MAIZE HARVESTING AND POST HARVEST HANDLING

Time to harvest

Maize can store for a considerable period in unprocessed form without undergoing deterioration. Its shelf life greatly depends on the prevailing ambient temperature and relative humidity, and other factors like the inherent moisture pests and diseases. Therefore, recommended post harvest handling and managing operations involve the manipulation of the above factors in order to obtain high quality maize grains.

Quality control starts with harvesting. Harvesting is the single deliberate action to separate the cob from its grown medium. The optimum time of harvesting maize is when the stalks have dried and moisture of grain as about 20-17%.

Requirements during the Harvesting Process

- Harvest maize as soon as it is dry but not overstay in field it will be attacked by weevils if does and lodge. In addition to reducing post harvest losses, this will also release the field for early land preparation.
- Keep the grain as clean as possible. Dry maize on cement floor or use tarpaulin to reduce chance of contamination.
- At home, do not first heap the cobs in any room, kitchen or in the yard because this will expose them to all the dangers that cause post harvest losses. Transfer them to the drying place (like the crib) immediately.
- Dry on concrete or canvas not on bare soil

Activities before Harvesting

Currently, most of the maize grown in Uganda is harvested by hand. Considering the need for a farmer to keep the cobs clean, to dry the cob immediately and avoid infestation of the harvested cobs, a farmer makes the following preparations:

- Make sure the drying place or equipment is clean and disinfected, ready to receive the cobs.
- Remove old grain and dirt from anything that will come in contact with the good or new grain. This includes harvesting tools, carts, wheel barrows, bags and baskets.
- Where possible, fumigate them or at least treat them with boiling water to kill insects or their eggs. This is done in order to avoid infection of new grain by insects and their eggs.
- Organize enough labour to reap and carry the cobs to the drying place.

Harvesting

Harvest the maize cobs and transport them to the crip without putting them on soil to avoid contamination.

Activities after Harvesting

After harvesting, farmers should clean all the materials used in the process of harvesting and store them properly, away from sources of contamination and insect breeding places. The same materials may be needed during the proceeding operations e.g. to transport cobs from the crib for threshing or to transport grains to the store. If the materials are not cleaned properly, they can easily contaminate clean grains or become source of pest infestation since at times pest infestation starts from the field.

Drying

After harvesting, the greatest enemy of grain is moisture. Wet grains and attract insects and mould. Therefore, the grain must be dried as soon as possible after harvesting. Drying is the systematic reduction of crop moisture down to safe levels for storage, usually 12%-15.5% moisture content. It is one of the key post harvest operations since all down-stream operations depend on it. This is particularly so in some regions of Uganda where humidity and rainfall remain high at harvesting delaying the harvest and constraining actual drying. Sometimes the next season starts early when the crops are still in the field as much as possible the choice of varieties should be such that they mature at the beginning of dry season.

Drying permits the escape of moisture from grain moisture to an acceptable level, which can sustain very low metabolism. The enzyme activities and grain tissue respiration is reduced to a very low level, thus inhibiting sprouting/germination. During drying, the dry air rapidly takes moisture away from the grain, especially if the air is moving and has got low humidity. Grain can be dried in a crib before shelling and on tarpaulins after it has been shelled.

Figure 2: Common drying methods

Avoid drying the maize on the ground. Grain that is in contact with the ground will **absorb moisture and** pick up dirt and insects. Drying maize on plastic sheets or mats is becoming a **common practice** with farmers who are trying to keep maize off the ground during drying. This practice is discouraged because of the following reasons:

- Someone should watch the grain while it dries.
- At night or when it rains, the grain must be brought under shelter.
- Grain can be washed away in case of a sudden down pour.
- Risk of contamination from dusts, soil, stones, animal droppings, fungal and insect infestation.
- Losses from birds, poultry and domestic animals, resulting into contamination and quantitative losses.
- The method is time consuming and labour intensive involving lots of grain handling.

Shelling

Shelling is commonly done by beating maize cobs with stick in a sack or a confined floor space where farmers can afford it. It is better to use a maize shelter as indicated in figure 6. Beating maize will result in physical damage which makes it more vulnerable to pests and moulds and damage to the germ. Using a maize shelter is preferred although it will not be afforded by most farmers.

Storage

The principal objective in any maize grain storage system is to maintain the stored grains in good condition so as to avoid deterioration both in quantity and quality. During storage, the grain must remain dry and clean. Grain storage can be extended for up to 2 years without any significant reduction in quantity and quality. However, the majority of farmers sells off their maize grains cheaply soon after harvesting due to anticipated losses in storage and later buy food at exorbitant prices. There are improved storage structures that can prolong the storage duration until market prices for grains are favorable.

Improved storage structures

A good storage structure should:

- Provide protection from common storage loss agents such as insect pests, rodents, moulds, birds and man.
- Maintain an even, cool and dry storage environment. The maize should be placed on pellets above the floor to avoid cold conditions that may lead to moulds (figure 3)

Figure 3: Proper storage arrangement

- Should not allow re-wetting of grain by either moisture migration or rain.
- Offer reasonable protection from thieves.
- Be simple and inexpensive to construct using, where possible, locally available materials and skills. Be easy to clean and repair.
- Grain should be protected from rodents

Perfect storage hygiene is the basic prerequisite for successful storage. All hygiene measures are very simple, particularly effective and cheap. They can thus be perfectly performed by any farmer with little effort.

Figure 4: Storage silos for grain handlers and storage cribs for small & medium scale farmers

Store room

Bag storage of shelled grains in well designed store rooms is the most suitable in a tropical country like Uganda. Although bulk system of storage also exists and has its advantages, bag storage is more appropriate for Ugandan farmers because of the following reasons:

- At the moment all buyers in Uganda require bagging before dispatch.
- The transport system available is more suited to transporting bagged than bulk grains.
- Bagged grain is easily quantified when receiving, dispatching or checking stock.

Figure 5: Bagged maize grain ready for dispatch

- Bag storage requires less capital investment than bulk storage. .
- Bag storage is easy to manage, cheap and efficient.
- The bag system involves little risk in particular as far as long term storage is concerned.

Sitting and orientation

- The store should be located on a raised site with good drainage to ensure that there is no stagnant water in its store.
- Set up the store with the longitudinal side on an East-West axis (less radiation on the building) or exposed to the main wind direction. This creates balanced temperature conditions thereby reducing the danger of condensation.
- Locate the store on firm soil with good road connections to enable easy transportation.

Losses due to poor storage

Mould

Microbial infection in storage occurs due to inadequate drying of produce. The situation is made worse when there are large numbers of insects present or when the stored crop is exposed to high humidity or actual wetting due to poor storage management. Fungal infection results into rots and development of aflatoxins, which are poisonous compounds to live stock and cause cancer in human.

Conditions that favour aflatoxin contamination in maize grains

Aflatoxin contamination is encouraged by:

- Inadequate drying
- Physical damage due to poor shelling/threshing methods
- Poor storage methods (exposure to moist condition)
- Insect infestations.

Aflatoxin cannot be seen with a naked eye. However, suspect materials tend to:

- Be rotten
- Be mouldy
- Be discoloured

- Have unpleasant smell
- Have bitter taste
- Have poor milling quality
- Be warmer than room temperature.

Losses due to mould

- Loss of weight
- Loss of quality (smell, taste, colour, nutritional value, germination)
- Further increase in temperature and moisture, causing more grain deterioration.

Spillage

Careless handling of either maize cobs or grains can lead to spillage. This leads to loss in terms of quantity. Spillage can also lead to loss of quality in case contaminated grains or cobs are again mixed with the clean stuff. In this case, contamination will lead to mould development. The situation will be worse if the spill gets into contact with moisture. Losses due to spillage are common during shelling that is done by beating the cobs with sticks.

Ministry of Agriculture, Animal Industry and Fisheries
National Agricultural Research Organization

Supported by:
Agricultural Sector Programme Support
Agri-Business Development Component
Agri-Business House
Plot 58 Lumumba Avenue
P.O. Box 29851, Kampala
Te: +256-312-351600
abdc@asps.or.ug