Sorghum Flour Small-Scale Production

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Sorghum flour is a staple food with high domestic demand. The flour is fine and white, but the incorporation of different quantities of bran alters the colour to pale brown.

Harvesting:
Sorghum is harvested when fully mature. The mature plants are cut and left in the field with the head exposed to the sun to dry. Drying is complete when the moisture content is reduced to 10-12%. If sun drying is not possible, the heads are hung from a structure under a roof to dry; a fire can be made on the ground to assist in drying the heads. Once dry, the heads are cut 7.5 to 15cm below the grain bearing portion and taken for threshing.

Threshing:
Threshing is done manual by beating the heads with sticks on the ground or in sacks or using a mortar and pestle. It is possible to improve yield and efficiency of the threshing process when the following guidelines are used:

- The heads should be threshed on mats or cement blocks, not on sand, gravel or stones.
- The grains should have a maximum moisture content of 12%. This reduces the possibility of mould development during storage.
- Threshing should be done early to reduce exposure to pests.

Winnowing:
The threshed sorghum kernels are cleaned using a winnowing basket to remove light grains, leaves, dust and husks. Larger material is removed by hand. The grain should also be inspected for signs of mould or other spoilage, with affected grain being removed immediately.

Storage:
The cleaned sorghum may be stored if required. The grain can be stored in bins, silos, tanks, or bags on condition that they are clean, dry and resistant to pests and rodents. A cool, dry storage environment is required. The grain should be inspected regularly during the storage period to ensure it is not infested. The container should be opened and the grain lifted and checked for heating and odours. Dark kernels (signs of mould) indicate that the moisture content is rising. In this case the grain should be tipped out and dried again before further storage. Sun drying may be used.

Husking:
The outer layer of the kernel, called the husk or bran, is removed by a husking machine (huller). This machine consists of abrasive disks or stones set on a horizontal shaft that rotates at high speed inside a casing. The husks are rubbed off by the grinding action of the whirling stones and the friction of the other grains. The rate of flow of the grain must be adjusted so that the grain is kept in the casing long enough to remove the desired

percentage of husk. The lighter husk particles are continually removed from the hulled grain by a fan. The husked grain flows from the overflow outlet into collection containers. The grain is now ready to be milled.

Milling:
Milling of sorghum can be a dry or a wet process on small scale. Traditionally, the grains are soaked and milled, but modern equipment make use of a 'dry abrasion' technique. Both options will be discussed.

Wet Milling:
The grains are soaked for 3-4 days is water, drained and dried in the sun for 3-5 hours. Soaking improves the good milling characteristics of the grains by traditional stone grinding methods. The correct amount of moisture has been absorbed when the grains are soft, but not wet, when squeezed. Too little moisture will result in the grains breaking down to a fine powder in the will without shattering into pieces. Too much moisture clogs the mill.

The moist grains are milled using grinding mills of various designs. The type of mill, speed, and setting adjustment all effect the quality of the flour obtained. Stone and plate mills are typically used on small-scale.

Stone mills: The grain is milled between two flat stone surfaces of which the base stone is stationary, and the top stone is rotated. The grain is fed through the centre of the top stone and crushed and ground as it moves between the stones towards the periphery. Stone mills come in different sizes and can be turned by hand, animals, water, diesel, or electric motors. The flour obtained from stone milling can vary from coarse to very fine, depending in the size and quality of the stone.

Plate mills: this is a variation on the traditional grinding stones. Metal plates are used instead of stones, and both rotate. The grain is fed between the two plates and is ground by a constant rubbing action. The pressure between the plates can be adjusted by a hand-screw to deliver either fine or course flour of various degrees. The flour emerges and falls into a bag or bowl at the bottom of the mill. Take note that plate mills are also suitable for dry milling.

The moist flour obtained by wet milling must be dried for safe storage. This can be done in the sun for 1-2 hours by spreading the flour out in thin layers. The flour can be mixed and turned at regular intervals to ensure uniform drying.

Dry milling:

Dry milling is performed by hammer mills or plate mills. Hammer mills essentially consist of a circular chamber in which fixed or swinging hammers rotate at high speed. The grain is ground by impact; by rubbing against the casing; and by compression. The flour passes through a removable sieve at the base of the chamber into collection containers. The hammers in the mill should be of good quality, hardened steel.

Sieving:

The flour is sieved with a fine sieve with 1mm apertures if the flour is intended for human use. Larger sieves are used if the flour is intended for animal use. The coarse flour left on the sieve is returned to the mill. Hammer mills have the added advantage that milling and sieving can be performed in one action.

Packaging:

Under correct storage conditions, sorghum flour has a shelf life of up to two years. Wet milling can reduce the expected shelf life, especially if the post-milling drying is not done properly. If the flour is produced in areas with high humidity, special care should be taken to package it is dry, moisture-proof plastic bags as stored in a cool, dry area that is rodent free. In areas with low humidity, it may be stored in hessian or jute sacks. Heat sealable polyethylene bags are used for retail packaging.

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