
FOOD RESEARCH INSTITUTE



RICE SECTOR SUPPORT PROJECT

TECHNICAL ASSESSMENT OF RICE PRODUCTION AND POST HARVEST PRACTICES

*REPORT ON BASELINE SURVEY AND NEEDS ASSESSMENT OF
FARMERS AND PROCESSORS IN THE NORTHERN REGION OF GHANA*

Gayin¹ J, E Baïdoo¹, W Quaye¹ and MF Peget¹

¹-Food Research Institute

DECEMBER, 2011

Table of Contents

1. INTRODUCTION	3
1.1 Background	3
1.2 Survey Objectives	4
1.3 Methodology	5
2. SURVEY FINDINGS	6
2.1 Farmer Level Findings	6
2.1.1 Profile	6
2.1.2 Other crops cultivated by rice farmers interviewed	8
2.1.3 Rice varieties cultivated	8
2.1.4. Planting	9
2.1.5 Methods of Pest control on rice farms	10
2.1.6 Harvesting	10
2.1.7 Methods of threshing	11
2.1.8 Source of financing and Supporting Agencies/Organisations	11
2.1.9 Problems/Constraints in Rice Farming	12
2.2. Processor Level Findings	13
2.2.1 Processing Capacity	14
2.2.2 Parboiling	15
2.2.3 Constraints in Parboiling	18
2.2.4 Marketing	19
2.2.5 Identification of intervention points and training needs for processors	21
2.3 Miller Level Findings	23
2.3.1 Profile of Respondents	23
2.3.2 The milling process	24
2.3.3 Sources of paddy & Milling charges	25
2.3.4 Cooperative Societies / Associations, Technical & Financial support	25
2.3.5 Challenges	26
3. CONCLUSIONS AND RECOMMENDATIONS	27

1. INTRODUCTION

1.1 BACKGROUND

Rice Sector Support Project (RSSP) is part of the bilateral co-operation between the Government of Ghana (Ministry of Food Agriculture) and Agence Française de Développement. It is a follow up of the Lowland Rice Development Project (LRDP) which was executed from February 1999 to December 2003 with the specific purpose of establishing lowland rice production and processing methods which are economically viable and sufficiently attractive for Farmers and the Women Processors responsible for processing and commercializing this production in the Northern Region of Ghana.

The overall goal of RSSP is to strengthen stakeholders of the rice sector with the view of contributing to reduce poverty in the northern part of Ghana and ultimately improve upon national food security. In furtherance of this goal the RSSP purposes to increase rice productivity (and production) and household incomes in northern Ghana through the adoption of appropriate technologies by low-income and/or resource poor farm households, rice processors, marketers and communities in targeted areas of northern Ghana. The project is being implemented in four regions namely; Upper-East, Upper-West, Northern and Volta with the under listed outcomes and expected outputs.

Outcomes:

- Strengthened rice value chain in the Northern, Upper East, Upper West and Volta regions
- Strengthened national rice sector organization
- Developed research activities on cropping systems adaptable to the natural conditions of northern Ghana
- Improved rice processing techniques aimed at increasing the acceptability, marketing and consumption of local (Ghana grown) rice

Project outputs:

- Increased access to rural credit from banks and other financial institutions
- Enhanced adaptive research responsive to productive and environmental needs
- Improved project management and coordination, support to MoFA structures and Coordination Unit
- Strengthened External technical assistance

The Directorate of Crop Services (Ministry of Food and Agriculture) and CSIR-Food Research Institute have agreed to work in partnership on the improvement of rice parboiling and milling in the project implementation areas in order to improve the quality of the processes throughout the transformation chain and to produce local rice able to compete with imported rice on the national market. This is to be done through training, extension activities

and also research into continuously improving the post-production handling of rice and consumer demands in order to satisfy the various market segments.

To this end, CSIR-FRI is to conduct baseline surveys in all the three northern regions of Ghana (Northern Upper East and Upper West Regions) and the northern part of the Volta Region in order to establish benchmarks for monitoring purposes and to assess needs of the rice value chain actors that need intervention to bring about enhanced productivity in the industry. This report presents the baseline survey findings in the Northern Region.

1.2 SURVEY OBJECTIVES

A baseline survey is relevant in measuring impacts and gauging progress of implementation activities while the needs assessment aspects establish the urgent requirement for improved post harvest practices and processing activities. Information gathered from this survey also helps to gain a better understanding of the project areas for fine-tuning planned interventions. Key output from this survey is that needs of rice value-chain actors to consistently produce high quality rice are established and recommended. Specific information related to the objectives and indicators of the project document are as follows:

At Farmer Level

- To investigate the current rice production practices in selected project areas
- To investigate the current rice harvesting and post harvest practices in selected project areas
- To investigate social interactions among rice farmers in relation to associations, financial support and technical assistance
- To assess constraints and needs of rice farmers in the selected project areas

At Processors Level

- To investigate the current rice processing practices in selected project areas
- To investigate social interactions among rice processors in relation to associations, financial support and technical assistance
- To assess constraints, challenges, opportunities and needs of rice processors in the selected project areas

At Millers Level

- To investigate the current milling practices in selected project areas
- To investigate social interactions among rice millers in relation to associations, financial support and technical assistance
- To assess constraints, challenges and needs of rice millers in the selected project areas

1.3 METHODOLOGY

The survey employed a combination of one-on-one interviews, participant observation and focus group discussions. As indicated in the methodological framework below, a comprehensive review of previous interventions by FRI was done. Secondly, primary information on the production, harvesting, post harvest practices and marketing were collected using the survey instruments. Data collection took place in November 2011. In the Northern Region, a total of 29 farmers, 35 processors and 3 millers were interviewed. Quantitative data was analysed using Statistical Package for Social Scientists (SPSS), version 16.0 and Excel package.



Fig. 1. Interview process in Jana

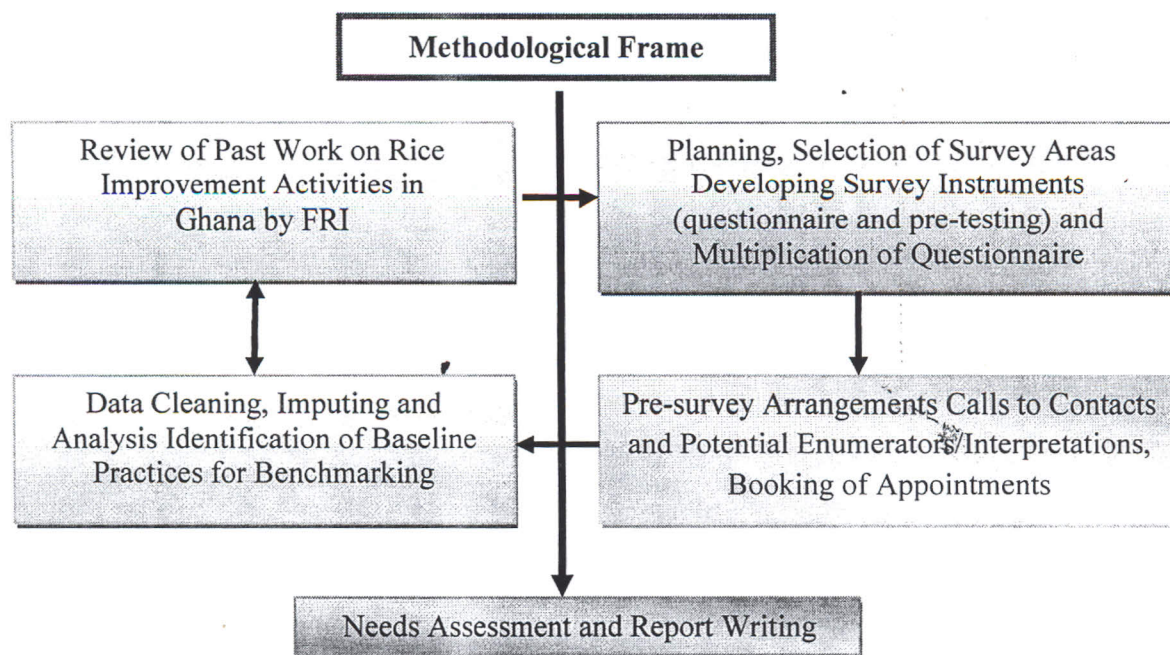


Figure 2: Methodological framework

Sampling

The table below shows the surveyed areas and the communities. A sampling frame consisting of members in the various farmer and processor groups was obtained from RSSP contacts in the districts. Random sampling was then used to select the respondents.

Table 1: Surveyed areas and the number of respondents

Surveyed Areas Location/District	Farmers		Processors		Millers	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Makango/Gonja East	9	31.1	10	28.6	2	50.0
Zugu-						
Dabogin/Tolon	5	17.2	6	17.1	-	-
Kumbugu						
Balshei/Savelegu						
Nanton	4	13.8	5	14.3	-	-
Manguli/Savelegu						
Nanton	-	-	4	11.4	-	-
Jana/Savelegu						
Nanton	-	-	4	11.4	-	-
Pion/Yendi	11	37.9	6	17.1	-	-
Tamale	-	-	-	-	2	50.0
Total	29	100.0	35	100.0	4	100.0

2. SURVEY FINDINGS

2.1 FARMER LEVEL FINDINGS

2.1.1 Profile of Respondents

Majority of the farmers interviewed were between 20-60 years of age and economically active. A third of the total respondents were females. Approximately, 90% of the respondents were married; about 64% had no formal education. Approximately, 22% and 56% of the overall sample had less than 5 years and between 5-10 years experience in rice farming respectively. Rice farm sizes were between 1 and 2 acres. Table 2 shows the socio-economic background of farmers interviewed.

Table 2. Biodata of Farmers in the 4 communities visited

Characteristics	Percentage Response				
	Makango	Zugu-Dabogin	Balshei	Pion	Across all communities
Age					
21-30	33.3	25.0	-	18.2	21.4
31-40	-	25.0	75.0	9.1	17.9
41-50	44.4	-	25.0	27.3	28.6
51-60	22.2	25.0	-	27.3	21.4
61-70	-	25.0	-	9.1	7.1
>70	-	-	-	9.1	3.6
Sex					
Male	22.2	100.0	100.0	81.8	67.9
Female	77.8	-	-	18.2	32.1
Marital status					
Married	100.0	100.0	100.0	72.7	89.3
Single	-	-	-	9.1	3.6
Divorced	-	-	-	18.2	7.1
Educational Background					
No Education	66.7	75.0	50.0	63.6	64.3
Basic level	22.2	-	25.0	36.4	25.0
Secondary and High school	11.1	25.0	25.0	-	10.7
Experience in Rice Farming					
<5years	44.4	-	-	20.0	22.2
5.-10years	33.3	75.0	50.0	70.0	55.6
10.1-15years	11.1	-	25.0	-	7.4
15.1-20years	11.1	25.0	25.0	10.0	14.8

Source: Field Data Survey, November, 2011

2.1.2 Other crops cultivated by rice farmers interviewed

In addition to rice, some other crops were cultivated by respondents. These included yam (reported by 50% of sample interviewed), cassava (34%), soybeans (17%) and cereals such as millet (7%), maize (85%) and sorghum (14%). Few respondents also cultivated groundnuts (3%) and vegetables (3%) as well. Figure 3 shows the relative importance of selected crops cultivated in terms of sale for cash and household consumption.

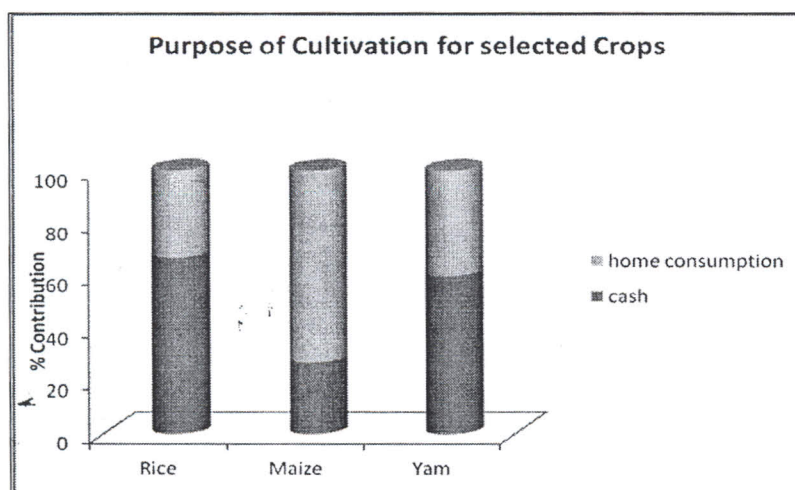


Fig. 3. Purpose of cultivation

2.1.3 Rice varieties cultivated

Varieties grown depended on availability, accessibility and level of introduction of improved varieties by RSSP/MoFA. For RSSP farms, *Jasmine* was mainly grown. However, a combination of other varieties was grown on other farms including *Mandi*, *GR-18* and *Tox*. Some local varieties were also grown largely due to their capacity to withstand harsh conditions. Figure 4 shows varieties reported by farmers interviewed. According to the farmers, *Jasmine* is high yielding and early maturing.

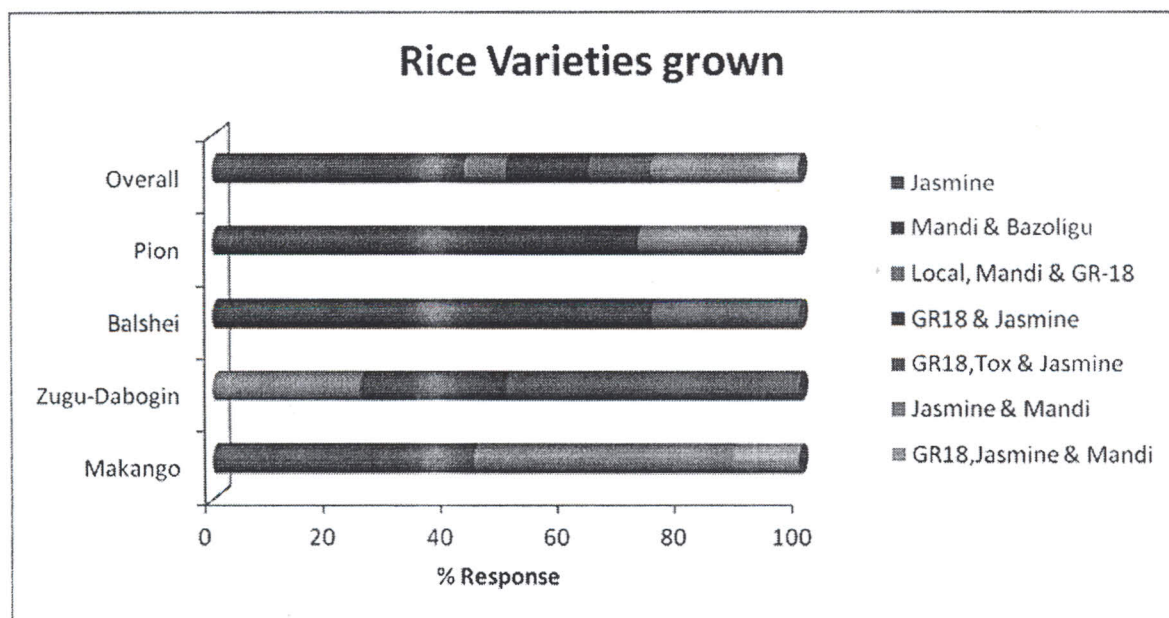


Figure 4. Rice varieties cultivated in communities surveyed

2.1.4. Planting time and Sources of Seeds

Local varieties are planted between March and May while improved varieties are planted between June and July depending on the rainfall pattern. There were differences in planting times with respect to varieties (local versus improved).

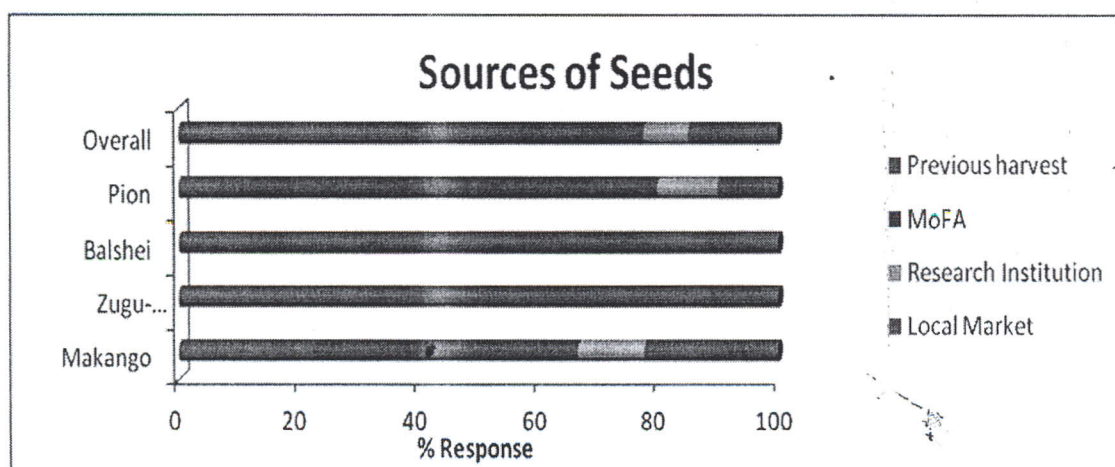


Figure 5. Sources of seeds for planting

The local rice varieties are late-maturing and therefore cultivated early enough to be able to take advantage of the dry season for post-harvest practices. On the average farmers weed or applied weedicides on their rice farms twice before harvesting. In some cases hand picking was done instead of weeding a second time. Seeds were either obtained from MoFA, previous harvest or local market as seen in Figure 5.

2.1.5 Methods of Pest control on rice farms

About 38% of the farmers interviewed reported that no pest control measure was practiced on their rice farms. Approximately 28% physically drove pests away, 17% used pesticides while 14% employed the use of scare crows. The rest reported that pest infestations were usually reported to MoFA for the necessary actions to be taken. Location specific pest control measures were as follows:

- Makango - *Nothing is done (33%), scare crows (11%), scaring pests away (45%) and use of pesticides (11%)*
- Zugu-Dabogin - *Nothing is done (20%), scare crows (20%) and use of pesticides (60%)*
- Balshei - *Nothing is done (75%) and scare crows (25%)*
- Pion - *Nothing is done (36.5%), report to MoFA (9%), scare crows (9%), scaring pests away (36.5%) and use of pesticides (9%)*

2.1.6 Harvesting

The optimum harvesting time after sowing ranged between 90 and 180 days (average of 140 days) depending on the maturation of a particular variety. Signs of maturity of a rice field given by farmers included changes in grains, leaves and stalk colour and lodging. Yellowish-brown colouration of grains was the most commonly reported sign in all the surveyed areas. The optimum condition for harvesting is a sunny weather and when the soil condition is dry. Harvesting was done manually in the surveyed areas. This involves the use of sickle and knife. Length of time of harvest is reported to have effect on rice quality and percentage losses during harvesting. Pooled labour was supposed to be used for harvesting RSSP farms, which could take a maximum of 2 days per acre. However, an average of 7 man days for harvesting an acre of rice farm was reported for other farms.

Nearly 75% of respondents reported of incidence of lodging during harvesting. There were reported occurrence of shattering at harvest; Makango (100%), Zugu-Dabogin (25%), Balshei (100%) and Pion (75%). Causes of shattering include delays in harvesting, over drying of paddy on farm, too much sunny conditions and pests attack. Harvested rice was mostly sun-dried directly on the ground before threshing; Makango (100%), Zugu-Dabogin (100%), Balshei (100%) and Pion (73%). Only a few farmers in Pion reported drying harvested rice

on cemented floors/surfaces or on mats. According to farmers drying before threshing reduces moisture content and improves ease of threshing as well as the final quality of milled rice.

2.1.7 Methods of threshing

Threshing of harvested paddy was done by beating panicles with sticks or running over with tractor especially in large quantities. Drying of paddy after threshing was not a common practice in the surveyed areas. Drying of paddy after threshing was said to reduce moisture and improve quality of milled rice. Location-specific threshing methods were as follows:

- Makango – *Beating with sticks on the ground (88.9%) and beating with sticks on tarpaulin (11.1%)*
- Zugu-Dabogin - *Beating with sticks on the ground (60%), beating with sticks on tarpaulin (20%) and beating with sticks & use of tractor (20%)*
- Balshei - *Beating with sticks on the ground (75%) and beating with sticks on tarpaulin (25%)*
- Pion - *Beating with sticks on the ground (72.7%), beating with sticks & use of tractor (18.2%) and use of tractor only (9.1%)*

Problems associated with manual threshing were as follows:

- Loss of grains and development of cracks and breakages of grains
- Drudgery and time consuming
- Adulteration of paddy with stones and foreign materials
- Inadequate means of transporting threshed paddy home (currently using bicycles, head load, bullocks, tractors and trucks)

2.1.8 Source of financing and Supporting Agencies/Organisations

In addition to the support received from RSSP, about 61% of the total sample interviewed used their own resources or finance for rice farming. The rest used resources from friends and family relations. Location-specific sources of funding for rice farming were as follows:

- Makango- *Personal Income (56%) and Credit from RSSP and personal resources (44%)*
- Zugu-Dabogin- *Personal Resources (100%)*
- Balshei- *Personal Resources (100%)*

- Pion – *Personal Resources (36%), Family and Friends (46%) and Credit from RSSP and personal resources (18%)*

2.1.9 Problems/Constraints in Rice Farming

Cross cutting constraints and challenges in rice farming enumerated by respondents are listed below:

- Unreliable rainfall patterns
- Late delivery of inputs
- Inadequate rains (adversely affected farmers in Makango)
- Lack of financing
- Lack of appropriate harvesting equipment and tarpaulins
- Lack of training in improved agronomic practices and post harvest practices
- Inadequate capacity in land preparation, ploughing and weed control
- Pest attack on stored milled rice
- Lack of milling facility in some communities

Location-specific constraints and challenges in decreasing order of importance were as follows:

- Makango- Inadequate rainfall & irregular rainfall pattern, late delivery of inputs, lack of finance, inaccessibility to fertilizer and problems with Fulani herds men (cattle eating rice)
- Zugu-Dabogin- Lack of finance, Inadequate rainfall & irregular rainfall pattern, inadequate tractor services and late delivery of inputs
- Balshei- Termite attack and lack of tractor services
- Pion – Lack of tractor services, lack of finance, inadequate supply of labour, pest attack and late delivery of inputs

Overview of Farmer Level Needs Across surveyed communities

<u>Specific Level/Need</u>	<u>Current Practice</u>	<u>Recommendations/Quality Requirements</u>
<p>Input Supply</p> <p>(Seeds, fertilizer and Weedicides/pesticides)</p>	<ul style="list-style-type: none"> • Late delivery of inputs • Use of improved seeds from MoFA/RSSP • Use of more than one variety on other farms 	<ul style="list-style-type: none"> -Timely supply of inputs -Farmer access to improved seeds, fertilizer and plant protection products. -Sensitization of farmers on admixtures of seeds and its implications on rice quality
<p>Agronomic Practices</p> <p>Land preparation Time of planting Fertilizer application Weed control Pest control</p>	<p>Planting in April -May for local varieties, June-July for improved.</p> <p>Weed control with weedicide, weeding and hand picking.</p> <p>Pest control by scare crows, Physically driving birds away and use of pesticides</p>	<p>Proper land preparation</p> <p>Timely planting</p> <p>Training on GAPs</p> <p>Timely harvesting</p> <p>Sensitization of farmers on fire prevention (fire belts around farms)</p>
<p>Harvesting and Post Harvest</p> <p>Harvesting and Threshing Conditions Time of harvesting and threshing methods Storage methods</p>	<p>Moderate sunny weather as optimum condition</p> <p>Use of sickles, cutlasses and knives for harvesting</p> <p>Drying on fields before threshing</p> <p>Storage in rooms and barns</p>	<ul style="list-style-type: none"> • Introduction of mechanization (Combine harvesters, threshers, winnowers, e.t.c) • Training in best harvesting and threshing practices • Use of tarpaulins for threshing and drying to reduce losses and prevent introduction of stones, foreign matter • Training in proper storage methods

2.2. PROCESSOR LEVEL FINDINGS

Three categories of processors were identified in the surveyed areas. These included existing village level processors, new village level processors (largely identified in Pion) and urban level processors (predominantly located in Tamale). It was observed that new processor groups had been formed by Grameen under the RSSP. However some members of the newly formed processor groups had no experience in rice parboiling. This survey did not cover the existing processors in the Tamale metropolis. However, information on the existing capacity of all processors groups in Grameen Ghana's operational areas was obtained. According to the report received from Grameen Ghana, all the restructured

processors groups in Tamale (Nyabu bi yoono 1, Nyabu bi yoono 2 and Nyabu bi yoono 3 all in Nyohini community) have certificates from the Department of Cooperatives, accounting journals and bank accounts with various banks in Tamale including Agricultural Development Bank. These groups may have received training under the Lowland Rice Development Project. Table 3 shows the biota of respondents.

Table 3: Socio economic profile of Processors in the communities visited

Characteristics	Percentage Response (%)						
	Makango	Zugu-Dabogin	Balshei	Manguli	Jana	Pion	Overall
Age							
21-30	10	25	0	25	0	16.7	12.1
31-40	30	0	0	0	75	33.3	24.2
41-50	30	50	0	0	0	16.7	18.2
51-60	30	25	80	50	25	33.3	39.4
61-70	-	0	20	25	0	0	6.1
Sex							
Male	-	-	-	-	-	-	-
Female	100	100	100	100	100	100	100
Marital status							
Married	100	100	80	100	100	100	97.1
Widowed	-	-	20	-	-	-	2.9
Educational Background							
No Education	100	100	100	100	100	100	100

Source: Field Data Survey, November 2011

2.2.1 Processing Capacity

Processing capacities by the respondents in the communities surveyed were relatively high (especially in Jana, Manguli, Balshei and Makango) as compared to those interviewed in the Upper West Region. An average processing capacity of 7 bags (85-kg bag) per week was recorded. As shown in Figure 6, majority processed more than 5 bags per week. However, processing levels largely depended on availability of paddy. Traditional method of processing was used at the village level processing and no improved vessels were being used.

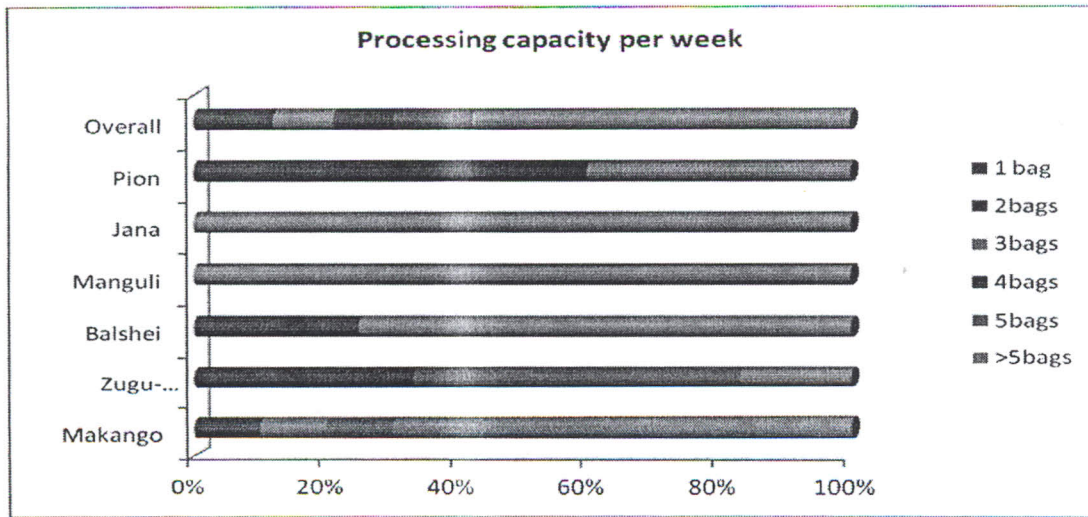


Figure 6. Processing capacity of Respondents

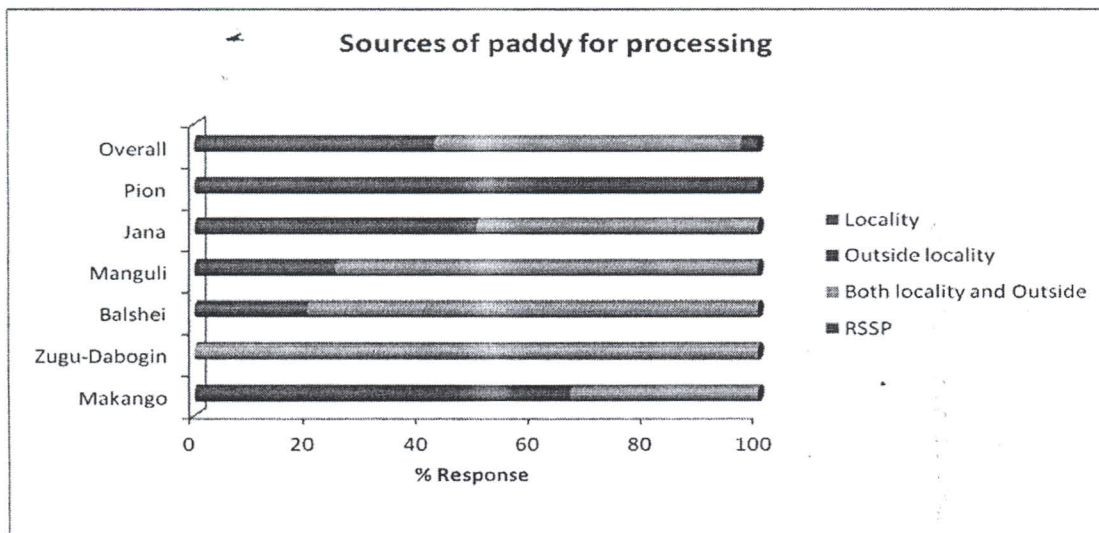


Figure 7. Sources of paddy for processing

2.2.2 Parboiling

Varietal Preference

About 70% of the processors interviewed in the northern region did not have any preference for any variety of rice for processing. The usual practice among processors is to buy paddy rice in small quantities from different sources and mix them before processing. 100%, 80% and 80% of respondents in Makongo, Jana, and Pion respectively did not have any particular

preference for any variety while 80% and 30% of respondents in Balshei and Manguli respectively preferred local white variety. Of the six communities it was only Manguli where 40% of respondents preferred improved varieties. Some processors were of the view that mixing of varieties before processing did not have any effect on processing but a close observation showed that grain colour and size was not uniform in some of the milled rice and appearance was not very attractive. This might be due to varietal admixture.

Cleaning

All respondents reported that cleaning of the paddy before parboiling is done. This unit operation involves winnowing, removal of straw as well as washing paddy with water to remove immature and unfilled grains which tend to float and removal of stones which settle down the washing trough by gravity.

Source of Water for processing

All the respondents from the various communities use well water for rice processing but in two communities namely Manguli and Makongo 50% and 40% respectively use stream/river sources. 30% of respondents indicated that water supply is fairly reliable while 40% reported that it was not reliable.

Soaking of Paddy

From the results of the survey in the northern region, various methods are applied in the soaking of paddy. 40% of all respondents used warm water to soak the rice overnight, 30% soaked paddy rice with cold water overnight while others soaked paddy in cold water for less than an hour and thereafter in hot water for 30 minutes.

Some processors indicated that the soaking regime is sometimes varied depending on how dry the paddy is. Most processors cover the soaked paddy with plastic materials to prevent other foreign material falling into it and almost certainly to retain heat as shown in Figure 8 below.



Figure 8. Traditional soaking process

Starting Temperature and Soaking Duration

Approximately 60% of processors interviewed in the northern region used cold water at room temperature to start the parboiling process while the other 40% add the soaked paddy to warm water in the soaking process. It was observed that the time required for hot soaking depended on the amount of paddy processed per batch and the intensity of the fire being used. However the length of time to reach the required temperature was estimated by 70% of all respondents to be about 50 minutes.

Draining

Two methods of draining excess water after soaking were identified in this survey. 60% of respondents drain excess water by using a perforated bowl (improvised sieve) to scoop paddy while 20% drain by pouring the mass into a basket to separate the excess water from the soaked paddy.

Type of stove used

All the processors interviewed used the traditional wood stove for parboiling as shown in Figure 9 below. In general the fuel used is firewood which is a cheap source of energy and easily available.

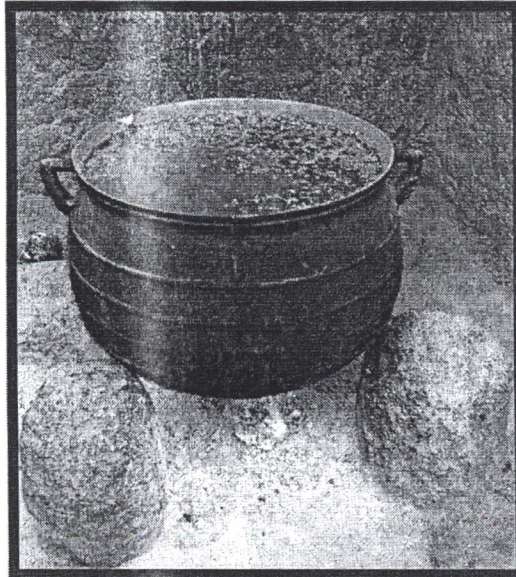


Figure 9. Traditional wood stove used in parboiling

Drying

There were four basic drying practices identified in the survey. These were sun drying directly on the ground (15% of respondents), sun drying on cemented floors (75% of respondents), drying in the shade (5% of respondents) and on tarpaulins laid on bare ground (10%). None of the respondents had drying patios, as the cemented floors were actually terraces, some of which had developed cracks and therefore not generally very suitable for drying.

Duration of drying

The results of the survey indicated that the time to dry parboiled rice was generally between two and eight hours. The responses varied because of the different methods of parboiling in the surveyed communities. However, nearly 80% of all respondents reported that drying usually lasted two to six hours. Most processors were not able to tell the number of times paddy is turned during drying as it depended on the intensity of the sunshine.

2.2.3 Constraints in Parboiling

The processors interviewed in this survey reported an array of constraints and challenges in parboiling. Some of the major challenges and vital needs as indicated by the processors are lack of mills (80% of all respondents), high cost of transportation (50% of all respondents)

inadequate credit to finance operations (50% of all respondents), lack of improved vessels (40% of all respondents) and lack of water holding containers (40% of all respondents). All the processors in Savelugu-Nanton District namely Balshei, Jana and Manguli have no mills in the communities and complained of high transportation costs when parboiled rice is sent to Tamale for milling and sale.

Other challenges were lack of market (30% of all respondents), lack of tarpaulins (20% of all respondents), lack of drying patios (20% of all respondents), inadequate supply of paddy for processing (10% of all respondents) and poor access to water for processing (10% of all respondents). Only 6% and 2% of all respondents complained about lack of improved stoves and the drudgery involved in processing respectively.

2.2.4 Marketing

Marketing

Parboiled rice in all the communities surveyed is custom-milled and sold immediately at the milling sites (mostly outside the processors' localities), markets outside localities or the local/community markets. Majority of the processors preferred selling immediately after milling to individual traders either for cash or on credit basis when there was excess supply. Majority (65%) of the processors interviewed sold outside their communities as shown in Figure 11. Some processors (26%) sold at the mills and did not want to bother themselves with marketing expenses although there were no barriers to market entry. Local rice was considered fairly acceptable in the market and highly patronized by "waakye" (cooked rice and beans) sellers. Selling price in the peak season ranged between GHS1.5 and GHS3 with an average of GHS 2.2 per bowl (2.8kg). Selling price in the lean season ranged between GHS1.8 and GHS4.0 with an average of GHS 3.4.

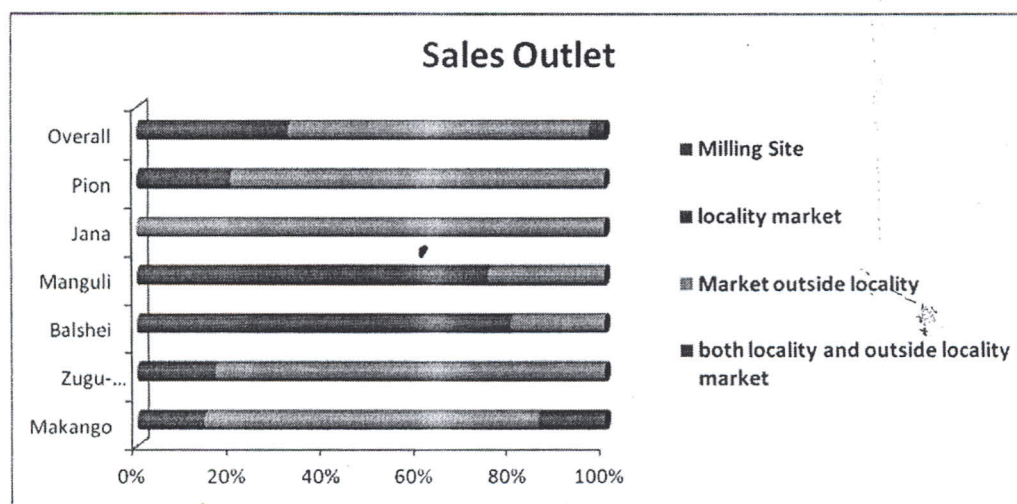


Figure 10. Sales outlets used by processors in surveyed areas

Location Specific Sales Outlets were as follows:

- **Makango-** *Yeiji, Ejura & Makango markets*
- **Zugu-Dabogin** - *Savelegu and Kumbugu markets*
- **Balshei-** *Milling site in Tamale and Tamale Aboabo market*
- **Manguli-** *Milling site in Tamale and Tamale Aboabo market*
- **Jana-** *Milling site in Tamale and Tamale Aboabo market*
- **Pion** - *Pion and Yendi*

Distribution channels for milled rice observed in the communities surveyed included the following:

- Direct sales to final consumers or food vendors
- Sales to itinerant traders in the same localities
- Sales to itinerant traders coming from other localities for bulk purchases. Usually package milled rice in polypropylene sacks and truckload to urban markets in the south of Ghana.
- Agents who buy rice at the mills on behalf of other traders (none of the respondents used this channel)

Storage of milled rice was rarely done by processors. This observation was also made in previous projects implemented by FRI. Almost all the respondents sold parboiled rice by themselves (Not through agents). Cleaning of rice after milling was done by winnowing and hand picking of stones, black heads and other foreign materials. However, extensive cleaning of milled rice was not a common practice. There was no special packaging in the communities surveyed. Milled rice was packaged in jute sacks and polythene sacks for onward transportation to market centers. In the open market, rice was presented in open basins.

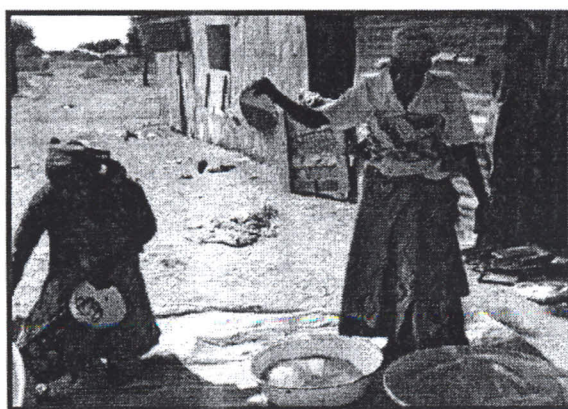


Figure. 11. Winnowing after milling

Table 4. Costing for processing 85kg-bag paddy (Done by the processors)

Item	1 st Costing (GHS)	2 nd Costing (GHS)	3 rd Costing (GHS)	Average
Paddy	45.0	50.0	50.0	48.3
Water	0.0	4.0	4.0	2.7
Labour	0.0	5.0	5.0	3.3
Fuel	4.0	5.0	5.0	4.7
Milling	1.5	2.0	2.0	1.8
Transport	2.5	2.0	2.0	2.2
Total Cost	53.0	68.0	68.0	63.0
Selling Price/bowl	2.5	3.0	3.0	2.8
Quantity of Rice (bowls)	23.0	23.0	23.0	23.0
Revenue	57.5	69.0	69.0	65.2
Gross Margin	4.5	1.0	1.0	2.2

2.2.5 Identification of intervention points and training needs for processors

Training needs of the processors interviewed were assessed based on interactions with them and reflections on observed processing practices to establish the knowledge and technology gaps. Critical quality control points in rice processing were also identified. These include thorough cleaning of paddy before processing, soaking, steaming, drying, milling and packaging. Below is a summary of steps involved in the traditional parboiling of rice. Details of critical quality control points and proposed interventions are presented in Table 5.

Steps involved in traditional parboiling

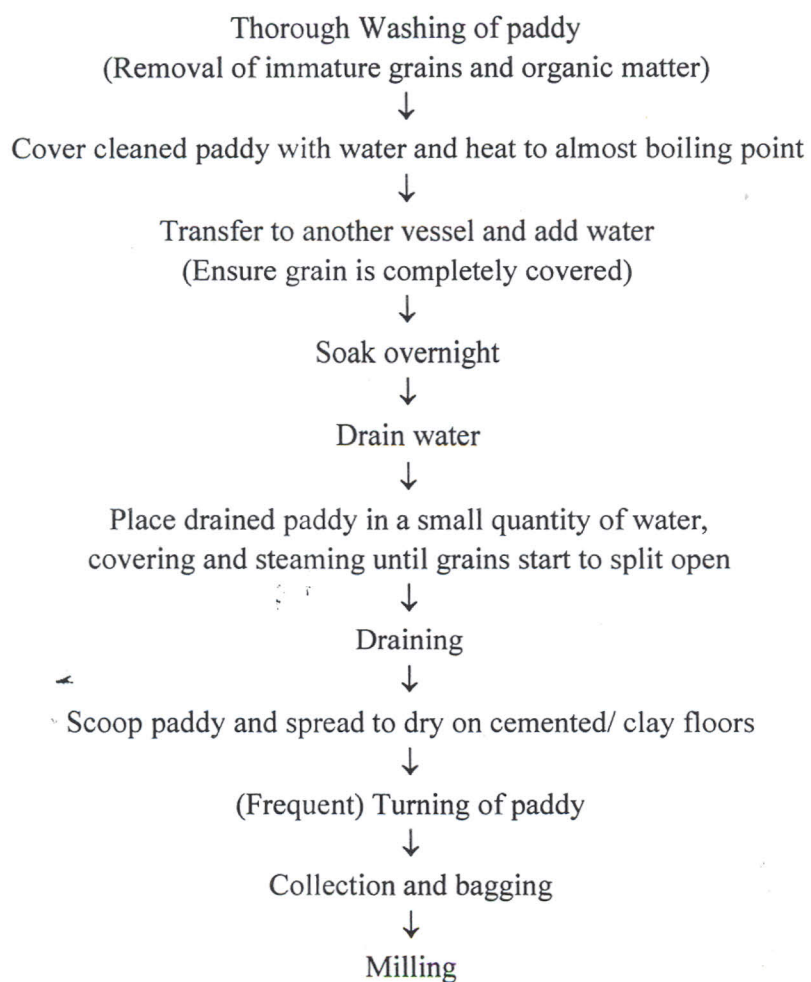


Table 5. Identification of intervention points and training needs for processors

Critical Quality Control Point	Training and Equipment Needs
Cleaning and Washing (Removal of stones, sand, foreign materials, immature grains)	Capacity building of processors / training, access to clean water sources
Soaking	Capacity building of processors on optimum conditions
Steaming	Capacity building of processors and provision of parboiling vessels
Drying	Capacity building, provision of drying patios, tarpaulins, wooden rakes for turning paddy
Storage	Capacity building of processors on storage practices
Milling	Capacity building of millers in standard milling operations and preventive maintenance and rehabilitation of existing mills. There were no mills in some communities (<i>Jana, Pion, Zugu-Dabogin, Balshei and Manguli</i>)
Packaging	Capacity building in packaging for urban level processors

Other Needs of processors

- Hand holding and linkages to more lucrative markets down south for urban level processors
- Business development services for urban level processors
- Access to credit facilities for all processors for purchase of raw materials, equipment and business expansion

2.3 MILLER LEVEL FINDINGS

2.3.1 Profile of Respondents

Mills visited were located at Nyankpala, Kanule and Makango in the Tolon Kumbungu, Tamale and East Gonja districts respectively (see table 6). With the exception of SARI Rice Processing Center which was government owned, all the mills visited were privately owned. The ages of the respondents ranged between 38 and 50 years and were married. The manager at the SARI rice processing centre was a university degree holder. The other mills were managed by men with either no formal education or just basic education and had no special skills in agriculture. Staff capacity was low as half of the respondents had no employees but

used family labour while the remaining had one assistant each. On the whole, milling assistants were trained on the job.

Table 6 Characteristics of Mills

Location	Year of installation	Shareholders	Country of Origin	Capacity
Makongo	Can't tell	Owner	Ghana	25HP
Makango	Can't tell	Owner	Ghana	25HP
Kanule	1992	Family Members	England	25HP (Could mill about 100 maxi bags per day)
Nyankpala	2007	Government	Japan	200 maxi bags per day. About 25,000 bags of paddy milled between January and July 2011
Nyankpala	2009	Government	China	200 maxi bags per day

2.3.2 The milling process

Parboiled paddy was assumed to be cleaned and therefore no further cleaning was done before milling. The technician from SARI reiterated that the paddy was not cleaned before milling because there was a destoner attached to the mill which removed stones, dust particles, rice stalks and other foreign materials. The staff at the SARI rice processing centre indicated that moisture content was checked first to ascertain whether paddy should be milled straight or parboiled.

Primarily, paddy was custom-milled. On the average, current operating capacity at the SARI processing centre was approximately estimated at 200 maxi bags of rice paddy per day. Mills in Makango were very old and highly underutilized due to irregular supply of paddy. Milling capacity of approximately 10 maxi bags per week was reported. Processors in Makango complained about poor quality of milled products with local mills and rather preferred patronizing mills in Yeiji, where sale of product could be done.

Recovery rate was approximately 0.65 (20 bowls (2.8kg/bowl) of milled rice obtained from 85kg of paddy).

2.3.3 Sources of paddy & Milling charges

Sources of paddy for the centre were from Nyankpala, Tamale and surrounding villages and supply was fairly reliable. Sources of paddy for other mills were from the same localities and the surrounding communities.

Milling charge ranged between GH¢ 2 and GH¢ 4 per maxi bag of paddy depending on the areas and season. Electricity was the main power source and milling is all year round but capacities largely depended on the availability of paddy; November to January being the peak milling season. The SARI rice processing centre charged GH ¢ 2.50 per maxi bag of paddy. Milling was done all year round but not at full capacity.

Grading

Except for SARI rice processing centre, there was no grading of rice after milling. Rice was graded upon request by the clients at the SARI rice processing centre.

By-products

Some of the respondents indicated that the rice bran was used for animal feed, especially pig feed. The rice husk was either disposed off or used for fuel to generate energy.

2.3.4 Cooperative Societies / Associations, Technical & Financial support

Cooperative Societies / Associations

Half of the respondents have been members of the Tamale Corn Millers Association for about ten years while the other half were not members of any association. Those who belonged to an association received some benefits such as price negotiations (bargaining power) and welfare support.

Technical & Financial support

The millers had problems of technical nature such as repair works, unavailability of quality spare parts, etc. The millers are sometimes able to fix the repair works but unavailability of quality spare parts was the major problem confronting them. All the respondents did not receive technical assistance from local or external agencies. The SARI rice processing centre sometimes encountered problems of technical nature, but were fixed by personnel from the SARI mechanical workshop. Primarily, the millers supported their own operations financially.

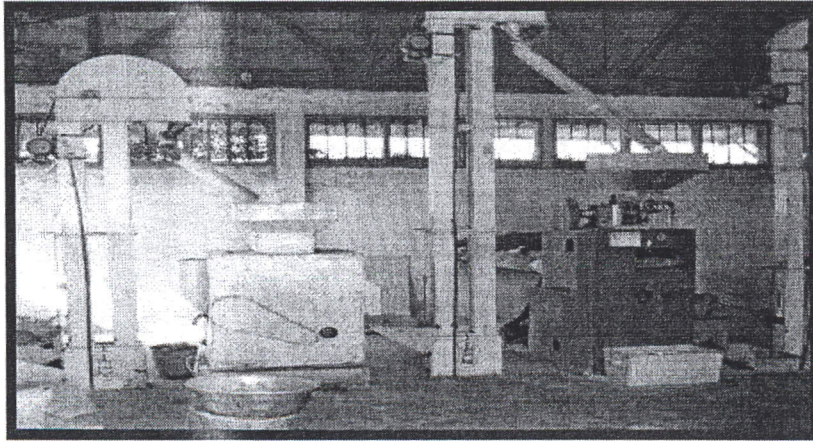


Figure 12. Rice mill, Nyanpkala (SARI Processing Centre)

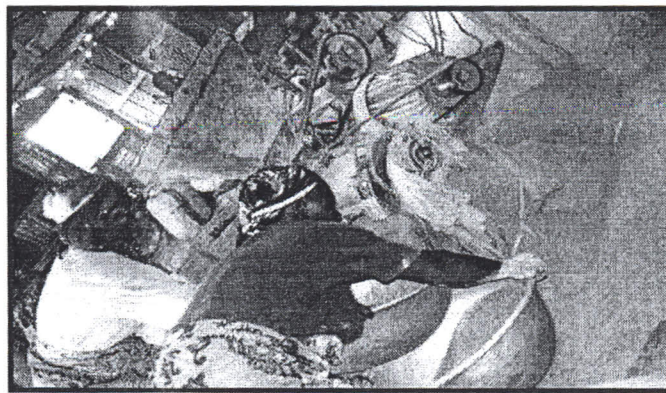


Figure 13 Women at a mill in Tamale

2.3.5 Challenges

Unavailability and high cost of spare parts, power outages and irregular patronage were major challenges faced by millers interviewed. Half of the respondents could not obtain spare parts easily in the Northern Region and had to travel to Kumasi in the Ashanti Region. All the mills have had some major replacement since installation except the mills at the SARI processing center. Some of the spare parts which had been replaced included motors, bearings and sieves.

CONCLUSIONS AND RECOMMENDATIONS

The following are the key farmer- related recommendations:

- Land preparation should be timely and appropriately done
- Farmers should be introduced to mechanization of some major farm operations (Combine harvesters, threshers and winnowers)
- Farmers should be trained in best harvesting and threshing practices
- Farmers should be assisted to acquire tarpaulins for threshing and drying to reduce losses and prevent introduction of stones and foreign materials
- Farmers should be trained in proper storage methods
- Provision of improved seeds, fertilizer and plant protection products should be timely
- Farmers should be sensitized on admixtures of seeds and its implications on rice quality
- Farmers should be sensitized on fire prevention (fire belts around farms)

Key recommendations at the processor level include the following:

- Capacity of processors should be built on improved parboiling technology
- Training in Good Hygienic Practices (GHPs) and Good Manufacturing Practices (GMPs)
- Processors should be assisted to acquire parboiling vessels
- Processors should be assisted to have access to clean water for processing
- Processors should be assisted with drying patios and tarpaulins to facilitate effective drying
- Capacity building of millers in milling operations, safety and preventive maintenance
- Rehabilitation of existing mills in Tamale Municipal
- Provision of new standard mills to some communities if possible
- Capacity building in packaging for urban level processors

The table below shows the baseline of the identified project indicators for impact tracking purposes.

Table 7. A snapshot of benchmark indicators for impact tracking

Indicator	Baseline
Number of technologies transferred	-
Number of processors trained by gender	-
Number of millers trained by gender	-
Increase in processing levels	Estimated monthly processing levels ranging from 340kg – 2380kg paddy per processor
Increase in milling levels	-
Improvement in quality of parboiled rice	-
Additional income generated by processors	Estimated average monthly income per processor of GHS60
Additional income generated by millers	-