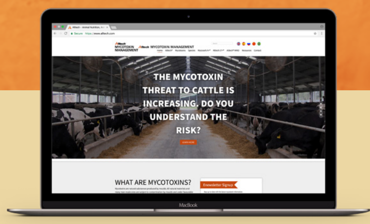
Alltech® Mycotoxin Management



Feed Mill Services

Alltech® MYCOTOXIN MANAGEMENT

Alltech®

knowmycotoxins.com

Alltech.com AlltechNaturally @Alltech

Introduction

Prevention of mycotoxin contamination in the feed mill environment.

Mycotoxins are natural substances produced by molds and fungi, which are common in the farm environment – surviving in many places and on many different types of feed sources. More than 500 different mycotoxins have been identified to date and most animal feedstuffs are at risk of contamination from multiple mycotoxins.

The growth of molds – and mycotoxin production – is typically encouraged by heat and the presence of moisture. However, mycotoxins can also be produced because of other factors that induce plant stress, such as drought.

Climate and feed storage practices influence the range of molds occurring in farm feed stocks, and with traditional tilling and crop rotation practices diminishing in many developed countries, mold contamination is persisting year-on-year, making the multiple mycotoxin threat very real.

Effective mycotoxin management is about seeing the whole challenge, from the farm to feed mill and from risk assessment to feed management. Thankfully help is at hand. The Alltech Mycotoxin Management Team provide a number of unique assessment services to help you mitigate the threat you could face in your feed mill operation.

Our specialist team can provide advice and recommendations in the following areas of mill operation:

- **Receiving**
- **Sampling**
- **Drying management**
- **Storage**
- **Processing**
- **Finished product**

Receiving

Receiving can be the start or stopping point of a potential problem at the mill.

Receiving is often the most demanding area of the mill. Mycotoxins and other quality issues can be controlled before becoming an issue at receiving. It is crucial to have Standard Operating Procedures (SOPs) written on how employees should handle certain situations at receiving.

SOP recommendations:

- Proper sampling techniques
- Visual inspection of ingredients
- Correct use of equipment and application of SOPs by employees
- Cleaning procedures
- Employee training

Sampling

Improper sampling can create a problem that may not exist in the mill.

This important stage of the process is often overlooked due to pressure from drivers or due to other circumstances that restrict time availability at receiving.

However, it is important to get an accurate sample to ensure proper quality assurance is being executed.

SOP recommendations:

- A consistent setup that is repeatable for employees
- Proper sampling equipment (probe)
- Access to a visual inspection before unloading
- Ensure samples are dry, organized, and properly labelled

Grain selection

The receiving process and procedures for grains are crucial to guarantee that the feed is of good quality and is of proper standard to meet regulatory limits for moisture, impurities and mycotoxin levels.

When looking at mycotoxin contamination, it is imperative that proper sampling techniques are used. They should represent the load as a whole, as more than 90% of errors in testing come from a faulty sampling procedure. Mycotoxins can vary immensely in the same load; within one ear of corn, you can find various levels of contamination as shown by Wetter et al. (1999), who indicated that DON contamination was higher on the tip of the ear and at the base of the ear.

After harvest, large variations in mycotoxin contamination can still remain. Johnson et al. (1969) showed that inside a corn silo, there can be a big variation in aflatoxin contamination. As a result, sampling representation could completely change the reading of the overall mycotoxin contamination in the load.

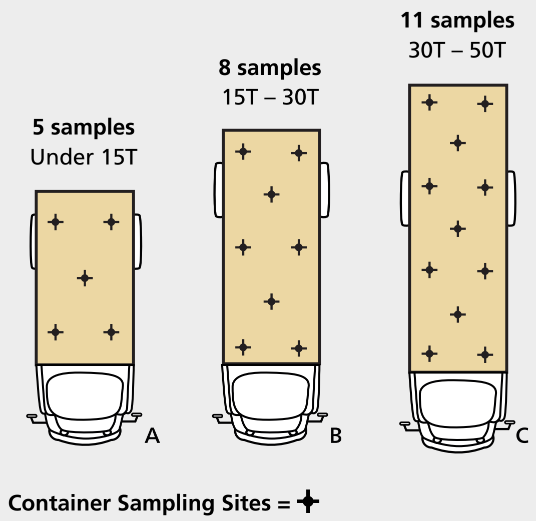
Sampling

When receiving grains, there are two methods of sampling the load, the first of which is sampling grains inside the container (truck/train).

Container sampling needs to follow United Nations Food and Agriculture Organization (FAO) regulations, which state that when a container is less than 15 tons, it is necessary to collect 5 samples.

At 15–30 tons, collect 8 samples, and from 30–50 tons there should be 11 samples. These samples should be collected from different areas of the load using a probe and making sure the whole load is represented (Figure 1).

Figure 1: Number of samples to take from containers of various sizes



(Source: Sampling for Mycotoxin Analysis, FAO)

The second method is sampling a falling stream of grains when it is being unloaded.

When using the falling stream method, sampling should be completed with a stream cutter and should cut the stream 10 times in homogeneous amounts of time and intervals. Samples should not be taken from the first or the last portions of a load, as these areas do not provide a representative cross-section. Samples should be collected from the grain stream where the stream is established at approximately 12 inches below the end gate (Figure 2).

- Use the correct equipment (stream cutter)
- Cut the stream 10 times in homogeneous amounts of time and intervals

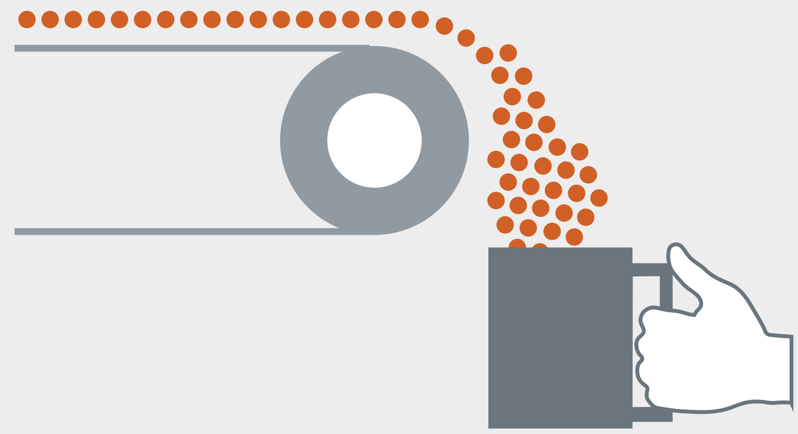
As part of the Alltech® Feed Mill Services, a sampling protocol can be designed for specific mills and conditions that may vary among mills.

Once the load is sampled, it needs to be tested for physical parameters and mycotoxin contamination. It is crucial that the mill has the correct equipment to conduct the necessary analysis on grain quality.

Damages to grains include:

- **Rot:** When grains have lost the staining due to heat, humidity or fermentation in more than ¼ the size of the grains
- **Mold:** When grains have molds visible to the naked eye
- **Sprouted:** Grains with visible germination
- **Weevil damaged:** Grains perforated by insect infestation or with living insects in the load
- **Withered:** Grains wrinkled by developmental disabilities
- **Broken:** Pieces of grains that are retained in a 5 millimeter screen

Figure 2



What to do

- While feed is in motion, use a sample cup to cut the stream at equal intervals.
- Cut the stream at least 5 times or as many times as it takes to gather a total of 100 grams.
- Once you gather 100 grams, homogenize the sample in an airtight plastic bag and send to the lab.

Sampling

For mycotoxin testing, our rapid test kits can be used to obtain instant information at the mill regarding the level of contamination for the key 6 mycotoxins, with accurate results determined for aflatoxins, ochratoxins, zearalenones, DON, T2/HT-2 toxins and fumonisins in under 10 minutes.

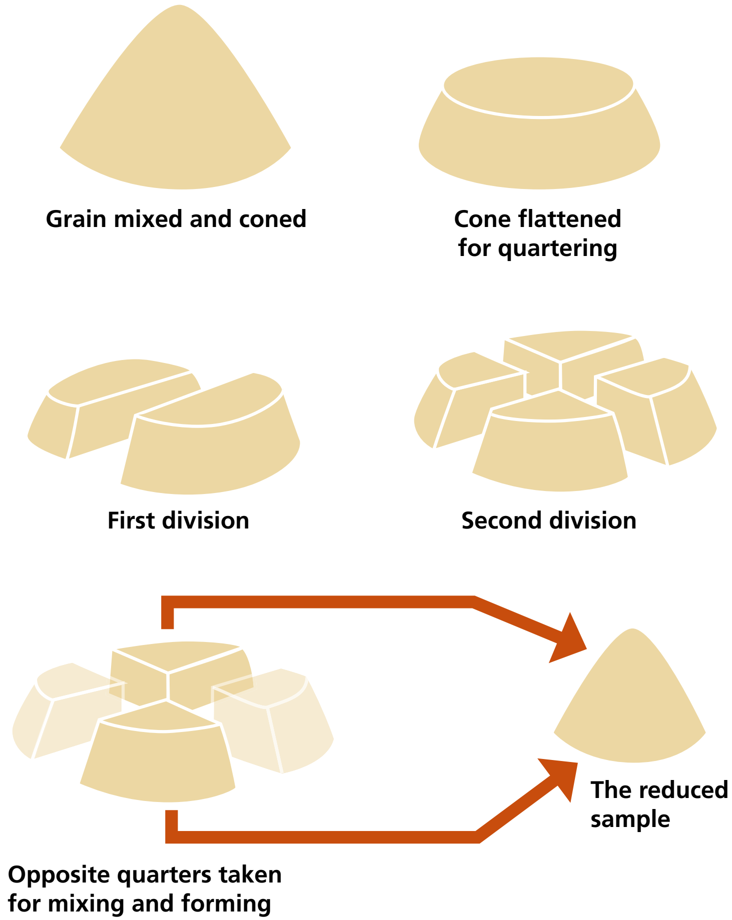
The limits, categorized as low, medium and high, can be based on the practical limits developed by the Alltech Mycotoxin Management Team.

It is also recommended that once a week a sample is submitted to the Alltech 37+® Mycotoxin Analytical Services Laboratory to be tested for a broader range of mycotoxins and in a more precise method.

The sample submitted to the Alltech 37+ ® Laboratory should represent all the loads from that specific week. To ensure sampling accuracy, it is recommended to do a blend of the samples collected every day and combine all 5 samples by the end of the week.

Once you have all 5 samples combined, it is recommended to use quartering equipment or a method (Figure 3) that would provide 2 final samples of 1 pound each, one submitted to the lab and the other held for possible re-test.

Figure 3: Quartering method of sample preparation



Drying management

Drying when grains are received at over 15% moisture is crucial to guarantee a better quality grain during storage.

There are several factors that can influence the correct process of drying, including the temperature in the chamber, the initial and final moisture of the grain, the air speed and the time inside the chamber.

During the drying process the moisture is first removed from the external portion of the grain. This process creates a gradient between the center and the outer part of the grain. When this gradient is high it causes a rupture (stress cracking) of the grains that can allow for increased mold growth.

The most important factor associated with the formation of cracks is the drying air temperature, while internal cracks are often associated with rapid drying of corn at high temperatures (Thompson and Foster, 1963; Gunasekaran et al., 1985; Kirleis and Stroshine, 1990; Naplava et al., 1995). Silva et al. (1995) demonstrated that drying corn with temperatures over 60°C (140°F) reduces energy value and palatability.

Also, according to the same authors, when the temperature of grains is over 60°C (140°F), the endosperm suffer chemical changes. Lima (2001) recommends that continuous flow dryers work with air temperature not over 90°C (194°F). With that, the mass of grains would be around 45°C (113°F), not causing any risks to the integrity of grains. The ideal moisture for longer storage is under 14%, as most molds will not grow below this level.

Storage

Proper storage conditions are essential to ensure all ingredients are kept at the quality expected at receiving.

Proper bin management, monitoring, inspection, and cleaning are key factors that should be implemented to prevent the build-up of mold and formation of mycotoxins.

SOP recommendations:

- Have a ventilation program in place to prevent the introduction of harmful mold and mycotoxins into the milling system
- Bins should be used on a rotation when possible
- Dedicated bins for higher risk ingredients
- Visual inspections should be performed
- Proper bin cleaning and equipment

Storing grain should maintain the quality it had at harvest for a longer period, but it will never improve the quality of the grain. To keep the quality as close as possible to harvest time, there are important practices to be followed.

Harvest and drying are crucial to a good start. It is also important to run the grain through screens, removing all impurities and broken grain, as these usually carry higher levels of mycotoxin contamination.

Once silos are filled it is important to monitor temperature and moisture. The improper control of temperature causes moisture to migrate from one part of the grain mass to another, where the moisture can accumulate, forming 'hot spots' and causing grain spoilage problems.

During silo filling, better quality grains tend to roll and occupy the side areas, while broken ones with impurities accumulate in the central portion.

This can interfere with air circulation inside the silo and generate more risk to the good quality grain as they touch the walls, where there is risk of condensation.

Therefore, it is a good practice to rotate grains, removing this central column to allow the better quality grains to occupy the middle section. Aeration is a critical process to maintain the quality of the stored material; however, it needs to be done at the correct time. The main reasons to aerate are to keep the temperature low and uniform, reduce the risk of deterioration, avoid moisture migration and provide additional drying to correct minor variations in humidity and temperature of the grain mass.

Aeration should be preventive rather than corrective, because once temperatures increase, problems have already occurred.

The guiding principle should be the reduction of grain temperature. Therefore, you should intervene when the air temperature is a few degrees lower than the temperature of the grain. This takes into account two limiting factors: the relative humidity and the temperature difference between the air and the grain.

When the grains are slightly humid, the temperature difference between the air and the grain is more important than the relative humidity, but when grain moisture is close to the commercial standard, these two factors are equally important. Ventilation when the relative humidity is above 70–75% should be avoided if the temperature difference between the air and the grains is less than 3°C (37°F) to 5°C (41°F). However, if you must choose between the two alternatives (risk of heating or weight loss by loss of water), the grain quality conditions at the time should guide the best decision (Lasseran, 1978).

Another important step to secure a good quality material and the absence of molds is insect control.

The book 'Encyclopaedia of Entomology' by John L. Capinera (2008) indicates that the most favorable grain moisture range for stored grain insects is 12–18%. In many instances, insect infestation amplifies mold problems in grains, exposing otherwise hidden endosperm surfaces to molds, transporting mold spores to new areas and encouraging mold germination in microhabitats made moist by insect metabolic activity.

Also recommended is the use of a combination of organic acids in the grains that will be stored for a longer period, as described by Krabbe (1994). Grains stored over 10 days with higher moisture content had a statistically higher respiratory ratio, which is an indication of mold growth. When not treated with propionic acid, even corn stored at 12.5% moisture had an increased CO_2 production.

Finally, cleaning silos between loads is also a crucial step in minimizing the risk of mold growth. This cleaning should be completed with approved disinfectant mixes sprayed onto the silo walls.

Processing

Each mill is unique and will have its own set of specific circumstances that may need addressing.

Equipment, space, customers, environment, and other factors will be different at each mill. Therefore, each piece of equipment, manufacturing step, and milling system should have its own set of standards for employees to follow.

SOP recommendations:

- Instructions on how each piece of equipment is used
- List of issues and solutions for newer employees
- Quality standards and setup
- Proper start-up and shutdown procedures

Finished product

Your finished product tells the story of the mill.

Quality checks should be performed to ensure finished product quality meets specifications and results in satisfied customers.

SOP recommendations:

- A nutrition value, particle size and pellet quality check should be performed as recommended by the nutritionist
- A sampling procedure should be in place for finished products along with facilities for retained sample storage

Feed Mill Services

Josh Teulker
jteulker@alltech.com
001 812-569-4700

For more information, visit knowmycotoxins.com