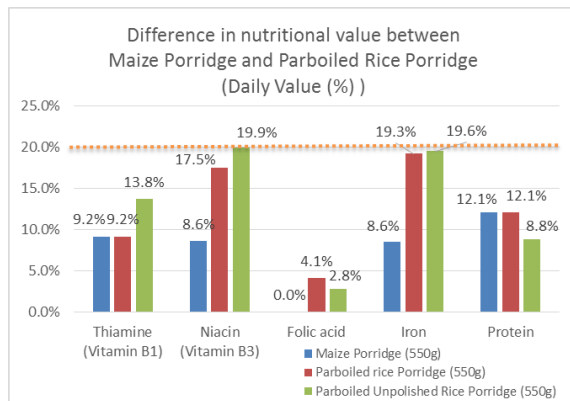


Figure 25: Nutrition contents of Maize and Parboiled Rice Porridge

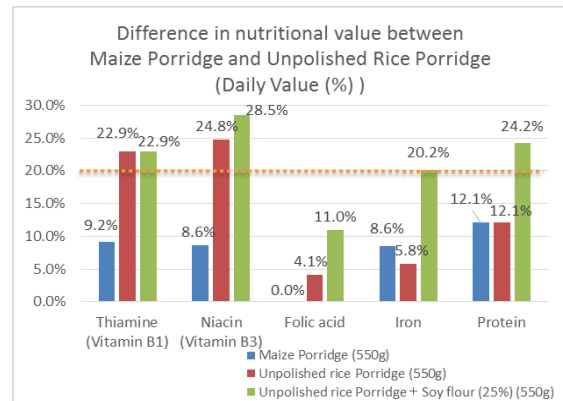


Figure 26: Nutrition contents of Maize and Unpolished Rice Porridge

Source: TENSUI2 Project (analysed in Japan Food Research Laboratories)

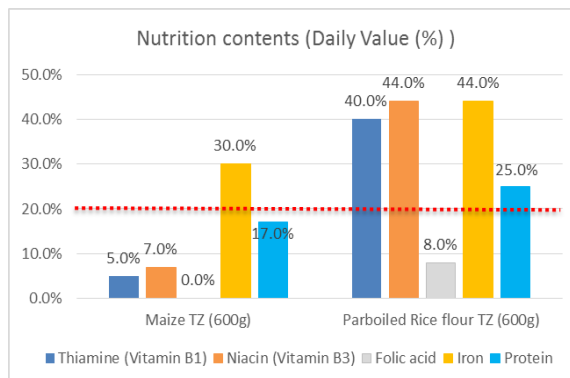


Figure 27: Nutrition contents of Parboiled Rice flour TZ

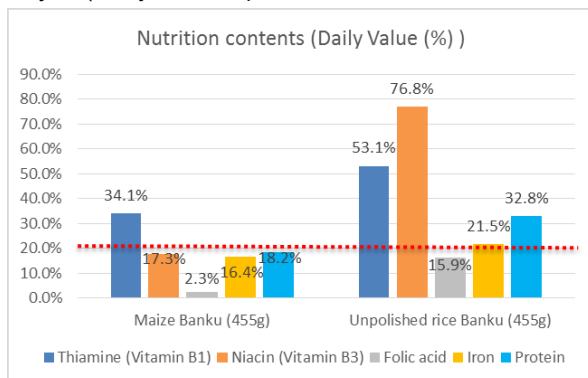


Figure 28: Nutrition contents of Unpolished Rice Banku

Source: TENSUI2 Project (analysed in Japan Food Research Laboratories)

In parboiled rice and unpolished rice dishes, most of the target nutrients are contained at the same level as or higher than maize dishes. The high nutritional value is remarkable in TZ and Banku. Furthermore, it is confirmed that the addition of soy flour to porridge has a certain effect on improving nutritional value. In particular, it is significant that it can contribute to the reduction of iron deficiency anaemia, which is an important health issue in Ghana.

Demonstration of cooking with illustrated recipes is the best way to promote, as even illiterate female farmers can understand it easily. The illustrated recipes are shown below for reference:

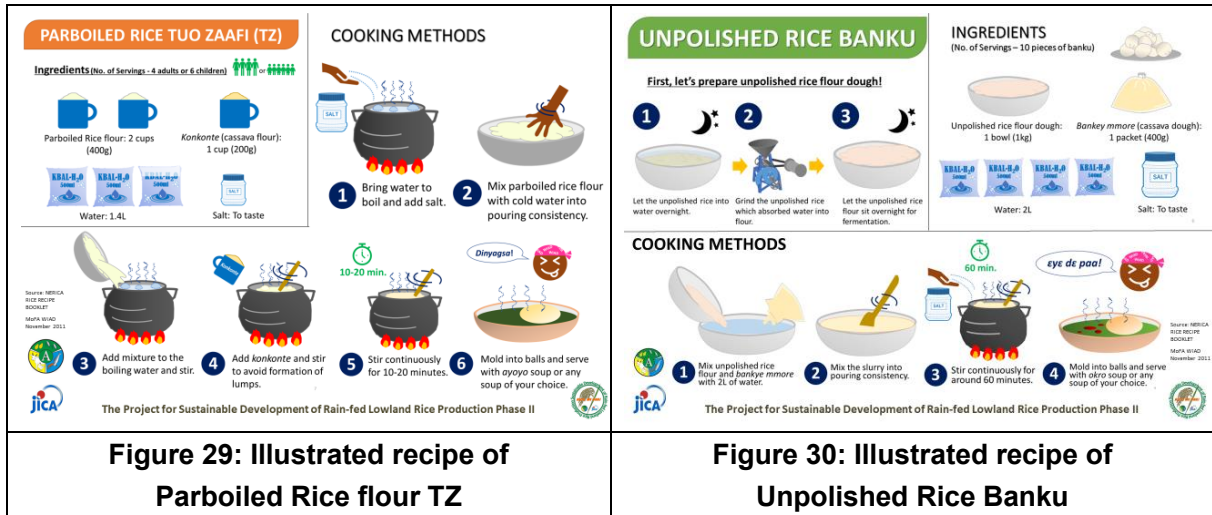


Photo 50: Cooking demonstration

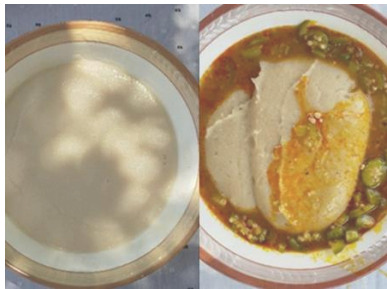


Photo 51: Parboiled rice flour dishes (porridge and TZ)



Photo 52: Un-polished rice dishes (Banku)

CHAPTER 3 IMPLEMENTATION OF THE GUIDE

As mentioned in Section 1.3, the following points are focused for effective implementation. The success of this Extension Guideline would depend largely on its effective and efficient implementation. This can be achieved through the following steps:

1. Preparing District Rice Extension Plan

The District Rice Extension Plan is a strategic document on the plan of each district on how to expand rice production in their district. The plan is based on the National Rice Development Strategy (NRDS) developed by the country. The highlights of the plan include the potential area under cultivation of each district, total farmers in the district cultivating rice and how the district plans would increase overall rice production.

2. Group Formation & Community Facilitation

Farmers are formed into groups in order to facilitate the dissemination of rice production technologies. Groups formed are expected to be cohesive and members willing to implement knowledge acquired on their own fields. Each group comprises not less than 10 rice farmers.

3. Action Plan for Demo-Plot prepared by AEA: Action plan is a series of planned tasks or activities designed to achieve an objective or goal. In planning, one should know when to carry out each activity and which input needed for the activities.

4. Conducting Training: Trainings are categorized into a cascade model of training. Training of Trainers at Regional Level, Training of Trainers at District level, Onsite Trainings.

5. Monitoring and Evaluation (M&E): The M&E system of this guideline is adjusted to suit the monitoring system of the various Departments of Agriculture. All recommended M&E are to be mainstreamed and utilized for reporting of rice extension to District Assemblies and Regional Agricultural Departments.

6. Sharing Results: Based on the results of the activities implemented, results are shared with stakeholders. Field days and field trips are held for farmers and stakeholders within the same community and stakeholders to understand the outcome of all activities implemented.

Sharing of results is an important step in the implementation process of rice extension since it highlights the good results to other farmers and stakeholders as well as facilitate farmer to farmer extension.

3.1 Preparing District Rice Extension Plan

Rice extension activities should be managed within “Plan-Do-See” cycle for making them effective. District rice extension activities start with planning of Rice Extension Plan followed by implementation of planned activities. Periodic monitoring is undertaken during implementation to assess whether the activities are on track. The results of monitoring are utilized to feed them back into the planning process. At the end of the cycle, evaluation is conducted to assess the results/ impact.

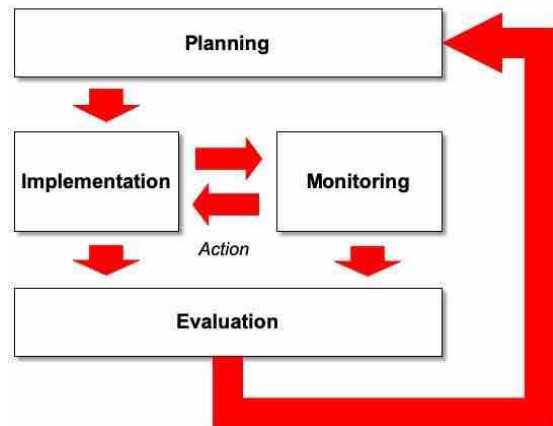


Figure 31: Annual Planning Cycle

(1) Developing Expected Logical Causal Sequence for Rice Extension Activities

In planning Rice Extension, logical causal sequence of intervention should be developed, as shown in the figure to the right. Shaded area in the figure is area of control within plan. Outside area is area of impact where plan cannot control but can make impact on. Based on the logical causal sequence developed, rice extension plan is prepared.

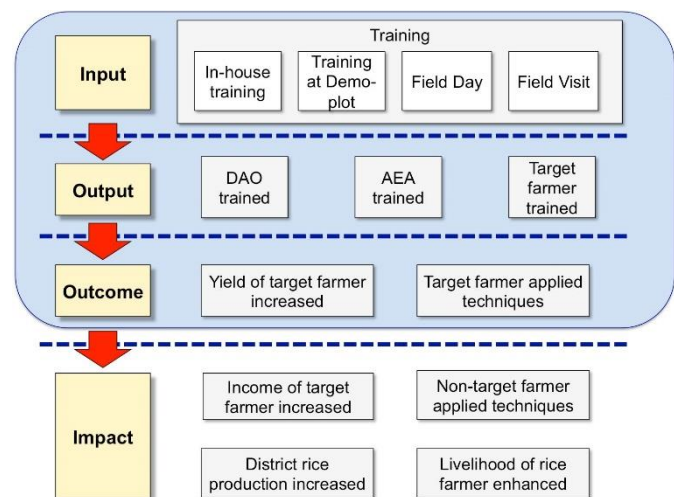


Figure 32: Causal Sequence

(2) Rice Extension Plan as part of District Development Plan

District Rice Extension Plan have to be incorporated into the District Development Plan as official district activities. District Development Plans are mid-term and annual District Development Plan under the existing planning framework.

Box: Preparing District Rice Extension Plan in the Existing Planning Regime

The focus of this Guideline is on the Annual District Rice Extension Plan. Planning for District Rice Extension Plan is under the multi-structured and multi-year planning framework as shown in the figure to the right. District Rice Extension Plan is part of the Annual District Agricultural Plan which is also a part of **District Annual Work Plan**. This plan is based on the 4-year **District Medium Term Development Plan (DMTDP)**.

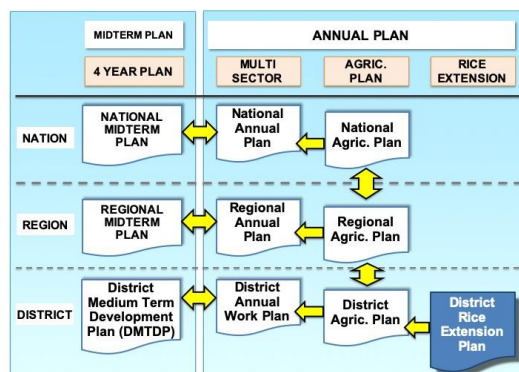


Figure 33: Rice Extension Plan in the Existing Planning Framework

Currently, District Medium Term Development Plan (DMTDP) is the official district development planning document. All district activities have to be included in this plan. DMTDP is 4-year multi-sectoral plan. Current planning period is the 4-year period from year 2018 to 2021. DMTDP is updated every 4 year.

DMTDP has “*Programme of Action (PoA)*” and “*Annual Action Plan (AAP)*” as contents showing district activities. Programme of Action shows 4 years programmes, which is not updated during the 4-year planning period. Annual Action Plan shows activities of a single fiscal year. Initial DMTDP (2018-2021) has 2018 Annual Action Plan. Annual Action Plan is updated every year. The structure of Programme of Action and Annual Action Plan in DMTDP is as shown in the figure to the right.

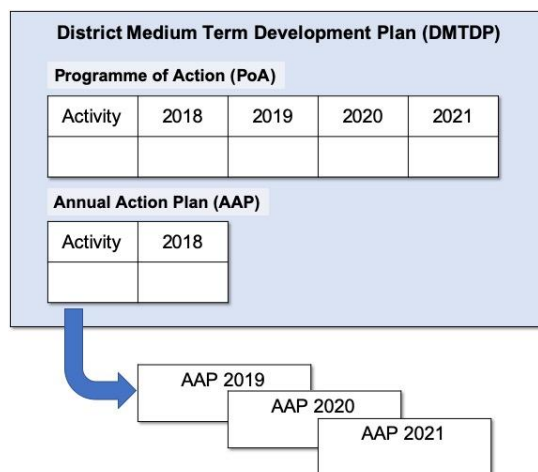
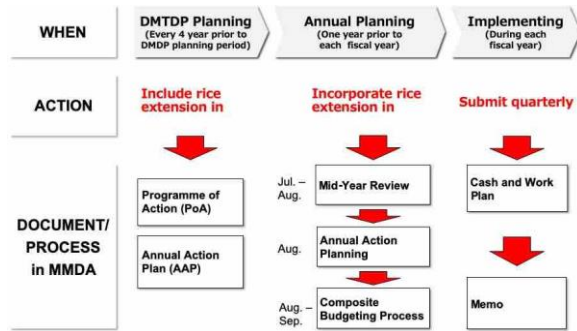


Figure 34: PoA & AAP in DMTDP

District Rice Extension Activities have to be included in DMTDP as official district activities, especially into PoA and AAP. In addition, Rice Extension Plan has to be budgeted and implemented timely. For effective planning, budgeting and implementation with timely budget release for Rice Extension Plan, the following actions should be taken, which are highlighted in the figure below:

1) During DMTDP planning process (one year prior to the planning period)

4-year plan with budget of rice extension activities shall be included in Programme of Action and Annual Action Plan. District Agricultural Department (DAD) has to input the target of the rice extension plan in DMTDP.



2) During annual planning process (one year prior to the implementation year)

Actions to be taken at three stages.

Mid-Year Review (July or August of prior year):

Target of rice extension activities should be compared to that of previous year and updated.

Preparation stage of Annual Action Plan (July or August of prior year): Rice Extension Plan shall be included in Annual Action Plan. This is necessary for proper budget releases for Rice Extension Plan.

Preparation stage of budget (August or September of prior year): Based on Annual Action Plan, MMDAs estimate costs for implementation of Rice Extension Plan according to the updated targets.

Figure 35: Actions to be taken

3) During the current fiscal year (every quarter)

Submission of “Cash and Work Plan”

District Assembly announces annual budget ceiling to DAD in January or February in the beginning of each fiscal year. DAD has to submit its “Cash and Work Plan” to MMDA. Cash and Work Plan provides necessary information and seeks confirmation on the amount of budget for Rice Extension Plan. The Cash and Work Plan are submitted every quarter.

Activities	Location	Time Frame				Indicative Budget	Indicators	Source of Funding
		2018	2019	2020	2021			

Activities	Location	Time schedule				Annual Budget		Implementing Agency	
		1st	2nd	3rd	4th	Local	External	Lead	Collaborating

Figure 36: Format of PoA (top) and AAP (bottom)

Submission of “Memo” to request budget release

DAD has to submit “Memo” to request budget release from MMDA according to Cash and Work Plan and composite budget. The Memo is submitted every quarter.

3.2 Group Formation and Community Facilitation

Farmers in many communities have a long tradition of performing certain agricultural productive activities as a group rather than as individuals. Group formation facilitates the swift transfer of knowledge, information and technologies.

The Role of AEAs in Group activities:

- Facilitation role: District Agricultural Officers (DAOs) and Agricultural Extension Agents (AEAs) sensitize chiefs, opinion leaders, assembly members, unit committee members and community members and explain the purpose of rice extension.
- Ensure a cohesive group activity (Group by-laws, operation of bank account, meetings etc).
- Help in the preparation of rice action plan and cropping calendar.
- On-the-job training for farmers from valley selection through to rice marketing.
- Monitoring and backstopping roles.
- Organizes agriculture extension programme (Field days, Field trip, farmer competition etc).

Some Key Criteria for selection of group members:

- Group membership should be voluntary and optional by farmers.
- Farmers in same community and preferably in same valley or whose fields are near.
- Farmers who already have experience in rice cultivation.
- Farmers keenly interested in rice cultivation
- Membership constitution should be by individual farmer's willingness (grouping) e.g. same social, religion, scale of production, etc.
- 25 members in a group (1 Key farmer, 9 -24 members)

The role of Key farmers and group members:

- The Key farmer plays leadership roles as well as serves as contact person
- He could also lead discussions during field days.
- Should be able to teach and explain necessary rice techniques to other group members upon request.
- Group members transfer rice technology to colleague group farmers and other non-group rice farmers.
- All group members develop skills in rice technologies as they work on demonstration plot.

3.3 Action Plan for Demo-Plot Prepared by AEA

(1) Action Plan

Action plan is a series of planned tasks or activities designed to achieve an objective or goal. In planning, one should know when to carry out each activity and which input needed for the activities. For instance, action plan for rice demonstration plot should consists of field work, timeframe and recommended tools and inputs. AEA in charge of Demonstration plot should plan the activities with the group farmers to have a common understanding.

Table 7: Standard Action Plan for Transplanting Method

No.	Field work	Week-based Time frame	Tool & inputs
1	Seed preparation	1 week before sowing	Rice seeds, salt, bucket, sieve, egg
2	Nursery preparation	1 day before sowing	Hoe, cutlass, garden line
3	Nursery management	1 day before sowing to transplanting	Hoe, watering can, nursery tray
4	Sowing	Week 0	String, stick, hoe
5	Land clearing	3 weeks (or more) before transplanting	Cutlass
6	Bund construction	1 - 2 weeks before transplanting	Hoe, spade, garden line
7	Ploughing	1 week before transplanting	Hoe
8	Puddling and or Levelling	1 day before transplanting	Hoe, spade, leveler
9	Uprooting and seedlings preparation	1 day before transplanting	Strings
10	Transplanting	3 weeks after sowing	String, stick
11	1st Weeding	5 weeks after sowing	Push weeder
12	1st Fertilizer application	5 weeks after sowing	Fertilizer (NPK), weighing scale, containers
13	Off-type removal (for seed production)	From 5 weeks after sowing to the day for harvesting	No tool (hand removal)
14	2nd Weeding	7 weeks after sowing	Push weeder
15	2nd Fertilizer application	7 weeks after sowing	Fertilizer (SOA), weighing scale, containers
16	3rd Weeding (depending on the field condition)	10 weeks after sowing	Push weeder, uprooting by hand
17	3rd Fertilizer application	10 weeks after sowing	Fertilizer (SOA), weighing scale, containers
18	Heading	Heading more than 50% of rice plants.	
19	Bird scaring	13 - 18 weeks after sowing	Fishing net
20	Maturing	Accumulated temperature 950°C from heading date	
	Harvesting	19 weeks after sowing (determined by observation)	Sickle
	Threshing		Tarpaulin, Bambam box, sacks, head carriage
21	Winnowing	19 weeks after sowing	Tarpaulin, pans, sacks
	Drying		Stirring sticks
22	Storing	19 weeks after sowing ~	Storage facility, wooden pallets
23	Milling	19 weeks after sowing ~	Sacks
	Packaging	19 weeks after sowing	Packaging materials
24	Selling	19 weeks after sowing ~	Sacks

Table 8: Standard Action Plan for Direct Sowing Method

No.	Field work	Week-based Time frame	Recommended tool & inputs
1	Land clearing	3 weeks (or more) before sowing	Cutlass, pick axe
2	Ploughing	1 week before sowing	Tractor
3	Bund construction	1 week before sowing	Hoe, spade, compactor, slapper, garden line
4	Harrowing	1 week before sowing	Tractor, Harrow, hoe
5	Seed preparation	1 week before sowing	Rice seeds, salt, egg, bucket, sieve, firewood, pot, seed net
6	Sowing	Week 0	Hoe, line drawer
7	1st Weeding	3 weeks after sowing	Weeding hoe
8	1st Fertilizer application	3 weeks after sowing	Fertilizer, weighing scale, containers
9	2nd Weeding	5 weeks after sowing	Weeding hoe
10	2nd Fertilizer application	5 weeks after sowing	Fertilizer, weighing scale, containers
11	3rd Weeding (depending on field condition)	10 weeks after sowing	Weeding hoe, uprooting by hand)
12	3rd Fertilizer application	10 weeks after sowing	Fertilizer, weighing scale, containers
13	Heading	Heading more than 50% rice plants	
14	Off-type removal (for seed production)	13 weeks, 14 weeks, 15 weeks, 16 weeks after sowing	No tool (hand removal)
15	Bird scaring	13 - 17 weeks after sowing	Fishing net
16	Maturing	Accumulated temperature 950°C from heading date	
	Harvesting	18 weeks after sowing	Sickle
	Threshing		Tarpaulin, Bambam box, sacks, head carriage (pans and buckets)
17	Winnowing	18 - 19 weeks after sowing	Tarpaulin, sacks, pans
	Drying		Stirring sticks
18	Storing	18 weeks after sowing ~	Storage facility, wooden pallets
19	Milling	18 weeks after sowing ~	Sacks
	Packaging	18 weeks after sowing	Packaging materials
20	Selling	18 weeks after sowing ~	Sacks

(2) Crop Budget

Crop budget consists of variable cost (e.g. input and labour) and fixed cost (e.g. equipment). It is important for farmers to know the necessary cost in advance and prepare the budget for upcoming cropping season. The examples of crop budget are shown below:

Table 9: Example of crop budget (Transplanting)

Conventional method (1/4 acre)					Improved Package (1/4 acre)					
	Item	Qty	Unit price (GHC)	SubTotal (GHC)		Item	Qty	Unit price (GHC)	SubTotal (GHC)	
Variable cost	Subsidized Seed	12 kg	3	36	Variable cost	Certified Seed	6 kg	4.5	27	
	Land rent			40		Land rent				40
	NPK	30 kg		45		NPK	20 kg			30
	Urea	15 kg		30		Urea	6 kg			14
	Herbicide	1500ml		24		Herbicide	1 bottle			18
	Sowing (dibbling)	2 manday		80		Bund construction				250
	Spraying	1 manday		40		Transplanting				100
	Bird scaring	40 manday		50		Weeding				20
	Harvesting			40		Harvesting				40
	Threshing			40		Threshing				30
	Drying, Winnowing, Bagging			20		Drying, Winnowing, Bagging				20
	Carting of paddy			40		Carting of paddy				40
	Milling charge	2 bags	21	42		Milling charge	8 bags	21		168
	Total (GHS)			527		Total (GHS)				797
Fixed cost	Cutlass	1	20	20	Fixed cost	Mattock	1	30	30	
	Hoe	1	7	7		Hoe	3	20	60	
	Knapsack sprayer	1	65	65		Compactor	2	40	80	
	Polyethene sheet	2	10	20		Leveler	2	45	90	
	Barrel	1	15	15		Push weeder	2	45	90	
	Total (GHS)			127		Bird scaring net	2	40	80	
				Sickle		2	10	20		
				Bambam box		1	45	45		
				Tarpaulin		1	100	100		
				Total (GHS)					565	

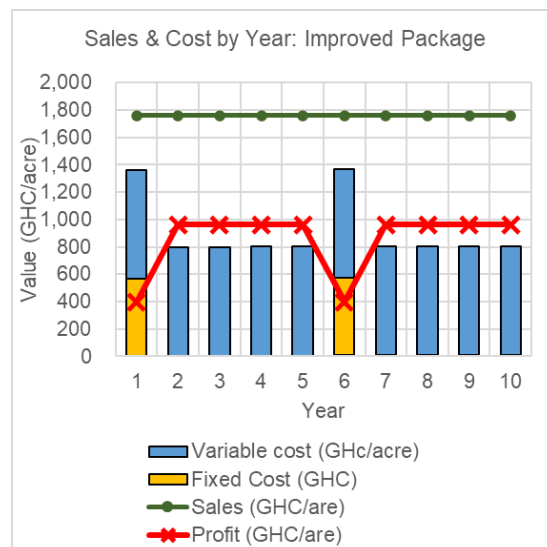
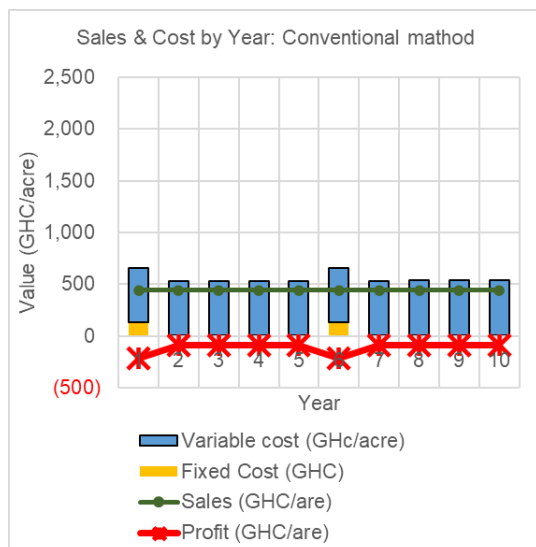


Figure 37 Estimation of profit interannual changes (Transplanting: 1/4 acre plot)

Table 10: Example of crop budget (Direct sowing)

Conventional method (1 acre)

	Item	Qty	Unit price (GHC)	Sub Total (GHC)
Variable cost	Seed	40 kg	4	160
	NPK15	100 kg	68/50kg	136
	Urea	50 kg	63/50kg	63
	Herbicide	1 bottle	40	40
	Plough	1 time	80	80
	Spraying	2 times	20	40
	Bird scaring	3 weeks		100
	Harvesting	1 bag of paddy from harvest		
	Land rent	1 bag of paddy from harvest		
	Total (GHS)			619
	Fixed cost	Knapsack sprayer	1	55
Sickle		1	15	15
Total (GHS)				70

Improved Package (1 acre)

	Item	Qty	Unit price (GHC)	SubTotal (GHC)	
Variable cost	Seed	30 kg	4	120	
	NPK15	80 kg	68/50kg	109	
	Urea	26 kg	63/50kg	33	
	Herbicide	0.5	40	20	
	Plough & Bund const.	1.5 times	80	120	
	Harrow	2 times	40	80	
	Drilling	4 person	20	80	
	Weeding	8 person	20	160	
	Bird scaring	3 weeks		100	
	Harvesting	1 bag of paddy from harvest			
	Land rent	1 bag of paddy from harvest			
	Total (GHS)			822	
	Fixed cost	Hoe	1	20	20
		Compactor	1	60	60
Line drawer		1	130	130	
Sickle		1	15	15	
Bambam box		1	350	350	
Tarpaulin		1	250	250	
Total (GHS)				825	

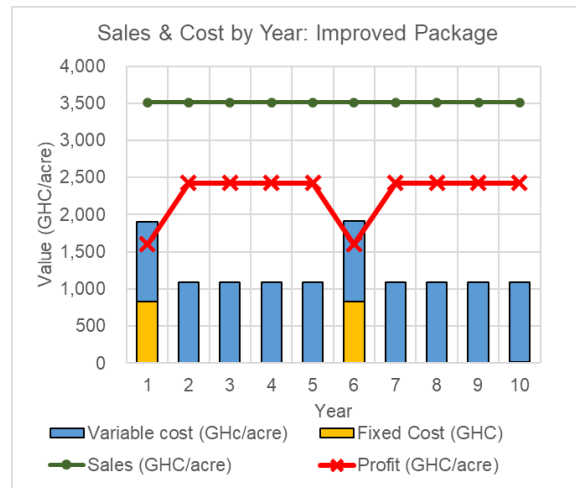
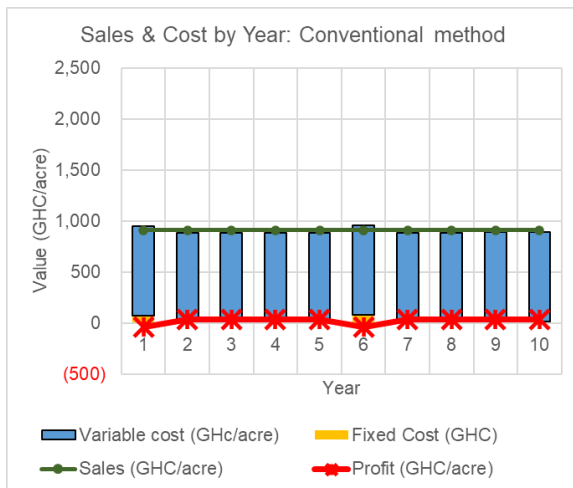


Figure 38 Estimation of profit interannual changes (Direct Sowing: 1 acre prot)

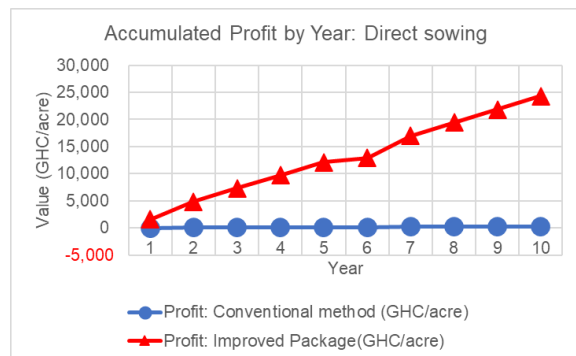
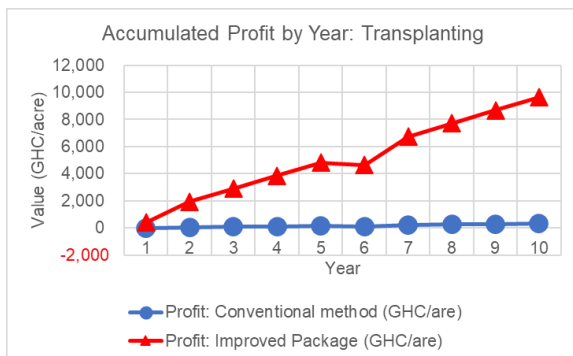


Figure 39: Estimation of accumulated profit

3.4 Conducting Training

(1) Training of Trainers (ToT)

Training of Trainers (ToT) aims at building capacity of officers on all aspects of rice extension at the district level. The officers trained at ToT are expected to be trainers for onsite training at demo-plot. ToT is organized as in-house training with practical exercise and group work. It is recommended to carry out the training 3 times during the rice cropping season.

Table 11: Training of Trainers

	1st TOT (Before sowing)	2nd TOT (After 2nd fertilization)	3rd TOT (Before harvesting)
Land development	<ul style="list-style-type: none"> • Site selection, • Ploughing, harrowing, • Bund construction, land levelling, puddling, • On-farm water management, etc. 	<ul style="list-style-type: none"> • Bund maintenance, • Water management. 	<ul style="list-style-type: none"> • Bund maintenance, • Water management.
Rice cultivation	<ul style="list-style-type: none"> • Seed selection and treatment, • Nursery preparation, • Transplanting, • Direct sowing, • Fertilizer management and calculation, • Weed control, • Disease and pest control. 	<ul style="list-style-type: none"> • Fertilizer management, • Young panicle observation, • Disease and pest control, • Estimation of harvesting time. 	<ul style="list-style-type: none"> • Bird scaring, • Timely harvesting, • Yield components, • Harvesting and post harvesting
Farm management	<ul style="list-style-type: none"> • Farm management, • Record keeping, • Gender 	<ul style="list-style-type: none"> • Marketing, • Rice value chain • Nutrition Improvement 	<ul style="list-style-type: none"> • Cost benefit analysis (a tale of two farmers)
Extension	<ul style="list-style-type: none"> • Rice extension guideline, • Preparation and operation of on-site training 	<ul style="list-style-type: none"> • Group formation, • Points of monitoring by AEAs 	<ul style="list-style-type: none"> • Points of monitoring by AEAs, • Preparation and operation of field trip
Planning/ M&E	<ul style="list-style-type: none"> • M&E tools 	<ul style="list-style-type: none"> • 2nd quarterly report, • Planning and budgeting for the next year 	<ul style="list-style-type: none"> • 3rd quarterly reporting, • Guide of annual report preparation

Table 12: Standard Program for 1st ToT

Time Allocation	Topics	Materials/ Texts/ Tools
1 hour	Introduction / Purpose of Training Explain on District Rice Extension Plan Presentation of Rice Extension Guideline	<ul style="list-style-type: none"> • Rice Extension Guideline • Rice Production Handbook
2 hours	Presentation of Land Development	<ul style="list-style-type: none"> • Flipchart and marker pens (for Heron's formula) • Tape measure (for Heron's formula)
2 hours	Presentation of Rice Cultivation Including practical training	<ul style="list-style-type: none"> • Seed, bucket, salt, egg (for salt-water seed selection) • Thermometer, seed net bag, firewood etc. (for hot water seed treatment)
	Lunch break	
1.5 hours	Presentation of Farm Management	
1 hour	Presentation of M&E and practical exercise Way forward	<ul style="list-style-type: none"> • M&E Tools

Table 13: Standard Program for 2nd and 3rd ToT

Time Allocation	Topics	Materials/ Texts/ Tools
0.5 hour	Purpose of Training	
1 hour	Presentation of Land Development	
2 hours	Presentation of Rice Cultivation Including practical training	Sample young panicle for observation (for 2 nd ToT)
2 hours	Presentation of Farm Management	
	Lunch break	
0.5 hour	Presentation of Extension	
1 hour	Presentation of M&E Way forward	

Procedure:

1. Good preparation brings good result.

Programme: Inform all participants in advance.

Venue: Identify and book a venue (if necessary) and inform all participants in advance.

Budget: Arrange within limited resources and request release of the funds as early as possible.

Contents: Assign DAOs to respective sections for presentation.

Materials: Texts Relevant documents (Rice Production Handbook and M&E Tools) are supposed to be printed and distributed to all participants. Projector should be ready to present power point materials. Items for practical training should be ready (seed, salt, egg, water, firewood etc.).

2. Be punctual. Start on time. Consider time management of programme. Make presentations within time allocated.



Photo 53: Lecture



Photo 54: Practice on land measurement using Heron's formula



Photo 55: Practice: Seed selection by saltwater method



Photo 56: Practice: Hot water seed treatment



Photo 57: Practice: Young panicle observation



Photo 58: Group exercise: M&E tools

(2) Onsite training (OST)

Onsite training (OST) is a practical training for target farmers at demonstration plot. OST is organized according to the Action Plan for Demo-Plot. It is recommended to conduct OST 4 times or 5 times during the rice cropping season depending on the cultivation method either transplanting or direct sowing method.

Transplanting method:

- OST 1: Salt water seed selection and hot water seed treatment, nursery preparation, transplanting.
- OST 2: Land Development (bund construction, levelling, puddling)
- OST 3: Transplanting
- OST 4: Fertilizer Application and Weeding (including rogueing)
- OST 5: Timely Harvesting (including rogueing)

Direct sowing method:

- OST 1: Land Development (ploughing, harrowing, bund construction)
- OST 2: Salt water seed selection and hot water seed treatment, sowing.
- OST 3: Fertilizer Application and Weeding (including rogueing)
- OST 4: Timely Harvesting (including rogueing)

Procedure:

When DAO/AEA conduct OST, all necessary materials and tools should be prepared in advance and brought to demo-plot. Materials and tools are:

1. Onsite Training Material, (laminated flip chart or book)
2. Demo Plot Action Plan,
3. Tools for salt water seed selection (bucket, salt, egg) and hot water seed treatment (thermometer, seed net bag, firewood, etc.),
4. Improved Tools (hoe, shovel, compactor, slapper, leveler, line drawer, garden line, push weeder, bird scaring net, sickles, tarpaulin, bambam box, etc.), and
5. Farm Inputs (seed, fertilizer, agrochemicals, etc.).

Table 14: Standard Program of Onsite Training

Time Allocation	Activity	Responsibility
0.5 hour	Arriving at Training Plot / Demo Plot	All
1 hour	Explanation of the planed activity (by using Onsite Training Material)	DAO / AEA
3 hours	Field work	All
	Lunch break	All
2 hours	Field work (continued)	All
10 minutes	Way forward (explain about the next activity and date by using Demo Plot Action Plan)	DAO / AEA



Photo 59: Using Onsite Training Material for explaining technical package to farmers

3.5 Monitoring and Evaluation (M&E)

(1) M&E and Feedback

Monitoring is a process of 1) collecting data, 2) Assessing the progress and achievements, and 3) identifying challenges and necessary actions of plan, programme and project. The result is utilized as feedback into the plan as part of management cycle. Evaluation is conducted at the end of the “plan-do-see” cycle to assess its performance. The results and lessons learnt from the evaluation are shared among stakeholders for future planning.

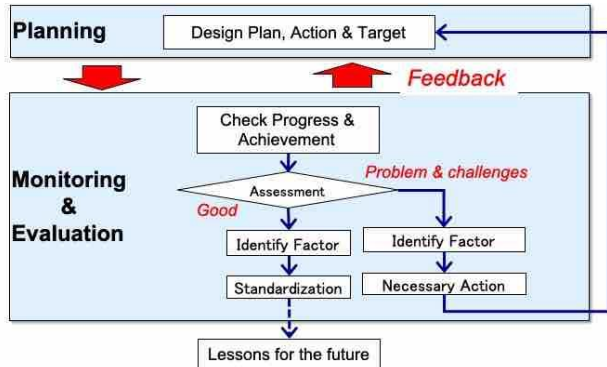


Figure 40: M&E and Feed Back

(2) Monitoring

Based on the direction given by Ministry of Food and Agriculture (MoFA) and regional department, districts prepare annual plan which is fine-tuned to the respective local situation. MoFA has introduced uniform formats for M&E reporting. Progress and challenges of the annual plan is monitored and reported periodically. Monitoring is conducted by regularly checking the implementation of day to day activities. The monitoring report is sent to higher entities vertically and/or horizontally, as shown in the figure to the right. When problems and challenges are found, necessary actions are to be taken.

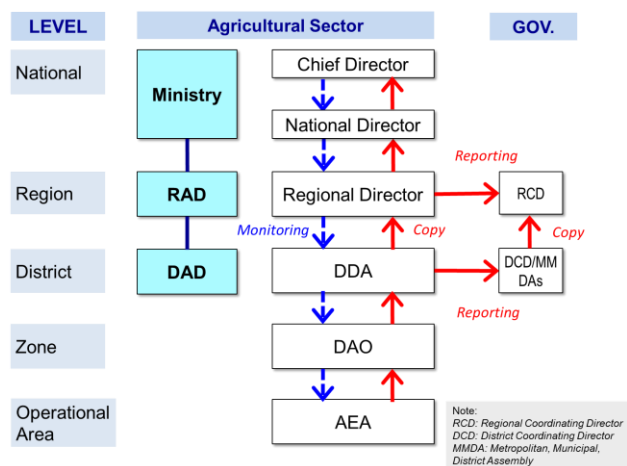


Figure 41: MoFA Monitoring Flow

(3) Evaluation

Evaluation is conducted at the end of an intervention to assess the achievement, results & impacts. Evaluation report can highlight the performance and achievements. The results can be utilized to report to the District Assembly on how the rice extension activities contribute to the improvement of livelihood of people in the district. To assess the progress, achievement and impacts, logical framework is utilized (See table below).

Table 15: Standard Logical Framework of Rice Extension Plan

	Activity Summary	Indicators	Source Means of verification	Base	Target	Progress/ achievement
Input	A set of trainings in the district	Trainings conducted as planned	- Training record	•	•	•
Output	Training of DAO, AEA, and target farmers	- Number of trained DAO, AEA, and target farmers - Demonstrated well in demo-plot	- Training record - Demo-plot	•	•	•
Outcome	- Target farmers apply the techniques - Yield of target farmers' field increased	- Application rate of target farmers - Average yield of individual target farm field	- Target farmers	•	•	•
Impact	- Livelihood of rice farmer enhanced - Improved techniques disseminated to non-target farmers - Rice production in the district increased	- Income of target farmers increased - Number of non-target farmers applied - Rice production amount	- Target farmers - Non-target farmer	•	•	•

(4) Data Collection for M&E

Timely availability of relevant data is vital for effective performance of managerial functions such as planning, organizing, leading, control and evaluation. Necessary data is collected through regular monitoring, baseline survey, and endline survey. The monitoring information flow from district is shown in the figure to the right. Prior to evaluation, endline survey should be conducted to understand the changes. With both data of baseline and endline, one can assess the impact comparing the conditions after intervention with before.

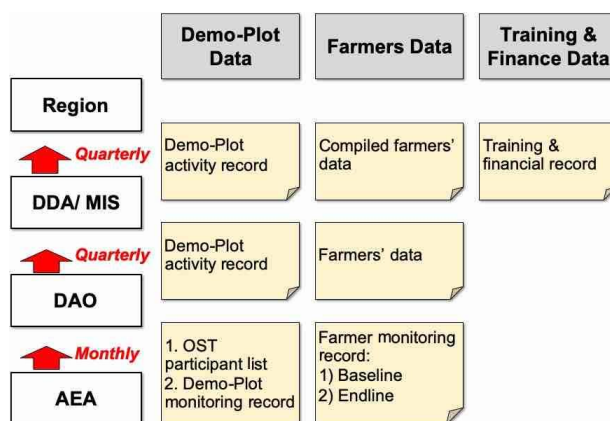


Figure 42: Data Collection Flow

Baseline Survey:

AEAs conduct interviews with all group farmers and other farmers to understand the real situation before the farmers adopt technologies. Information from interviews is based on field size, production, cost and sales for the previous year(s) before the intervention.

Endline Survey:

This study is conducted at the end of an intervention. The endline data is analyzed comparatively against the baseline data for critical analysis and interpretation.

Box: What to Monitor for Rice Extension

Rice extension activities are conducted mainly through 1) in-house training and 2) on-site training by managing demo-plots. Through these trainings, farmers are capacitated to practice the improved rice cultivation techniques at their own fields. To facilitate training, districts need to mobilize financial resources. Therefore, major monitoring points of rice extension activities are as follows:

Activities to monitor:

- District level: Have rice extension activities been financed well?
- District level: Have in-house trainings been conducted well?
- Field level: Have Demo-plot activities been conducted well?

Outcome to monitor:

- Field level: Have farmers' capacities been developed?

Field level information collected by AEA is reported to the district level. Monitored records are processed and reported by quarterly reports. The items to monitor are as follows.

Monitoring item to be reported in District Quarterly Report

1. Finance record:

- ✓ Submitted budget, approved budget, released budgeted, expended budget.

2. Training record:

- ✓ Name of training, topic, date, number of beneficiaries trained.

3. Demo-plot activity record:

- ✓ Area of demo-plot, number of group farmers participated, progress and problems, harvested result of rice.

4. Farmers' monitoring record: baseline & endline

- ✓ Number of famers, their practice & progress, harvested result of rice, income from rice.

3.6 Sharing Results

(1) Field Trip

Before harvesting, decision makers of the District Assembly are invited to the best demo-plot in the district to observe the improved rice cultivation technology and its performance. Field trip expects that decision makers to be motivated to allocate budget for rice extension activity and release fund in timely manner for demo plot establishment.

(2) Field Day

In every demo-plot, field day is organized for non-target farmers and potential rice buyers in the community. Field day enhances participants' awareness on the improved rice cultivation techniques and quality of rice produced by Group Farmers. Non-target farmers are expected to learn how high yield is obtained from an acre and farm income increase, and then apply the improved rice cultivation techniques to their own farm.

Procedure:

“Seeing is believing”, as the popular saying goes. In addition to field observation, use pictorial materials and tools to explain what the improved rice cultivation techniques. Such as:

1. Show the Onsite Training Material to explain seed selection by salt water, hot water seed treatment and other cultivation techniques; and
2. Demonstrate how to use tools (e.g. compactor, push weeder, bambam box etc.).



Photo 60: Field trip: Brief explanation to participants



Photo 61: Field trip: Field observation

(3) Farmers Day

National/ District Farmers Day is one for the opportunities for sharing experience among stakeholders.

Procedure:

1. Prepare well-packaged samples of good quality milled rice for exhibition or sales.
2. OST materials, other pictorial materials and pictures are used for explaining to visitors.

3. Improved tools (e.g. compactor, push weeder, line drawer, bambam box, tools for hot water seed treatment etc.) are also demonstrated at the stand.
4. Print enough copies of Rice Production Handbook and distribute to farmers.



Photo 62: Exhibition Stand



Photo 63: Briefing to Vice President of Ghana and Minister of Food and Agriculture



Photo 64: Showcase of rice, brochure and training materials



(4) District Joint Sector Review Meetings

During Assembly meeting with Assembly members from the various electoral areas, short video showing success story from group farmers or short presentations are made for Assembly members.

APPENDIX

List of Dissemination Kits

No.	Name of material	Type of material	Main user of material
1	Rice Production Handbook	Booklet	DAO-Crop, AEA
2	M&E Tools	Booklet	MIS officer
3	Planning Map and Budget Calendar	PR handout	DDA
4	ToT Materials (1 st , 2 nd , 3 rd) including following topics:- Land Development Rice Cultivation Farm Management System Support Extension / Plan & Budget/ M&E	Power point for in-house training	DAO-Crop
5	Hot water seed treatment	Video	DAO-Crop, AEA
6	Check List of Site Selection	Handout	DAO-Crop, AEA
7	Onsite Training Material (1 st , 2 nd , 3 rd) including following topics:- Land Development Rice Cultivation Farm Management System Support	Pictorial flip chart	AEA
8	Cropping Calendar	Handout	DAO-Crop, AEA
9	Farm Record Keeping Book / Sheet	Handout	Farmer
10	Rice Promotion Sheet	PR handout	Farmer
11	Check Sheet for Marketing Opportunity	Handout	Farmer
12	Resources for Marketing Support	Handout	AEA
13	Value Chain Questionnaire	Handout	AEA
14	Rice Recipes	PR handout	WIAD, Farmer
15	Brochure on Technical Package	PR handout	DAO-Crop, AEA

Rice Production Handbook

In Rain-Fed Lowland Area

With Appropriate Technologies



Rice, we can!

TENSUI RICE Phase II

The Project for the Sustainable Development of
Rain-Fed Lowland Rice Production Phase 2 (Tensui 2)

April 2021



MINISTRY OF
FOOD & AGRICULTURE
REPUBLIC OF GHANA



Japan International Cooperation Agency

Rice Production Handbook

In Rain-Fed Lowland Area

With Appropriate Technologies

TENSUI RICE Phase II

**The Project for the Sustainable Development of
Rain-Fed Lowland Rice Production Phase 2 (Tensui 2)**



PREFACE

This Handbook shows how to grow more rice in the rain-fed lowland area with sustainable technologies for smallholder farmers.

The technical package in this Handbook is developed through field trials and adaptation in the rain-fed lowland areas in Ashanti and Northern regions supported by *the Project for the Sustainable Development of Rain-Fed Lowland Rice Production Phase 1 & 2 (Tensui 1 & 2)*.

Tensui 2 project is under implementation by Ministry of Food and Agriculture (MoFA) in collaboration with Japan International Cooperation Agency (JICA) from April 2016 to February 2021.

Most of the techniques in this Handbook can be applied in the agro-ecological zones in *Semi-Deciduous Rainforest, Forest-Savannah Transition, and Guinea (Interior) Savannah zones*.

The application of improved technical package will increase yield and production as well as improve the quality of local rice. The technical package recommended in this Handbook is developed in consideration of:

1. Proper land and water management to fully utilize limited resource under rain-fed condition, and
2. Introducing low cost and simple rice production techniques to enable smallholders to practice.

Main expected users of this Handbook are Agricultural Officers of MMDAs (Metropolitan, Municipal and District Assemblies) providing extension services to rice farmers.

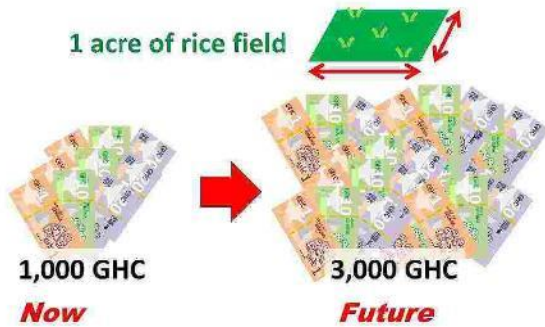
"Rice, We Can!"

What we can? We can...



We can...

Earn more!



We can...

Produce more!



We can...

Be happier!



How?



Rice, we can!

With simple technique!



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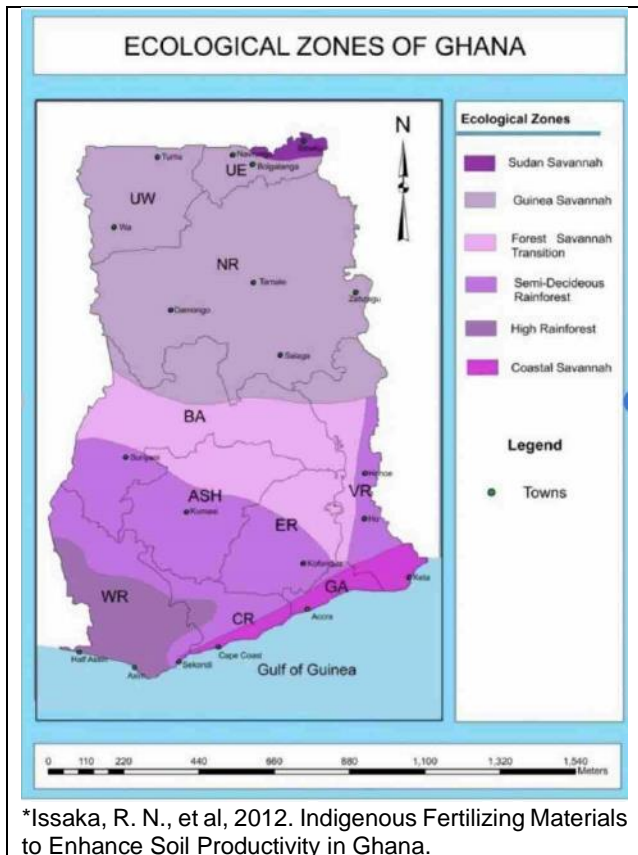
1 INTRODUCTION

Background

Rice is the seed of a semi-aquatic grass plant; *Oryza sativa* is botanical name.

Rice has become one of the most important staple food in Ghana. Domestic consumption reached 1 million ton (2013) because of population growth, urbanization and change in dietary habits.

Rice is produced in all ten regions of Ghana for the major ecological-climatic zones. Those are Guinea (Interior) Savannah Zone, Forest Savannah Transition zone, Semi-deciduous Rain Forest zone, High Rainforest zone and Coastal Savannah zone.



Rice cultivation methods are mainly divided into two major types: 1) transplanting and 2) direct sowing.

Transplanting cultivation is applied in relatively humid area mainly in Semi-deciduous Rain Forest zone in Ashanti region. Direct sowing is applied in Guinea (Interior) Savannah Zone in Northern region. In Forest Savannah Transition zone, method depends on the site-specific conditions.

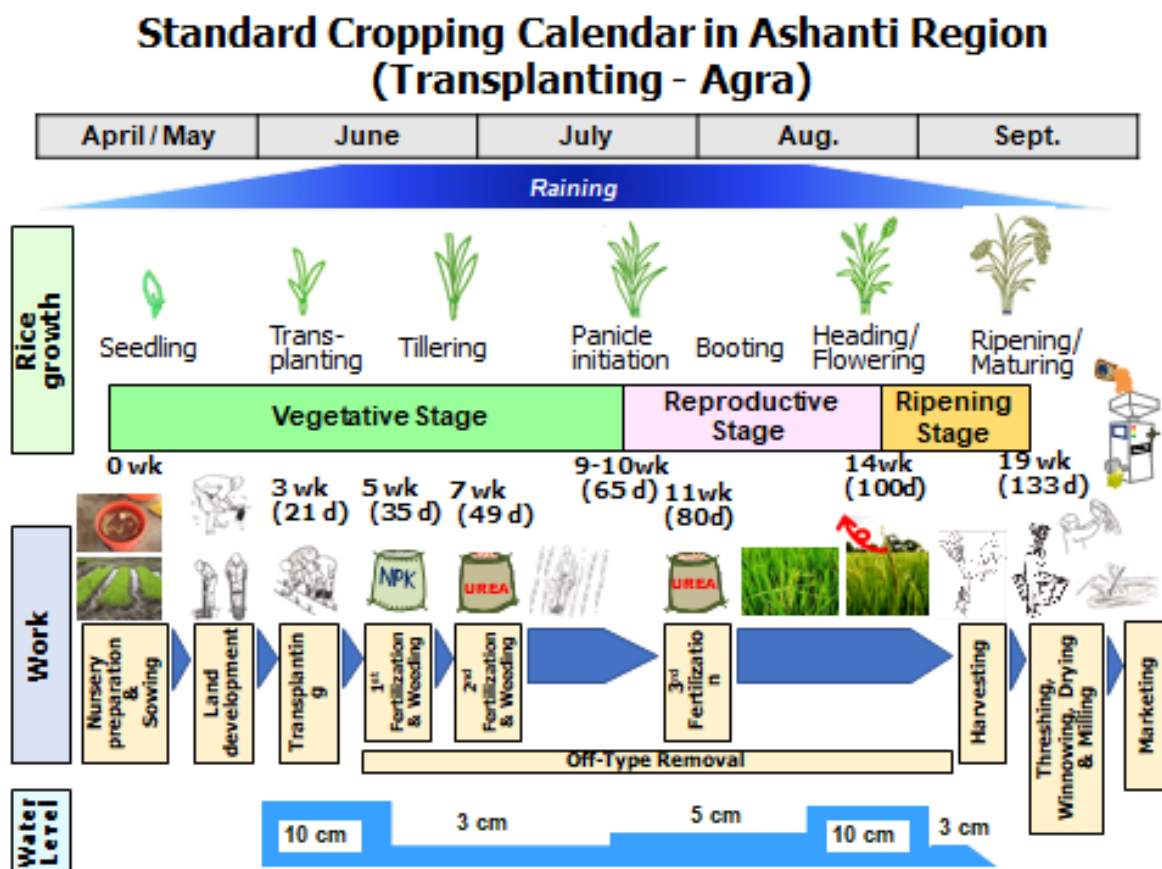
Standard Cropping Calendar and Two Cultivation Methods

Cropping calendar is convenient tool for planning rice cultivation. We get to know what comes next. We can plan and prepare activities in advance.

Standard cropping calendars for transplanting and direct sowing are developed as shown below. This graphical cropping calendar guide farmers and extension workers what they have to do next.

(1) Transplanting

Cropping Calendar for Transplanting method for Agra is shown below.



Transplanting method is applicable mainly in Semi-deciduous Rain Forest zone where water sources are relatively available.

Main difference between transplanting and direct sowing is sowing seeds on nursery beds. In transplanting, seedlings are transplanted in rice field when seedlings matured.

The advantage of transplanting is to have healthy seedlings and optimize plant population.

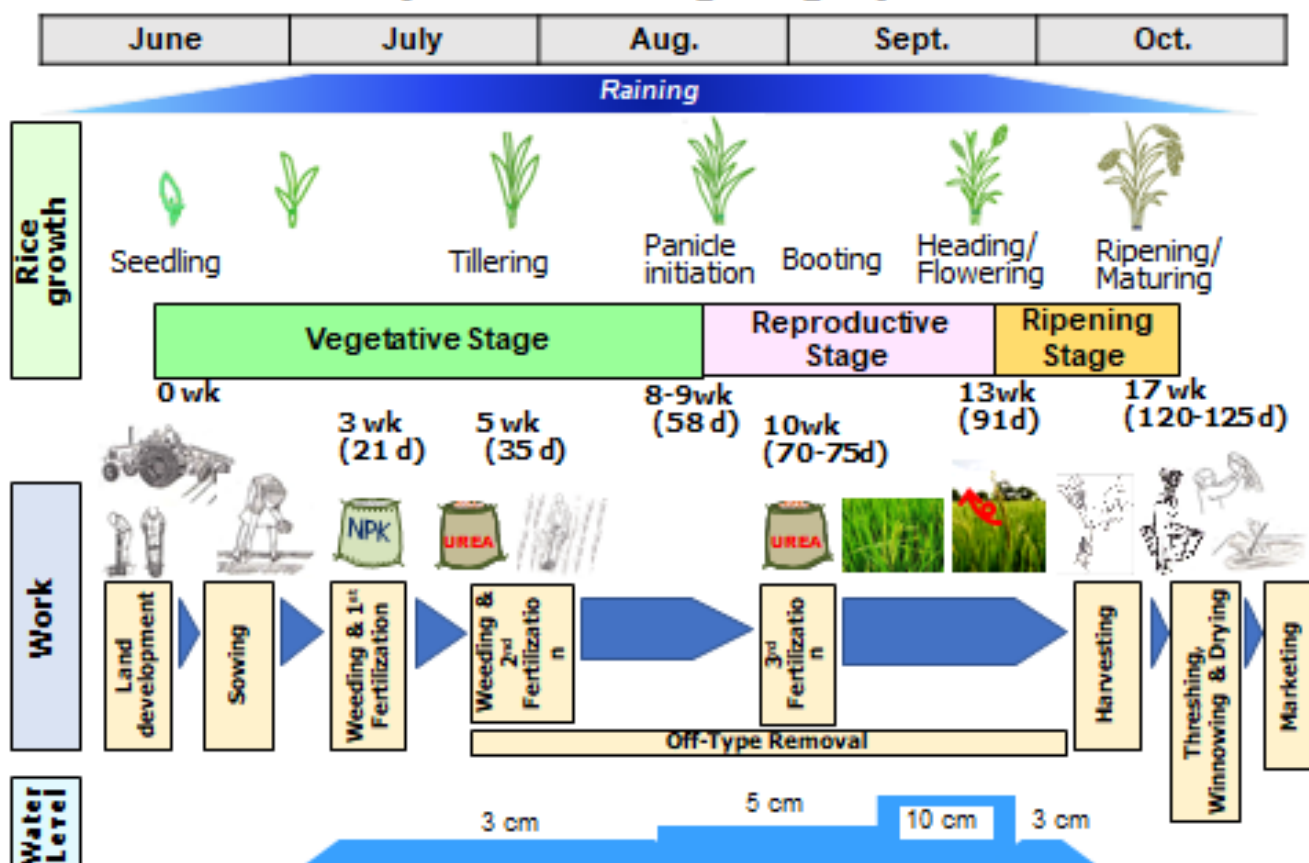
Based on experience, the introduction of this improved technical package can help farmers double harvest of rice as compared with conventional method. It could make smallholder farmers livelihood better.

	Conventional methods	Improved
Bags harvested (84kg)	8 – 10 bags	15 – 30 bags
Yield (ton/ha)	1.6 – 2.0 ton/ha	3.0 – 6.0 ton/ha

(2) Direct Sowing

Standard Cropping Calendar for Direct Sowing method for Agra is shown below (The duration of growth period could vary depending on weather conditions).

Standard Cropping Calendar in Northern Region (Direct Sowing - Agra)



Direct sowing method is applicable mainly in Guinea (Interior) Savannah zone and Forest Savannah Transition zone where water resources is relatively limited. Northern part of Ashanti Region and most of Northern Region can be potential areas.

	Conventional methods	Improved
Bags harvested (84kg)	6 – 8 bags	12 – 16 bags
Yield (ton/ha)	1.2 – 1.6 ton/ha	2.4 – 3.2 ton/ha

2 Land Development

The land development activity for rice cultivation is an integrated process involving good valley/site selection, bund construction, ploughing, puddling, land levelling, water harvesting and management.

2.1 Valley/Site Selection

Some factors to consider in valley/site selection are;

- Valley ownership / Custodian [Chief, family head, Individual]
- The attitude of the owner/farmer or user of the plot or valley
- Accessibility by car/motorbike and other group farmers to the valley
- Number of farmers working in the valleys
- Flood water level should not be above the knee level.
- Good source of water (temporary and permanent, but permanent preferred)
- Valley should be as flat as possible
- Valley should always have some level of moisture
- Some vegetation cover such as Gamba Grass, “Acheampong” Weed, Elephant Grass, Oil Palm, Cyperus Esculentus and other local grasses can give an indication of a good valley for rice growth.

The following should be avoided when choosing a valley for rice cultivation. One should avoid;

- Steep or high undulating fields/valley
- Reserved or protected/totem areas
- Areas where either soil or water has been contaminated [Galamsey operated areas.

Below are some examples of vegetation cover to look out for during valley selection.



Gamba Grass



Elephant Grass



Cyperus Esculentus



A fairly flat valley / Valley with a gentle slope

2.2 Bund Construction

Bunds are small earth embankments used to contain and manage irrigation water within basins. The height of bunds is determined by *the irrigation depth*. The width of bunds should be such that it will be stable and leakage will not occur.

The two main types of bunds constructed are the peripheral and interlocking bunds. The inter-locking bunds are created within the fields to avoid deep water deposit in the field. Thus, created to separate places of higher elevations from lower elevations.

Bunds constructed should be maintained. Minor repairs such as hilling up the soil, reshaping and cutting grasses should be done to maintain the function of bunds. Again, cutting of grasses, re-compaction of bunds and reshaping of bunds should be done after harvesting. Reinforcement of bunds where weak should be done.

The importance of bunds includes;

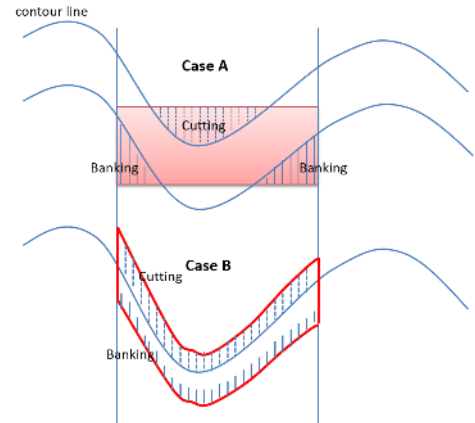
- Conserving water in the field for the rice plants
- Directing water in and out of the field for water management
- Controlling floods
- Serving as walk ways and boundaries

Steps to follow in bund construction.

1. Peg the bund alignment using a rope.
2. Clear the bund alignment and scoop the top soil aside

3. Scoop soil from both sides of the alignment.
4. Compact the heaped soil in small layers using the flat wooden compacter.
5. Continue the heaping and compaction process until the required height of 30cm – 50cm is achieved.

Note: It is necessary to note that the length of the field should be along the contour line and width should be across the contour. The wider the width is, the more the volume of earth work for levelling increases depending on land slope.



Height

- ✓ 30-50cm for main/peripheral bunds
- ✓ 10-15cm for interlocking bunds

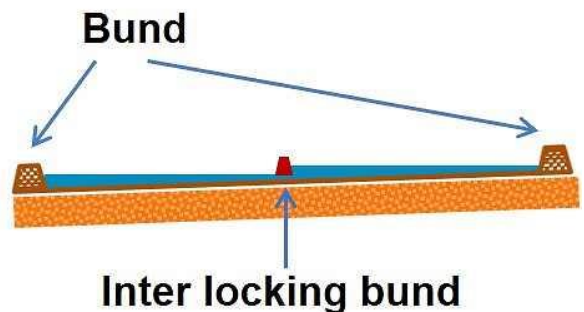
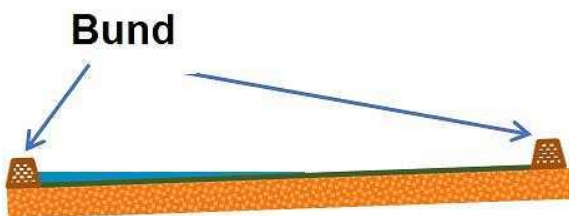


Bund



Compaction

If the surface of land is sloping, irrigate land a little to identify higher portion and lower portion and make inter locking bund between both portions. After making inter locking bund, both portions are levelled respectively.

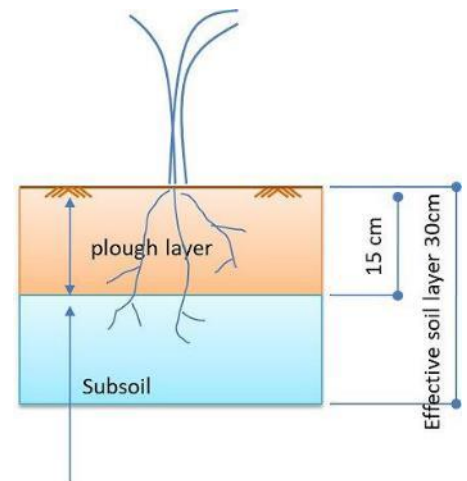


2.3 Land Clearing, Ploughing, Puddling and Levelling

Valleys selected should be cleared of weeds, grasses and other unwanted vegetation. Remove existing vegetation.

2.3.1 Ploughing

Ploughing is the process of turning up the soil or the process of cutting, breaking and inverting the soil partially or completely to make it suitable for sowing rice. Some tools and implements used in ploughing the soil are hoe, power tillers and tractor mounted ploughs.



Points to note during Ploughing

1. Land should be cleared before ploughing
2. Soil should be moist
3. Avoid deep ploughing to avoid turning of subsoil
4. Ploughing depth should be uniform
5. Lump soils and debris removed

The ploughing depth should not be more than 15cm. Effective soil layer should also not be more than 30cm including the ploughed layer of 15 cm.

2.3.2 Puddling

Puddling involves working the ploughed saturated soil or near saturated soil with the feet to make it soft structureless mud.

Puddling softens the soil and assists manual transplantation of rice seedling, minimizes water use through reduced percolation losses and effective weed control. Over time, soil puddling also creates a compacted layer below the puddled zone which further reduces percolation losses. It is advisable that one wears the field boots before puddling.

2.3.3 Land Levelling

Land levelling is the process of reducing the field undulations. It is also a process of making the ploughed field level. It enhances even water distribution and drainage of surface water. It enhances uniform growth of rice, and effective fertilizer and herbicide utilization.

Land levelling is done using a wooden land leveller. The user of the leveller pulls or pushes the ploughed soil from places of higher heights to places of lower height to enable even water distribution.

Some simple tools for land levelling include;

- Manual land leveller

- Flat leveller tied with a rope
- Ladder tied with a rope
- Sack with 2 holders
- Sack with a rope



Puddling



Levelling

2.4 Water Use & Management

This involves the introduction of useful structures such as bunds, weirs, canals, ponds, seepage water collection ditches and drains to harvest, manage and helps in the distribution of harvested water. Water use and management entails the optimum use of available water resources by the rice plant. The aim of water use and management is to secure water for the rice plant for non-continuous rainy days with a storing or water harvesting facility.

Water management techniques are integrated processes that uses;

- 1 Use of interlocking bunds
- 2 Use of diverging and drainage canal
- 3 Use dug outs, weirs
- 4 Use of sand bags

2.4.1 Water Management Using Weirs, Diverging and Drainage Canal

Weirs are constructed by using a semi permeable or impermeable material such as wooden planks or sand bags to obstruct the flow course in other to impound water. The impounded water is then conveyed onto the basins using a canal.

2.4.2 Construction of Canals

In order to construct irrigation canals, the following procedure should be followed:

1. The canal alignment for construction should be marked and pegged with line/string.

2. Construct the canal by digging out and also filling depressions along its walls to give it a uniform height.
3. Filled areas along the canal alignment and walls should be compacted to make them stable to avoid erosion.
4. Shape the canal to a recommended trapezoidal shape to reduce erosion.
5. Divert water from upstream into the constructed canal.

2.4.3 Canal Maintenance

Maintain the canal by;

1. Removal of silt & clearing of weeds,
2. Repairing collapsed slopes
3. Immediately removing obstructions or blockage
4. Maintain growth of vegetative coverings to help stabilize the walls of the canal such as vertiver
5. Mending and compacting broken canals and bunds
6. Immediately repairing any damage caused by animal activity to maintain the efficiency of the canal.

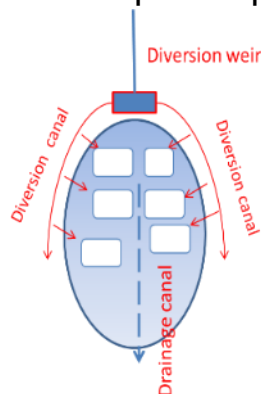
Below are the canal types used in the Tensui techniques. These are;

a. Divided Canal Type

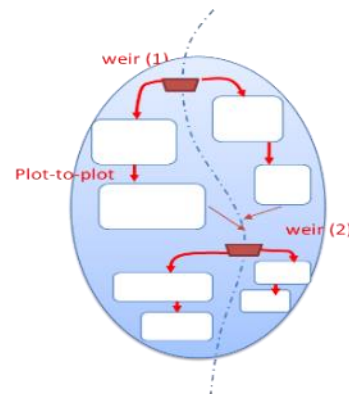
Diversion weir/dug out is constructed to gather and raise water level at upstream for gravity water use. Around the land, diversion canals are constructed. In the center of the land, existing river is developed as a drainage canal.

b. Dual Purpose Canal

Original water way is developed as a dual purpose canal. Along this canal, a weir is put in the canal in order to raise water level. Raised water go into rice field, then use in plot-to-plot.



Divided Canal



Dual Purpose Canal

2.5 Drains

There are two types of drainage system under the production of rice using the Tensui technique. These are the main drain [flow course] and the field drains. The drains should be constructed at the lowest portion or existing stream if that is the lowest. By improving drainage on the field, workability is improved and the operation of machines such as power tiller is enhanced. In order to improve the flow of drainage water from the fields it is recommended to have a straight layout.

2.5.1 Construction of Drains

1. The drainage alignment for construction should be marked and pegged with line/string.
 2. Construct the drains by digging out and also filling depressions along its walls to give it a uniform height.
 3. Drainage channels should be lower than the plot levels in order to enhance the efficiency of it.
 4. Filled areas along the drainage alignment and walls should be compacted to make them stable to avoid erosion.
 5. Shape the drain to a recommended trapezoidal shape to reduce erosion.
- Divert water from field drains into the main drain which is a flow course.

2.5.2 Maintenance of Drains

1. Removal of silt & clearing of weeds,
2. Repairing collapsed slopes
3. Immediately removing obstructions or blockage
4. Maintain growth of vegetative coverings to help stabilize the walls of the drains such as vertiver
5. Mending and compacting broken drains
6. Immediately repairing any damage caused by animal activity to maintain the efficiency of the drains

3 Rice Cultivation

3.1 Choice of Variety

Obtain certified seed of recommended varieties from reliable sources. MoFA currently recommends the following varieties in rain-fed low land area. AGRA is recommended because of resistance to Rice Blast disease.

Variety	Maturity (days)	Ecology
AGRA	120 – 135	Lowland
Jasmine 85	110 – 114	Lowland

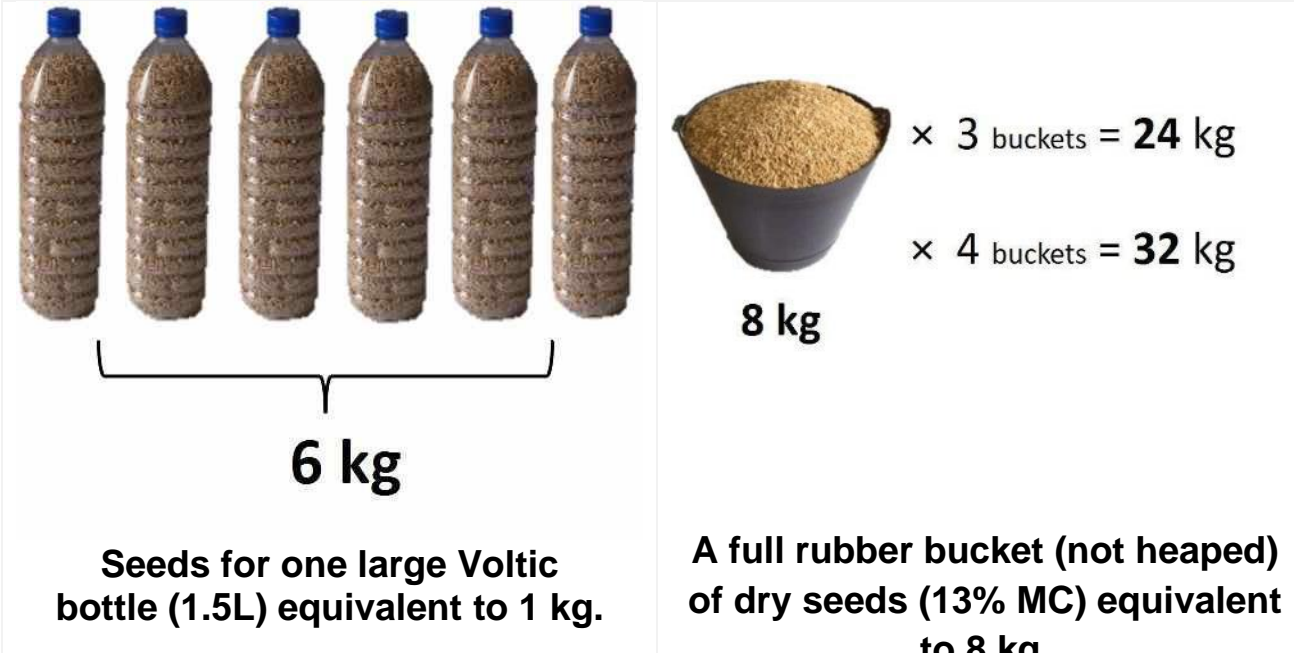
Qualities of good seeds

Select good quality of seeds.

- ✓ Germination rates above 80%
- ✓ Not mixed with seeds of other crops and weeds
- ✓ Free from pests and diseases
- ✓ Free from stone, dirt and foreign matter
- ✓ Well dried with moisture content between 10-12%
- ✓ Past the dormancy period

Sowing Rate

Prepare 6 kg of dry seed for 1/4 acre or 25 - 30 kg for 1 acre.



6 kg

Seeds for one large Voltic bottle (1.5L) equivalent to 1 kg.

8 kg

× 3 buckets = 24 kg

× 4 buckets = 32 kg

A full rubber bucket (not heaped) of dry seeds (13% MC) equivalent to 8 kg.

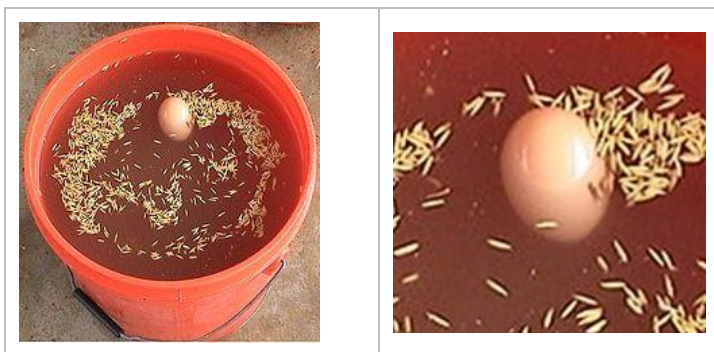
3.2 Seed Preparation

(1) Seed Selection

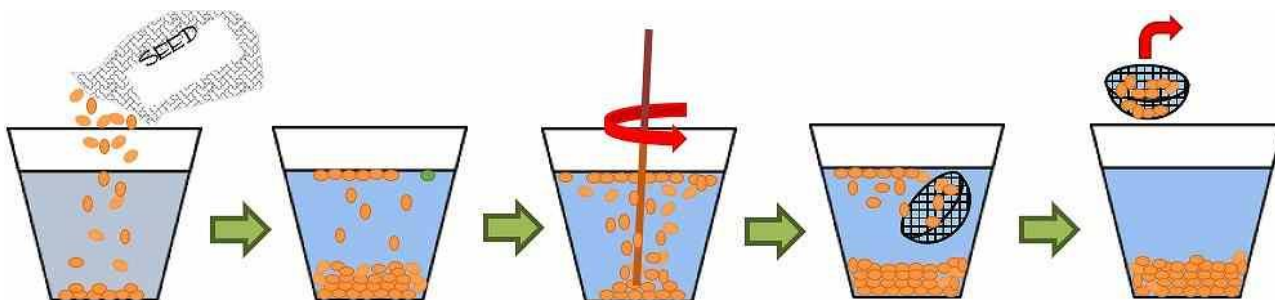
Soak seeds in salt water (specific gravity 1.10) and remove floated grains. Then wash away salt from the sunken seeds. Wash the seeds 5 times.

Procedure:

1. Measure ten (10) liters of water and two (2)kg of salt.
2. Mix salt and water then stir well.
3. Put the fresh egg in the solution, if the egg float above the water, the solution is correct for seed selection
4. Remove the egg and put seeds.
5. Remove the floating seeds.
6. Wash the remaining seeds with fresh water 5 times.
7. Seeds should be fully submerged into the salt solution.
8. The solution can be used for several times.



Specific gravity 1.10 salt water is made by 2.0 kg salt and 10 liter water. The specific gravity can be confirmed by floating **fresh egg** on the salt water.



(2) Hot Water Seed Treatment

Objective: Hot Water Seed Treatment is one of counter measures to prevent diseases and as effective as seed dressing. It can remove pathogens causing diseases can be on or in seed. Seed-borne pathogens include fungi causing Rice Blast. This method is environment friendly and cost-saving.

Diseases Controlled: Rice Blast, Brown Spot, Bakanae, Bacterial Grain Rot, Bacterial Seedling Blight, rice nematodes, etc.

Process: Process is as shown in the chart blow.



1. Heat up water. Use clean water.



2. Keep water temperature at **60°C**. Observe the water temperature by using thermometer.



3. Put seed into hot water of exactly 60°C for 10 minutes. Gently shake the seed bag from time to time.



4. Take out the seed bag from hot water after 10 minutes. Put the seed bag into cold water quickly and stir it for cooling down.



5. Allow the water to drain. Do not place the seed directly on the ground.



6. For transplanting, Tensui 2 recommends soaking & incubation right after this hot water seed treatment.

Hot Water Seed Treatment Process

Important Instruction

Precise control of water temperature and treatment period is important especially for Indica rice.

(3) Seed Soaking

Soak seeds in clean water for 2 – 3 days. In case seeds are soaked in water in a bucket or a container, change water every 12 hours (twice a day) during soaking. Alternatively, seeds can be soaked in a stream when placed in a sack.

Process:

1. Put seeds in adequate amount of fresh water.
2. Change the water every twelve (12) hours.
3. Check the condition of seed daily.
4. After 2 - 3 days, remove seed from water and dry the seed for half day **under a shade**.

If sprouting is excessive, roots and sprouts of grains are damaged causing injury at the time of sowing.

Rice grain needs to have the accumulated water temperature of 100 °C for germination. Therefore,

- ✓ When water temperature 33 °C, Rice seed needs 3 days to germinate



3.3 Planting

There are two methods of planting: transplanting and direct sowing. Transplanting is practiced mostly in humid areas like most part of Ashanti Region. Direct sowing is practiced in Forest Savannah and Guinea Savannah zones.

----- Transplanting -----

3.3.1 Nursery Preparation and Sowing

(1) Nursery Preparation

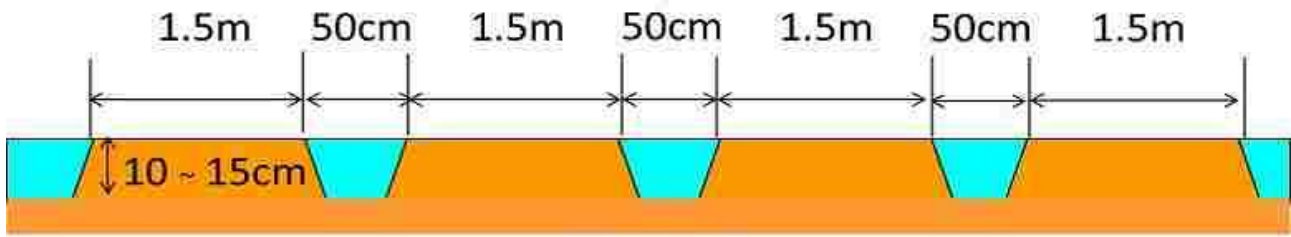
Location

Choose suitable locations to prepare for nursery as follows:

- ✓ An area where a source of water is reliable.
- ✓ A flat area
- ✓ An area where irrigation and drainage of water can be controlled freely.

Seedbed setup

1. Ploughing: 2 weeks before sowing
2. Puddling: a day before sowing
3. Setting up nursery beds: a day before sowing
4. Make surface of beds flat.

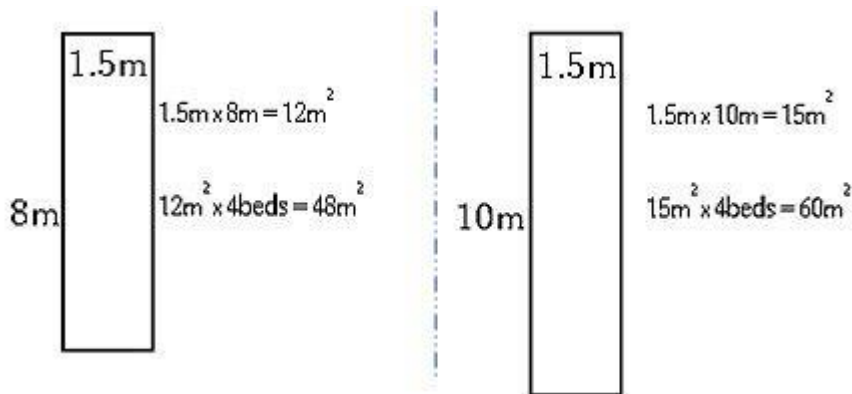


Cross-section of Nursery

Size of nursery

Width: 1.5m, Intervals of the beds: 50 cm

1. 5 kg of seed is sown for 1/4 acre of paddy field.
2. 100 grams of seed covers 1m²
3. Therefore, the area of nursery bed is 50m² for ¼ acre of paddy field.
4. If the nursery bed is 1.5-meter wide, 4 of 8~10-meter long nursery bed are required.
5. Arise mud to 10 ~ 15 cm above original level.



Ploughing and Puddling



Setting up nursery beds



Levelling of seed bed



Completed wet nursery bed



Sowing on nursery bed



Covering by soil

(2) Sowing

Quantity of Seed

Prepare pre-treated seeds. (See 3.2 Seed Preparation part)

5 kg per 1/4acre (20 kg per acre, 50 kg / ha) or more

Sowing Rate: 100g / m²

Sowing:

1. At a rate of 100 grams per m², seed is sown on the nursery bed.
2. Broadcast seeds evenly on the nursery bed.
3. Cover seeds with soil well by hand.
4. Cover nursery beds with palm leaves or other materials to prevent bird damage.

Water Management

At the sowing: Water level must be 2-3 cm lower than the bed surface.

After germination: The bed surface should be covered by 2-3 cm of water.

Nursery Period: 14 - 21 days

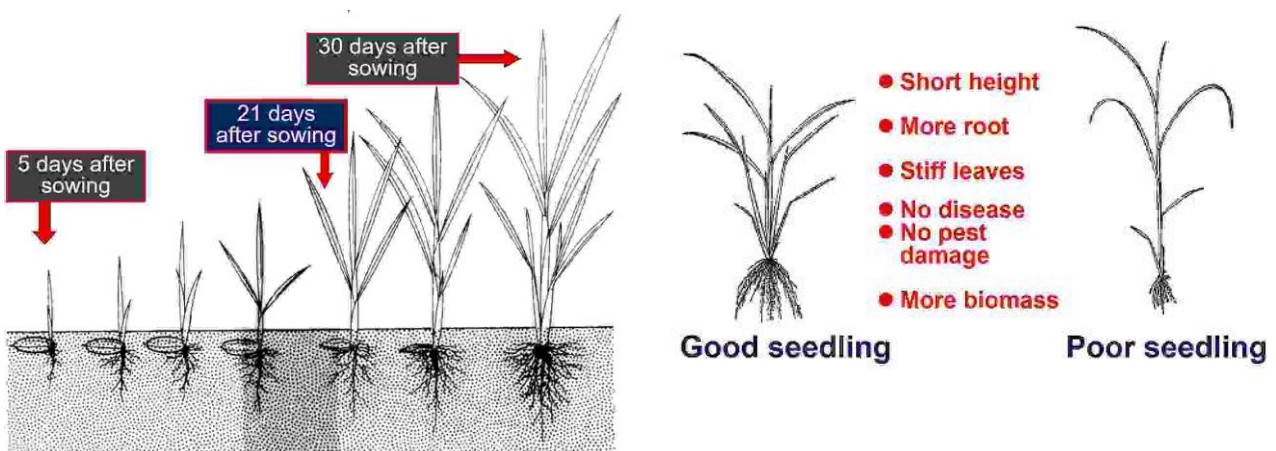
Growth of seedling:

1. 5 days after sowing, Seedlings emerge.
2. Although from 14 days after sowing, seedlings can be transplanted, optimum transplanting time is 21 days after sowing.

A note of caution

If disease, for example “Blast”, is developed, fungicide should be sprayed.

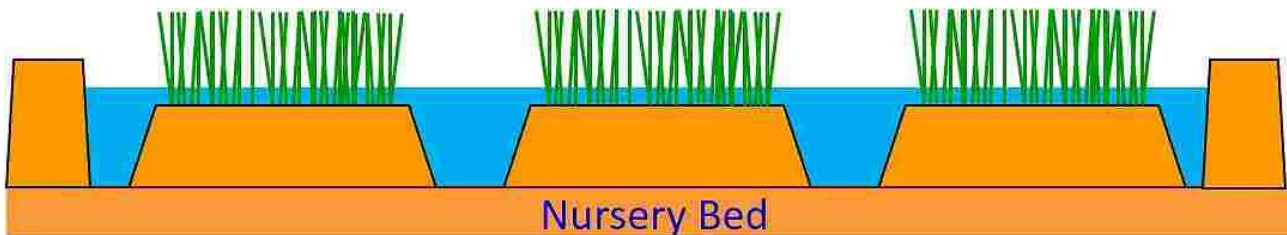
If “Bakanae disease” appears, infected seedlings must be removed.



3.3.2 Transplanting

(1) Uprooting seedling

1. Water the surface of nursery bed to soften soil before uprooting.
2. Remove seedlings from the nursery bed gently and carefully taking care not to damage roots.
3. Do not pull out seedlings from the nursery bed. Remove seedlings with a ball of soil.



Nuresery

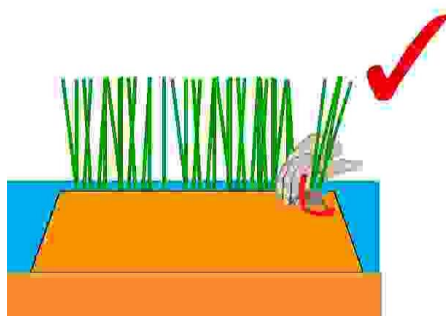


Uprooting

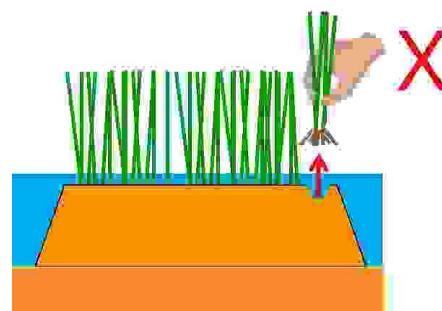


Uprooted

Important: Ensure minimal damage of roots during uprooting



Good



Bad

Caution!

- Do not leave uprooted seedlings more than one day.
- Do not transplant older seedlings such as the one past more than 21 days after sowing.
- Seedlings are bundled in proper size.

(2) How to transplant

- Seedlings are planted in row along the guide rope.
- Row Distance: 30 cm,
- Hill Distance: 10 cm
- # In case of Certified Seed Production, row distance is 30 cm and hill distance is 15 cm.



Number of Seedlings per Hill: 3 - 4 seedlings / hill

Planting depth: Plant the seedlings 2 - 3 cm deep in soil.

Advantages of Row Planting

1. Crop management after transplanting is easier.
 - i. Weeding
 - ii. Pest management
 - iii. Fertilizer application
2. Optimum planting density could be attained and sufficient panicle number assured.

Advantages of Transplanting

- It is easy to arrange the number of hills per area to attain planned number of panicles.
- Good and strong seedlings can be selected.
- Transplanted seedlings grow faster and compete well with weeds.
- Weeding can be easier because push weeder can be utilized.
- Right amount of seed is used to reduce production cost.
- Growing period can be shorter compared to direct sowing.

----- Direct Sowing -----

3.3.3 Direct sowing

Two types of sowing: Drilling or Dibbling.

	Drilling	Dibbling
Row distance	30 cm	20 cm
Hill distance		20 cm
Sowing rate	20-30 kg per acre	15-20 kg per acre
Sowing depth	2-3 cm	2-3 cm
Number of seeds per hill		3-4

(1) How to sow:

1. Make seed furrows along the guide rope and sow seeds in furrows.



Row Distance



Making seed furrows



Making seed furrows

2. Line Drawer

If the line drawer is used, working time is reduced. Put a weight on the drawer as shown below for easier drawing. When the drawer is used, soil surface should be evenly levelled by harrowing.



Line drawer



Weight on line drawer



Drawing

3. After sowing, cover with soil well.



Sowing

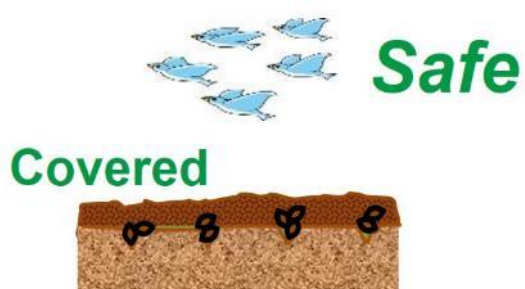


Covered by soil



Sowed

4. If seeds are exposed, seeds suffer feeding damage by birds.



Precaution:

1. Sowing time: At the beginning of rainy season. Avoid delayed sowing. Standing water in the field inhibits germination.
2. In case water is standing in the field, soak seed in water for two days to acquire higher germination ratio. Change water every 12 hours during soaking.



(2) Pre-emergence Herbicide

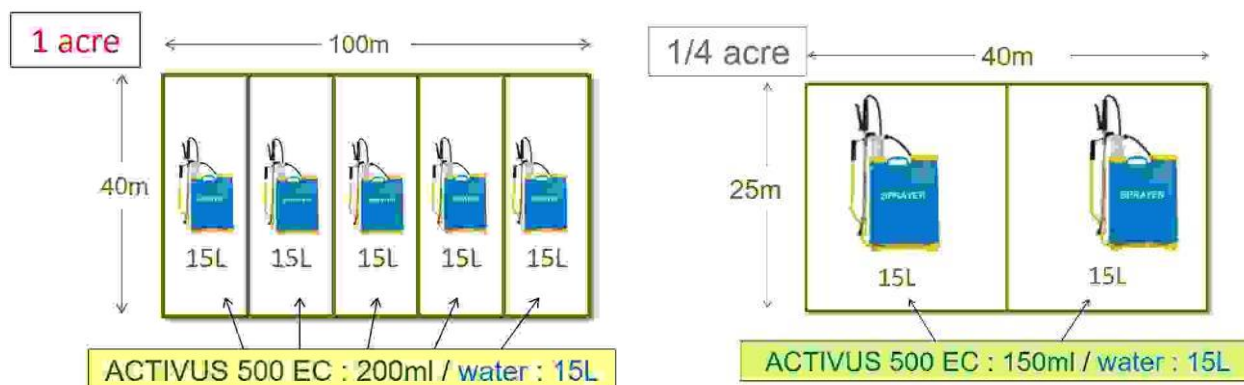
Apply pre-emergent herbicide when necessary. Apply the herbicide on the same day of sowing or within 2 days after sowing.

1. The herbicide containing *Pendimethaline* or *Butachlor* can be applied as pre-emergent herbicide.
2. When using pre-emergent type herbicide, seed must be covered well with soil to prevent damage on germination.
3. If soil is too dry, the herbicide will not be effective and therefore avoid spraying in dry soil.
4. The dilution ratio and spray volume are different from chemical to chemical

[Example of dilution ratio]

Activus 500 EC

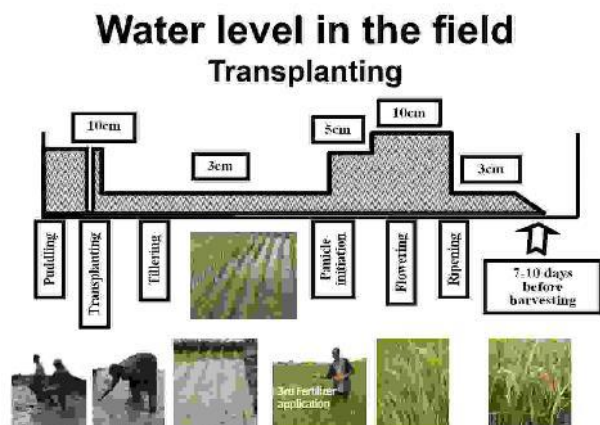
- ✓ Prepare 80 litres of water and 1 litre of the herbicide for 1 acre or 30 litres of water and 300 ml of the herbicide for 1/4 acre. Applicable for both drilling and dibbling.



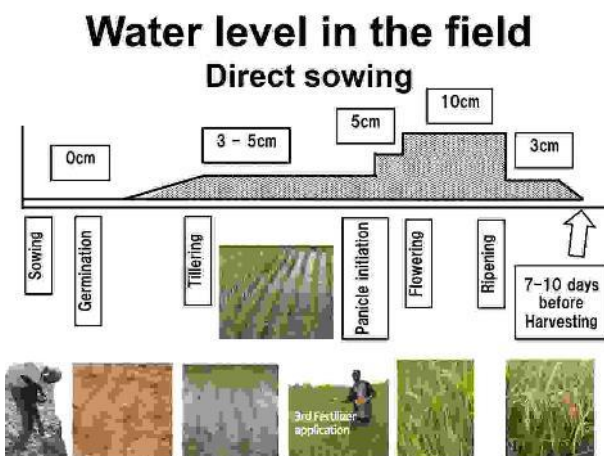
1. First mix 15 litres of water and 200 ml of the herbicide and spray it to 1/5 of 1 acre field.
 2. Then mix another 15 litres of water and 200 ml of the herbicide and spray it to next 1/5 of the field.
 3. Repeat it 3 more times.
1. First mix 15 litres of water and 150 ml of the herbicide and spray it to the first half of a 1/4 acre field.
 2. Then mix another 15 litres water and 150 ml of the herbicide and spray it to the other half of the field.

3.4 On-farm Water Management

Water level: Required water level depends on the growth stage of rice plant as shown below.



1. Maintain 10 cm depth of water at puddling and drain water during planting.
2. Maintain 10 cm depth of water again for a few days after transplanting in order to protect the seedlings from wilting.
3. After that maintain 3 cm depth of water up to panicle initiation stage (at 3rd fertilizer application time).
4. Maintain 5 cm depth of water between panicle initiation stage and heading time.
5. After heading time maintain 10 cm depth of water for 2 weeks.
6. Then maintain 3cm depth of water for 1 week and drain 7 or 10 days before harvesting. half of the field.

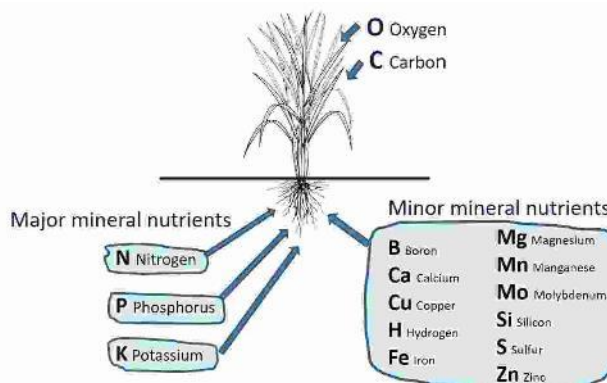


1. In direct sowing cultivation, on-farm water management is more difficult than that in transplanting cultivation.
2. However, it is important to understand an ideal way of on-farm water management and to drain standing water in the field as much as possible for maintaining good growth condition.
3. Increase water level gradually after germination.
4. Keep 3 – 5 cm depth up to panicle initiation stage (at 3rd fertilizer application time).
5. Keep 5 cm depth between panicle initiation stage and heading time.
6. After heading time keep 10 cm depth for 2weeks.
7. Then keep 3cm for 1 week and drain 1 week or 10 days before harvesting.

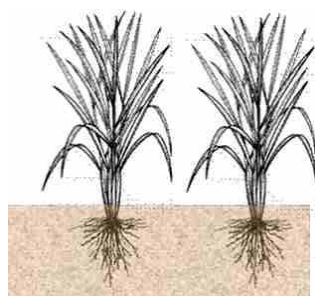
3.5 Fertilizer Management

(1) Fertilizer

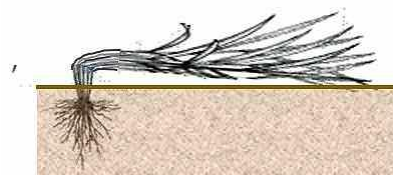
1. Fertilizers are food for plants, they contain important mineral nutrients.
2. The major nutrients in fertilizers are Nitrogen (N), Phosphorus (P) and Potassium (K).
3. Apply fertilizers when the soil fertility is insufficient to ensure good growth.
4. Fertilizers are two types: 1) organic, such as farm yard manure, and 2) inorganic, such as urea.



	Function	Deficiency symptoms	Excess symptoms
N	Enable plant tiller	Stunted plants	Lodging
P	Promote strong roots	Stunted growth	Non
K	Grow grain	Stunted plants, few tillers	Non



Optimum nitrogen: Optimum growth



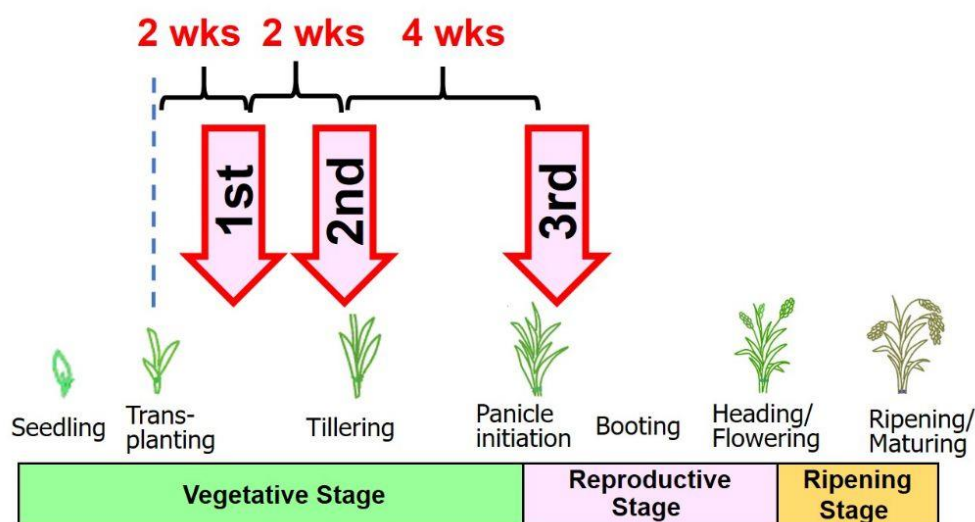
Excessive nitrogen: Lodging

(2) Application time

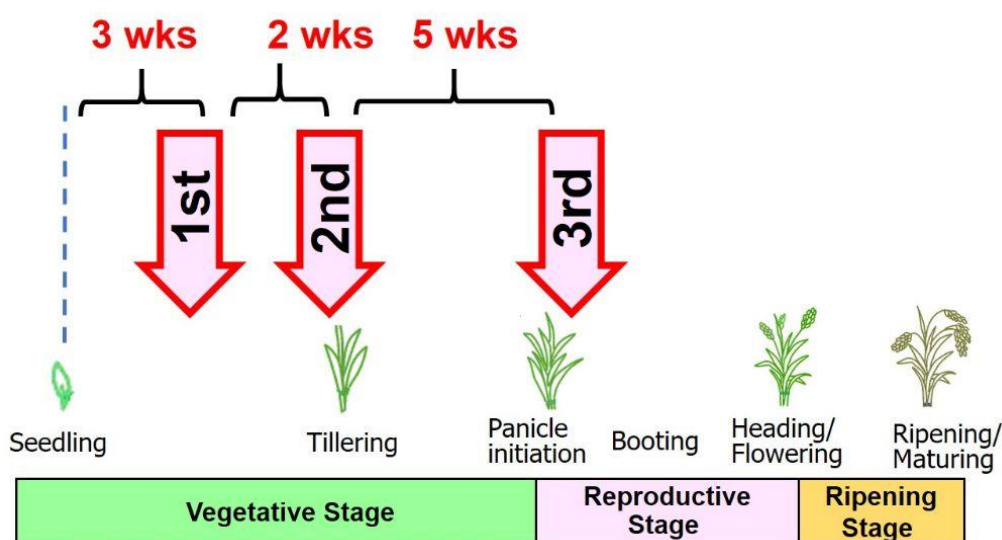
Apply fertilizer at correct growth stage:

1. Fertilizer is applied 3 times at particular times according to growth stage.
2. These 3 periods are important in determining yield respectively.
3. Times of application and applied amount should be considered.

	1st	2nd	3rd
Stage	Tillering stage	Tillerling stage	Panicle formation state
Effect	Increase panicle number.	Increase grain number per panicle	Increase grain number per panicle



Fertilizer Application for Transplanting



Fertilizer Application for Direct Sowing

(3) Application rate

1) Principle: N-P-K: 60 - 30 - 30

Recommended amount of nutrition is 60 kg of Nitrogen (N), 30 kg of Phosphorous (P), and 30 kg (Potassium) for 1 ha (10,000m²) split in three times.

	1st	2nd	3rd	Total
N (kg/ha)	30 kg	15 kg	15 kg	60 kg
P (kg/ha)	30 kg			30 kg
K (kg/ha)	30 kg			30 kg

2) Application rate of fertilizer

- 1st application is N-P-K (15-15-15). 2nd and 3rd applications are either Urea (46% of nitrogen) or Sulphate of Ammonia (SOA: 21 % of nitrogen).
- Application rate for 1 **acre** is shown in the table below.

1st	2nd	3rd
80 kg of N-P-K (15-15-15)	13 kg of Urea	13 kg of Urea
	or	or
	29 kg of SOA	29 kg of SOA

- Application rate is calculated depending on the area as shown below.

Application	1st	2 nd and 3 rd	
	N-P-K	Urea	SOA
1/8 acre (500 m ²)	10 kg	1.7 kg	3.6 kg
1/4 acre (1,000 m ²)	20 kg	3.3 kg	7.1 kg
1/2 acre (2,000 m ²)	40 kg	6.6 kg	14 kg
1 acre (4,000 m ²)	80 kg	13 kg	29 kg
1 ha (10,000 m ²)	200 kg	33 kg	71 kg

3.6 Weed Control

(1) Why necessary?

- The rate of yield reduction from harmful weeds is tremendous.
- The yield declines significantly without weed control.

(2) Timing

Weeding must be done at least twice. It is desirable to carry out 1st and 2nd weeding at the same time as fertilizer application. Weeding must be done as necessary besides above.



<u>Transplanting</u>	<u>Direct sowing</u>
<ul style="list-style-type: none"> ● 1st: 2 weeks after trans planting ● 2nd: 2 weeks after 1st weeding 	<ul style="list-style-type: none"> ● 1st: 3 weeks after sowing ● 2nd: 2 weeks after 1st weeding

Weeding by Push Weeder

Adjust the depth of standing water to a few centimetres and push the weeder ahead moving it back and forth.



Push Weeder



Weeding



Weeding

Under the condition without standing water, carry out weeding using the weeding hoe. If the soil is too wet to weed, consider the application of the selective herbicide.

(3) Herbicide application

In case using the herbicide, the concentration of the herbicide must be proper and adequate volume of spray must be ensured. When herbicide is used

- The timing of application (size of weeds) is very crucial.
- Concentration of the herbicide must be proper.
- Adequate volume of spray must be ensured.

3.7 Disease and Pest Control

(1) Rice Blast (*Magnaporthe grisea*)

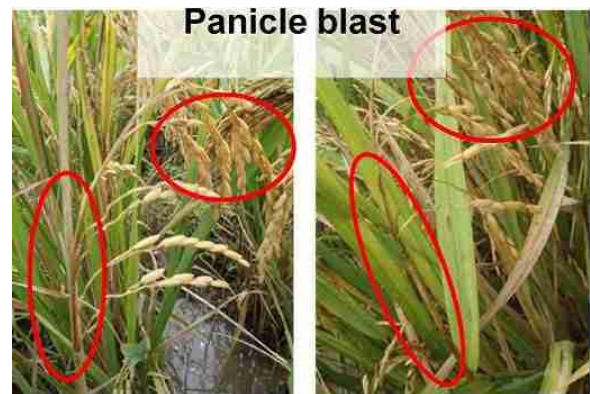
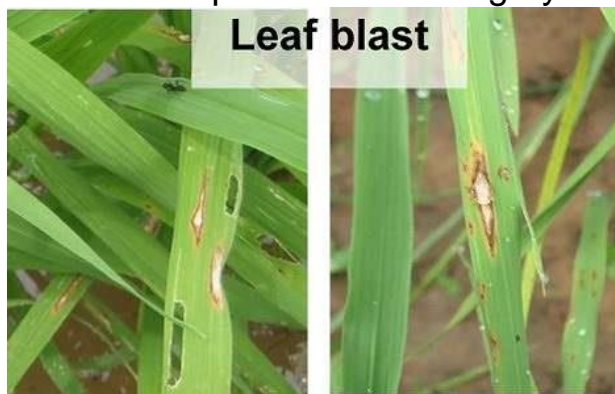
A fungal disease caused by *Pyricularia oryzae*.

Conditions suitable for the development of “Blast”

- Low-temperature (below 18 °C)
- High-temperature (25 – 28 °C)
- High-humidity
- Less sunlight (Cloudy, Rainy)
- Excessive fertilizer application

1) Symptoms

Diamond shaped lesions with grey center and brown or reddish borders.



2) Control

Non-chemical Control for “Blast”



1. Select disease tolerant Variety
 - ✓ Jasmine 85 is not tolerant to Blast.
 - ✓ AGRA is Blast tolerant
2. Avoid the use of diseased seed
3. Proper seed selection
4. Hot water treatment (see Section 3.2 (2))
5. Avoid excessive fertilizer application

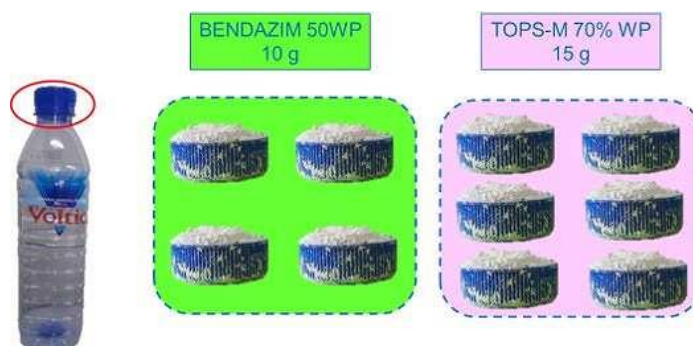
Chemical Control (Fungicide) by Seed Treatment for “Blast”

At a time of seed soaking

Refer to Hot Water Seed Treatment as alternative seed treatment method.

[Example]

<p>TOPS-M 70% WP Active ingredients: <i>Thiophanete methyl</i> (THIOPSIN 70% WP) 300-fold, 24 hours</p>	<p>BENDAZIM 50WP Active ingredients ; <i>Carbendazim</i> 400-fold, 24 hours</p>
	
<ol style="list-style-type: none"> 1. Measure 33 grams of TOPS-M (or THIOPSIN) and 10 litres of water. 2. Mix them in a bucket and soak seeds for 24 hours. 3. Do NOT wash seed after seed treatment. Soak seed in water directly. 	<ol style="list-style-type: none"> 1. Measure 2.7 grams of BENDAZIM and 4 litres of water. 2. Mix them in a bucket and soak seeds for 24 hours. 3. Do NOT wash seed after seed treatment. Soak seed in water directly.

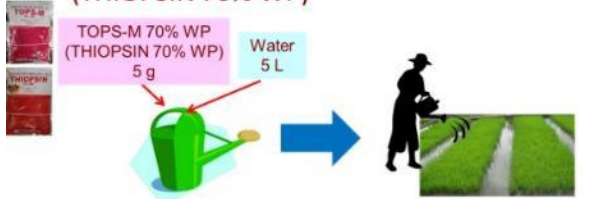
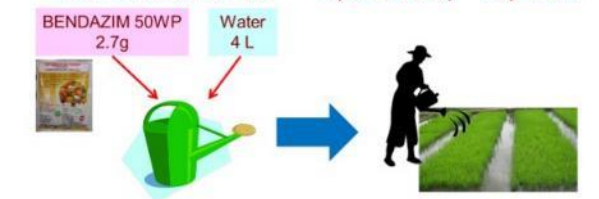


Chemical Control (Fungicide) for Nursery for “Blast”

If symptoms appear

[Example]

<p>TOPS-M 70% WP fold, 5L / 50m2 (THIOPSIN 70% WP)</p>	<p>1,000- BENDAZIM 50 WP fold, 4L / 50m2 1,500-</p>
--	---

<p>• TOPS-M 70% WP 1,000-fold, 5L / 50m² (THIOPSIN 70% WP)</p> 	<p>• BENDAZIM 50 WP 1,500-fold, 4L / 50m²</p> 
<ol style="list-style-type: none"> 1. 5 litres of 1000-fold dilute solution of TOPS-M (or THIOPSIN) is applied for 50 m² of the nursery. 2. Measure 5 grams of TOPS-M (or THIOPSIN) and 5 litres of water. 3. Mix them in a watering can and apply it to the nursery. 	<ol style="list-style-type: none"> 1. 4 litres of 1500-fold dilute solution of BENDAZIM is applied for 50 m² of the nursery. 2. Measure 2.7 grams of BENDAZIM and 4 litres of water. 3. Mix them in a watering can and apply it to the nursery.

Chemical Control (Fungicide) by foliage application for “Blast”

1. After heading time, if neck of panicle, rachis of branch and grains are infected, those colour change to brown and the fullness of grains becomes worse or grains go die.
2. If these symptoms appear, the fungicide that is effective against Blast should be sprayed immediately to prevent epidemic in whole field.
3. It is important to apply fungicide before it is too late.
4. When the fungicide is used for Blast control, the chemical that is effective against Blast must be selected.
5. If fungicide is applied after the spread of Blast, damaged plants do not recover again.

(Reference)

Effective Active Ingredients for Seed Treatment for “Blast”	Effective Active Ingredients for Nursery for “Blast”	Effective Active Ingredients for Foliage Application for BLAST	
<ul style="list-style-type: none"> · Benomyl · Carbendazim · Fludioxonil · Ipconazole · Pefurazoate · Prochlorazole · Thiophanete methyl · Thirum · Triflumizole 	<ul style="list-style-type: none"> · Azoxystrobin · Carbendazim · Diclocymet · Orysastrobin · Probenazole · Pyroquilone · Tiadinil · Thiophanete methyl · Tricyclazole 	<ul style="list-style-type: none"> · Azoxystrobin · Carbendazim · Diclocymet · Edifenphos · Fenoxanil · Ferimzone · Fthalide · Iprobenfos · Isoprothiolane 	<ul style="list-style-type: none"> · Kasugamycin · Metomiostrobin · Orysastrobin · Probenazole · Pyroquilone · Thiophanete methyl · Tiadinil · Tricyclazole

[Example]

- TOPS-M 70% WP 1,000-fold, 100L / ¼ acre (THIOPSIN 70% WP)
Active ingredients: *Thiophanete methyl*



x 7 rounds
for ¼ acre



TOPS-M 70% WP : 15 g / water 15L
(THIOPSIN 70% WP)

1. 100 litres of 1000-fold dilute solution of TOPS-M (or THIOPSIN) is applied for ¼ acre.
2. 105 grams of TOPS-M (or THIOPSIN) with 105 litres of water are required for ¼ acre.
3. First, mix 15 litres of water and 10 grams of TOPS-M or (THIOPSIN) and spray it to 1/7 of ¼ acre field.
4. Then, mix same dilute solution and spray it to the next 1/7 of the field.
5. Repeat it 5 more times.

- BENDAZIM 50WP 1,500-fold, 75L / ¼ acre
Active ingredients ; *Carbendazim*



x 5 rounds
for ¼ acre



BENDAZIM 50WP : 10 g / water 15L

1. 75 litres of 1500-fold dilute solution of BENDAZIM is applied for ¼ acre.
2. 50 grams of BENDAZIM and 75 litres of water and 105 litres of water are required for ¼ acre.
3. First, mix 15 litres of water and 10 grams of BENDAZIM and spray it to 1/5 of ¼ acre field.
4. Then, mix same dilute solution and spray it to the next 1/5 of the field.

A note of caution

Spray volume of these two (2) chemicals are different from one another.

Method of measuring chemicals

1. The bottle for drinking water can be used as in place of the scale to measure dust formulation chemicals.
2. 10 grams of BENDAZIM equivalents to four (4) scoops of the screw-top lid of the bottle of “Voltic”.
3. 15 grams of TOPS-M equivalents to six (6) scoops of it.

(2) False smut

1) Symptom



False Smut

2) Control

1. False smut can be controlled by fungicide application before heading time.
2. Excess fertilizer application encourages a development of this disease.
3. If fungicide for Blast is applied, this disease is also controlled at the same time.

(3) Bakanae Disease



Bakanae disease can be reduced by seed selection and seed disinfection.

(4) Brown spot

1. This disease tends to occur by the lack of N, K, Si, Fe, Mn etc. in the soil.
2. In many cases, there is no need to control by chemicals.
3. Improvement of soil fertility is necessary rather than chemical control.

(5) Virus disease (insect transmitted)

1) Symptom

1. The yellowing of leaves starts from the tip of lower leaves.
2. Plants become stunted and the number of tillers is reduced.



Virus



Virus

2) Control

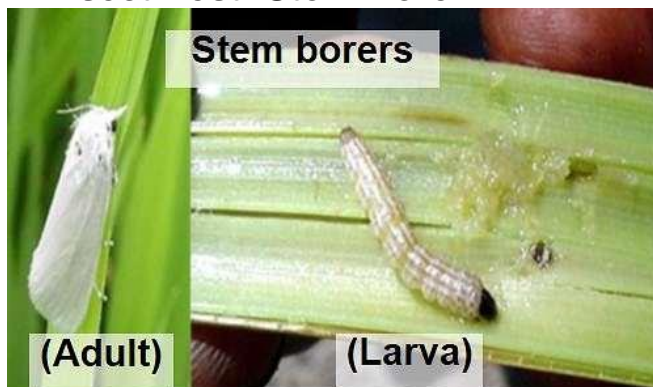
This type of diseases is transmitted by hoppers or beetles. If symptoms appear, apply insecticide.

Even if the chemicals are applied, damaged plants do not recover well. But, further spreading of diseases can be prevented by chemical control.

[Example]

1. Twenty (20) litres of 250-fold dilute solution of the insecticide is applied for 1 / 4 acre.
2. 20 litres of water and 80 ml of insecticide are required.
3. First, mix 10 litres of water and 40 ml of insecticide and spray it to half of ¼ acre field.
4. Then, mix another 10 litres water and 40 ml of insecticide and spray it to the other half of the field.

(6) Insect Pest: Stem Borer



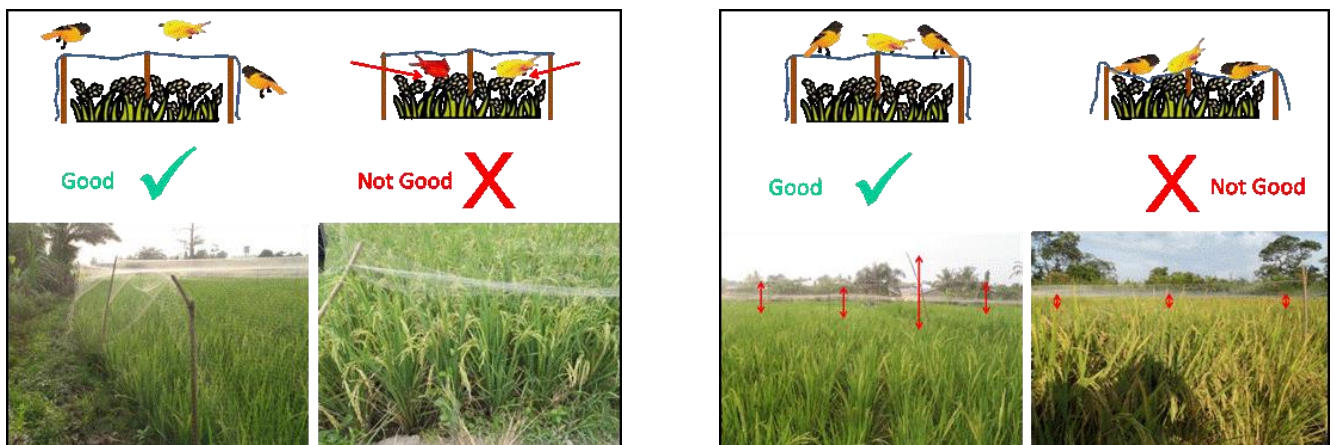
Before insecticides are applied against Stem Borer, the cost of chemical control and the loss caused by Stem Borer should be compared to judge rationale of spraying.

4 Harvesting of Rice

4.1 Before Harvesting

(1) Bird Scaring

1. Bird scaring by use of fishing net is effective in addition to human work
Bird netting should start a week after of heading (at milky stage).
2. Not only top face, but also side of the field should be covered fully by the net to prevent the entry of birds.
3. Net should not be too close to rice grain.



(2) Off-type Removal

(Rogueing)

1. Off-types and damaged plants are uprooted from the field once a week from 5th week after transplanting/sowing to harvesting time (At least 4 times).
2. If abnormal plants or damaged plants appear, those should be removed from the field even when it is before heading time.
3. Rogueing should be done by uprooting, not by cutting stand or panicles.

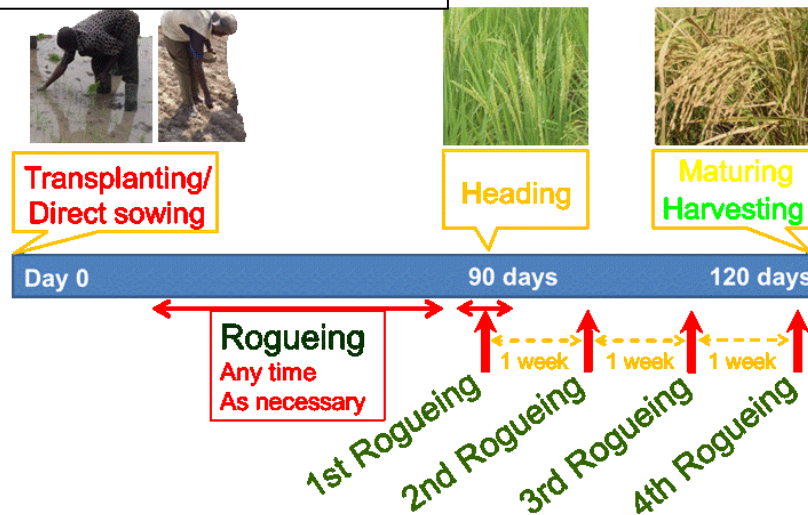
The ways to identify off-types are:

- 1) Plant height (taller or shorter)
- 2) Heading time (earlier or later)
- 3) Maturation (earlier or later)
- 4) Color of husk, leaf and stem
- 5) Presence or appearance of Awn
- 6) Other characteristics (shape of flag leaf, panicle, paddy etc.)



Off-Type

Example of Off-type Removal



4.2 Harvesting

The goal of good harvesting is to maximize grain yield, and to minimize grain losses and quality deterioration.

Harvesting of paddy includes cutting, stacking, handling, threshing, drying, winnowing, cleaning and hauling of paddy.

(1) Good quality local rice

Quality rice should have characteristics below:

- No stone, husk, chaff, soil, chalky other impurities
- Higher percent of whole grain
- Same variety
- Preferred aroma
- Acceptable taste
- Good texture and required moisture content
- Uniform colour

(2) Parameters considered

Quality factors should cover aspects such as;

- Safety and suitability for human consumption
- Flavors and odors
- Moisture content
- Wholesomeness of kernels
- Foreign (unwanted) matter
- Contaminants (heavy metals and agro-chemicals residues)
- Inappropriate tool and poor harvesting methods
- Moisture reabsorption during harvesting



In order to prevent grains from contaminating by soil and stones, stems must be cut at some distance from the ground.



Reaped rice should not be put on the bare soil.

(3) Harvesting

Too early

- Harvesting rice earlier will result in a larger percentage of unfilled or immature grains, which results in lower yield and grain quality.
- If the grain has a moisture content of more than 25%, it is more difficult to remove the grains from the panicle and some damage may occur during machine threshing.

Too late

- Shattering of grain
- Logging during rain storm
- Losses through birds, insects and rodents.
- Grains that dry during the day might absorb moisture during night or during rainfall resulting in cracks, which reduces the milling yield. In addition, grains become more brittle and therefore break easier in the thresher.



Keep fields free from weeds to avoid weeds getting mixed in with grains.

4.3 Threshing, Winnowing and Drying

(1) Threshing

Tarpaulin or mats, a wooden box (bambam box)



Workers take their boots or shoes off, when they work on the tarpaulin.

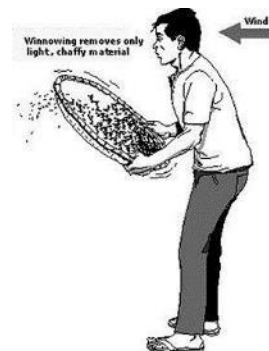
Wrong methods of rice processing

Re-absorption of moisture due to harvested paddy getting in contact with the bare soil

- Threshing using a rusty drum
- Threshing and drying on a bare floor
- Using field boot to stir paddy on drying floor
- Uneven exposure of paddy to sunshine at drying
- Old milling machine and unskilled operators

(2) Winnowing

- Lighter materials such as unfilled grains, chaff, weed seeds, and straw can be removed from the grain by using a blower, air fan or by wind.
- Winnowing recovers only the heavier grains but other heavy particles like heavier weed seeds, off types, stones and dirt might still be included in the rice.



(3) Cleaning

- Removes unwanted materials from the grain.
- Clean grain has a higher value than the ones which is contaminated with

straws, chaff, weed seeds, soil, rubbish and other non-grain materials.

- Grain cleaning will improve the drying and the storability, reduce breakage at time of milling and improve milling output and quality



(4) Drying

- Drying is the process that reduces grain moisture content to a safe level for storage (14% & below).
- Seed (13% and below)
- Drying is the most critical operation after harvesting a rice crop.
- Delays in drying, incomplete drying or ineffective drying will reduce grain quality and result in losses.

Half day with mixing paddy every 30 min under sunlight



Whole day with mixing paddy sometimes under cloud



4.4 Quality Seed Production

(1) Pure seed or mixed seed

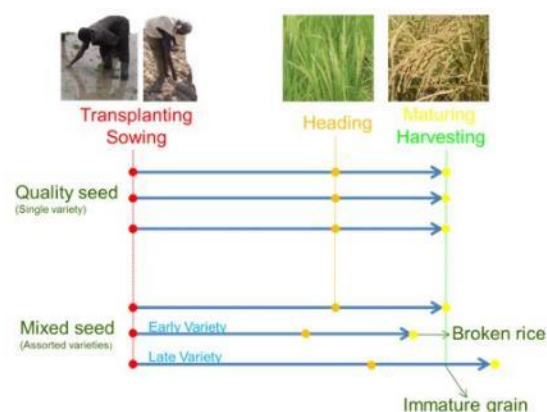
- If mixed seed is used, heading and maturing time is not uniform.
- Therefore, overdry grains and immature grains are mixed in harvested grains.
- Overdry grains cause broken rice and immature grains become thin grains.
- If quality seed is used, heading and maturing could be uniform.
- Then, the rice quality is improved and milling loss is decreased



Many broken grains are mixed

Discoloured grains and coloured grains are mixed

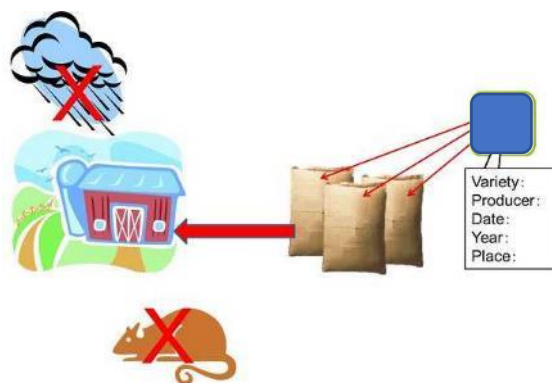
Good quality



(2) Winnowing, Drying and Storing

- Winnow and dry well before storing.
- Variety name, harvested date and year, produced plot, producer's name are attached to or written on the sack.
- Store seeds in house to prevent damages.

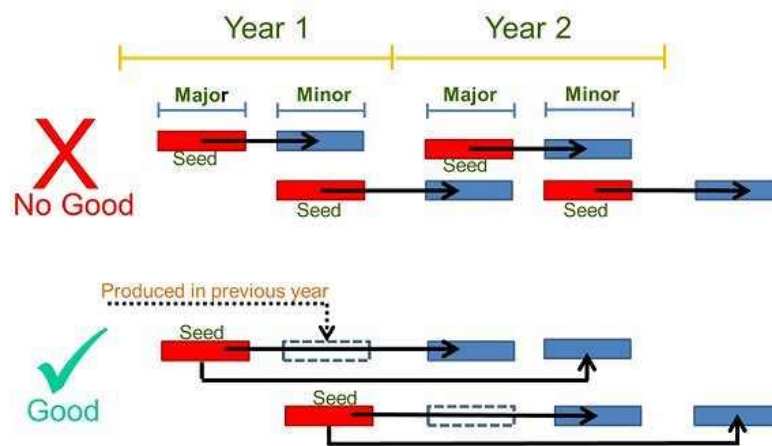
In case of certified seed production, the certification **blue** card is put in each sack and variety name, harvested date and year, produced plot, producer's name are written on each sack.



Storing

(3) Dormancy

- In general, plant seeds often do not germinate immediately after they have been detached from their mother plant.
- The phenomenon is called Dormancy.
- The period of dormancy is different from variety to variety.
- As germination ratio of “Jasmine 85” harvested within one (1) month is lower because of the dormancy, such seeds cannot be used for the second crop.
- The seed of “Jasmine 85” can be used from three (3) months after harvesting.



5 Rice Marketing

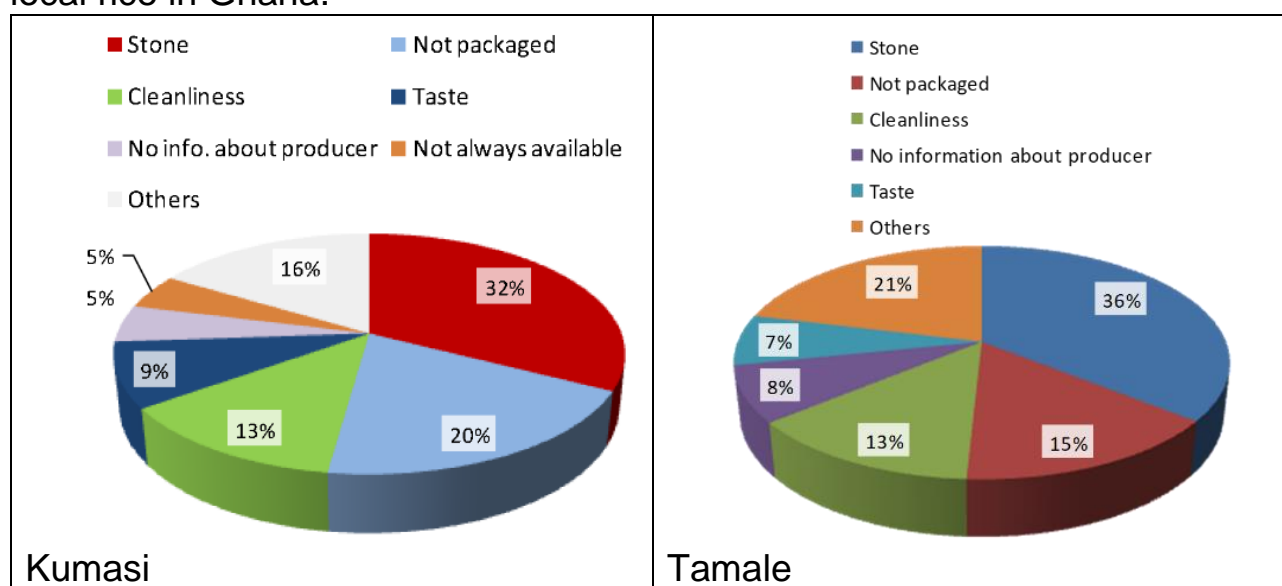
5.1 Marketing Support

(1) What is Marketing?

The aim of Marketing is to know and understand the “Customer’s Needs and Wants” so well that the product sells itself.

NEEDS

Figures below show the survey result that consumers recognize the presence of stones, selling without packaging, and cleanliness as the major problems of local rice in Ghana.



Source: SUEMITSU Kenji, JICA Expert on Marketing Accomplishment Report, The Project for Sustainable Development of Rain-Fed Lowland Rice Production in the Republic of Ghana, 10. Mar. 2011

Discuss with farmers why metropolitan consumers do not purchase local rice?

1) Presence of stones

It is tedious for busy metropolitan consumers to remove stones by themselves and they prefer to purchase imported rice without stones.

2) Selling without packaging

Packaged rice in small size is preferred by metropolitan consumers because it is less likely to be affected by rats, insects, moisture, etc. and can be easily kept at home.

3) Cleanliness

It is tedious for busy metropolitan consumers to remove contaminants such as husks and dust.

WANTS

Discuss with farmers which types of rice metropolitan consumers want to buy?



1) Good taste:

The freshly harvested rice is delicious.

2) Good smell (Aroma):

The rice which is just milled has aroma, especially aromatic varieties

3) Stone free:

These can be achieved by not putting rice directly on the rice field after harvesting, using tarpaulin when drying paddy and using rice mills equipped with de-stoners.

4) Cleanliness: same as 3)

5) Whiteness: same as 3)

6) Package appearance:

The number of domestic companies that sell local rice by making original packages is gradually increasing. They are constantly looking for good quality paddy as the demand for local rice is becoming higher

(2) Relationship between Marketing and Production

High quality rice can be achieved by whole activities from field to shop.

If farmers apply the improved rice cultivation technologies shown in this Handbook Chapter 2 and Chapter 3, farmers can harvest good quality paddy which is demanded by the market.

When farmers sell good quality of paddy to aggregators or miller-sellers, they will like to buy it. It's because their customers such as wholesalers and retailers will definitely purchase good quality paddy and price negotiation will be easier. Final consumers will be able to eat delicious and healthy local rice which is comparable to imported rice.

All the actors of local rice value chain such as farmers, aggregators, millers,

wholesalers, retailers and customers will make better profit, if farmers produce good quality of paddy.

On the other hand, if farmers produce poor quality paddy, the entire local rice business may become stagnant.

When farmers sell low quality paddy to aggregators or millers, they will refuse to buy it or purchase only at low price. It's because their customers such as wholesalers and retailers will not purchase it at good price and price negotiation will be very difficult, too.

Wholesalers, retailers and final consumers in urban areas will purchase imported rice instead of low-quality local rice. All the actors in the local rice value chain will have high risk of keeping paddy which cannot be sold anywhere for long.

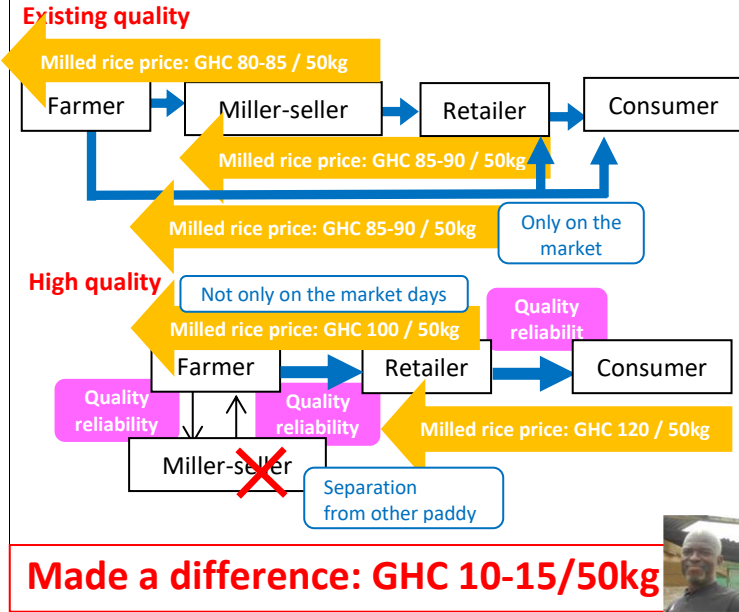


Quality of your paddy affect an entire value chain



(3) Learn from Good Practices of Rice Marketing

1: Direct Sales to Retailer



1: Direct Sales to Retailer

Before Tensui Intervention:

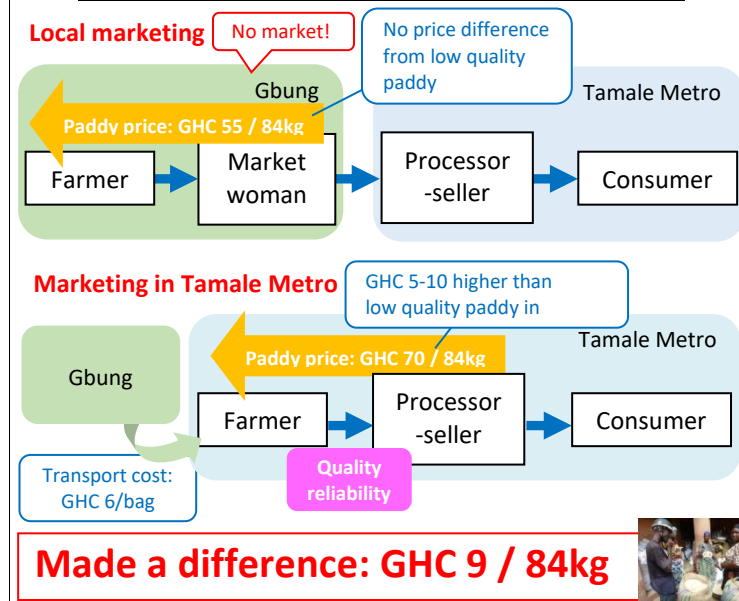
- Farmer (Frenchman) sold paddy to miller-seller
- Miller-seller then sold milled rice to retailer
- Retailer sold rice to consumers
- Except on market days, he sold milled rice to either retailers or consumers.

After Tensui Intervention:

- Frenchman now sells milled rice directly to retailer and consumer
- Retailer in turn sells rice to consumers

Note: Farmers no longer sell their milled rice to miller-seller because of good quality grains they produce.

2: Direct Sales to Milling Company



2: Direct Sales to Milling Company

Before Tensui Intervention

- At local market in Gbung, farmers sold paddy to Market women irrespective of the quality.
- Market women in turn sold Paddy to Processor-seller then to Consumers.

After Tensui Intervention

- Farmers improved on Paddy quality and sells paddy directly to Processor-seller.
- Produce sold is between GHc 5-10 higher than selling it to market women in Gbung.

3: Direct Sales to Consumer

Existing channel



Direct marketing



Made a difference: GHC 10 / 50kg



3: Direct Sales to Consumer

Before Tensui Intervention

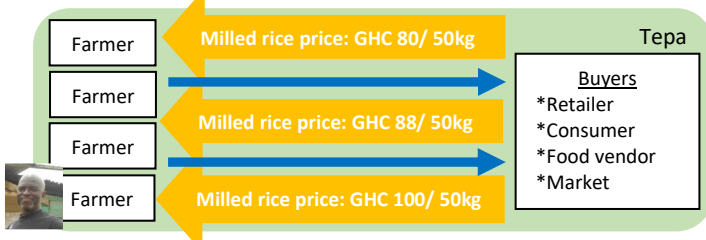
- Existing channel that farmers used to sell paddy, was through Miller-seller to Consumers.
- There was no price difference for low- and high-quality rice.

After Tensui Intervention

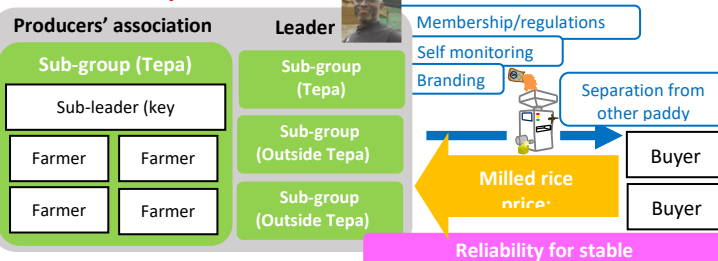
- Farmer improved on grain quality and carry out promotional activities
- Farmer now sells directly to Consumers at GHc 10 higher than before.

4: Collective Sales

Existing situation



What Emo Papa Kuo aims at



4: Collective Sales

Before Tensui Intervention

- Individuals farmers sold milled rice to different Buyers at different prices.

After Tensui Intervention

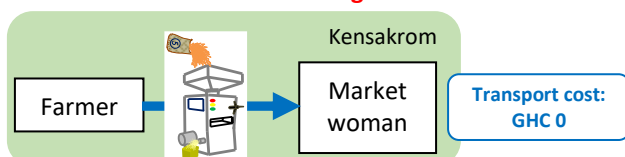
- The rice farmers formed an association
- Farmer leaders of the association monitor other farmers to practice the new techniques and produce high quality rice.
- Members package and brand milled rice and sell to Consumers at higher prices of the same rate.

5: Establish own Milling Station

Before establishment of the milling station



After establishment of the milling



- Cost for land: GHC 3,000
- Cost for milling machine: GHC 3,500
- Milling charge: GHC 15/ 120 kg bag
- De-stoner (future plan): GHC 5,000



5: Establish own Milling Station

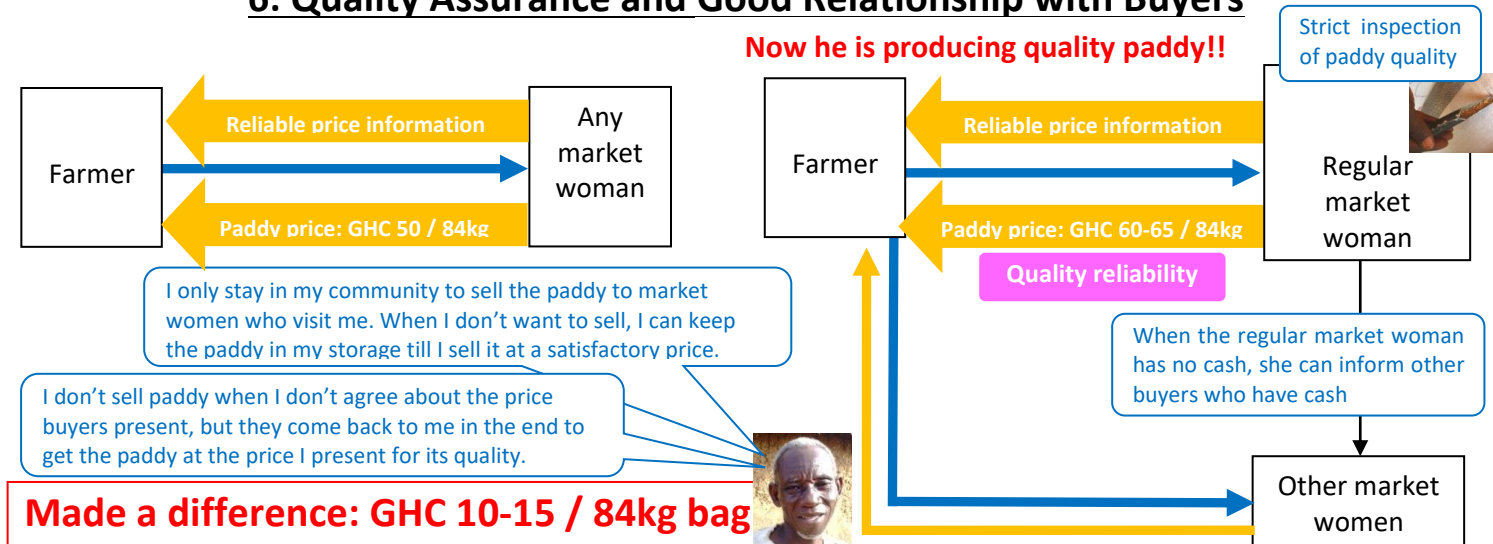
Before Tensui Intervention

- Kensakrom farmers transported Paddy to Bibiyani at a distance of 15 km to mill.

After Tensui Intervention

- A farmer adapted the Project techniques, expanded his field and produced quality rice which got him high income.
- The farmer used the money to install a milling center in the community
- Rice farmers in Kensakrom now no longer incur transportation cost of transporting paddy to milling center, thereby saving money and increasing profit.

6: Quality Assurance and Good Relationship with Buyers



7: Certified Seed Production

How much profit can you expect from seed production? (acre)

	QTY/NO	GHC	
		Grain	Seeds
Purchase price of foundation seeds	30 kg (GHC 8/kg)	-	240
Registration fee	Producer unit (max. 5 acres)	-	50
Field inspection	4 times (GHC 20/time)	-	80
Lab analysis (purity, germination rate, moisture, seed health)	4 checkpoints (GHC 5/checkpoint)	-	20
Other production costs		205 ¹⁾	308 ²⁾
TOTAL COSTS		205	698
Selling price	1,077 kg (production of grain)	754	-
	800 kg (production of certified seeds)	-	1,600
PROFIT		549	902
Return rate (%)		268	293

1) Sourced from Impact survey 2013 (Table 7 (2) / 1st group - material, tractor hiring, and paid labor costs).

2) 1.5 times higher than other production costs for grain (assumed)

7: Certified Seed Production

After Tensui Intervention

- Encourage a farmer who adapted the Project techniques to become a certified seed producer.
- Additional cost is necessary for being a certified seed producer such as registration fee, field inspection fee and laboratory analysis. However, the price of seed is much higher than the price sold as grain. Therefore, certified seed producer can make more profit.

5.2 Rice Value Chain Development

(1) What is "Rice Value Chain"?

Let's learn local rice supply chains. There are two patterns observed in Ashanti Region.

Pattern A: Farmers sell paddy to rice miller in their community or district

Along with the price rise of imported rice, wholesalers looking for good quality paddy and milled rice, they visit rice miller in local area even from other districts

or regions.

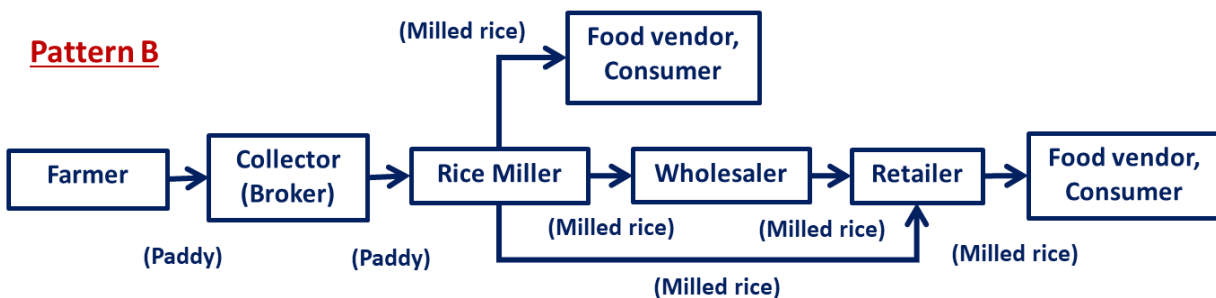
Mostly, the price negotiation is done by rice miller on behalf of farmers. For this reason, farmers need to acquire market information continuously.



Pattern B: Farmers sell paddy to collector (broker) who visit them directly

Collectors (brokers) ride a large trailer in front of the farmer’s house and pick up paddy. In this case, the cost of labor and hiring tricycle for carrying paddy to rice miller are unnecessary.

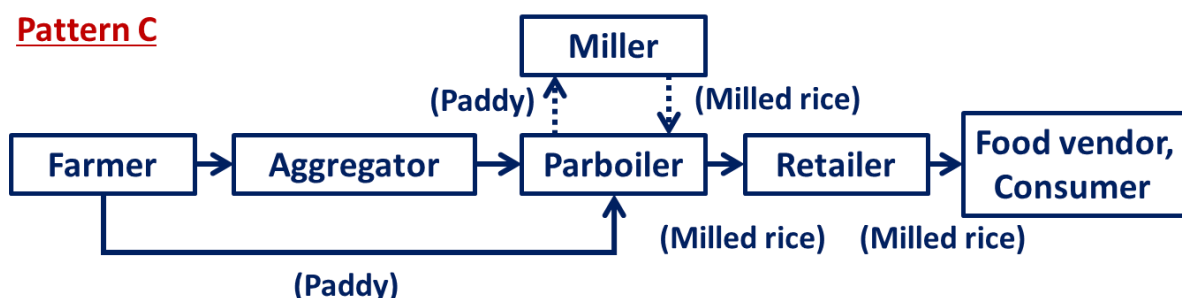
However, most of farmers are not given chances to negotiate and only have to accept price given by the collector (broker). For this reason, farmers are required to establish multiple sales routes.



In Northern region, there are also two patterns of local rice supply chain.

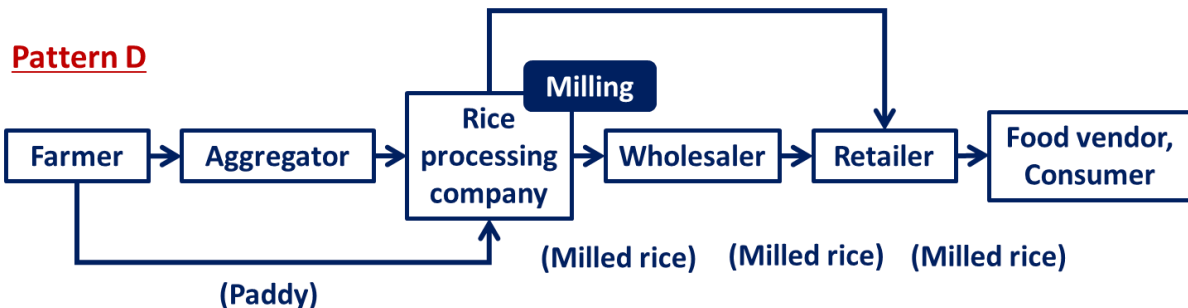
Pattern C: Farmers sell paddy to aggregators who visit them or parboilers

Farmers are not given chances to negotiate and only have to accept price given by the buyers.



Pattern D: Farmers sell paddy to rice processors

Farmers sell paddy to rice processors such as Avnash which sell local rice with an original brand. They have their own quality standards to differentiate paddy price.



(2) Collect information on the actors of local value chain

The situation of VC is different for each district or community. In order to raise the target farmer's profit, Agric officer will need to better grasp all the actors of local rice value chain and strengthen the weak part where the value chain is not functioning. To do that, it is recommended to collect information on the actors of local rice value chain.

Interview to Farmers

Questionnaire on Value Chain of Domestic Rice (1)

Region: Ashanti / Northern Date: / / 2018

District: Community:

Name of interviewer: Sex: Male / Female

Name of interviewee: Position: AEA / DAO /

1. Trade of Local Rice (Please fill in the rough estimate of the last year)

1) Amount of production	bags	2) Area of rice field	Acres
3) Size of bag	kg	4) Production volume	kg
5) Quantity of seeds	bags	6) Quantity for home consumption	bags

2. Total Expenses for Rice Production (Please fill in the rough estimate of the last year)

1) Paddy	Quantity of sales	Price	Sales
ii. Milled rice	GHC/bags	GHC	GHC
iii. Milling rice	GHC/bags	GHC	GHC
iv. Parboiled paddy	GHC/bags	GHC	GHC
v. Parboiled rice	GHC/bags	GHC	GHC

3. Distribution of Local Rice (Please select in ascending order of quantity from the Box 1 below)

Paddy	1)	2)	3)	4)	5)
Milled rice	1)	2)	3)	4)	5)
Parboiled rice	1)	2)	3)	4)	5)

4. Availability of the Market Information (Please select 3 choices from the Box 2 below)

Market information: such as price, quality, quantity and packaging of rice that required for commercial market.

1) 2) 3)

5. Three Major Issues of Local Rice Production (Please specify)

1) 2) 3)

Interview to 1) Rice miller, 2) Broker, 3) Wholesaler, 4) Retailer

Questionnaire on Value Chain of Domestic Rice (2)

Region: Ashanti / Northern Date: / / 2018

District: Community:

Name of interviewer: Type of business: 1) / 2) / 3) / 4)

Name of interviewee: Position: AEA / DAO /

1. Trade of Local Rice (Monthly)

	1) Quantity of sales	2) Price	3) Sales
i. Paddy	bag	GHC/bag	GHC
ii. Paddy (raw)	bag	GHC/bag	GHC
iii. Paddy	bag	GHC/bag	GHC
iv. Milled rice	kg	GHC/kg	GHC
v. Milled rice	Graa	GHC/Graa	GHC
vi. Parboiled rice	kg	GHC/kg	GHC
vii. Parboiled paddy	bag	GHC/bag	GHC
viii. Parboiled paddy	bag	GHC/bag	GHC
Total			GHC

2. Total Expenses for the business (Please fill in the rough estimate of the last month)

Purchasing expense	GHC/month
Labors	GHC/month
Transportation cost	1) GHC/bag 2) GHC/month
Other expense	GHC/month
Total	GHC/month

3. Supplier of Local Rice (Please select in ascending order of quantity from the Box 1 below)

Paddy	1)	2)	3)	4)	5)
Milled rice	1)	2)	3)	4)	5)
Parboiled rice	1)	2)	3)	4)	5)

4. How to find suppliers:

1) 2) 3)

5. Main Customer of Local Rice (Please select in ascending order of quantity from the Box 1 below)

Paddy	1)	2)	3)	4)	5)
Milled rice	1)	2)	3)	4)	5)
Parboiled rice	1)	2)	3)	4)	5)

6. How to find customers:

1) 2) 3)

VC Actors

Basic Info

Processing / Sales

Expenses / Profit

Supply of local rice

Access to customers

Issues/ Challenges

Calculation should be accurate!

Select only applicable items!

Fill in the corresponding number.!

5.3 Connecting Farmers to Buyers for Higher Profit

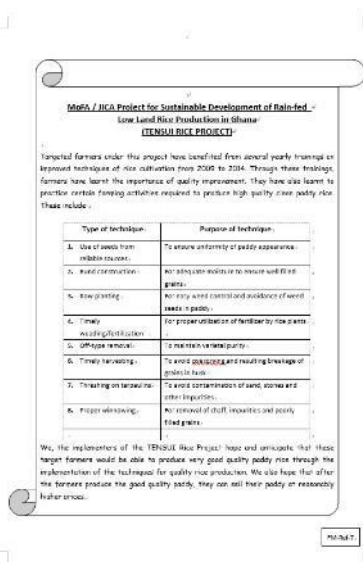
Use following reference materials for Marketing Support.

- (1) Promotion Sheet
- (2) List of Buyers
- (3) Format to collect quantity of paddy in stock (for supporting group sales)
- (4) ESOKO
- (5) Cost calculation for transporting (for supporting group transporting)

(1) Promotion Sheet

Target Users: Farmers, Rice millers and AEAs

Purpose: To explain to potential buyers about effort for quality improvement at the time of negotiation.



(2) List of Buyers

Target users: AEAs

Purpose: To introduce farmers buyers interested in purchasing quality paddy/milled rice in bulk.

(3) Format to collect quantity of paddy in stock

Target users: AEAs

Purpose: To compile paddy of individual farmers in stock.

(4) ESOKO

Target users: AEAs

Purpose: To introduce farmers to using ESOKO, the mobile price information system

Service 1:

Send "Rice" to 1900 => Get weekly price information of local rice price of 46

major markets in Ghana (GHC 0.06)

Service 2:

1900 (phone call) = > Daily weather information (GHC 0.2765/min. by MTN)

Service 3:

Bids & offers (GHC 0.2765/min. by MTN)

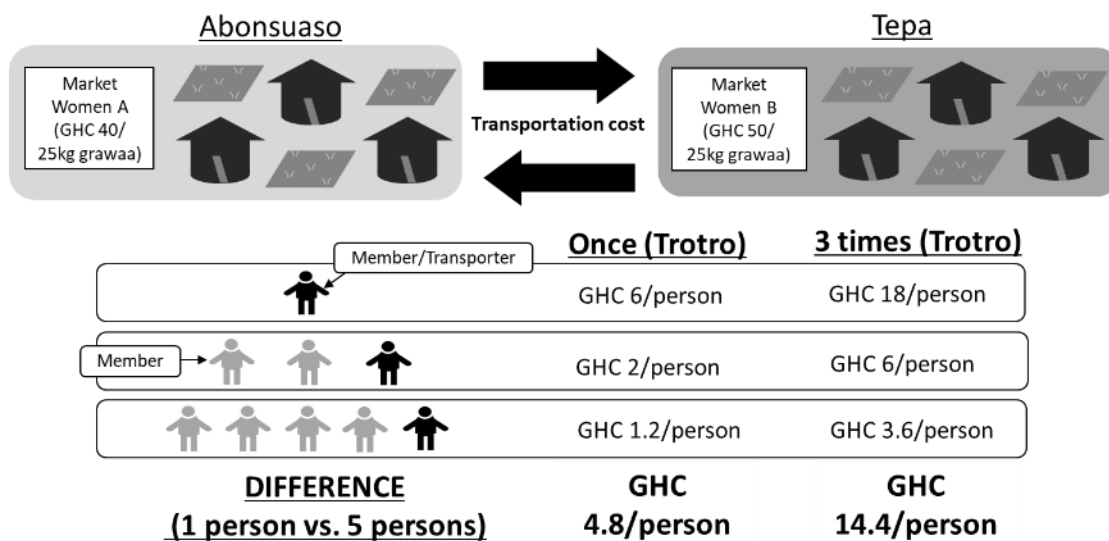
1. Inform ESOKO quantity of products you have
2. Package the products nicely
3. Submit information (location, phone no., farmers' name, to ESOKO
4. ESOKO distribute the information to all the subscribers on the platform
5. Any subscribers can directly call to the farmers for negotiation

(5) Cost calculation for transporting

Target users: AEAs

Purpose: To get the idea that farmers can save costs through group transporting.

EXAMPLE

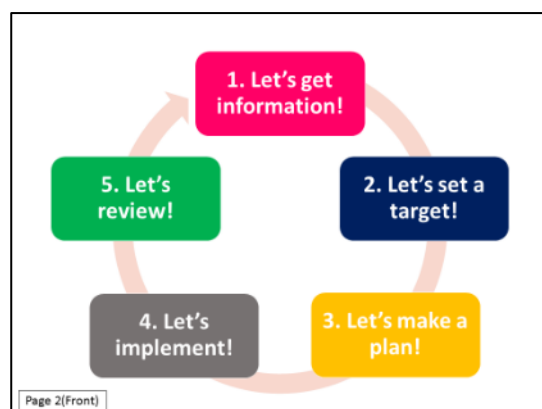


6 Farm Management

6.1 Cycle of Farm Management

Explain to farmers how to manage own plot as business venture.

Farm management is the cycle which is consisted of 5 components; 1) information collection, 2) target setting, 3) planning, 4) implementation and 5) review.



(1) Information Collection

Before start cultivation, farmers need to know market preference of rice variety, characteristics of each variety (duration of growth etc.), expected production and expected income. Having that information, farmers can compare several varieties and take a decision.

(2) Target Setting

Before start cultivation, farmers need to set a target how much they want to earn. According to the money to be earned, farmers can set a target of amount produce and acreage cultivate for the season.

Box: Tips for discussing with farmers

In many cases, farmers worry about high cost for adapting Tensui improved technical package since the package includes a lot of intensive work. However, it is not true. Let's discuss with farmers to discover how Tensui improved technical package is cost-effective.

Step 1: Ask farmers "how many bags do you want to harvest this year?"

Farmers know how many bags of paddy are necessary for family expense. Some may answer "30 bags", others may say "25 bags" etc.

Step 2: Ask farmers about last year result; "how many acres did you cultivate? How many bags did you harvest? How much did you spend last year?" Facilitate farmers to be able to answer the total cost by asking respective items e.g. land rent, input (seed, fertilizer and chemicals), hired

labor and tractor etc.

Farmers may answer “it was 3 acres, 20 bags, GHC 1,900”, or others may say “3 acres, 17 bags, GHC 1,650” etc.

Step 3: Ask farmers “did you achieve your target last year?”

Most of the case, farmers may say “no”, their achievement is less than the target.

Step 4: Tell farmers how many acres can achieve their target if they fully adapt Tensui improved technical package. Also show an example of crop budget.

Based on the experience, farmers can harvest 28-30 bags from an acre.

Example of crop budget is GHC 822 per acre (input and labor only) and additional GHC 825 for equipment if necessary.

Compare cost and production between the conventional farming and Tensui improved technical package. It is obvious that farmers who adapt Tensui improved technical package can achieve the target even smaller acreage and cheaper cost than conventional farming.

Step 5: Ask farmers “would you like to adapt Tensui improved technical package this year?”

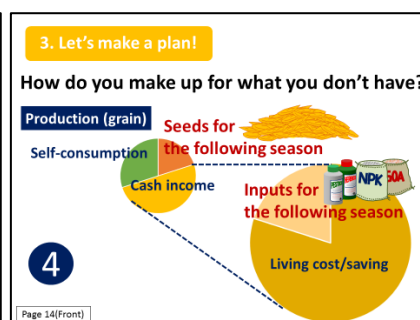
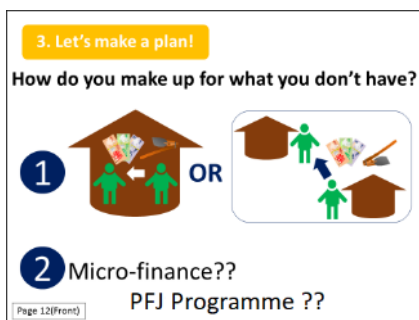
Most of farmers will say “yes!”

(3) Making a Plan

Budget Plan

Based on the target, farmers need to know the total cost of the necessary inputs for cultivation.

Next, farmers need to think about resources for getting inputs. If they don't have enough resources, discuss with farmers on countermeasures.



- 1: Get loan from family members or village members
- 2: Make use of micro-finance, take inputs from planting for food and job programme (MOFA)
- 3: Use advantages of working in a group as follows;
 - Cooperative work (no cash payment except for food)
 - Group input acquisition (saving transportation cost)
 - Group accessing to tractor services (strengthening bargaining power)
 - Equipment/tools sharing
 - Group marketing (strengthening bargaining power, accessing bulk buyers, saving transportation cost, etc.)
 - Ideal number should be 8-15 members per group
- 4: Spend income to purchase inputs for the following season

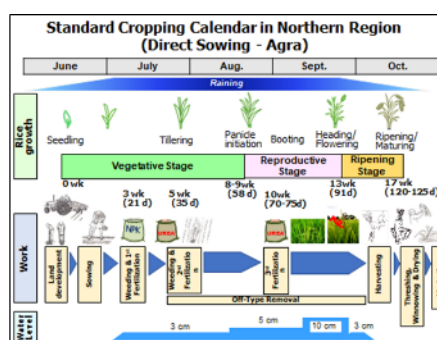
Action Plan

Based on the cropping calendar, prepare Action Plan of demo-plot together with group farmers. Action plan format is shown in Annex 1.

Action Plan will guide AEAs, Key Farmers and Group Farmers on the timing and type of works to do at demo-plot.

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
Transplanting	3 weeks	gardenline
Weeding	5-10 weeks	Push weeder
Fertilizer application	5-10 weeks	Fertilizer, container, scale
Harvesting	19 weeks	Sickle

Sample action plan



Rice cropping calendar

(4) Implementation

① Keep record

Use Record Keeping Book or Record Keeping Sheet (Annex 2).
Record keeping should start when farmers begin purchasing inputs.

FARM RECORD KEEPING BOOK -ASHANTI REGION-

**Standard Cropping Calendar in Ashanti Region
(Transplanting - Agra)**

April / May June July Aug. Sept.

Rice growth

Seeding Transplanting Tilling Partic initiation Rooting Heading/ Flowering Ripening/ Harvesting

Vegetative Stage (0 wk to 7 wk) **Reproductive Stage** (7 wk to 15 wk) **Ripening Stage** (15 wk to 18 wk)

Work

Land preparation, Seedling, Transplanting, Tilling, Partic initiation, Rooting, Heading/ Flowering, Ripening/ Harvesting, Weeding, Fertilizer application, Bird scaring, Harvesting, Threshing & Winnowing, Drying, Milling, Transporting (from field to houses)

Water Level

10 cm 3 cm 5 cm 10 cm 3 cm

Name: _____

Let's do an exercise!

INSTRUCTION

- Costs = Costs for land + Costs for materials + Costs for labour + Costs for milling
- Sales = Number of grains or bags sold x Unit price
- Profit or Loss = Sales - Cost

Farmer A

Land tillage: GH¢ 110

Materials: GH¢ 110

Labour: GH¢ 40

Milling: GH¢ 30

Total costs: GH¢ 280

Total sales: GH¢ 450

Profit: GH¢ 170

Farmer B

Land tillage: GH¢ 110

Materials: GH¢ 110

Labour: GH¢ 40

Milling: GH¢ 30

Total costs: GH¢ 360

Total sales: GH¢ 750

Profit: GH¢ 390

EXAMPLE

Farmer A	GH¢
Land	100
Materials	110
Labour	40
Milling	30
Total costs	280
Total sales	450
Profit	170

LET'S TRY!

Farmer B	GH¢
Land	
Materials	
Labour	
Milling	
Total costs	
Total sales	
Profit	

Farm record keeping sheet / Ashanti region

INSTRUCION: ICA Project on Sustainable Development of Rain-fed Lowland Rice Production

Farmer's name: _____

MATERIALS

Item	Cost (GH¢)
Seeds	GH¢ 32
Fertilizer	GH¢ 45
Chemicals	GH¢ 10
Push seeds	GH¢ 25
Leveler	GH¢ 20
Sickle	GH¢ 2
Ho	GH¢ 30
Net	GH¢ 5
Tarpaulin	GH¢ 45
Bamboo	GH¢ 5
Sacks	GH¢ 5
SUB-TOTAL	GH¢ 200

LABOUR

Item	Cost (GH¢)
Bund construction or maintenance	GH¢ 50
Weeding	GH¢ 60
Fertilizer application	GH¢ 47
Bird scaring	GH¢ 30
Harvesting	GH¢ 50
Threshing & Winnowing	GH¢ 50
Drying	GH¢ 50
Transporting (from field to houses)	GH¢ 50
Milling	GH¢ 50
SUB-TOTAL	GH¢ 500

Total production

Item	Value (GH¢)
No. of bags harvested (84kg)	9
Land	1/4
Total costs (GH¢)	560
Total sales (GH¢)	950
Profit or loss (GH¢)	390

Cost/Sales/profit or loss: $100 + 200 + 250 = 550$ $950 - 560 = 390$

② Start cultivation, following Action plan and Rice Cropping Calendar See Chapter 2 and 3.

③ Apply post-harvest techniques, following Action plan and Rice Cropping Calendar See Chapter 4.

④ Do marketing See Chapter 5.

⑤ Record sales Use Record Keeping Book or Record Keeping Sheet.

(5) Review

At the end of the implementation stage, refer to the record in Farm Record Keeping Book or Sheet. Then, compare total costs and total sales, and find the difference (= profit or loss).

Review whether the profit equal to the planned target per season or per year? If yes, a farmer can continue the cycle of farm management in the following cropping season.

If no, review the following points, correct the wrong and do the good more;

1: Go back to the Action plan

-Was the application of each activity carried out timely?

-Did you follow all the recommended activities? (if no, see Chapter 2-4)

2: Go back to Farm record keeping book or sheet

-Did you overspend for inputs and labor? (if yes, see Section 6.2)

3: Does your sales price depend on quality of the produces or not?

-If yes, keep improving the quality.

-If no, store rice and sell it later when prices are high.

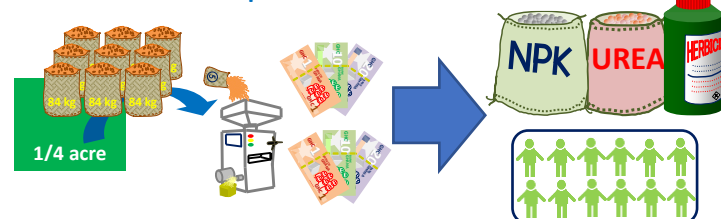
6.2 Cost Saving is Fun!

Learn from the cost saving practices observed in the field.

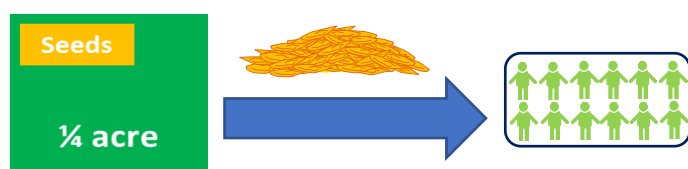
1: Purchase and store inputs for the next season

Year 2015

Purchase and store inputs for the next season



Produce seed for the next season



1: Purchase and store inputs for the next season

- Beposo Rice Growers Association (12 members), Atwima Mponua district, harvested 8.5 bags of paddy in $\frac{1}{4}$ acre of a demo-plot (714kg). After milling the paddy at a mill, the group sold the milled rice at GHC 1,100. The group purchased fertilizers for the following season to be used in the demo-plot and also by individual members.
- In addition, the group established a seed plot in the demo-plot to share seeds among the members so that they could save cost for procuring seeds.

2: Advance Purchase of Inputs

Year 2012

Purchase and store inputs after minor season



Year 2013

Use the materials purchased in 2012 (no procurement in 2013)



Price increase in 2013

NPK: GHC 51/ 50kg
Urea: GHC 55/ 50kg
Herbicide: GHC 14/ 1 L

If he purchased in 2013,
he would spend....

Total: GHC 720

Made a difference: GHC 273/3 acre



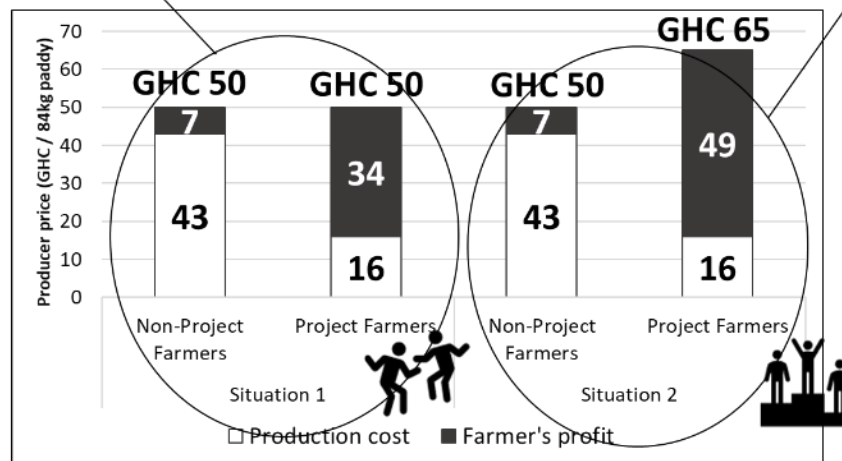
2: Advance Purchase of Inputs

In order to guard against increment in prices of inputs

- Rice farmers purchase and store inputs after minor season cropping.
- At major season, farmers are sure of readily available inputs to start farming in time.
- Farmers also save money because of increase in prices of inputs in the preceding year

Tensui Improved Technical Package is cost-effective. Farmers who apply the techniques can get a higher return as shown in the picture below. Use the on-site training material “a Tale of Two Farmers” to explain farmers.

When there's no price difference between quality... When there's price difference between quality, fortunately...



Situation 1: Farmers' profit can be increased only by applying the TENSUI technical package

Situation 2: Farmers' profit can be increased by applying the TENSUI technical package and with an increase in producer price reflecting quality

Expected Increase in Farmers' Profit per Unit in Different Situations

ANNEX

Form 1: Demo-Plot Action Plan & Monitoring Sheet for Transplanting method

Name of AEA:	Number of Group Farmers: M: F:	Community:
Phone No. of AEA:	(Youth: Aged: PLWDs:)	Size of Demo Plot: acre
Operational Area:	Name of Key Farmer:	Rice Variety:
District:	Phone No. of Key Farmer:	

No.	Field work	Action Plan			Monitoring			
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated	- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
1	Seed preparation	1 week before sowing		Rice seeds, salt, egg, bucket, sieve, firewood, pot, seed net		M: F:		
2	Nursery preparation	1 day before sowing		Hoe, cutlass, garden line		M: F:		
3	Nursery management	from 1 day before sowing to the day for transplanting		Hoe		M: F:		
4	Sowing	Week 0		String, stick, hoe		M: F:	Quantity of seeds: kg	
5	Land clearing	3 weeks (or more) before transplanting		Cutlass		M: F:		
6	Bund construction	1 - 2 weeks before transplanting		Hoe, spade, garden line		M: F:		
7	Ploughing	1 week before transplanting		Hoe		M: F:		
8	Puddling and or Leveling	1 day before transplanting		Hoe, spade, leveller		M: F:		
9	Uprooting and seedlings preparation	1 day before transplanting		Strings		M: F:		
10	Transplanting	3 weeks after sowing		String, stick, garden line		M: F:	Row transplanting: cm x cm	
11	1st Weeding	5 weeks after sowing		Push weeder		M: F:		

No.	Field work	Action Plan			Monitoring			
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated	- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
12	1st Fertilizer application	5 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	
13	Off-type removal	From 5 weeks after sowing to the day for harvesting		No tool (hand removal)		M: F:		
14	2nd Weeding	7 weeks after sowing		Push weeder				
15	2nd Fertilizer application	7 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	
16	3rd Weeding	10 weeks after sowing		Push weeder		M: F:		
17	3rd Fertilizer application	10 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	
18	Heading	Heading more than 50% rice plants						
19	Bird scaring	13 - 18 weeks after sowing		Fishing net		M: F:		
20	Maturing	Accumulated temperature 950°C from heading date						
	Harvesting	19 weeks after sowing (determined by observation)		Sickle		M: F:	Moisture content: %	
	Threshing			Tarpaulin, Bambam box, sacks		M: F:		
21	Winnowing	19 weeks after sowing		Tarpaulin, sacks		M: F:		
	Drying					M: F:	Moisture content: % Number of bags:	Bag size:
22	Storing	19 weeks after sowing ~		Storage facility, wooden pallets		M: F:		
23	Milling	19 weeks after sowing ~		Sacks		M: F:		
24	Selling	19 weeks after sowing ~		Sacks		M: F:		

Form 2: Demo-Plot Action Plan & Monitoring Sheet for Direct Sowing Method

Name of AEA:	Number of Group Farmers: M: F:	Community:
Phone No. of AEA:	(Youth: Aged: PLWDs:)	Size of Demo Plot: acre
Operational Area:	Name of Key Farmer:	Rice Variety:
District:	Phone No. of Key Farmer:	

No.	Field work	Action Plan			Monitoring			
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated	- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
1	Land clearing	3 weeks (or more) before sowing		Cutlass		M: F:		
2	Ploughing	1 week before sowing		Tractor		M: F:		
3	Bund construction	1 week before sowing		Hoe, spade, compactor, slapper, garden line		M: F:		
4	Harrowing	1 week before sowing		Tractor, Harrow		M: F:		
5	Seed preparation	1 week before sowing		Rice seeds, salt, egg, bucket, sieve, firewood, pot, seed net		M: F:		
6	Sowing	Week 0		Hoe, line drawer		M: F:	Quantity of seeds: kg Sowing method: Row distance: cm	
7	1st Weeding	3 weeks after sowing		Weeding hoe		M: F:		
8	1st Fertilizer application	3 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	
9	2nd Weeding	5 weeks after sowing		Weeding hoe		M: F:		
10	2nd Fertilizer application	5 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	

No.	Field work	Action Plan			Monitoring			Remarks on the field and crop condition, if any
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated	- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	
11	Off-type removal (for seed production)	from 5 weeks after sowing to the day of harvesting		No tool (hand removal)		M: F:		
12	3rd Weeding	10 weeks after sowing		Weeding hoe		M: F:		
13	3rd Fertilizer application	10 weeks after sowing		Fertilizer, weighing scale, containers		M: F:	Type of fertilizer applied: Quantity applied: kg	
14	Heading	Heading more than 50% rice plants				M: F:		
15	Bird scaring	13 - 17 weeks after sowing		Fishing net		M: F:		
16	Maturing	Accumulated temperature 950°C from heading date				M: F:		
	Harvesting	17 weeks after sowing (determined by observation)		Sickle		M: F:	Moisture content: %	
	Threshing			Tarpaulin, Bambam box, sacks, head carriage		M: F:		
17	Winnowing	17 weeks after sowing		Tarpaulin, sacks		M: F:		
	Drying					M: F:	Moisture content: % Number of bags:	Bag size:
18	Storing	17 weeks after sowing ~		Storage facility, wooden pallets		M: F:		
19	Milling	17 weeks after sowing ~		Sacks		M: F:		
20	Selling	17 weeks after sowing ~		Sacks		M: F:		

Farm record keeping sheet for Transplanting method

MoFA-JICA Project on Sustainable Development of Rain-fed Lowland Rice Production

Farmer's name: _____

MATERIALS



Seeds GH¢	Fertilizer GH¢	Chemicals GH¢	Push weeder (for one season) GH¢
Leveler (for one season) GH¢	Sickle (for one season) GH¢	Hoe (for one season) GH¢	Net (for one season) GH¢
Tarpaulin (for one season) GH¢	Bambam box (for one season) GH¢	Sacks (for one season) GH¢	SUB-TOTAL: GH¢

LABOUR



(excluding unpaid labour)

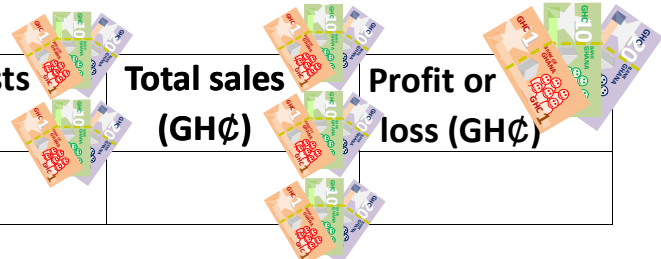
Bund construction or maintenance GH¢	Ploughing GH¢	Puddling & Leveling GH¢	Transplanting or Direct sowing GH¢
Weeding GH¢	Fertilizer application GH¢	Bird scaring GH¢	Harvesting GH¢
Threshing & Winnowing GH¢	Drying GH¢	Transporting (from field to house) GH¢	Milling GH¢
			SUB-TOTAL: GH¢

Total production

No. of bags harvested	
84kg	120kg

Cost/sales/profit or loss

Land	Total costs	Total sales	Profit or loss
Acre:	(GH¢)	(GH¢)	(GH¢)
Hiring: GH¢			












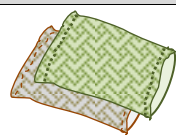
Farm record keeping sheet for Direct Sowing method

MoFA-JICA Project on Sustainable Development of Rain-fed Lowland Rice Production

Farmer's name: _____

MATERIALS






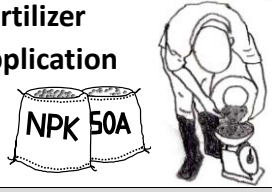


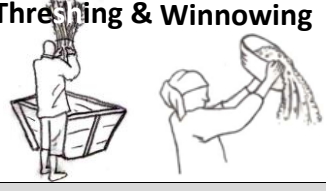




Seeds  GH¢	Fertilizer  GH¢	Chemicals  GH¢	Leveler (for one year)  GH¢
Sickle (for one year)  GH¢	Hoe (for one year)  GH¢	Net (for one year)  GH¢	Tarpaulin (for one year)  GH¢
Bambambox (for one year)  GH¢	Sacks (for one year)  GH¢	Others GH¢	Others GH¢
SUB-TOTAL:			GH¢



LABOUR



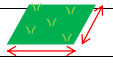


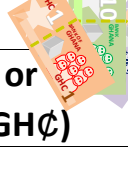
(excluding unpaid labour)

Bund construction or maintenance  GH¢	Ploughing  GH¢	Harrowing  GH¢	Sowing  GH¢
Weeding  GH¢	Fertilizer application  GH¢	Bird scaring  GH¢	Harvesting  GH¢
Threshing & Winnowing  GH¢	Drying  GH¢	Transporting (from field to house)  GH¢	Others GH¢
SUB-TOTAL:			GH¢

Total production

No. of bags harvested
84 kg 
120 kg 

Cost/sales/profit or loss

Land	Total costs (GH¢)	Total sales (GH¢)	Profit or loss (GH¢)
Acre:  Rent: GH¢			

**The Project for the Sustainable Development of
Rain-Fed Lowland Rice Production Phase 2 (Tensui 2)**

Monitoring and Evaluation Tool (M&E Tool) for District Rice Extension Plan



TENSUI RICE Phase II

July 2020

**Project Coordinating Unit, TENSUI RICE Phase II
Ministry of Food and Agriculture (MoFA)
Japan International Cooperation Agency (JICA)**

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Abbreviation

AEA	Agricultural Extension Agent
DAD	District Agriculture Department
DAO	District Agriculture Officer
DCD	District Coordinating Director
DCE	District Coordinating Executive
DDA	District Director of Agriculture
JICA	Japan International Cooperation Agency
KF	Key Farmer
M&E	Monitoring and Evaluation
MIS	Management Information System (Officer)
MMDA	Metropolitan, Municipal and District Assembly
MoFA	Ministry of Food and Agriculture
PCU	Project Coordinating Unit
PPRSD	Plant Protection and Regulatory Service Division
RAD	Regional Agriculture Department
RAO	Regional Agriculture Officer
RDA	Regional Director of Agriculture
TOT	Training of Trainers
WIAD	Women in Agricultural Development

Monitoring and Evaluation Tool

Introduction

The Project for the Sustainable Development of Rain-Fed Lowland Rice Production Phase 2 (Tensui 2) is under implementation by Ministry of Food and Agriculture (MoFA) in collaboration with Japan International Cooperation Agency (JICA) from April 2016 to February 2021. Phase 1 of the project (Tensui 1: 2009-2014) developed a technical package to increase yields and farmers' income and compiled it into a Rice Extension Guideline (Guideline) which was approved by MoFA. The Project outline of Tensui 2 is shown below.

Overall Goal	Domestic rice production is increased.
Project Purpose	The rice cultivation practice based on the Extension Guideline developed in Phase 1 is disseminated in 35 Metropolitan, Municipal District Assemblies (MMDAs) of Ashanti and Northern Regions.
Output 1	Target MMDAs increase the capacity to develop their District Rice Extension Plan and to estimate needed budget for its implementation.
Output 2	Using the Extension Guidelines, the trainings are conducted in target MMDAs.
Output 3	The capacity of Regional Agricultural Department (RAD) and District Agricultural Department (DAD) regarding monitoring and evaluation is increased.
Output 4	The Extension Guideline is fine-tuned.

District governments (MMDAs) are expected to develop and manage their own District Rice Extension Plan according to Guideline in the midst of ongoing process of decentralization.

This booklet of Monitoring and Evaluation Tools (M&E Tool) is designed for facilitating M&E activities of the District Rice Extension Plan for the district agriculture officers (DAOs), agricultural extension agents (AEAs), and regional agriculture officers (RAOs). M&E Tool is developed in consideration of: 1) aligning to the existing monitoring system and practice in MoFA; and 2) being simplified and user-friendly. Putting into practice of M&E Tool can:

- ✓ Strengthen the capacities of DAO, AEA and RAO to undertake M&E,
- ✓ Provide information of rice extension activities, which facilitates the existing MoFA M&E and periodical reporting process, and
- ✓ Contribute to the improvement of the existing MoFA M&E system.

Introducing M&E Tool can also expedite implementing and achieving the target set in the District Rice Extension Plan, which can contribute to the better livelihood of farmers in the districts.

Developing and Revising M&E Tool

This booklet of M&E Tool is revised as Version 4 through learning from the experience in 2017, 2018 and 2019 practices. M&E Tool should be fine-tuned to the local conditions and workable. M&E Tool is being continuously revised and improved by learning from the experience. The time frame and process of developing M&E Tool is shown as follows:

<u>Time frame</u>	<u>Action</u>
February 2017	Developing M&E Tool Version 0 based on the comments in M&E Workshop held in Ashanti and Northern Regions.
April - December 2017	Introducing M&E Tool into practice at the field
February 2018	Review and revise the M&E Tool incorporating lessons learnt from the experience of the practices.
March 2018	Revising M&E Tool as Version 2.
March – December 2018	Introducing M&E Tool Version 2.
February 2019	Revising M&E Tool as Version 3.
March – December 2019	Practice M&E Version3.
June 2020	Revising M&E Tool as Version4.
July – December 2020	Practice M&E Version 4.

1. Monitoring and Evaluation (M&E)

Monitoring is a process of 1) collecting data, 2) checking the progress and achievements, and 3) identifying challenges and necessary actions of plan, program and project. The result is utilized to feed them back into the plan as part of management cycle. Evaluation is conducted at the end of planning period to assess its performance. The results of and lessons learnt from evaluation are shared among stakeholders and utilized for the next planning.

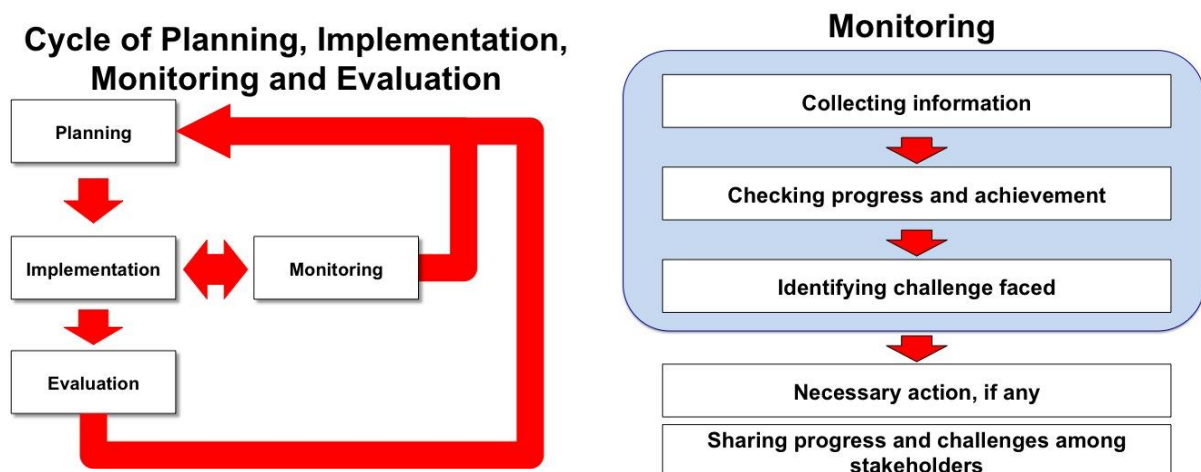


Figure 1 Plan, Program and Project Cycle and Monitoring

2. Existing MoFA Monitoring System

Given the direction by Ministry of Food and Agriculture (MoFA), regions and districts prepare annual plans fine-tuned to the specific local situation. MoFA introduced uniform formats for M&E. Progress and challenges of the annual plan is monitored and reported periodically. The monitoring report at field level is sent to higher entities vertically and horizontally, as shown in the figure below.

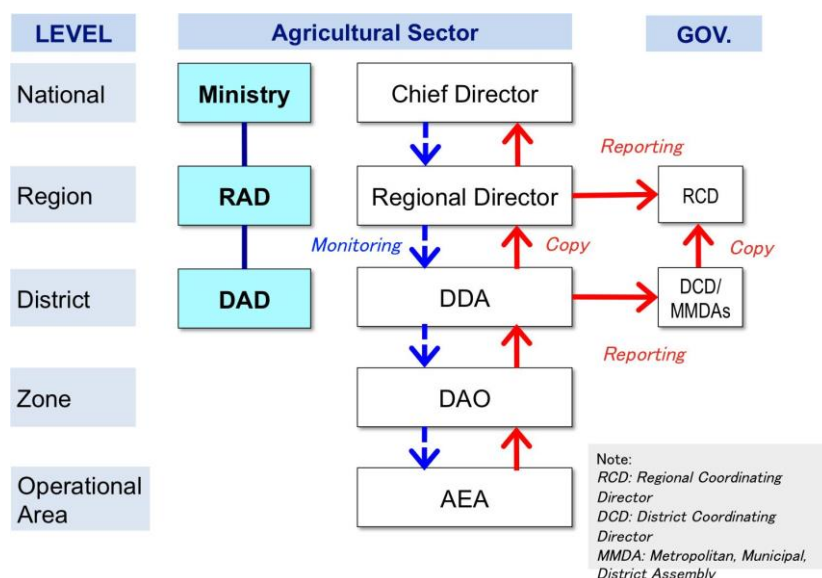


Figure 2 MoFA Monitoring Flow

At district level, AEAs submit monitoring report to respective DAO. District M&E/MIS officer compiles DAO's monitoring reports and submit to District Director of Agriculture (DDA). DDA

reports to District Coordinating Director (DCD) of MMDAs and copies to Regional Agricultural Department (see the figure below).

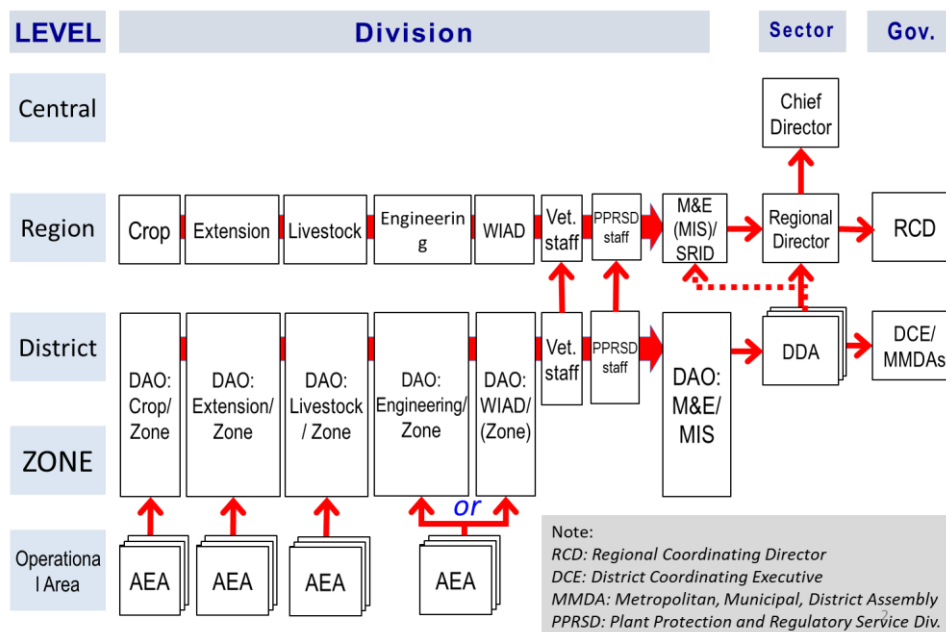


Figure 3 Reporting Flow at District & Region

Types and frequencies of those monitoring and its reporting are shown in the table below. The information included in the existing monitoring report on rice cultivation is area planted, area harvested, land intensification status, production, and average wholesale price of local rice.

Table 1 Types and Frequency of Monitoring Reports

	Annual Plan	Monitoring Frequency	Reporting				Evaluation (Project/program base)
			Monthly Report	Quarterly Report	Annual Report	Situational Report	
Ministry	✓	2 times a year					✓
Regional Director	✓	Quarterly		✓	✓	✓	✓
DDA (District)	✓	Fortnightly		✓	✓	✓	✓
DAO (Zone)		Weekly		✓	✓	✓	
AEA (Operational Area)		4 times a week	✓	✓	✓	✓	

Source: PCU, Tensui 2 Project

3.2 Approach at the Field Level

Key extension approach at the ground level is as follow.

- A set of Demonstration plots (**Demo-Plots**) and group of farmers (**Group Farmer**) in communities is a core component of the extension at the field.

Demo-Plot and Direct Beneficiaries

Demo-Plots are established in communities to demonstrate the improved rice cultivation technical packages. Group Farmer is formed as target farmers (Target Farmer). They are direct beneficiaries trained during Onsite Training. Group Farmers are expected: 1) to learn the rice cultivation techniques at Demo-Plots, 2) to operate Demo-Plots, and 3) to apply the techniques into their farms.

Indirect Beneficiaries

Farmers nearby Demo-Plots are non-target farmers (Non-Target Farmers) as indirect beneficiaries. They are expected to observe Demo-Plot and to copy and apply the techniques into their own fields. Field day (Field Day) is a tool to disseminate technical packages to Non-Target Farmers.

Replication of Demo-Plot and Group Farmer

A core component (Demo-Plot and Group Farmer) is replicated in other places to disseminate the improved rice cultivation techniques to be expanded into other areas.

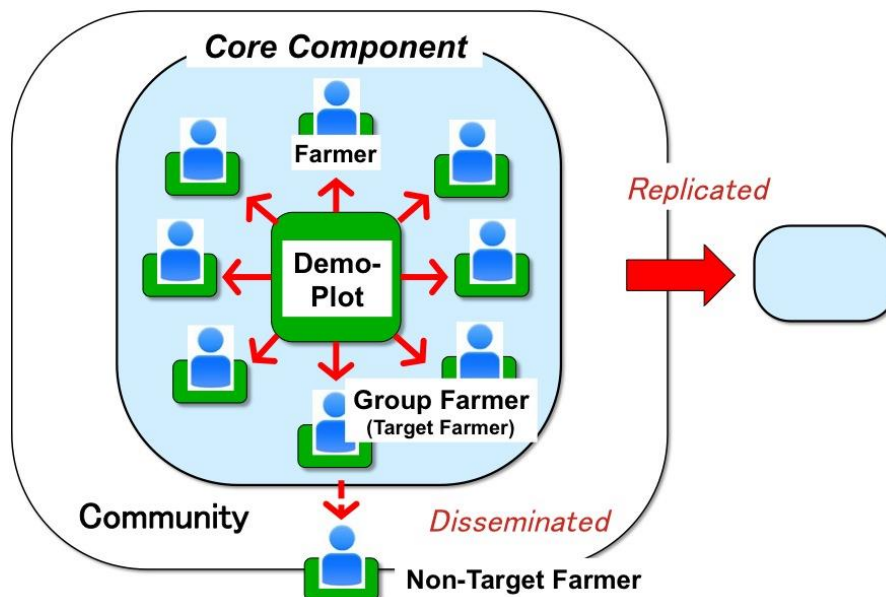


Figure 4 Demo-Plot and Group Farmer

3.3 Cascade Training

To introduce the field level extension, five steps of cascade trainings are introduced. Beneficiaries of trainings would in turn become trainers in the next step of cascade training.

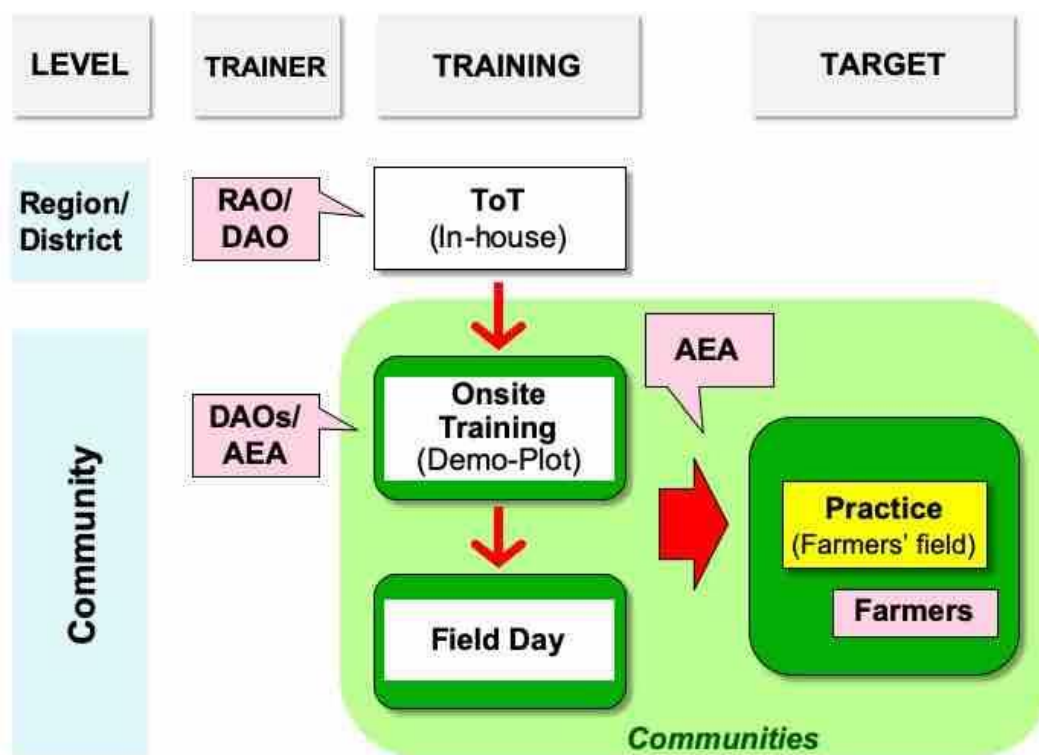


Figure 5 Cascade Training

Trainings are divided into three stages: 1) theoretical (In-House Training), 2) Practical Training (Onsite Training), and 3) Observation.

Training of trainers (ToT) is a theoretical in-house training at the district level (at the regional level as optional), and **Onsite Training** is a practical training at the communities.

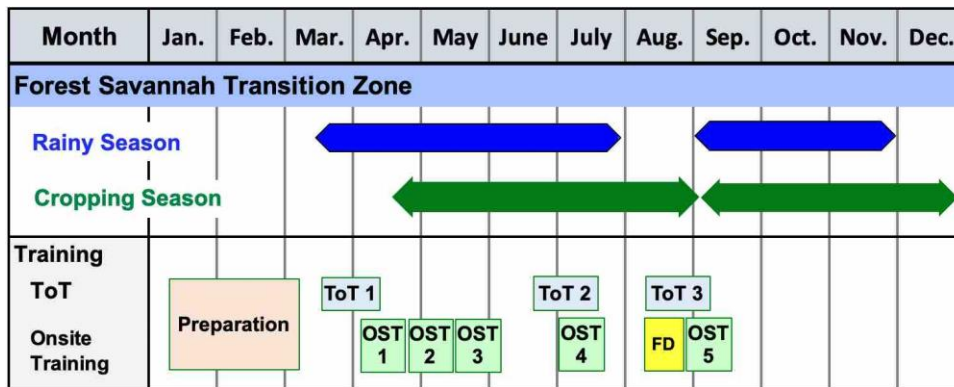
Onsite Training is the key training at the field level to train Group Farmers (Target Farmers) at Demo-Plots. After learning the technical package at Demo-Plot, Target Farmers are expected to practice on their own field and adopt the improved techniques.

Field Trip can give opportunities to AEAs for mutual learning of the experience by observing the progressive cases. **Field Day** is organized to show improved rice cultivation techniques to Non-Target Farmers and potential buyers.

Annual Schedule of the Model

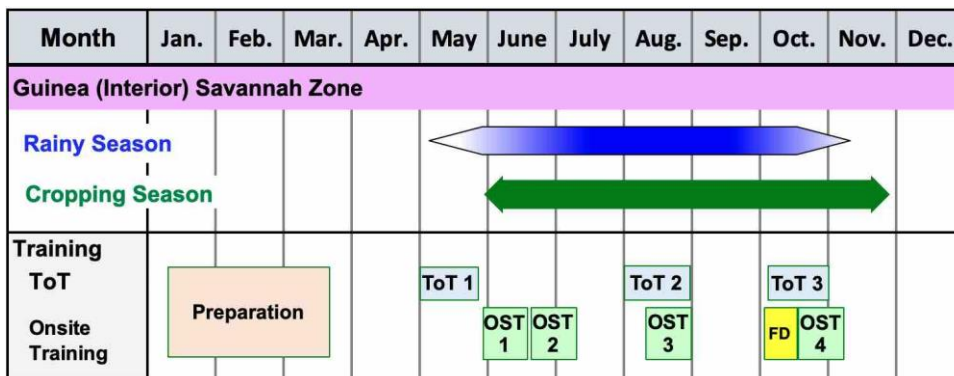
The proposed timing of each activity is shown below.

Yearly Activity Calendar for Forest Savannah Transition Zone (Ashanti)



Note: ToT: Training of trainers; OST: Onsite Training; FD: Field Day; FT: Field Trip

Yearly Activity Calendar for Guinea Savannah Zone (Northern)



Note: ToT: Training of trainers; OST: Onsite Training; FD: Field Day; FT: Field Trip

Figure 6 Annual Calendar

4. M&E Tool Proposed for Rice Extension Plan/ District Annual Plan

4.1 Planning

In planning Rice Extension Plan, causal sequence of intervention should be structured, as shown in the figure below. Shaded area in the figure is area of control within plan. Outside area is area of impact which plan cannot control but can make impacts on. Planning and monitoring framework is developed with monitoring indicators (table below). A plan is prepared with “District Rice Extension Plan (Form 4) shown in Annex.

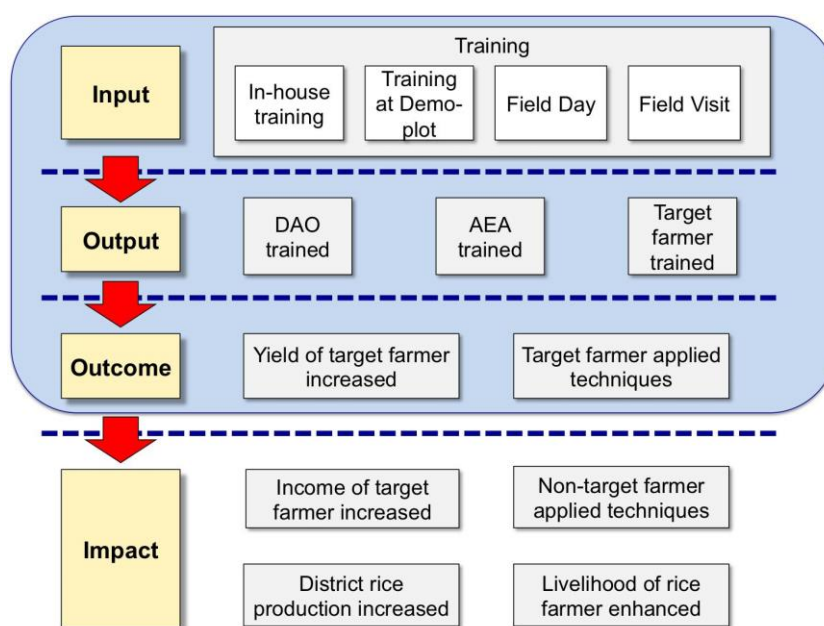


Figure 7 Causal Sequence

Table 3 Plan and Monitoring Framework

	Activity Summary	Indicators	Source Means of verification	Base	Target	Progress
Input	A set of training in the district.	- # of training conducted	- Training record			
Output	Training of DAO, AEA, and target farmers	- # of trained DAO, AEA, and target farmers	- Training record - Demo-plot record			
Outcome	- Target farmers apply the techniques - Yield of target farmers field increased	- Application rate of target farmers - Average yield of individual target farm field	- Farmer data			
Impact	- Livelihood of rice farmer enhanced - Improved techniques disseminated to non-target farmers - Rice production in the district increased	- Income of target farmers increased - Number of non-target farmers applied - Rice production amount	- Farmer data			

4.2 Monitoring

Monitoring activities are conducted during the implementation. When problems and challenges are found, necessary actions are to be taken.

Collecting information is the starting point of monitoring. Collected information is reported in line with the existing MoFA monitoring system. Community level Information is collected by AEA and reported to DAO responsible for responsive Operational Areas. DAO in charge of M&E/ MIS (DAO M&E/MIS) compiles the information from respective AEA through DAOs. DAO M&E/MIS prepares monitoring and evaluation reports. Report checked by DDA is submitted to DCE, and its copy is sent to Region. DAO in charge of M&E plays a key role in monitoring and evaluation of Rice Extension Plan.

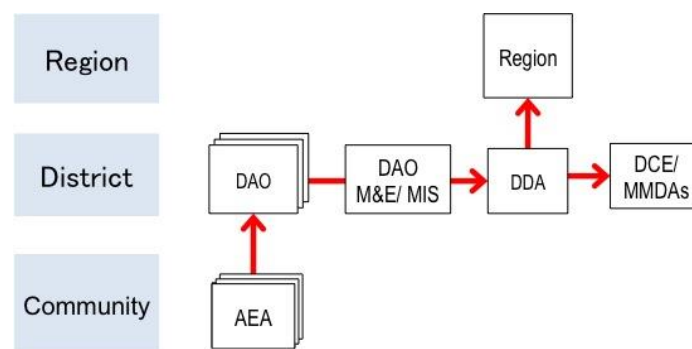


Figure 8 Reporting Flow

Information to be collected

A proper monitoring enables to highlight outcome and impacts on the farmers so that DDA can explain the outcome to Assembly. Outcome and impact information to be highlighted are:

- Demo-plot: yield increased
- Target Farmers: # of farmers applied, yield increased, income increased
- Non-target farmers: # of farmers applied, yield increased, income increased

Methods to collect information:

The monitoring flow is as shown below. AEAs prepare “Demo-Plot Action Plan” and monitor demo-plots and farmers and collect the information with “AEA Report format (Form 2)”. AEA reports monthly to DAO with AEA Report. DAOs compile and tabulate data on demo-plots and farmers based on AEA Report. DAOs report DAO/MIS quarterly. DDA/MISs compile data on demo-plots and farmers based on DAO reports. DDA/MIS also compile the information on training and finance. DDA/MIS reports to Region quarterly with “District Quarterly Report (Form 1)”.

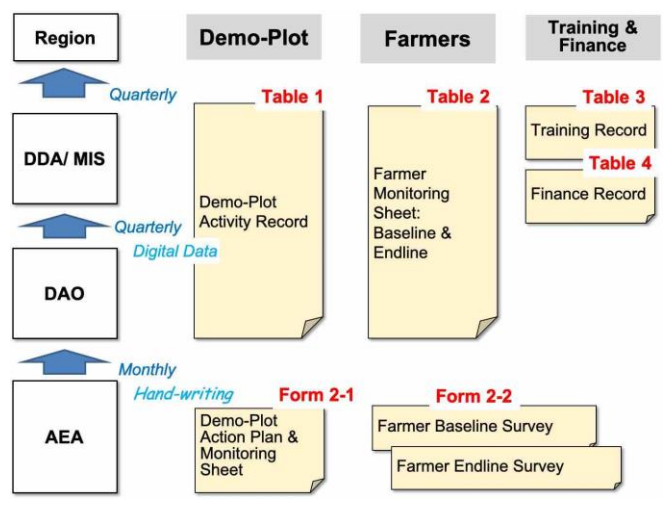


Figure 9 Monitoring Flow

Processing Information to Report

AEAs report to DAOs with “AEA Report” to DAOs. DAO/MISs report to Region with “District Quarterly Report”. All district information collected is compiled into 4 tables.

DAO/ MIS	Form 1: District Quarterly Report	Table 1: Demo-Plot Activity Record Summary Table 2: Farmer Monitoring Sheet Summary: Baseline & Endline Table 3: Training Record Table 4: Financial Record
AEA	Form 2: AEA Report	Form 2-1: Demo-Plot Action Plan & Monitoring Sheet Form 2-2a: Farmer Baseline Survey Form 2-2b: Farmer Endline Survey

4.3 Evaluation

Evaluation is conducted at the end of the annual plan to 1) assess the achievement & impacts, and 2) identify the challenges and possible actions to be taken. Evaluation is made with “Annual Report (Form 3)” shown in Annex.

Annual Plan

	Summary	Baseline	Target	Achievement
Inputs	Training			
Outputs	# of trained/ participated			
Outcome	Yield increased			
Impacts	Income increased Non-target farmers applied			

Evaluation

1. Assess achievement 
-  2. Analyze factors
-  3. Identify challenges & actions to be taken

Source: PCU, Tensui 2 Project

Figure 10

Evaluation

Example of Quarterly Report: 4th QUARTER 2018												
Activities: Finance												
Total approved budget, releases and expenditure (Gh¢) by MMDA for Rice Extension Activities.												
Items	Budgeted Estimated (Gh¢)		Approved Budget (Gh ¢)		Released (Gh ¢)			Expenditure (Gh ¢)				
	2018		2018		2018			2018				
MAG	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	
GOG	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
Private					500	500	500	500	500	500	500	
TOTAL	15,500	15,500	15,500	15,500	16,000	16,000	16,000	16,000	16,000	16,000	16,000	
Note: In case of in-kind contribution by input dealers and farmers and Planting for Food and Jobs, calculate the amount in GHS.												
Analysis: District mobilized resources in collaboration with the private sector.												
Activities: Training												
Program Objective	Activity	Target group	Number of Participants / Beneficiaries					Number of Beneficiaries			Outcome	Source of Funds (MAG, GOG, IGF, etc)
			Male	Female	Youth	Aged	PLW Ds	DAO	AEA	Farm er		
Food security and	Joint Training on improved technical package of Rain-Fed Lowland Rice	DAOs and AEAs	15	5	1	0	0	5	12		DAOs and AEAs obtain the knowledge and skill to conduct On-Site Training	MAG

On-Site Training on improved technical package of Rain-Fed Lowland Rice at the established demo-plot in AAA community.	AEAs and Farmer groups	17	5	1	1	0		12	10	Farmers obtain knowledge and skill to produce more.	MAG
On-Site Training on improved technical package of Rain-Fed Lowland Rice at the established demo-plot in BBB community.	AEAs and Farmer groups	7	3						10	Farmers obtain knowledge and skill to produce more.	GOG
On-Site Training on improved technical package of Rain-Fed Lowland Rice at the established demo-plot in CCC community.	AEAs and Farmer groups	8	2						10	Farmers obtain knowledge and skill to produce more.	GOG
Field Day	Farmers	40	20	2	5	1	5	5	50	Farmers are expected to learn techniques.	GOG
Field trip	Farmers and AEAs	17	5				1	1	10	AEAs and Farmers are expected to learn good practice.	MAG
Total		104	40	4	6	1	11	30	90		

Analysis: Timely resource mobilization resulted in successful training.

Status Report: Rice Extension Activities

Demo-Plot Achievement:

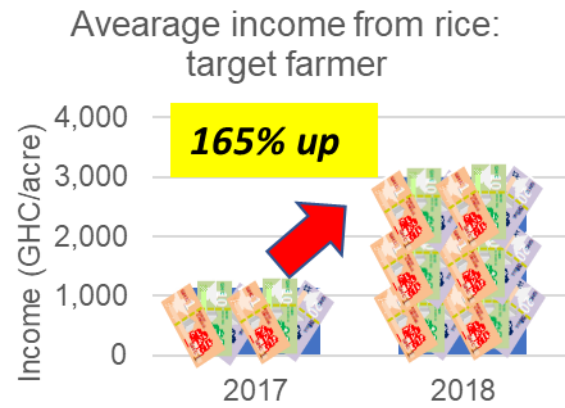
Community	Group member					Area Size (acre)	Quantity of paddy harvested (kg)	Yield (Mt/ha)
	Male	Female	Youth	Aged	PLWDs			
AAA	6	4	0	1	0	0.25	627	6.2
BBB	7	3	1	0	0	0.25	546	5.4
CCC	8	2	1	1	0	0.25	526	5.2
Total/ Av.	21	9	2	2	0	0.75	1,700	5.6

- 3 demo-plot established.
- 30 farmers trained.
- 5.6 MT/ha of yield was achieved on average

Outcome of targeted farmers

Community	Number of Farmers Trained	Number of Farmers Applied	Average Area Harvested (ha)	Average Quantity of Paddy harvested (kg)	Yield (Mt/ha)	Average income from rice (GHC/acre)	Average income from rice (GHC/area) in previous year	Income increase (%)
AAA	10	8	0.20	444	5.49	3,330	1,214	174%
BBB	10	6	0.25	520	5.14	3,120	1,093	186%
CCC	10	4	0.50	850	4.20	2,550	1,093	133%
Total/ Av.	30	18	0.95	1,814	4.72	3,000	1,133	165%

- 18 (60%) farmers applied the improved technical packages.
- They achieved 4.34 MT/ha of yield on average.
- They earned 3,000 GHC/area on average increased 165 %.



Impact on non-target farmers

Community	Number of Non-Target Farmers Applied	Average Area Harvested (ha)	Average Quantity of Paddy harvested (kg)	Yield (Mt/ha)	Income from rice (GHC/area)	Income from rice (GHC) in previous year	Income increase (%)
AAA	6	0.2	350	4.32	2,625	1,335	97%
BBB	3	0.25	380	3.76	2,280	1,093	109%
CCC	1	0.4	550	3.40	2,063	1,032	100%
Total/ Av.	10	0.85	1280	3.72	2,259	1,153	96%

- 10 surrounding farmers applied improved technical packages.
- They earned 2,259GHC/area on average increased 96 %.

Monitoring and Evaluation Tool (M&E Tool) for District Rice Extension Plan

Version 4

ANNEX: M&E Formats

Form 1: District Quarterly Report	17
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Form 1: District Quarterly Report

Table 1: Demo-Plot Activity Record (Data Entry Form)

Demo-Plot Community	Operational Area	Demo-Plot Area (acre)	Rice Variety	Number of group farmers						Progress of Demo-Plot (date-month)							Harvest (No. of bag)*	Size of bag (kg)	Remarks (moisture content %)
				Male	Female	Total	Youth (18-29)	Aged (60>)	PLWDs	SW	TP	FR1	FR2	FR3	HD	HV			
Football	J-League	0.25	Agra	9	1	10	1	0	0								5	84	
Baseball	Liga Espanola																		
Basketball	Serie A																		
Track & Field	Eredivisie																		
Swimming	Premier League																		
Karate	Bundeslega																		
0	0																		
0	0																		

Note: OST (On-site training), SW (Sowing), TP (Transplanting), FR (Fertilization), HD (Heading date), HV (Harvesting)

* As for number of bags harvested, indicate the size of bag or weight of bag. Also indicate moisture content of paddy in Remarks column.

Table 2: Farmer Monitoring Sheet: Baseline (Data Entry Form)

PROFILE									BASELINE																	
Demo-Plot Community	No.	Name of Farmer	Non-target farmer?	Key farmer?	Male/Female	Age	PLWD (Mark 1)	First participated year in <i>tensui</i> training	Baseline										Cost					Profit (GHc)		
									Year	Total Area harvested (acre)	Total No. of Bags harvested	Bag size harvested (kg)*	Total production (kg)	Yield (ton/ha)*	Number of Bags sold	Rice form sold (paddy/milled rice)	Bag size sold (kg)*	Selling price per Bag (GHc)	Total Sales (GHc)	Land rental cost (GHc/yr)	Inputs (GHc)	Equipment (GHc)	Paid labor (GHc)	Total Cost (GHc)	Profit (GHc)	Profit per acre (Ghc/acre)
Football	1	a			Male			2020	2019	1.000	3.0	84	252	0.63	3	Milled	100	200	600					0	600	600
Baseball	2	b			Female			2019	2018	3.000			0	0.00					0					0	0	0
Basketball	3	c			Male			2018	2017	1.000			0	0.00					0					0	0	0
Track & Field	4	d			Female			2017	2016	1.000			0	0.00					0					0	0	0
Swimming	5												0						0					0	0	
	6												0						0					0	0	
	7												0						0					0	0	
	8												0						0					0	0	
	9												0						0					0	0	
	10												0						0					0	0	

Table 2: Farmer Monitoring Sheet: End-line (Data Entry Form)

ENDLINE																			Evaluation of Technical Adaption										
Training participated													Cost				Profit (GHc)		Score either 1. Poor, 2. Fair, 3. Good										
Year	OST 1 (mark 1)	OST 2	OST 3	Total Area harvested (acre)	Total No. of Bags harvested	Bag size harvested (kg)*	Total production (kg)	Yield (ton/ha)*	Number of Bags sold	Rice form sold (paddy/milled rice)	Bag size sold (kg)*	Selling price per Bag (GHc)	Total Sales (GHc)	Land rental cost (GHc/yr)	Inputs (GHc)	Equipment (GHc)	Paid labor (GHc)	Total Cost (GHc)	Profit (GHc)	Profit per acre (Ghc/acre)	1. Bund construction	2. Improved variety of seed	3. Seed selection and treatment	4. Sowing or transplanting in row and appropriate planting distance	5. Split fertilization application	6. Weed control	7. Harvesting on time	8. Threshing on tarpaulin	Applied (yes/no)*
				1	20	100	2,000	5.00	15	Milled	100	200	3,000	50	50	50	50	200	2,800	2,800	2	2	2	2	2	1	1	1	yes
				0.25	10		0	0.00					0					0	0	0	2	2	1	1	1	1	1	1	No
				0.5	20		0	0.00					0					0	0	0	2	2	2	2	2	1	1	2	yes
				0.25	30		0	0.00					0					0	0	0	2	2	2	2	2	1	1	2	yes
							0						0					0	0										
							0						0					0	0										
							0						0					0	0										
							0						0					0	0										
							0						0					0	0										
							0						0					0	0										

Table 3: Training Record (Data Entry Form)

Training Name	Times (1st, 2nd, ...)	Topic	Venue/ Community	Plan (day-month-year) <i>*Type: "20/5/3" showing "3-May-2020".</i>	Implemented (day-month-year)	Number of farmers trained (gross)						Number of officers trained (gross)			Number of officers trained in district a year (NET)		
						Male	Female	Total	Youth (18-29 years old)	Aged (over 60 years old)	PLWDs	DDA/DAO	AEA	Total	DDA/DAO	AEA	Total
ToT	1st			3-May-2020	10-May-2020	4	3	7	1	0	0	3	4	7	3	7	10
ToT	2nd			3-Jun-2020	5-Jun-2020	9	1	10	0	0	0	2	3	5			
ToT	3rd							0				3	6	9			
OST	1st							0				4	5	9			
OST	2nd							0						0			
OST	3rd							0						0			
OST	4th							0						0			
OST	5th							0						0			
OST	6th							0						0			
OST	7th							0						0			
OST	8th							0						0			
OST	9th							0						0			
OST	10th							0						0			
Field Day								0						0			
Field Trip								0						0			
								0						0			
								0						0			
								0						0			
								0						0			
								0						0			
								0						0			

Table 4: Financial record

Total approved budget, releases and expenditure (Gh¢) by MMDA for **Rice Extension Activities**.
 Financial transfers by MMDA for **Rice Extension Activities**.

Budget for RICE EXTENSION ACTIVITIES						Financial transfers by MMDA for RICE EXTENSION ACTIVITIES (*Type: "20/5/3" showing "3-May-2020".)							
Items	Budget Submitted (GHc, Whole DAD)	Budget Approved (GHc, Whole DAD)	Budget Approved (GHc, Rice Extension)	Releases (GHc, Rice Extension)	Expenditure (GHc, Rice Extension)	Received Date by Assembly Account (day-month-year)				Received Date by DAD Account (day-month-year)			
	2020	2020	2020	2020	2020	1st Release	2nd Release	3rd Release	4th Release	1st Release	2nd Release	3rd Release	4th Release
GOG		1,000	700	400		3-Feb-2020	5-Apr-2020	10-Jul-2020	10-Oct-2020	25-Feb-2020	5-May-2020	10-Aug-2020	5-Nov-2020
DACF													
IGF													
ABFA													
PFJ													
MAG													
Other donors		10,000	900	800		3-Mar-2020	5-May-2020			15-Mar-2020	10-May-2020		
Input dealer													
Others													

Note: In case of in-kind contribution by input dealers and farmers and Planting for Food and Jobs, calculate the amount in GHS.

No.	Field work	Action Plan			Monitoring				
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated		- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
						Male	Female		
13	Off-type removal	From 5 weeks after sowing to the day for harvesting		No tool (hand removal)					
14	2nd Weeding	7 weeks after sowing		Push weeder					
15	2nd Fertilizer application	7 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg		
16	3rd Weeding	10 weeks after sowing		Push weeder					
17	3rd Fertilizer application	10 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg		
18	Heading	Heading more than 50% rice plants							
19	Bird scaring	13 - 18 weeks after sowing		Fishing net					
20	Maturing	Accumulated temperature 950 °C from heading date							
	Harvesting	19 weeks after sowing		Sickle			Moisture content: %		
	Threshing	(determined by observation)		Tarpaulin, Bambam box, sacks					
21	Winnowing			Tarpaulin, sacks					
	Drying	19 weeks after sowing					Moisture content: % Number of bags:	Bag size:	
22	Storing	19 weeks after sowing ~		Storage facility, wooden pallets					
23	Milling	19 weeks after sowing ~		Sacks					
24	Selling	19 weeks after sowing ~		Sacks					

Onsite Training (OST) Record

	1 st OST	2 nd OST	3 rd OST	4 th OST	5 th OST
Date					
Topic					
Participants	M: F:	M: F:	M: F:	M: F:	M: F:
	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:

Form 2-1b: Demo-Plot Action Plan & Monitoring Sheet (2) Direct Sowing Ashanti Region

Name of AEA:	Number of Group Farmers: M: F:	Community:
Phone No. of AEA:	(Youth: Aged: PLWDs:)	Size of Demo Plot: acre
Operational Area:	Name of Key Farmer:	Rice Variety:
District:	Phone No. of Key Farmer:	

No.	Field work	Action Plan				Monitoring			
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs	Date Implemented	No. of farmers participated		- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
						Male	Female		
1	Land clearing	3 weeks (or more) before sowing		Cutlass					
2	Bund construction	1 week before sowing		Hoe, spade, flat compactor, garden line					
3	Ploughing	1 week before sowing		Hoe					
4	Seed preparation	1 week before sowing		Rice seeds, salt, egg, bucket, sieve, firewood, pot, seed net					
5	Sowing	Week 0		Hoe, line drawer			Quantity of seeds: kg Sowing method: Row distance: cm		
6	1st Weeding	3 weeks after sowing		Weeding hoe					
7	1st Fertilizer application	3 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg		
8	2nd Weeding	5 weeks after sowing		Weeding hoe					
9	2nd Fertilizer application	5 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg		
10	Off-type removal	from 15 weeks after sowing to the day of harvesting		No tool (hand removal)					
11	3rd Weeding	10 weeks after sowing		Weeding hoe					
12	3rd Fertilizer application	10 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied:		

No.	Field work	Action Plan			Date Implemented	Monitoring			
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs		No. of farmers participated		- Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
						Male	Female		
							Quantity applied: kg		
13	Heading	Heading more than 50% rice plants							
14	Bird scaring	13 - 17 weeks after sowing		Fishing net					
15	Maturing	Accumulated temperature 950°C from heading date							
	Harvesting	19 weeks after sowing (determined by observation)		Sickle			Moisture content: %		
	Threshing			Tarpaulin, Bambam box, sacks, head carriage					
16	Winnowing	19 weeks after sowing		Tarpaulin, sacks					
	Drying						Moisture content: % Number of bags:	Bag size:	
17	Storing	19 weeks after sowing ~		Storage facility, wooden pallets					
18	Milling	19 weeks after sowing ~		Sacks					
19	Selling	19 weeks after sowing ~		Sacks					

Onsite Training (OST) Record

	1 st OST	2 nd OST	3 rd OST	4 th OST	5 th OST
Date					
Topic					
Participants	M: F:	M: F:	M: F:	M: F:	M: F:
	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:

Form 2-1c: Demo-Plot Action Plan & Monitoring Sheet (3) Direct Sowing Northern Region

Name of AEA:	Number of Group Farmers: M: F:	Community:
Phone No. of AEA:	(Youth: Aged: PLWDs:)	Size of Demo Plot: acre
Operational Area:	Name of Key Farmer:	Rice Variety:
District:	Phone No. of Key Farmer:	

No.	Field work	Action Plan			Date Implemented	No. of farmers participated		Remarks on the field and crop condition, if any
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs		Male	Female	
1	Land clearing	3 weeks (or more) before sowing		Cutlass				
2	Ploughing	1 week before sowing		Tractor				
3	Bund construction	1 week before sowing		Hoe, spade, compactor, slapper, garden line				
4	Harrowing	1 week before sowing		Tractor, Harrow				
5	Seed preparation	1 week before sowing		Rice seeds, salt, egg, bucket, sieve, firewood, pot, seed net				
6	Sowing	Week 0		Hoe, line drawer			Quantity of seeds: kg Sowing method: Row distance: cm	
7	1st Weeding	3 weeks after sowing		Weeding hoe				
8	1st Fertilizer application	3 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg	
9	2nd Weeding	5 weeks after sowing		Weeding hoe				
10	2nd Fertilizer application	5 weeks after sowing		Fertilizer, weighing scale, containers			Type of fertilizer applied: Quantity applied: kg	
11	Off-type removal (for seed production)	from 5 weeks after sowing to the day of harvesting		No tool (hand removal)				
12	3rd Weeding	10 weeks after sowing		Weeding hoe				

No.	Field work	Action Plan			Date Implemented	No. of farmers participated		Monitoring - Describe each activity in detail, - Evaluate each work whether it is implemented along with the guideline	Remarks on the field and crop condition, if any
		Week-based Time frame	Date-based Time frame (from to)	Recommended tool & inputs		Male	Female		
13	3rd Fertilizer application	10 weeks after sowing		Fertilizer, weighing scale, containers				Type of fertilizer applied: Quantity applied: kg	
14	Heading	Heading more than 50% rice plants							
15	Bird scaring	13 - 17 weeks after sowing		Fishing net					
16	Maturing	Accumulated temperature 950 °C from heading date							
	Harvesting	17 weeks after sowing (determined by observation)		Sickle				Moisture content: %	
	Threshing			Tarpaulin, Bambam box, sacks, head carriage					
17	Winnowing	17 weeks after sowing		Tarpaulin, sacks					
	Drying							Moisture content: % Number of bags:	Bag size:
18	Storing	17 weeks after sowing ~		Storage facility, wooden pallets					
19	Milling	17 weeks after sowing ~		Sacks					
20	Selling	17 weeks after sowing ~		Sacks					

Onsite Training (OST) Record

	1 st OST	2 nd OST	3 rd OST	4 th OST	5 th OST
Date					
Topic					
Participants	M: F:	M: F:	M: F:	M: F:	M: F:
	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:	Youth: Aged: PLWDs:

Form 2-2a: Farmer Baseline Survey - Rice Production and Income Analysis

Farmers Name: _____ District: _____ Date of interview: _____

Male/ Female: _____ Age: _____ PLWDs: _____ Demo-Plot Community: _____ Target Farmer / Non-Target Farmer

Key Farmer: Yes / No

When did you start rice cultivation? Since: _____

Please specify the year before participating *Tensui* training as

When did you FIRST participate in *Tensui* training? Year: _____

baseline year. Year: _____

Season	Area (acre)	Rice Variety	Total No. of Bags Harvested	Unit (Size of Bag: Refer *below)	Total Production (kg)	No. of maxi bags Sold	Unit (Size of Bag: Refer *below)	Unit price to sell per maxi bags (GHc)	Total Income (GHc)
Major rainy season			<input type="checkbox"/> Paddy		kg	<input type="checkbox"/> Paddy <input type="checkbox"/> Milled			
Minor rainy season			<input type="checkbox"/> Paddy		kg	<input type="checkbox"/> Paddy <input type="checkbox"/> Milled			
Total									(1)

* If respondent answers the bag as "unit", please specify the type of bag:

(ASH): KG= kilogram (kg), MinB = Minibag (size 3) **50 kg**, MaxB = Maxibag (size 4) **84kg**, SizF=Size 5 bag **120kg**, SmG=Small Grawaa (tin) **25kg**, BiG=Big Grawaa(Big tin) **64kg**,

(NOR): Bag=Maxibag **84kg**, Bow=Bowl **2.5kg**, Other (Specify :with confirmation in Kilogram)

Season	Cost of Land (GHc)	Cost of Inputs (GHc)			Cost of Equipment (GHc)	Cost of Labor (GHc)	Total Cost (GHc)
		Seeds	Fertilizer	Chemicals			
Major rainy season							
Minor rainy season							
Total							(2)
		<i>Total:</i>					

Cost of equipment includes: Push weeder, Leveler, Sickle, Hoe, Net, Tarpaulin, Bambam box, Sacks, Others

Cost of labor includes: Bund construction, Ploughing Pudding & Leveling, Transplanting, Harrowing, Sowing, Weeding, Fertilizer application, Bird scaring
Harvesting, Threshing & winnowing, Drying Transportation, Milling, Others.

Net Profit = (1) Total Income – (2) Total Cost	(GHc)
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Form 2-2b: Farmer End line Survey – Rice Production and Income Analysis

Farmers Name: _____ District: _____ Date of interview: _____
 Male/ Female: _____ Age: _____ PLWDs: _____ Demo-Plot Community: _____ End line Year: _____
 Participation in: OST(SW) 1: Yes / No OST 2(LD): Yes / No OST 3(TP): Yes / No OST 4(FT): Yes / No OST 5(HV): Yes / No

Season	Area (acre)	Rice Variety	Total No. of Bags Harvested	Unit (Size of Bag)	Total Production (kg)	No. of maxi bags Sold	Unit (Size of Bag)	Unit price to sell per maxi bags (GHc)	Total Income (GHc)
Major rainy season			<input type="checkbox"/> Paddy		kg	<input type="checkbox"/> Paddy <input type="checkbox"/> Milled			
Minor rainy season			<input type="checkbox"/> Paddy		kg	<input type="checkbox"/> Paddy <input type="checkbox"/> Milled			
Total									(1)

Season	Cost of Land (GHc)	Cost of Inputs (GHc)			Cost of Equipment (GHc)	Cost of Labor (GHc)	Total Cost (GHc)
		Seeds	Fertilizer	Chemicals			
Major rainy season							
Minor rainy season							
Total							(2)
		<i>Total:</i>					

Cost of equipment includes: Push weeder, Leveler, Sickle, Hoe, Net, Tarpaulin, Bambam box, Sacks, Others

Cost of labor includes: Bund construction, Ploughing Pudding & Leveling, Transplanting, Harrowing, Sowing, Weeding, Fertilizer application, Bird scaring Harvesting, Threshing & winnowing, Drying Transportation, Milling, Others.

Net Profit = (1) Total Income – (2) Total Cost	(GHc)
---	--------------

Evaluation of Technical Adaption

Evaluation: 1. Poor (not implemented), 2. Fair (partially implemented), 3. Good (implemented thoroughly)

Note: At least 5 activities are evaluated either "Fair" or "Good", the farmer is recognized as applying the technics in the Extension Guideline.

Bund construction	Improved variety of seed	Seed selection and treatment	Sowing or transplanting in row and appropriate planting distance	Split fertilization application	Weed management	Harvesting on time	Threshing on tarpaulin

Form 3: Annual Report: Evaluation

District:

Region:

Year:

1. Introduction

** Objective of the evaluation is to assess the implementation of the annual plan at the end of planning period. The results of and lessons learnt from evaluation are shared among stakeholders and utilized for the annual planning in the next year.*

2. Achievement

2.1 Whole District (*Data to be obtained from SRID*)

	Last Year	Target	Achievement
Rice cultivation area in district (ha)			
Rice production in district (tons)			
Average yield in district (ton / ha)			

2.2 Demo Plot Achievement (*attach Table1 Demo Plot Activity Record Summary*)

Name of Community	Area (acre)	No. of bag harvested	Yield (ton / ha)

2.3 Annual Target of Rice Extension Plan and Achievement (*attach Table2 Farmer Monitoring Sheet Summary and Table3 Training Record*)

	Indicator	Target	Baseline	Achievement/End line
INPUT	Number of trainings conducted			
OUTPUT	Number of DAO trained			
	Number of AEA trained			
	Number of target community			
	Number of target farmers trained			
OUTCOME	Number of target farmers trained (female)			
	Number of target farmers applied			
	Number of target farmers applied (female)			
	Application rate (%)			
IMPACT	Average yield of individual farmers applied (ton/ha)			
	Average income of target farmers from rice (GHC/ year)			
	Number of non-target farmers applied (person)			

2.4 Good practice identified

Name of community	Person practicing	Good practice	Remarks

3. Evaluation

3.1 Performance

**Narrative summary.*

3.2 Analysis:

**Analyzing causes of outputs and outcomes: supporting factors and constraints, i.e., weather, techniques, extension approaches, costs, selection of sites, ...*

Analysis

Item	Contributing factors
What went right	
1.	
2.	
3.	
What went wrong	
1.	
2.	
3.	

3.3 Challenges and possible actions

Challenges	Possible action to be taken
1.	
2.	
3.	

Form 4: District Rice Extension Plan

1. District Information

General information

Item	Number	Remarks
Population		
Total household		
Number of farmers		
Number of rice farmers		
Male		
Female		
Total area		

Rice Cultivation (Year)

Items	Total	Rain-fed lowland	Irrigated	Upland
Potential rice cultivation area				
Area under rice cultivation				

2. Agricultural Extension Capacity

Human resources

Position	Number required	Number at post	Remarks Experience of rice extension/ project
Director			
DAO Crop			
DAO Extension			
DAO Livestock			
DAO Engineering			
DAO WIAD			
DAO M&E/ MIS			
Veterinary Staff			
PPRSD Staff			
AEA			
Total			

AEA to farmer ratio: *1:4,000 (example)*

Physical resources

Item	Number	Available	Remarks
Automobile			
Motor bike			
Bicycle			
Total			

Others

Division of the District

Name of Zone	DAO in charge	Name of Operational Area	AEA in charge	Number of Community	Number of Rice Cultivating Community
Total					

3. Target

Target in whole district

	2015 (Baseline)	2016	2017	2018	2019	2020
Rice Cultivation Area (ha)						
Rain-fed lowland						
Irrigated						
Upland						
Total						
Rice Production (tons)						
Rain-fed lowland						
Irrigated						
Upland						
Total						
Average Yield of Rice (ton / ha)						
Rain-fed lowland						
Irrigated						
Upland						
Total						
Rain-fed lowland						
Number of target community						
Number of target farmers (total)						
Number of target farmers (male)						
Number of target farmers (female)						

Annual Target

	Indicator	Last Year (Baseline)	This Year (Target)
OUTPUT	Number of training conducted		
OUTPUT	Number of DAOs trained		
	Number of AEAs trained		
	Number of target community		
	Number of target farmers trained (male)		
	Number of target farmers trained (female)		
OUTCOME	Number of target farmers applied (male)		
	Number of target farmers applied (female)		
	Application rate (%)		
	Average yield of individual farmers applied (ton/ ha)		
IMPACT	Average income of target farmers from rice (GHC/ year)		
	Number of non-target farmers applied (person)		

Manual for District MIS Officers

MIS officers collect the data from AEAs and DAOs and enter those data into 5 kinds of EXCEL format.

Excel file consists of data sheets.

Sheet:

“0_Data Input”

“Table 1_Demo”

“Table 2_Farmer”

“Table 3_Training”

“Table 4_Finance”

Once all sheets are input, the District Summary sheet is automatically filled (see the figure in the right). Data are already consolidated as either district total or district average, which are ready for use for any reports.

District Summary		Adansi Asokwa							2020													
Table 1: Summary of Demo-Plot																						
No.	Community	Demo-Plot Area (acre)	Number of group farmers					Harvest (kg)	Yield (ton/ha)													
			Male	Female	Total	Youth	Aged	PLWDs														
Total	7	1.5	39	21	60	1	0	0	3276	5.46												
14	0	0	0	0	0	0	0	0	0	-												
15	0	0	0	0	0	0	0	0	0	-												
16	0	0	0	0	0	0	0	0	0	-												
17	0	0	0	0	0	0	0	0	0	-												
18	0	0	0	0	0	0	0	0	0	-												
19	0	0	0	0	0	0	0	0	0	-												
20	0	0	0	0	0	0	0	0	0	-												
Table 2: Summary of Impacts on Farmers																						
No.	Community	Number of Target Farmers	# of Male farmer	# of Female farmer	Baseline						Endline											
					# of Farmer	Area Harvested (acre)	Total Harvested (kg)	Average Yield (ton/ha)	Total Profit (Ghc)	Average Profit (Ghc/acre)	# of Farmer	Area Harvested (acre)	Total Harvested (kg)	Average Yield (ton/ha)	% Increase	Total Profit (Ghc)	Average Profit/ Acre (Ghc/acre)	% Increase	# of Farmer Applied	# Male applied	# Female applied	Application rate (%)
Total		6	4	2	6	4.25	2,240	1.43	3,200	1,000	6	3.00	5,900	5.00	249%	5,800	2,467	147%	5	4	1	83%
1	Football	2	2	0	2	1.50	660	1.20	800	500	2	1.50	3,100	5.25	338%	3,400	2,000	300%	2	2	0	100%
2	Baseball	1	0	1	1	0.25	200	2.00	800	3,200	1	0.25	500	5.00	150%	800	4,000	25%	0	0	0	0%
3	Basketball	1	1	0	1	1.00	480	1.20	600	600	1	0.50	900	4.50	275%	600	2,000	233%	1	1	0	100%
4	Track & Field	1	0	1	1	1.00	600	1.50	800	800	1	0.25	600	6.00	300%	800	4,000	400%	1	0	1	100%
Table 3: Training Summary																						
Training	Times	Number of farmers trained (gross)							Number of officers trained (gross)			OST1	Seed treatment									
		Male	Female	Total	Youth	Aged	PLWDs	DDA/DAO	AEA	Total	OST2			Land development (Bund construction)								
1	ToT	3	13	4	17	1	0	0	8	13	21	OST3	Nursery preparation and sowing									
2	OST	10	0	0	0	0	0	0	4	5	9	OST4	Transplanting									
3	Field Day	1	0	0	0	0	0	0	0	0	0	OST5	1st fertilizer application and weeding									
4	Field Tnp	1	0	0	0	0	0	0	0	0	0	OST6	2nd fertilizer application and weeding									
5	Others	0	0	0	0	0	0	0	0	0	0	OST7	3rd fertilizer application (young panicle observation)									
6		0	0	0	0	0	0	0	0	0	0	OST8	Heading date									
Total	Total	15	13	4	17	1	0	0	12	18	30	OST9	Harvest on time, threshing on tapulin									
									Number of officers trained (net)													
									3	7	10											
Table 4: Summary of Financial Record																						
		Budget Amount for RICE EXPENSES	Expended (Ghc)	%																		
Total		1,600	1,200	75%																		
Government source		700	400	57%																		
GOG		700	400	57%																		
DACF		0	0	-																		
IGF		0	0	-																		
ABFA		0	0	-																		
Other sources		900	800	89%																		
PFJ		0	0	-																		
Input dealer		0	0	-																		
MAG		0	0	-																		
Other donors		900	800	89%																		
Others		0	0	-																		
0		0	0	-																		
0		0	0	-																		

SHEET: "Data Input"

Please input the basic information in "Data Input" Sheet. Then, the information input is automatically input to other sheets.

Basic Information: Year of Intervention, Region, District, Operational Area, and AEA name.

Instruction of data input:

1. Please input data into the CELLS in YELLOW COLOR.
2. Please choose data from pulldown in the CELLS in ORANGE COLOR.
3. Please leave other cells. These parts are protected area. You cannot input data.

1. Protecte
d area.

Instruction:

Please input data into the CELLS in **YELLOW COLOR**.

Please choose data from pulldown in the CELLS in **ORANGE COLOR**.

Please leave other cells. CELLS in GREY COLOR is protected. You cannot type.

Year	20
Region	Ashanti
District	Adansi Asokwa
MIS Officer	

1. Data
selection area

Information Demo-Plot Community

No.	Community	Establishment year	Operational Area	AEA Name
1	Football	2020	J-League	Lionel Messi
2	Baseball	2019	Liga Espanola	Cristiano Ronald
3	Basketball	2018	Serie A	Diego Maradona
4	Track & Field	2017	Eredivisie	Ruud Gullit
5	Swimming	2016	Premier League	David Beckham
6	Karate	2015	Bundeslega	Franz Beckenbauer
7				
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29				
30	Ashanti			

1. Data
input
area

SHEET: "Table 1_ Demo-Plot"

Input Data

Table 1: Demo-Plot Activity Record Summary																					
		Number of group farmers								Progress of Demo-Plot (date-month-year) (*Type: "20/5/3" showing "3-May-2020".)											
Demo-Plot Community	Operational Area	Demo-Plot Area (acre)	Rice Variety	Male	Female	Total	Youth	Aged	PLWDs	SW	TP	FR1	FR2	FR3	HD	HV	Harvest (No. of bag)	Size of bag (kg)	Total Harvest (kg)	Yield (ton/ha)	Remarks (moisture content %)
Football	J-League	0.25	Agra	9	1	10	1	0	0	20-May-2018	4-Jun-2018	18-Jun-2018	2-Jul-2018	31-Jul-2018	30-Aug-2018	28-Sep-2018	5	84	420	4.20	
Baseball	Liga Espanola	0.25	Agra	8	2	10											6	84	504	5.04	
Basketball	Serie A	0.25	Agra	7	3	10											7	84	588	5.88	
Track & Field	Eredivisie	0.25	Agra	6	4	10											8	84	672	6.72	
Swimming	Premier League	0.25	Agra	5	5	10											7	84	588	5.88	
Karate	Bundeslega	0.25	Agra	4	6	10											6	84	504	5.04	
	0	0				0													0	-	
	0	0				0													0	-	
	0	0				0													0	-	
	0	0				0													0	-	

Type date in a way as:
 "20/5/3" shows "3-May-2020".
 "5/3" shows "3-May-2020".
 "18/5/3" shows "3-May-2018".

No need to input. Automatically processed.

Choose data from pulldown.

No need to input. Automatically processed.

Baseline

SHEET: "Table 2_Farmer"

Table 2: Farmer Monitoring Sheet Summary (Baseline)&(Endline)																							Adansi Asokwa			2020		
PROFILE								BASELINE															Cost		Profit (Ghc)			
Demo-Plot Community	No.	Name of Farmer	Non-target farmer?	Key farmer?	Male/ Female	Age	PLWD (Mark 1)	First participated year	Baseline										Cost		Profit (Ghc)							
									Base Year	Total Area harvested (acre)	Total No. of Bags harvested	Bag size harvested (kg)*	Total production (kg)	Yield (ton/ha)*	Number of Bags sold	Rice form sold (paddy/milled rice)	Bag size sold (kg)*	Selling price per Bag (Ghc)	Total Sales (Ghc)	Land rental cost (Ghc/yr)	Land rental cost (in kind: No. of bags)	Inputs (Ghc)	Equipme nt (Ghc)	Paid labor (Ghc)	Total Cost (Ghc)	Profit (Ghc)	Profit per acre (Ghc/acre)	
Football	1	a			Male			2016	1.00	3.0	120	360	0.90	3	Milled	100	200	600					0	600	600			
Baseball	2	b			Female	1		2016	0.25	2.0	100	200	2.00	4	Milled	100	200	800					0	800	3,200			
Basketball	3	c			Male	1		2017	1.00	4.0	120	480	1.20	3	Milled	100	200	600					0	600	600			
Tennis & Football	4	d			Female	1		2016	1.00	5.0	120	600	1.50	4	Milled	100	200	800					0	800	800			
Swimming	5	e			Male	1		2019	0.50	3.0	100	300	1.00	1	Milled	100	200	200					0	200	400			
Football	6	f			Male	1		2016	0.50	3.0	100	300	1.50	1	Milled	100	200	200					0	200	400			
Handball	7	g			Female	1		2016	0.25	2.0	100	200	2.00	4	Milled	100	200	800					0	800	-			
Rowing	8	h			Male	1		2016	0.25	2.0	100	200	2.00	4	Milled	100	200	800					0	800	-			

Endline

ENDLINE															Evaluation of Technical Adaption																	
Training participated			Endline Year:						Cost						Profit (Ghc)			Score either 1. Poor, 2. Fair, 3. Good														
Year	OST 1 (mark 1)	OST 2	OST 3	Total Area harvested (acre)	Total No. of Bags harvested	Bag size harvested (kg)*	Total production (kg)	Yield (ton/ha)	Number of Bags sold	Rice form sold (paddy/milled rice)	Bag size sold (kg)*	Selling price per Bag (Ghc)	Total Sales (Ghc)	Land rental cost (Ghc/yr)	Land rental cost (in kind: Ghc)	Inputs (Ghc)	Equipme nt (Ghc)	Paid labor (Ghc)	Total Cost (Ghc)	Profit (Ghc)	Profit per acre (Ghc/acre)	Blank	1. Bund construction	2. Improved variety of seed	3. Seed selection and treatment	4. Sowing or transplanting in row and appropriate planting distance	5. Split fertilization application	6. Weed control	7. Harvesting on time	8. Threshing on tarpaulin	Applied (yes/no)*	
				1.00	3	100	2,000	5.00	3	Milled	100	200	3,000	50	100	50	50	50	200	2,800	2,800		2	2	2	2	2	1	1	1	yes	
				0.25	5	100	500	5.00	5	Milled	100	200	1,000						0	1,000	4,000		2	2	1	1	1	1	1	No		
				0.5	9	100	900	4.50	5	Milled	100	200	1,000						0	1,000	2,000		2	2	2	2	2	1	1	2	yes	
				0.25	6	100	600	6.00	5	Milled	100	200	1,000						0	1,000	4,000		2	2	2	2	2	1	1	2	yes	
				0.5	8	100	800	4.00	2	Milled	100	200	400						0	400	800		2	2	2	2	1	2	2	2	yes	
				0.5	11	100	1,100	5.50	3	Milled	100	200	600						0	600	1,200		2	2	2	1	1	2	2	2	yes	
				0	-	-	0	-	-	-	-	-	0						0	0	-										No	
				0	-	-	0	-	-	-	-	-	0						0	0	-											No
				0	-	-	0	-	-	-	-	-	0						0	0	-											No

SHEET: "Table 3_Training"

Table 3: Training Record			Adansi Asokwa				2020											
Training Name	Times (1st, 2nd, ...)	Topic	District Code	Venue/Community	Plan (day-month-year) <small>*Type: "20/5/3" showing "3-May-2020"</small>	Implemented (day-month-year)	Number of farmers trained (gross)						Number of officers trained (gross)			Number of officers trained in district a year (NET)		
							Male	Female	Total	Youth	Aged	PLWDs	DDA/DAO	AEA	Total	DDA/DAO	AEA	Total
ToT	1st				3-May-2020	10-May-2020	4	3	7	1	0	0	3	4	7	3	7	10
ToT	2nd				3-Jun-2020	5-Jun-2020	9	1	10	0	0	0	2	3	5			
ToT	3rd								0				3	6	9			
OST	1st								0				4	5	9			
OST	2nd								0									
OST	3rd								0									
OST	4th		Input		Type date				0				Input					

Input net number (number of person).

SHEET: "Table 4_Finance"

Table 4: Financial Record (Budget for Rice Extension Activities)						Adansi Asokwa										2020			
Budget for RICE EXTENSION ACTIVITIES						Financial transfers by MMDA for RICE EXTENSION ACTIVITIES (*Type: "20/5/3" showing "3-May-2020")													
Items	Budget Submitted (GHc, Whole DAD)	Budget Approved (GHc, Whole DAD)	Budget Approved (GHc, Rice Extension)	Releases (GHc, Rice Extension)	Expenditure (GHc, Rice Extension)	Received Date by Assembly Account (day-month-year)				Received Date by DAD Account (day-month-year)				Duration (days)				Remarks	
	2020	2020	2020	2020	2020	1st Release	2nd Release	3rd Release	4th Release	1st Release	2nd Release	3rd Release	4th Release	1st Release	2nd Release	3rd Release	4th Release		
GOG		1,000	700	400		3-Feb-2020	5-Apr-2020	10-Jul-2020	10-Oct-2020	25-Feb-2020	5-May-2020	10-Aug-2020	5-Nov-2020	22	30	31	26		
DACF														0	0	0	0		
IGF														0	0	0	0		
ABFA														0	0	0	0		
PFJ														0	0	0	0		
MAG														0	0	0	0		
Other donors		10,000	900	800		3-Mar-2020	5-May-2020			15-Mar-2020	10-May-2020			12	5	0	0		
Input dealer														0	0	0	0		
Other														0	0	0	0		
														0	0	0	0		
														0	0	0	0		
														0	0	0	0		
														0	0	0	0		

No need to input. Automatically processed.

Note: In case of in-kind contribution by input dealers and farmers and Planting for Food and Jobs (PFJ), calculate the amount in GHc. Financial transfers should be written as follows. Type 'yyyy/mm/dd' or 'yy/mm/dd' such as '2020/5/3' or '20/5/3'. It will show '3-May-2020'. '0' if no amount is budgeted/approved/released/expended as shown in the example above (GOG, DACF and Other (PFJ)).

**M&E Tool for
District Rice Extension Plan**

July 2020