

# Pack #110, Item 1

# Type: Backgrounder

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**Backgrounder: Reducing post-harvest losses in maize**

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**Introduction**

***Why is this subject important to listeners?***

Because maize growers, traders, and processors should know:

* How to manage maize before harvesting to reduce post-harvest losses and infestation.
* The right harvesting equipment.
* The right time to harvest maize.
* How to effectively dry maize after harvest to avoid fungal infection and determine when it is sufficiently dry for storage.
* How to store maize after harvest to control pest and rodent infestations.
* The right facilities and conditions (including moisture content) to store maize grain after harvest.
* How to measure the moisture content in maize.

***What are some key facts?***

* Maize is sufficiently mature for harvest when the stalk withers and turns light brown, the grains harden, and (depending on variety) when the cobs droop downwards.
* If rain delays the harvest, farmers should break maize stems below the cob so that the cob hangs downwards to stop it from absorbing rainwater, which causes rot.
* Dry maize on tarpaulins, mats, or raised racks. Do not dry in contact with the ground.
* Keep animals away from drying maize to prevent contamination.
* Shell when maize grains have a moisture content of 13-14%. This will ensure that kernels are not damaged during shelling.
* Maize can be dried with direct sunlight or artificial methods such as blow drying machines or bubble dryers that can be locally fabricated.
* Shelled maize can be treated with insecticidal dust to protect it from storage pests like the large and lesser grain borers, weevils, and beetles.
* Organic pesticides derived from neem or Ocimum kilimandscharicum can also control pests like weevils and lesser grain borers.
* Treated maize should be washed before consumption, and should not be consumed until 90 days after treatment.

***What are the big challenges with reducing postharvest loss in maize?***

* Unpredictable weather during harvesting.
* Inappropriate harvesting and drying equipment.
* Farmers lack knowledge of the right level of moisture to store dried maize.
* Farmers lack the equipment needed to test moisture content.
* Mould infestation on grains, and insects and rodents that feed on maize.
* Farmers do not know how to identify grains infected with aflatoxin.
* Poor handling of maize, which results in grains shattering during transport.
* Drying maize grains on bare ground exposes them to fungi, bacteria, and mould, resulting in losses.

***Gender aspects of reducing postharvest loss in maize***

* In sub-Saharan Africa, female-headed households tend to experience lower postharvest losses, mostly due to adoption of improved storage technologies.
* In parts of Kenya, women farmers are more likely to adopt metal silos to store their grains if the silos are made by trained female artisans who the women farmers view as role models.
* In Uganda, post-harvest losses impact women the most, as they are the ones who dry, clean, and store the maize.
* In rural Benin and Mozambique, most post-harvest activities are handled by women, while men dominate commercial activities.
* In Benin and Tanzania, women are active in post-harvest management and storage of maize to ensure their families have food in and out of season.
* In sub-Saharan Africa, when mechanized methods are introduced in post-harvest activities, men take on roles that are traditionally reserved for women.

*For further information, please see documents 1, 2, 3, 5, 8, 9.*

**Key information about reducing post-harvest loss in maize**

**Pre-harvest**

Aflatoxin poisoning in maize can result in negative impacts on health, including loss of life, as well as post-harvest losses. But farmers can minimize their losses by:

* Practicing crop rotation—in other words, not planting maize in the same place in successive seasons. This will minimize buildup of aflatoxin-producing fungi.
* Irrigating maize during drought or extreme heat, especially 10 to 14 days before and after flowering. Irrigation reduces the moisture stress that causes aflatoxin-related fungi to thrive.
* Being careful when irrigating during flowering, as excess water encourages fungal growth, increasing the risk of aflatoxin contamination.
* Conducting soil tests to determine what fertilizers and soil conditioners can be applied to avoid plant stress during growth.
* Applying diammonium phosphate (DAP) fertilizer to improve crop resistance to drought and lower aflatoxin levels. This can be done after soil analysis to identify which nutrients are needed.
* Adding manure that contains phosphorus, nitrogen, and other micro and macronutrients vital for plant growth as a substitute for chemical fertilizers. Unlike poultry manure, cattle manure contains many of the essential nutrients required for crop production and can be used as an organic fertilizer.
* Planting maize varieties that are resistant to drought, disease, and pests, and suited to the local climate.
* If practical, during land preparation, destroying or ploughing under crop residues left on the farm so that they don’t serve as a food source for pests or disease organisms.
* When planting, practising good agriculture practices such as using recommended spacing to avoid overcrowding. Overcrowding creates warm, humid conditions in which disease microorganisms thrive.
* Removing diseased maize plants.
* Controlling weeds manually or with registered herbicides.
* Not planting maize when temperatures are extremely high, or in drought conditions.
* Using maize varieties that are appropriate for the relevant Agro Ecological Zone, i.e., low-, mid-, or upper altitude.

*For further information, please see documents 4, 5, 6, 11, 14.*

**Harvesting**

Farmers can determine whether their maize is ready for harvesting by observing signs in the field. This can avoid harvesting prematurely or late. If the harvest is delayed and the mature maize crop is rained on, there will likely be increased fungal growth and hence aflatoxin contamination. Signs of readiness for harvest include the following:

* The leaves of the maize plant become yellow and dry up.
* The husks of drying maize feel like paper when touched.
* The grains harden and acquire a glossy surface.
* Maize cobs with dry husks droop down on the stalk.
* A moisture content of 18-25%.
* A black layer at the base of the plant, where the maize grain connects to the cob.

When harvesting, farmers should do the following to limit post-harvest losses:

* When it’s rainy, harvest the maize with the husk intact to limit aflatoxin infection.
* Immediately remove and separate damaged husks from the maize.
* Clean harvest containers before adding maize to prevent contamination from old maize residues.
* To limit contamination, ensure that the mats, sacks, screens, or containers where harvested maize is collected are clean and dry.
* When possible, harvest when sunny.

*For further information, please see documents 1, 2, 3, 7.*

**Transportation**

* After harvest, transport maize immediately from the farm to drying and storage facilities. Farmers can use wheelbarrows, bicycles, and ox- or donkey-drawn carts to transport maize, depending on distance and the volume to be transported.
* For long distance transport, mount tarpaulins on vehicles to protect grains from rain, which can result in fungal growth.
* Ensure that vehicles and carts are clean, dry, and disinfected with natural or chemical insecticides or fumigants that will not harm consumers.
* Avoid spilling maize during transportation by using appropriate equipment to transport the crop.

*For further information, please see documents 1, 2, 11.*

**Drying**

* Immediately after harvesting (during sorting or just before drying), separate infected cobs from healthy cobs.
* Drying maize prevents germination, growth of fungi and bacteria, and insect or mite infestation. Drying in facilities such as granaries and warehouses rather than in the field allows farmers to better control the environment and reduce exposure to pests.
* Farmers can dry maize naturally with direct sunlight and natural air flow, or artificially with mechanical dryers that circulate heated air around the grains.
* For natural drying, spread maize in direct sunlight on surfaces such as mats, tarpaulins, layers of sacks, or concrete floors, and away from farm animals that can eat or destroy the grains and contaminate them with their waste.
* For natural drying, turn maize cobs regularly to quicken drying time.
* Farmers can test to see if their maize is dry enough for storing in bags by mixing some grains and a teaspoon of non-iodized salt in a dry jar with a tight cover. Shake and roll the jar gently for 2-3 minutes. If the salt doesn’t clump together or stick to the sides of the jar, the moisture content is below 15% and the maize is ready for storage.
* Farmers can also use moisture meters to measure moisture levels in maize and determine if it is ready for storage.
* When harvested maize has a moisture content of over 20%, rapid drying within 24-48 hours is recommended to lower moisture content to 14%, which inhibits the growth of aflatoxin-producing fungi.

Maize should be dried without the husk if:

* Conducting rapid drying with mechanical dryers. These dryers can lower moisture levels in 500 kg of maize from 20% to 13.5% in three hours—the moisture content level recommended for storage.
* The storage period after drying is brief, or the cobs will be shelled soon after drying.

Maize should be dried with the husk intact if:

* Rapid drying is not necessary.
* There is a danger that the cobs will get wet due to rain during drying.
* Cobs will be stored for at least three months after drying. In this case, keeping the husk intact will protect maize grains from insect infestation.

If you dry maize on plastic sheets, moisture from the grains will collect on the sheets. After drying the grains for two hours, farmers should shift them to one side of the sheet to allow the other side of the sheet to dry for a few minutes (or longer if it is not sunny), then spread the grains on the other side of the plastic sheet to dry the second side. It is recommended to use black sheets as they absorb sunlight more rapidly, which quickens drying.

At night, move grains to one side of the sheet, cover them with the other half of the sheet, and place heavy materials on top to prevent wind from blowing the cover off the grains.

*For further information, please see documents 1, 2, 6, 11, 12.*

**Shelling**

It is recommended that farmers shell maize when the moisture content is 13-14%. At this moisture level, the grains are less easily damaged by shelling.

Shelling can be done by hand, with motorized or pedal-operated shellers, or with hand-operated shellers.

* Shelling allows farmers to more effectively apply insecticidal dust or organic pesticides derived from the neem tree or the Ocimum kilimandscharicum plant.
* Shelling reduces the volume of maize to be stored, and therefore requires smaller storage spaces.
* Shelling reduces vulnerability to storage pests like the large grain borer.
* Hand shelling causes much lower losses than beating grain off the cobs with a stick or using pedal- and hand shellers or motorized shellers.
* After shelling, winnow maize and treat with an insecticidal dust or organic pesticide sourced from the neem tree or the *O*cimum kilimandscharicum plant. Follow the label directions for the amount of product required. Treat maize when it is expected to be stored for more than 90 days. Treated maize should be washed before consumption, and should not be consumed until after 90 days.

*For further information, please see documents 1, 2, 3, 7.*

**Storage**

Store maize in a ventilated facility that prevents rodents, birds, insects, and moisture from entering and damaging grains. Maize can be stored when shelled or as cobs.

* Ensure that storage bags in storage facilities are clean and dry, and piled on pallets that raise them off the ground and do not allow bags to contact walls.
* Use PICS bags or airtight containers during storage to reduce pest infestation.
* Regularly monitor all storage containers for changes in temperature and the moisture content of grain.
* A temperature change of 2-3 degrees centigrade could indicate bacterial or insect infestation.
* Maize storage facilities like granaries should be treated with fumigants, fungicides, and insecticides. Pests like weevils can be controlled organically by mixing lime with grains. Other non-chemical options include mixing wood ash with powdered chili pepper, powdered pyrethrum, or lilac seeds and combining the mixture with maize grains to control insects other than the large grain borer.

*For further information, please see documents 1, 2, 3.*

**Definitions**

*Soil conditioners*: Substances added to the soil to improve fertility and soil structure when soil is degraded.

**Where can I find other resources on this topic?**

*Documents*

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11. J. Atehnkeng, J. Augusto, L.A. Senghor, A. Akande, J. Akello, C. Mutegi, A. Ortega-Beltran, P.J. Cotty, and R. Bandyopadhyay, 2017. *Farmers’ Guide to Management of Aflatoxins in Maize and Groundnuts in Africa*. <https://aflasafe.com/wp-content/uploads/pdf/TrainingManual_WestAfrica.pdf> (4.72 MB)
12. FAO, undated. Grain crop drying, handling and storage. <http://www.fao.org/docrep/015/i2433e/i2433e10.pdf> (2.26 MB).
13. Wills Munthali, Harvey Jiwa, Lizzie Kachulu, Anitha Seetha, 2016. *How to Reduce Aflatoxin Contamination in Groundnuts and Maize: A Guide for Extension Workers.* <http://www.icrisat.org/wp-content/uploads/2017/02/Aflatoxin_mannual.pdf>(4.03 MB).
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## Common names for Ocimum kilimandscharicum

East Africa: Camphor basil, hoary basil, fever-plant, Kilimanjaro basil

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