Improving the Quality of Ghanaian Parboiled Rice

Training Manual

The Role of Millers

This publication is an output from the Crop Post-harvest Research Programme of the UK Department for International Development (DFID), for the benefit of developing countries. The views expressed are not necessarily those of DFID.

Session 4

The role of millers

Objective:
The objective of this session is to investigate the role millers could play in the production of good quality parboiled rice. We will look at current practices and explore ways in which they can be improved.

Parboiled rice is a manufactured product. This means that raw materials undergo certain processes to produce the final product.

The quality of any manufactured product is only as good as the quality of the raw materials and the controls exercised during processing.

The quality of parboiled rice produced in Ghana is very variable, even though the same raw materials and processes are used throughout the three northern regions of Ghana.

WHAT DOES QUALITY MEAN TO MILLERS?

We have already looked at the factors that affect rice quality, and have examined ways in which farmers and parboilers can be encouraged to produce good quality paddy. Now we will look at what millers do and how they can contribute to a better product.

Most millers are not very quality conscious because milling in Ghana is currently carried out on a "custom milling" basis. That is to say the miller charges a fixed rate for milling a quantity of rice – he

therefore has little incentive to produce the best quality rice since he will not gain financially

The miller has to invest in a mill, which often does not work for the whole day so profits are lower than could be expected. Servicing and repair of the equipment is seen as a loss of profit so is often not carried out as it should be, resulting in an inferior product and an increased number of breakdowns. The quantity of grain brought by each customer is restricted by the amount that can be carried.

If there are several mills in the same vicinity, the miller must try to attract custom, so may try to ensure that his mill is operating efficiently. As can be seen from the table below, the only quality attribute that is likely to be influenced by milling is the quantity of broken grains. Nevertheless consumers see this as a major quality attribute, so it is of great importance.

Quality attribute	**Intrinsic quality**	**Influenced by milling**
Density	4	
Size	4	
Shape	4	
Composition	4	
Colour	4	
Aroma	4	
Foreign matter		
Mixed varieties		
Maturity		
Infestation/infection		
Cracked grain		
Sprouted grain		
Moisture content		
Broken grain		4

WHAT IS MILLING?

Milling produces *refined* whole grains with their *indigestible* parts removed.

Milling is a mechanical process that transforms inedible paddy grains into an attractive, marketable product.

This is achieved in two stages:

- **Removal of the outer husk.**

  As the rice kernel grows it is protected by a hard, fibrous husk. This thick shell is totally inedible but is easily removed by milling since it splits open very easily and falls away from the kernel.

- **Removal of the bran layers**

  Beneath the husk is a thin layer of "bran". This layer contains many nutrients, such as fat, vitamins and minerals and is edible. However most rice consumers prefer this layer to be removed as it alters the cooking and eating characteristics of the grain. This layer is quite firmly attached to the kernel and needs to be polished (or rubbed) off.

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You have been provided with a few grains of parboiled paddy. Split open the husk and remove it. You can do this by rubbing a few grains ***very*** *hard between the palms of your hands (but it may hurt!) – its probably easier to slit it open with a sharp blade. You will then be able to see the bran layers, which will feel greasy when you rub them.*

THE MILLING PROCESS

There are two types of mill available for the small-scale processor – **rubber roll mills** and **Steel ("Engleberg") dehullers**. The basic principles of the two types of mill are shown below:

Steel hullers, often known as Engleberg mills are used to dehusk grain such as rice whose husk is loosely attached to the grain.

This is the most widely used type of mill in Northern Ghana.

A ribbed cylinder rotates inside a milling chamber and dehusking occurs when the grain is pinched between a metal bar and one of the ribs on the rotor.
Polishing occurs when the dehusked kernels rub against other grains and against the rough husk.

Dehusked grains and waste husk are often discharged together and must be separated by winnowing. Some machines have built in *aspirators* to remove the husk and bran.

Incorrect adjustment of the blade and poor rotor condition may lead to excessive kernel breakage and therefore to reduced outputs.

This type of mill usually has the capacity to mill between 150 and 250kg per hour. There are many models available, both imported and locally manufactured. The most efficient have an aspirator to remove husk and bran. Others have an additional polishing unit but most mill operators in Ghana are not aware of the advantages of this additional unit and have disconnected them.

Rubber roll mills.

These are used mainly in southern Ghana for milling raw (unparboiled) rice.

Paddy is passed between a pair of revolving rubber-coated rolls. As they rotate they create a shear force that breaks open the husk, separating it from the kernel. The husk is removed by aspiration and is cleanly separated from the kernel

The brown rice (dehusked paddy) subsequently goes through a polishing chamber similar to the steel huller where the bran is removed. The bran from such mills is ideal for animal feeding.

The capacity of rubber roll dehuskers is usually 200 -500 kg per hour.

There have been some attempts to introduce rubber roll mills into the northern regions – these have proved largely unsuccessful. A comparison of the two types of mill is shown below.

Steel hullers	**Rubber roll mills**
• Cheaper mills – may be imported (usually from India) • Can be manufactured locally • Spare parts usually available – can be locally manufactured • All parts made of metal – more durable Husk remains mixed in with dehuksed grain for longer and helps removal of bran layers	• Expensive, imported mills • Cannot be made in Ghana • Rubber rolls, which must be imported, need replacing very frequently – expensive and difficult to obtain in Ghana • Parboiled paddy wears rolls out very quickly because it is so hard • Bran layers not removed very effectively as husk is immediately separated from dehusked grain

You will shortly be shown an Engleberg mill in operation so you can see the processes which have been explained above.

IMPROVING THE QUALITY OF PARBOILED RICE – WHAT CAN MILLERS DO?

Make sure mills are well maintained and safely operated

Many mills are poorly maintained, as previously stated this is usually because millers are reluctant to replace parts as often as they should as it cuts down their profits and they have little incentive to produce milled rice of the highest possible quality.

Millers should be encouraged to adhere to Good Manufacturing Practices and operate in a safe, hygienic environment – after all they are manufacturing a food product!

Sensible safety precautions

- Any moving machinery is potentially dangerous, all moving parts should be fitted with guards to prevent the entrapment of limbs or clothing.
- ALWAYS stop the machine before greasing the driving parts or carrying out any maintenance.
- Check for looseness or damage on belts, nuts and bolts at least once per day before the start of work.
- No untrained personnel should be allowed to operate machinery.
- Children and other onlookers should be kept well clear of the mill.
- Never attempt to repair machinery with the power switched on
- Always disconnect the power when the mill is not in use
- Wear appropriate clothing, safety equipment such as dust masks should be provided.
- Try to minimise the formation of dust and do not inhale any dust.
- Store fuel away from the mill

- Do not smoke near a mill
- Ensure appropriate disposal of by-products
- When two or more persons are working together each person must confirm suitable hand signals before starting work

Operator responsibilities

The mill owner or trained operator should be responsible for:

- Keeping the premises clean and tidy.
- Carrying out routine maintenance and safety checks on the equipment.
- Ensuring the safety of everyone in the millhouse.
- Checking the quality of the grain entering the mill.
- Making sure that grain is fed to mill at a suitable rate.
- Adjusting the mill to produce the required product.
- Checking extraction rates to ensure that the mill is operating efficiently.
- Keeping records of inputs and production.
- Arranging service and repair of the mill as appropriate.
- Keeping records of repair and maintenance.
- Ensuring a supply of raw materials (grain, fuel, packaging etc.).
- Organising the day-to-day operation of the mill.

In addition to the above the operator is specifically responsible for checking that:

1. The machine is installed on a level and stable place. Unlevelled and unstable installation will cause vibration and poor performance.
2. The machine and any prime mover must be correctly positioned to ensure perfect alignment. (The prime mover can either be an electric motor or any diesel-powered engine). If alignment is correctly carried out belt tensioning will be efficient and slippage of belt would be eliminated.

3. All electrical connections conform to local power authority regulations.
4. Foundations of machines are well secured and tightened.
5. Planned preventive maintenance is followed e.g. lubrication of all bearings on machine, electric motors, diesel engines etc. at appropriate time intervals.
6. Regular inspection, adjustment of gaps for effective and optimum operations is carried out. Details of preventive maintenance (PM) can be obtained from operational manuals under “trouble shooting.”

Use good quality raw materials

The miller’s only raw material is the paddy provided by his customers. Nevertheless it is in his interest to try to ensure that paddy fed into the mill does not contain any foreign matter, since stones will damage his equipment and require screens to be replaced more frequently.

Control Processes

Some millers in the Upper West pass paddy through the dehuller twice, adjusting the mill setting for each pass, as they believe this reduces breakages and produces very well-milled rice.

Mills with fitted aspirators separate the husk and milled rice effectively, meaning that the women do not have to winnow the rice before marketing it.

This project aims to develop an aspirator which can be fitted to existing mills to improve their performance. Millers would be encouraged to visit the demonstration sites so that they become aware of the importance of their role in the production of good quality parboiled rice.