FACTSHEET:

Safety Concerns in Weather Damaged Wheat and Barley

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INTRODUCTION

Extensive rain during the 2010 harvest has significantly damaged many wheat crops in South Eastern Australia. The presence or absence of mycotoxins in wheat will determine whether it is suitable for milling, manufacturing or stock feed. Mycotoxins are produced by fungi and are toxic to humans and animals in low concentrations. The mycotoxins can be in the spores, hyphae (cotton like strands) or the grain in which the mould is growing. However, only some moulds produce mycotoxins and only under certain conditions. Different mycotoxins are produced by different fungi. The main mycotoxin-producing fungi that may be found in Australian wheat and barley are (table below):

Fungi	Mycotoxin	May be seen as
Fusarium graminearum	Deoxynivalenol, zearalenone	bleached or yellow grains, may have pinkish tips
Alternaria alternata	Alternariols, tenuazonic acid	darkened tip of wheat grain
Aspergillus flavus and Aspergillus parasiticus	Aflatoxins	Greenish mould on the exterior of the grains (rare)

**Not all staining is caused by fungi. Black staining of the wheat grain at the embryo end can also be a physiological response without fungal contamination known as black point.*

SIGNS THAT MYCOTOXINS COULD BE PRESENT

Mycotoxin testing is not done at receival points due to the time and equipment this testing requires. At receival points **staining** and the presence of **field fungi** are used as visual indicators that mycotoxins may be present.

Wheat is classified as having field fungi by the Grain Trade Australia Standards (GTA) if more than fifty percent of the seed coat is discoloured (e.g. white, grey, pink or black). If the level of discolouration is less than fifty percent the wheat is classified as stained. However, grain may have field fungi or fungal staining but no mycotoxin contamination. If your wheat is being downgraded due to fungi it may be worth having mycotoxin testing conducted and then consider your options to sell the grain.

TESTING FOR MYCOTOXINS

Mycotoxin testing needs to be conducted in a laboratory. There are several options to test for the presence of mycotoxins.

1. *A mould count* (i.e. counting the number of colonies of mould that grow from each seed) can give an indication of the total amount of mould present in the grain. This test measures the number of grains infected with mould but it doesn't tell you whether the grain is infested with moulds that make mycotoxins or other moulds.
2. *An ELISA test* (enzyme-linked immunosorbent assay) is a way of determining the presence or absence of a specific mycotoxin in a sample of grain. While ELISA tests are quick and relatively inexpensive if you want to know if more than one mycotoxin is present several ELISA tests have to be done.
3. *HPLC testing* (high performance liquid chromatography) is slower than ELISA testing and significantly more expensive; however it does quantify the concentration of a specific mycotoxin in the grain.

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MYCOTOXINS IN STOCK FEED

The wet harvest this season has resulted in higher than normal mould growth in wheat and barley. Mould infested grain:

- Has reduced starch, protein and lipid contents and correspondingly the grain typically has a higher fibre content.
- May have off aromas and flavours.
- May contain mycotoxins.
- May be less palatable to stock.
- May affect the health and productivity of livestock.

Animals vary in their susceptibility to mycotoxins depending on their

- Species – pigs are often the most susceptible.
- Age – young animals are often more sensitive to mycotoxins.
- Breeding status – breeding and lactating females are more at risk.

Many mycotoxins are stable at high temperatures, e.g. deoxynivalenol is stable at 120°C, and so typical manufacturing or pelleting temperatures will not denature the mycotoxin.

RECOMMENDED LIMITS OF MYCOTOXINS IN STOCK FEED

Currently there is no set of harmonised mycotoxin regulations. The United States uses one set of guidelines, the European Union another, Japan another and Australia yet another.

Deoxynivalenol

Deoxynivalenol is one of the most common mycotoxins found in grains and is often referred to as DON or vomitoxin. Wheat grains infected with Fusarium head blight, white grain disease and take-all may look similar – white grains which may be shrivelled and have a low test weight. *See Head Blight Factsheet.*

Mycotoxin testing is required to identify if deoxynivalenol is present. There are no regulations covering acceptable levels of deoxynivalenol in human and animal food in Australia but sales contracts may stipulate 1 part per million (ppm). When eaten by stock, feed contaminated with deoxynivalenol can cause food refusal, weight loss, vomiting (hence the name vomitoxin) and diarrhoea (Bennett & Klich 2003).

The following limits beyond which stock growth is impaired were presented by Blaney (2007):

mg/kg deoxynivalenol in the total diet	Animals
1	Pigs
3	Poultry
<30	Calves

Zearalenone

Low levels of zearalenone in feed can result in disrupted conception, abortion and other reproductive problems, particularly in pigs but also in cattle and sheep (Bennet & Klich 2003). There are only a few records of zearalenone poisoning of pigs in Australia but as zearalenone can also be present on the stalks of wheat and barley the use of infected hay for bedding is not recommended for pigs. Zearalenone is often found co-occurring with deoxynivalenol in which case a risk assessment should be based on the total mycotoxin concentration.

Limits recommended for stock feed by Blaney (2007) are:

mg/kg zearalenone in the total diet	Animals
0.1	Young pigs
0.2	Pet foods (10-50% final product)
0.5	Cattle & poultry
2	Stock food after dilution

Alternariols

While suspected of contributing to poor animal performance the toxicity of alternariols and other mycotoxins produced by *Alternaria* species is still being investigated. Cultures of *Alternaria* are toxic to poultry.

Aflatoxins

The presence of aflatoxins in Australian wheat and barley grown in a normal season is very rare. Aflatoxins have been detected in extremely mouldy wheat from temporary bunkers in Southern Queensland and visibly mouldy barley in a sealed silo. In both cases, poor storage created the right conditions for aflatoxin production. Two types of aflatoxins are produced in wheat – B and G and testing for both is recommended. The maximum level of aflatoxin in feed for lactating cows is lower than other cattle as aflatoxin can be passed into milk as aflatoxin M.

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Limits recommended for stock feed by Blaney (2007) are:

mg/kg aflatoxins in the total diet	Animals
0.005	Ducklings
0.01	Turkeys, dogs, cats.
0.02	Chickens, weaner pigs, dairy cows, dairy goats, dairy sheep. Upper permissible limit for grain in Queensland.
0.05	Young cattle, goats & sheep, breeding pigs, cattle & sheep, horses.
0.1	Grower and finisher pigs, mature cattle, sheep & goats.
>0.1 *for short periods*	Lot fed mature cattle, sheep, goats & finisher pigs.

KEY RECOMMENDATIONS:

1. Discard visibly contaminated or caked pockets of grain. Wear appropriate personal protection equipment (PPE), have a shower and launder clothes after handling mouldy grain.
2. Dry grain to less than 12.5% moisture immediately after harvest. Mix well to avoid wet pockets. Ensure grain in the silo remains dry and well ventilated to prevent moisture migration. *See Storing Weather Damaged Grain Factsheet.*
3. Take representative samples for mycotoxin analysis as a guide to the best use of the grain (at least 6kg/truck load). GrainGrowers can arrange ELISA testing to identify highly contaminated wheat samples.
4. Introduce weather-damaged grain gradually while watching for feed rejection or changes in animal health.
5. The cost effectiveness of adding a mycotoxin binder to the grain should be considered.

REFERENCES

- Agricultural Standards Regulation 1997 – Schedule 3.
- Bennet JW & Klich M 2003 Mycotoxins. Clin Microbiol Rev 16:497-516.
- Blaney BJ 2007 www.maizeaustralia.com.au Mycotoxins in Australian Maize: A Risk Assessment.
- Blaney BJ & Williams KC 1991 Effective Use in Livestock Feeds of Mouldy and Weather-damaged Grain Containing Mycotoxins – Case Histories and Economic Assessments Pertaining to Pig and Poultry Industries of Queensland. Australian Journal of Agricultural Research 42:993-1012.