## Primary processing

### 1. Cleaning and Grading

Before further processing, grains are cleaned and graded according to size. Winnowing machines can be used to separate out the chaff, soil and dirt. Some machines have integral sieves that combine cleaning with grading.

### 2. Hulling

Several grains have an unpalatable husk or shell that needs to be removed by a decorticator. A range of specialized machines are available for this task. A range of small rice hullers (both manual and powered) is available. Less rice is broken during hulling if the rice is parboiled first. Rice polishers are available for removing the rice bran after hulling.

### 3. Pounding/Milling

Three main types of grain mill are available: Plate mill, hammer mill and roller mill. The choice of mill depends on the raw material and the scale of production. Hammer mills are almost universally used throughout the developing world. Plate mills are widely available in West Africa. Roller mills are not used at the small scale because of their high cost and maintenance requirements. The plate mill is usually limited to about 7kg and is derived from the stone mill or quern. Two chilled iron plates are mounted on a horizontal axis so that one of the plates rotates and the grain is ground between them. The pressure between the two plates governs the fineness of the product and is adjusted by a hand screw.

There are manual versions of the plate mill available, though it is difficult and need hard work to use. Small-scale hammer mills range in size from 2kg to 20kg. It is consisted of a circular chamber in which beaters whirl at a high speed.

### 4. Parboiling

Parboiling rice is an optional step, but one that improves the quality of hulling as it results in fewer broken grains. About 50% of all rice grown is parboiled. Parboiling involves soaking and heating the rice which pre-cooks the grains, loosens the hull, sterilizes and preserves the rice. At the village level, parboiling is carried out in large

pans over an open fire. Rice parboilers, that improve the efficiency of cooking, are available.

5. **Drying**

6. **Storage-**

**Secondary Processing**

**Raw materials:**

The quality of raw materials has an influence over the quality of the products. High quality raw materials should be used.

Small-scale bakers do not normally have facilities for flour analysis and rely on information supplied by the miller or wholesaler. There are a few simple tests could carry out which give useful information about the flour quality.

1. **Flour**

Flour can be milled from a variety of cereals. The type available in each country or region may depend upon the types of cereal grown, although wheat flour tends to be available in most places.

**1.1 Wheat flour**

Wheat flour contains proteins known as glutens. These are capable of forming a strong elastic network within the dough, which is very useful when making leavened bread. The protein network traps the gas that is given off by the yeast during fermentation. This causes the dough to increase in volume and produces a bread with a light texture. If flours that are low in gluten are used to make leavened bread, the gas escapes and the bread is flat and heavy. Wheat flour is available in different grades according to the degree it is extracted from the whole wheat grain.

**1.2 non-wheat flours**

There are a variety of non-wheat flours available that can be mixed with wheat flour to make bread.

a. **Cassava flour** is a fine white powdery flour that has a shelf life of up to one year. It is widely used as a staple food and for the production of a range of fried and baked goods including bread, cakes and biscuits.

b. **Cereal flours**, especially from maize and sorghum, which are both staple crops, are used to make breads and snack-foods. Sorghum is mainly used to make bread or porridge. Maize is used to make tortillas, snacks and for the production of corn-flour and thickeners.

c. **Soy/composite flour** is a fine creamy flour that is combined with maize flour or other cereal flours to increase the protein content and balance the amino acid composition of the composite flours. In this form it is used as a breakfast porridge and as a weaning food.

**2. Maize**

Maize can either be wet or dry milled. In dry milling, maize is ground between stones or by using a hand-powered plate mill or at a larger scale, using a hammer mill or powered plate mill. In wet milling, the grain is soaked and allowed to ferment slightly to improve the flavor before milling with a hand or powered plate mill. Maize is sometimes soaked in alkaline water to facilitate removal of the bran before it is milled. If the maize meal is not used whole, it is transferred to a flat basket and shaken so that the bran is separated from the floury endosperm.

The flour is sometimes ground again to make a finer product. The bran is often used to feed

chickens. Maize has a relatively high fat content and tends to go rancid quickly. Ground maize meal therefore has a short shelf life.

**3. Paddy rice**

In some countries paddy is parboiled before the husk is removed. Parboiling is the partial cooking of the rice to gelatinize the starch, which makes the grain tougher. There is also a slight change in flavor which some people prefer. The toughening process makes the seed more resistant to insect attack and to shattering during husking. It also helps to prevent absorption of moisture from the air during storage. The parboiling process involves three stages:

- soaking or steeping of the paddy in cold or hot water to increase its moisture content

- steaming to gelatinize the starch in the kernel
- drying.

The rice should be dried carefully after parboiling to minimize losses. Husking paddy, which is sometimes referred to as de-husking or milling is the process of removing the outer husk.

Husked paddy is referred to as brown rice, whereas de-husked (or polished) rice is white rice. Brown rice is nutritionally superior to white rice as it contains some of the bran which contains protein and vitamin B1 (thiamine).

### 4. Millet

The outer layers of some varieties of sorghum seed (usually the red seed varieties) contain tannins that are slightly toxic, have a bitter taste and inhibit the digestion of proteins. For this reason, sorghum is generally hulled before grinding into a flour. Traditionally sorghum and millet are ground by hand using querns or hand plate mills. The seed is winnowed to remove foreign matter, then put into a large mortar and wetted. It is then pounded to strip the bran or shell from the grain, followed by winnowing to get rid of the bran, Pounding and winnowing are repeated several times to get a good quality millet seed. The seed is washed to remove any small pieces of bran and soaked in water for 24 hours to condition or temper it. The grain is dried to the correct moisture content then reground using a pestle and mortar.