Aflatoxin

Lesson 1: Intro

Topics: What is aflatoxin?, What fungi produce aflatoxin?, Different types of aflatoxin, Conditions conducive for aflatoxin, Health impacts of aflatoxin, How much aflatoxin is considered dangerous?

Aflatoxin is a type of mycotoxin, compounds that are produced by fungi as they grow and infect plant tissues. The most prevalent mycotoxins are found in groundnut, maize, wheat, barley, rye, rice, sorghum, spices and tree nuts.
Aflatoxin is produced by four species of *Aspergillus* fungi. The most common is *A. flavus*, but *A. parasiticus, A. nomius and A. niger* have been found to produce aflatoxin. Of the six types of aflatoxin – G1 & G2, B1 & B2 and M1 & M2 – Aflatoxin B1 is considered the most toxic.

The amount of aflatoxin contamination in a crop varies from season to season and from field to field. Some risk factors include late-season drought, damage by insects, insufficient drying or storage in humid and hot conditions. Aflatoxin cannot be detected by sight, smell or taste, but can cause acute toxicity in humans and livestock or, over time, liver and kidney damage or stunting in children.
The US has set a limit of 20 parts per billion and the European Union has the level at 4 parts per billion

Lesson 2: Detecting aflatoxin

Topics: Detection methods, Different lot sizes, Contamination not uniform, Testing procedure, Talking a sample, Preparing a sample, Analytical test methods, Source of error

The most accurate way to detect aflatoxin is by using one of several chemical test methods. All of these require extracting the toxin from a sample, then testing. While highly sensitive and accurate, these are expensive and can involve sophisticated instrumentation.

Lots can come in many forms and sizes – from a few 50 kg bags to a large warehouse. Figuring out when and how to sample the product is important. Aflatoxin contamination is not uniform, and the amount will vary from kernel to kernel, so to get an accurate test result, it is vital to take a representative sample from the lot.

There are three important steps in testing for aflatoxin:

- Collecting a representative sample from the lot
- Preparing that sample for analysis
- Preforming a proper analytical procedure to detect the concentration of aflatoxin present in the sample.

Of the three steps, sampling is the most complex, but also the most important. Following proper sampling protocol means taking small mini-samples randomly from throughout the lot and combining them. That sample then is shelled and ground into a paste or powder to assure homogeneous distribution and representation of all kernels within the sample. The particle size of the grind is important, with finer size resulting in a more accurate detection of aflatoxin levels within the analytical sample.

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A variety of testing methods exist for detecting aflatoxin, and each has trade-offs in accuracy, limitations in specifying different aflatoxin types, cost, throughput, safety, and required technical skill and infrastructure capacities. The current gold standard method is HPLC, which can accurately quantify the different aflatoxin types and is accepted by all regulatory bodies. However, this method is expensive, time-consuming, and requires significant equipment and technical capacity.

It is common for multiple tests from the same lot to have different results. The vast majority – around 70-80% – of the error can be attributed to the way the sample was collected from the original lot and the size of the sample.

Lessons 3 & 4: Managing risk for aflatoxin

Topics: Naturally-occurring mold, Plant stress, Poorly timed harvest, Improper drying in the field, Mishandling pods, Improper storage

Risk Factor: Plant stress

Manage by:

- Controlling fertility, particularly calcium, so that nuts develop properly
- Managing weeds, insects and diseases such as leaf spot, rust or rosette virus.
- Avoid drought by choosing fast maturing varieties and planting on time.
- Harvest on time. If groundnut is harvested too early, immature nuts take longer to dry and increase the risk of infection. If the groundnut is harvested too late, the plant is more prone to drought. Use the estimated maturity date for the variety and check the status by color of the inner shell.
- Consider biological controls, such as Aflasafe

Risk Factor: Moist pods

Manage by:

- Immediately after harvest, plants may be left in the field for two to three days for the first stage of drying, but should be inverted, so that pods lay on top of the plant and off the bare dirt. Avoid leaving the pods out in the rain.
- Once pods are removed from the vines, dry further on a tarp. Keep animals away and move the tarp inside if it rains.
- Pods should be to 10% moisture or less before storage.

Risk Factor: Poor storage

Manage by:

- Sort out obviously moldy or damaged nuts before storage.
- Store pods at 10% or less moisture and protect them from becoming re-wet. Store in clean, dry bags stacked off the ground and away from the wall. Repair leaky roofs or ventilation slots that allow rain into the building.
- Keep rodents or other pests from chewing holes in bags, which lets in moisture as well as insects can damage pods, making fungal infection more likely.
- Do not re-wet the pods to remove the shell.

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Resources

Intro
1. VIDEO: Groundnut Field Studies: Smallholder Farmers Improving Food Safety
2. GRAPHIC: Aflatoxin

Detection
1. GRAPHIC: Detecting Mycotoxins
2. VIDEO: Seminar on mycotoxin sampling, 2014

Managing Risk
1. Malawi Production Guide (Page 30-34)
2. SAWBO VIDEO: Harvest and storage
-- English
-- Chichewa male
Chichewa female