

**IMPROVING THE COMPETITIVENESS AND
MARKETABILITY OF LOCALLY-PRODUCED
RICE IN GHANA**

**DEPARTMENT FOR INTERNATIONAL DEVELOPMENT
(DFID)**

CROP POST HARVEST PROGRAMME

PROJECT R6688

2. Rice Production Systems in Ghana

**2.1 - Informal Baseline Survey of Rice Production Systems in
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1. Introduction

Agriculture is the largest sector of the Ghanaian economy contributing about 50% to the Gross Domestic Product and accounting for about 60% of export earnings (Statistical Service, 1994). Over 60% of the population is engaged in agriculture, 85% of whom are small scale farmers producing crops and keeping livestock. A bulk of the national supply of cereals emanates from northern Ghana comprising Northern Region (NR), Upper East Region (UER) and Upper West Region (UWR). While maize, millet and sorghum are cultivated mainly for home consumption, rice, groundnut and cotton are cash crops.

Over a 10-year period (1984-94) area cultivated to rice averaged 86,000 ha, 55% of which was in northern Ghana (PPMED, 1995). This represents about 23% of the total cultivable lowland (Dogbe, 1996). Domestic production has been less than human consumption need. The rate of growth of demand for rice has outstripped supply due to population increase and improved standard of living on the demand side and poor production and marketing arrangements on the supply side. Consequently, government imports up to 200% of local production to compensate for the short fall in supply with the known consequence of draining the country's scarce foreign exchange.

As a component of an over all study aimed at analysing the competitiveness of locally produced rice, this study seeks to document baseline information of rice production systems in northern Ghana. Organised in two stages, this first stage seeks to collect qualitative information through informal interviews as a basis for a formal survey to quantify relevant parameters.

2. Methodology

This study concentrates on rice cultivation under hydromorphic soils in northern Ghana as rice production under irrigation is not very important. Three villages were selected, one each in the three regions; namely Gbirimani in the Tolon-Kumbungu district of the NR, Sing in the Wa district of the UWR and Wiaga in the Builsa district of the UER.

A two-stage sampling technique was employed in selecting each village. Districts in each region were first stratified into rice and non-rice producing ones. From a list of rice producing districts, Tolon-Kumbungu, Builsa and Wa were selected from where Gbirimani, Wiaga and Sing villages subsequently selected.

Secondary information was obtained from published sources at the Ministry of Food and Agriculture (MoFA) and the Savanna Agricultural Research Institute (SARI). Primary data were obtained through key informant, individual and group interviews of farmers in the selected villages in the month of January, 1997 using a checklist (See Appendix 1).

3. Background Information

3.1 Location

As indicated above, the survey was conducted in three villages, one each in the NR, UWR and UER of northern Ghana (Table 1). Gbirimani is located about 45 km south of Tamale, the Northern regional capital. Sing is about 24 km west of Upper West regional capital Wa, while Wiaga is approximately 80 km south of Bolgatanga, the Upper East regional capital (See Map 1).

Table 1: Villages surveyed

Region	District	Contact village	Population density per district (persons/km ²)
Northern	Tolon-Kumbungu	Gbirimani	51 - 100
Upper East	Builsa	Wiaga	31 - 50
Upper West	Wa	Sing	31 - 50

Source: PPMED, 1996

3.2 Population

The Tolon-Kumbungu district with an estimated population density of between 51 - 100 is more densely populated than the other two districts each with 30 - 50 persons Km². UER generally has a high population density of over 150 except in the Builsa district with a relatively low population density. The main ethnic groups in Gbirimani, Sing and Wiaga are Dogombas, Dagartis and Builsas, respectively. There are no stranger settlers except government workers such as teachers and the Ministry of Food and Agriculture staff. Settlements in Gbirimani and Sing are clustered while those in Wiaga are dispersed permitting compound farming. Only bush farms are cultivated in the other two villages.

3.3 Climate

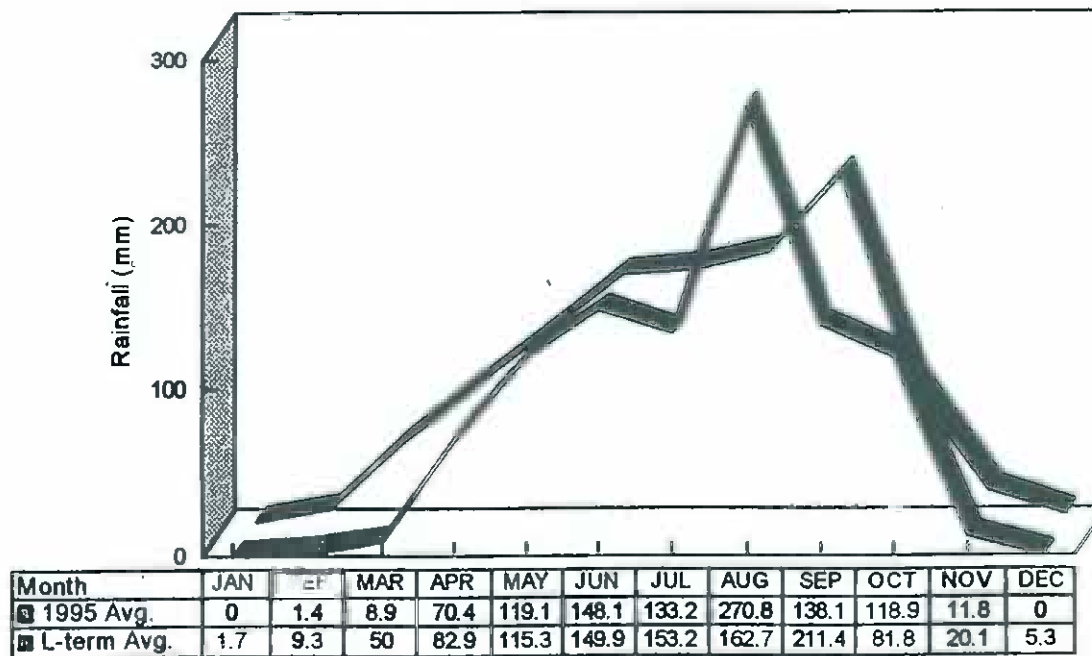
NR and UWR are located in the guinea Savanna zone while the UER in the Sudan Savanna zone. The two zones have a single rainy season from March/April to August/September with a total rainfall of between 750 - 1200 mm. This permits one growing season with growing period of 180 - 200 days in the Guinea Savanna and 150 - 160 days in the Sudan Savanna (Table 2).

Table 2: Climatic data of the Guinea and Sudan Savanna zones of Ghana

Factor	Savanna zone	
	Guinea	Sudan
Mean rainfall (mm)	1,100	1,000
Humid period days	120 - 140	90 - 100
Growing period days	180 - 200	150 - 160
Mean annual relative humidity (%)	46	39
Mean maximum temperature (°C)	33.6	34.5
Mean minimum temperature (°C)	22.3	22.3
Mean annual sunshine duration (%)	62	67

Source: MoFA/FAO

Figure 2: Distribution of rainfall in NR of Ghana, Long-term and 1995 average (mm)



Source: SA RI Agro-Meteorological Unit, 1996

Current rainfall pattern exemplified by the 1995 average compared with a long-term (30-year) average is short, starting in earnest in April, reaching a peak in August and dropping rapidly in November (Figure 2). The long-term average shows a gradual increase to a peak in October before dropping. Vegetation is a mixture of fairly tall grasses and widely spaced fire-resistant trees. The topography shows a gently undulating plain broken by hills or ranges.

3.4 Soils

The major soils of the area are Alfisols and Plinthic Luvisols with their intergrades. The Alfisols with their associated Gleysols and Luvisols constitute the good agricultural soils of this zone. However they have lower potential productivity than the corresponding forest soils (Gerner, et. al., 1995, 1990). They are lower in organic matter attributable to low leaf litter accumulation and partly to high temperatures and annual bush fires.

The groundwater laterites (Plinthic Luvisols) cover more than 50% of the Guinea and Sudan Savanna zones and constitute the poorest soils in Ghana (ibid.). They are very shallow to very gravelly with iron pan and boulders, very low in mineral nutrients and organic matter, and very susceptible to erosion under cultivation. Maize, millet, sorghum, yam, cowpea and groundnuts are grown on well drained, sandy soils (Alfisols), and rice on the heavier alluvial soils (Gleysols) in the flood-plains and valley bottoms.

3.5 Infrastructure development

The villages understudy are linked to other villages within the district by good feeder roads, motorable throughout the year. There are no markets in them but are near to villages with markets. In Gbirimani, farmers market at Tali, about 16 km away, Nyankpala 18 km away or Tamale 34 km away. The three markets operate on alternate days every other sixth day. Wa weekly market serves farmers in. Farmers from Wiaga

travel a distance of 8 km to Sandema to market every other third day. Farmers go by trucks, bicycles or foot to the market centres.

In Wiaga MoFA has offices and accommodation to house its staff. As in the other villages there are schools for children. Sources of drinking water are dams and dug outs. No rice mills were observed in these villages. Nearest mills are 8 km away. Inputs are purchased from the major towns of Tamale, Sandema and Wa from private input dealers contrary to the past when they were distributed by MoFA staff to farmers in their villages

4. Socio-economic environment of farm households

4.1 Household Demographic Features

An average farm family comprises a man, his brother, their elder sons, wives and children and dependants. Family sizes in Wiaga are smaller than those observed in Gbirimani and Sing (Table 3). Few children attend school. Illiteracy rate among farmers is very high and may even be about 100% for household heads.

Table 3: Ranges of family sizes in northern Ghana

Sex	Category	Gbirimani	Sing	Wiaga
Males	Old people (>50 yrs old)	1	1	1
	Adults (16 - 50 yrs old)	2 - 10	2 - 6	1 - 3
	Children (< 16 yrs old)	2 - 10	2 - 12	1 - 4
Females	Old people (>50 yrs old)	1	1	1
	Adults (16 - 50 yrs old)	2 - 5	1 - 8	1 - 3
	Children (< 16 yrs old)	2 - 8	1 - 5	1 - 4
Total		10 - 30	8 - 31	7 - 14

Source: Field survey, 1997

4.2 Sources of Off-farm Income

Farmers in the three villages depend on farming for their livelihood. In Gbirimani and Wiaga off-farm income sources are limited to splitting of wood and tailoring for men and petty trading for women. Unlike the above two village women in Sing have a number of opportunities including soap making, burning of charcoal, selling of firewood, basketry and petty trading. Men are engaged in dry season gardening, and in some cases, out-migrate to southern Ghana in the dry season to provide labour on plantations and returning home when rains begin to fall.

4.3 Credit Facilities

Farmers are limited in their ability to obtain production credit. They thus depend on the sale of agricultural products including livestock to finance their farm operations. In Gbirimani, farmers agreed that occasionally they obtained short-term credit from traders due to their long standing relationship. Such credits do not attract any interest but a token fee is appreciated. Because farmers sometimes have to sell the produce to the creditor at a time and price dictated by him/her (creditor), farmers in Sing have since discontinued such credit arrangements. The discontinuity was also in the interest of the traders because they were sometimes not given the rice to buy. Repayment of loans were also often delayed.

Some farmers in Sing are benefiting from the Low Risk Rice Project (LRRP), a World Bank sponsored project. Essentially the project finances bunding of rice fields and provides inputs on credit to be repaid after harvest. Bunding under LRRP incidentally is the only form of water management practice undertaken by rice farmers in the area.

5. Land Use Systems

Present day developmental activities are putting land under high pressure. Farming and industrial activities are both competing for land resulting in the degradation of the environment. Farm lands are becoming smaller and highly degraded and the tenure

arrangements are assuming diverse dimensions contrary to the situation observed in the past. Consequently attempts to improve the productivity of land especially through agro-forestry may be frowned upon by land owners as they may feel threatened of colonisation by such tenants. The system of ownership in the study area is examined below.

5.1 Tenure Arrangement

The most important resource of rice farmers in northern Ghana is land. Traditionally land ownership is vested in the skin. Farm families cultivate communal lands which they hand down from generation to generation. They thus have usufructural rights to land which they can neither sell nor buy. For farming purposes, strangers can get land from the chief or a friend. In return, some quantity of the produce is donated to the owner of the land. In the case of rice fields, tenant farmers donate up to a bag of paddy rice. Quantity donated does not necessarily relate to the size of land or quantity harvested.

In Gbirimani farm sizes vary from 0.5 - 10 ha with lowland fields up to 50% of total cultivable land (Table 4). Field sizes in Wiaga and Sing but upland fields in Wiaga tend to be about 50% of total land while in the case of Sing lowland fields are about 60% of total cultivated land. Farm sizes tend to decrease over the years due to reduced soil fertility as well as increased incidence of pests and diseases. Increased input prices has also been mentioned as a contributory factor to reduction in farm sizes.

Table 4: Farm sizes per household (ha)

Village	Upland	Lowland
Gbirimani	0.5 - 4	0.5 - 10
Wiaga	0.5 - 3.5	0.5 - 4
Sing	0.5 - 1.5	<0.5

Source: Field survey, 1997

Fallow periods range from 0 - 4 years, shorter than in previous years. For instance, in the 70s fallow periods were over 8 years, this reduced to about 5 years in the 80s. Farmers have some indicators for exhausted fields, especially for rice fields. Besides reduced yields, the emergence of *Imperata cylindrica*, (i.e. spear grass) indicates that the land is exhausted and should be fallowed.

5.2 Cropping Systems.

Ecological adaptability influences greatly the types of crops farmers can grow. Due to differential properties of soils in the upland compared to lowland, specific crops are supported. Very few crops are supported by both types of soil. In fact, modification in the micro-environment is required.

5.2.1 Upland Systems

In the upland conditions, sorghum, millet, groundnuts and cowpea are cultivated in all three locations. Yam, maize and cassava are also very important in Sing and Gbirimani but not Wiaga. On the other hand, early millet is a popular crop in Wiaga but not known in Sing and Gbirimani (Table 5). This is probably because Wiaga farmers suffer perennial food shortages and thus require relatively short duration crop such as early millet to bridge the hunger gap. Cotton and bambarabeans are also commonly found in all three places. In Gbirimani and Sing, these crops except groundnuts are grown exclusively by males. Females grow groundnuts for cash. In Wiaga, none of the crops grown is gender specific.

Even though cereals and legumes are grown in all regions the mixtures are quite variable from region to region. In Sing, common crop mixtures are sorghum/cowpea, late millet/cowpea, and yam/Cowpea. Groundnuts and maize are grown in pure stands. To a large extent a similar situation can be observed in Wiaga. The situation is quite different in Gbirimani where up to four different major crops may be observed on a piece of land. Over 16 different crop combinations may be grown but commonly

observed major mixtures include maize/millet/groundnuts/cowpea, yam/millet/maize/groundnuts, yam/millet/maize/cowpea, maize, millet/groundnut/cowpea, etc.

Table 5: Important upland crops grown in Northern Ghana.

Crop	Gbirimani	Sing	Wiaga
Late Millet	X	X	X
Early Millet	-	-	X
Sorghum	X	X	X
Cowpea	X	X	X
Groundnuts	X	X	X
maize	X	X	-
Yam	X	X	-
Cassava	X	-	-

Source: Field survey, 1997

Note: X Cultivated
- Not cultivated/important.

5.2.2. Lowland Systems

On the lowland rice is cultivated as a cash crop in pure stand in Wiaga and Gbirimani. Sing farmers sometimes intercrop rice with maize. In the past the situation was similar in Gbirimani. In such situations, rice fields are ridged and rice seeded in the farrows with the maize on the ridge. Women do not have access to rice fields in Gbirimani and Sing as such rice may be regarded as a men's crop in these areas. In contrast, rice is cultivated by both sexes in Wiaga. Over the years average acreage under rice per farmer has tended to reduce but the number of farmers growing rice has increased leading to an increase in total rice output.

Farmers recognised the reduced fertility status of their soils and therefore make attempts to ameliorate this deficiency by applying inorganic fertiliser contrary to the

practice upland where hardly any fertilisers are applied to crops. Compared to farmers in Gbirimani and Sing, fewer number of them in Wiaga apply fertiliser to rice. However, the rate of about 40 kg N/ha applied is higher than the 15 - 30 kg N/ha observed in Gbirimani and Sing. This higher rate is probably due to the relatively smaller fields they cultivate. Those farmers in Sing benefiting from the LRRP apply the recommended rates of 60 kg N/ha.

Apart from the LRRP beneficiaries who are supplied fertiliser direct to the farm, farmers purchase their fertilisers from Tamale, Sandema and Wa for Gbirimani Wiaga and Sing farmers, respectively. Transportation charges make up 10% of the field price of fertiliser in Gbirimani of ₵30,400/bag of compound fertiliser. In the case of Wiaga and Sing, they make up 5% of ₵28,000 and ₵30,000/bag.

5.2.3. Productivity of the Lowland Systems

Farmers prefer to plough and harrow their fields at the rate of between ₵70,000 and ₵80,000/ha in the three villages between April and July (Figure 3). When it is not possible to plough with tractors farmers in Sing and Gbirimani use hoe to ridge, while those in Wiaga plough with hoe.

The use of bullock for land preparation is not popular in Sing and Gbirimani unlike in Wiaga. Where tractors are used, rice seeds are broadcast before harrowing, sometimes twice. But where harrowing is not possible seeds are dibbled in lines in Gbirimani or planted randomly using small hoes as in Wiaga and Sing. Planting is a joint activity by men, women and children but where hoes are used it is a women's activity (Table 6). Seed is obtained from either the old stock or market at a rate of about ₵375/kg paddy. Seeding rates vary from 60 to 85 kg/ha. Soon after planting if no rains come to splash sand to cover the grains, they stand the chance of being picked up by birds and rodents, the single most important problem at planting.

Figure 3: Cropping calendar for rice in northern Ghana, 1996

Operation	Region	Labour input (md/ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Land preparation	NR	12 - 23												
	UER	13 - 70												
	UWR	5 - 70												
Planting	NR	12 - 25												
	UER	10 - 35												
	UWR	10 - 40												
1st Weeding	NR	8 - 13												
	UER	20 - 24												
	UWR	18 - 30												
2nd Weeding	NR	8 - 13												
	UER	15 - 24												
	UWR	18 - 30												
Fertilisation	NR	3 - 5												
	UER	2 - 5												
	UWR	4 - 7												
Harvesting/ Threshing/ Winnowing	NR	35 - 70												
	UER	35 - 80												
	UWR	45 - 63												
Total	NR	78 - 149												
	UER	95 - 238												
	UWR	100 - 240												

Source: Field survey, 1996

As indicated in the cropping calendar in Figure 3, planting is carried out as land preparation proceeds between April and June in Sing, May and July in Wiaga and June to Mid - August in Gbirimani. Up to 40 mandays are required to plant a hectare of rice with higher values in Wiaga and Sing than in Gbirimani due to the laborious way of planting when hoes are used.

Table 6: Source of labour input into rice production

	NR			UWR			UER		
	Family			Family			Family		
	F	M	H	F	M	H	F	M	H
Land preparation	-	X	-	-	X	-	-	X	-
Planting	X	X	-	X	-	X	X	-	-
Weeding	X	X	X	-	X	X	X	X	-
Fertilisation	X	X	-	-	X	-	-	X	-
Harvesting		X	-	X	X	X	X	X	-
Threshing	X	X	-	X	X	-	X	X	-
Winnowing	X	-	-	X	-	-	X		-
Transportation	-	X	-	-	X	-	-	X	-

Source: Field survey, 1997

Note: F = Female, M = Male; H = hired.
 X = Labour category participates in the activity
 - = Labour category does not participate in the activity or level of participation is small

There are a number of different varieties of rice grown. Variability is highest in Gbirimani where up to six varieties are grown than in Wiaga and Sing where only three are grown (Table 7). In order of importance in terms of number of farmers growing them is *Mande*, *Afeke*, *Farrow 15*, *Rok 3*, *Anyofula* and *Bazolugu*. In Sing, farmers cultivate local varieties, distinguished into late maturing (*Muikpong*), early maturing (*Muibile*) and reddish rice type (*Muikajia*). *Muikpong* is long grain while *Muibile* is short grain. Similar Reddish coated rice and white long grains are identified in the Wiaga in addition to another variety identified as Abidjan.

In Gbirimani, *Mande* is preferred due to its resistance to weed pressure. *Afefe* is also of great importance to farmers for its high yields but rather susceptible to weeds. *Muikpong* and white long grains are preferred by farmers in Sing and Wiaga due to their high yield potential. The long maturity is an added attribute of preference because the crop escapes serious birds damage as it matures when birds have grass seeds as a substitute. In general farmers plant at least two different varieties each.

Table 7: Important rice varieties grown by farmers

	Gbirimani	Sing	Wiaga
1.	<i>Mande</i>	<i>Muikpong</i>	White long grains
2.	<i>Afefe</i>	<i>Muibile</i>	Abidjan
3.	<i>Farrow 15</i>	<i>Muikajia</i>	Red coated grains
4.	<i>Rok 3</i>		
5.	<i>Anyofula</i>		
6.	<i>Bazolugu</i>		

Source: Field survey, 1997

Weeding of rice fields is by hand-pulling of weeds by both men and women on ploughed fields and by hand hoeing in ridged fields. Two weedings are carried out per season to ensure high yields. As a cash crop, farmers are prepared to engage hired labour to supplement family labour (Table 6). Spear grass is said to be the most notorious weed affecting the rice crop.

Besides birds, there are no other serious pests in rice. Birds attack could be very severe requiring enormous labour for scaring depending on the time of maturity. Severest time of attack being October and November when most weeds are still blooming thus leaving birds with little food, hence farmers preference for long maturing variety. The incidence of leaf blight appears to be the disease of common prevalence.

Majority of rice growers rely on the sickle to harvest rice. A threshing poddor is used to thresh harvested grain. Because they are not cemented, collected grain often contain

some stones. Both men and women do the threshing but the winnowing is done exclusively by women. The use of communal labour is observed in harvesting and threshing. Payment for harvesting by sickle and threshing range from small portions to about two and half bags per hectare depending on total rice harvested. Farmers with fields above one hectare use combine harvesters but are compelled to use the sickle when they fail to get one. When a combine harvester is used, the charge is five bags per hectare.

The observed yields of between 5 and 20 bags paddy per ha are said to be stagnating or even decreasing over the years due to decreasing soil fertility accompanied by high inputs costs. Total production is, however, on the increase due to increasing numbers of rice farmers as many farmers are market oriented. The increase is also partly due to the disappointing productivity of upland fields. At Gbirimani there are migrant farmers some of whom reside in Tolon, (18 km away), Nyankpala (16 km average) or Tamale.

6. Post Harvest Handling and Marketing of Rice

In Gbirimani, harvested grain is stored by heaping in the room on a mat made from grass until required for sale. Those with good harvests bag the produce like their counterparts in Sing and Wiaga. Between 6 - 20% of paddy harvested is stored as seed. Mice and rats are said to be the major stored pests of rice. They are known to be more destructive when grain is stored in sacks rather than heaped on the mat. As they attempt to climb heaped rice they roll down and are frightened and therefore run away thus causing less harm. Few farmers use traps but the majority use poisonous chemicals to kill them.

Even though farmers buy cooked rice from chop bars, eating rice in the family is reserved for festivals and special occasions such as out-dooring of newly born children, funeral celebrations, wedding ceremonies, etc. It is also the preferred dish given to visitors. Less than 5% of harvested rice is consumed in the family.

Between 75 - 90% of total output of rice is sold to market women who go from house to house in Gbirimani to buy grain and organise transport. In Sing and Wiaga farmers sell their produce on the market unlike those in Gbirimani. While milled rice has differentiated prices by variety, price of paddy is same irrespective of variety. A maxi bag of 80 kg attracts variable prices depending on the time of sale. In 1995, price ranged from ₦24,000 at harvest in December, rising to ₦44,000 at planting in May-June. Marketing in the house saves farmers up to ₦1,550 per bag, about 6% of farm gate price made up of loading and off-loading charge of about ₦200/bag, transport charge of ₦1000/bag within 30 km radius, market tolls of about ₦150/bag and rent of about ₦200/bag. Price at the market place is often about 5% higher than that observed at the farm gate at the time of harvest. Traders make profit after storing grain and transforming it into milled rice. Hence the important role of women in paddy rice trade.

Farmers in Gbirimani prefer to sell at home although prices are determined exclusively by traders because there are fewer risks such as misapplying the proceeds. Generally over 60% sales are made soon after harvest to settle production debts. A further 10% are sold at ploughing and the rest in between.

7. Conclusion

Rice is a cash crop cultivated by both males and females in Wiaga and exclusively by males in Gbirimani and Sing. Rice is sold to small traders who sometimes move from house to house to procure the produce. Par-boiling and milling is done by the initial assemblers before sending to wholesalers. To facilitate the estimation of the competitiveness of locally produced rice it is important to obtain quantifiable data related to inputs and outputs per cultivated areas. Relative prices of inputs and outputs at farm level requires quantification. It is also important to identify the relative importance of particular varieties and specific qualities desired in these varieties.

8. References

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APPENDIX 1. CHECKLIST FOR INFORMAL BASELINE SURVEY

A. General Information

1. Note the region, district, village, and number of farmers interviewed.

B. Cropping Systems

2. List major crops grown in the area
3. Which crops are mainly grown by males, which by females and which equally by both sexes?
4. What is the cropping calendar of the major crops? (*from planting to marketing*)
5. Is rice grown by few or many farmers?
6. Who grows rice? males, females, older people, or younger people?
7. Is rice cultivated as food crop or cash crop?
8. Is rice monocropped or intercropped? (*If intercropped list the intercrops*)

C. Resource Allocation

C1. Land

9. Who are the land owners?
10. Is land readily available for farming?
11. Are the rice lands very suitable for rice cultivation?
12. Is it equally easy for men and women to acquire (*general and rice*) land?
13. For how many years do you fallow your rice land?

C2. Labour

13. What is your source of farm labour?
14. Is labour readily available?
15. When does the rice crop demand much labour?
16. Any available mechanisation to substitute for manual labour in rice production?

C3. Cash

17. What is the source of finance for rice production?
18. When is it most difficult for you to get cash?
19. What are the particular reasons for the difficulties?

D. Farmers' Practices

D1. Varieties

20. List the names of the varieties of rice grown in the area and their maturity groups
21. Which varieties do you prefer to grow and why?
22. Is crop production in the area increasing, decreasing or same? (*Note reasons for the answer*)
23. Is the number of farmers growing rice increasing, decreasing or same over the years? (*Note reasons for the answer*)
24. Are rice farms increasing, decreasing or same over the years? (*Note reasons for the answer*)

25. Are rice yields increasing, decreasing or same over the years? (*Note reasons for the answer*)

D2. Planting

26. Who plants the rice?
 27. How is planting done? *in rows? randomly?*
 28. Number of seeds per hill? Spacing of hills

D3. Weeding

29. Who does the weeding of the rice farm?
 30. How is weeding done? (*pulling grass or hand hoeing?*)
 31. Number of weedings per season
 32. List the important weeds affecting the crop

D4. Insect Pests and Diseases

33. What are the major insect pests and diseases of rice?
 34. How do you detect these pests and diseases?
 35. What control measures do you use?
 36. How severe are the attacks?

D5. Harvesting and Storage

37. Who does the harvesting of rice?
 38. What proportion of the harvest is stored as seed?
 39. How do you store the seed?
 40. What are the main storage problems?
 41. How do you tackle the observed storage problems?

D6. Marketing and Food Use

42. Who is involved in the marketing of rice?
 43. Where do you market your rice?
 44. In what form do you market your rice? (*paddy or par-boiled?*)
 45. Which varieties attract higher prices and why?
 46. List the main marketing problems?
 47. Which varieties are most preferred for home consumption?
 48. Is rice used as a ceremonial crop? If yes indicate ceremony
 49. Any substitute for the crop in terms of traditional foods?