

Mycotoxins in Maize

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Summary

The aim of this demonstration was to determine if growers could do an early hand sample and test to see if their crop was suitable for markets that had strict limits on Aflatoxin and Fumonisin.

Unfortunately, regarding this demonstration the 2023/2024 season did not appear to be favourable for high levels of Aflatoxin and Fumonisin. All except one sample came in well below the current limits pre harvest, and were also well below at harvest. The only sample that did come in slightly higher for Fumonisin from a hand sample came in below the limit once harvested. This may have been due to a dilution effect, or areas that did contain high levels did not actually make it through the header to the truck.

Focus Paddock Details

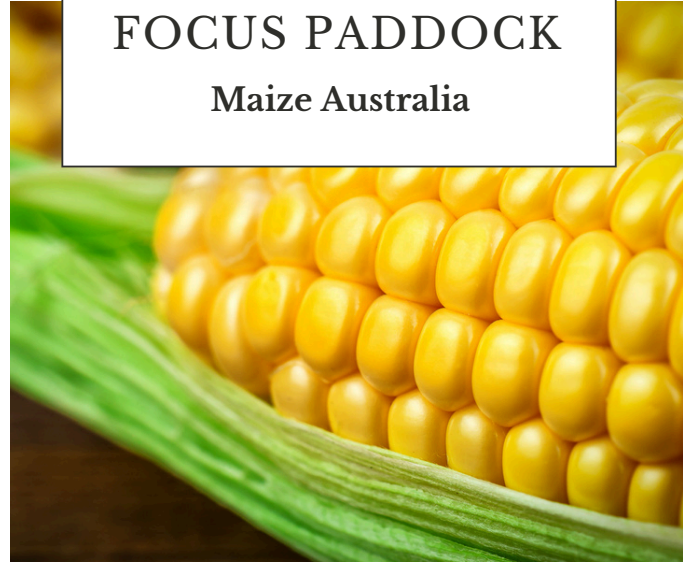
Location: 7 paddocks across 2 farms. Farms based in Leeton and Narrandera

Crop Type: Maize

Irrigation System: Overhead and surface irrigation

FOCUS Paddock

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Background and Aims

Mycotoxins are common in maize grains, and can be found in up to 25% of maize and maize products globally.

Mycotoxin contamination of Australian maize may cause an issue at marketing. Low to moderate levels of aflatoxins and fumonisins can be widespread in some seasons, but zearalenone, nivalenol and deoxynivalenol are usually confined to small growing localities. Mycotoxins are not common in Australian maize grains with the dryness of Australian grain, but in some seasons they do occur and cause rejection of loads by processors.

Mycotoxins are toxic fungal metabolites that can be harmful to human and animal health, and are a major contributor to cancer deaths and hepatocellular carcinoma

- **Aflatoxins:** A common mycotoxin in maize, especially in maize silage, which is used in dairy feed.
- **Deoxynivalenol (DON):** A common mycotoxin in maize, especially in grain-maize and whole maize plants.
- **Fumonisin:** A common mycotoxin in maize, especially in maize grains for food or feed.
- **Zearalenone:** A common mycotoxin in maize, especially in grain-maize and whole maize plants.
- **Trichothecenes:** A common mycotoxin in maize.
- **Ochratoxin A (OTA):** A mycotoxin that can occur in maize.
- **Fusarin C:** A possible human carcinogen produced by *Fusarium* species.

The fungi that produce mycotoxins in maize include Aspergillus, Fusarium, Alternaria, and Penicillium.

The risk of mycotoxin contamination can be increased by:

- Environmental factors
- High temperatures, water stress, and high humidity can all increase the risk of mycotoxin contamination.
- Damage
- Damaged grain is more prone to fungal invasion and mycotoxin contamination.
- Insects
- Insects can attack maize, creating conditions that are ideal for fungal activity.

If a load of maize grain is rejected at crop intake due to mycotoxins and aflatoxins this creates an issue for not only the grain buyer/processor, but also the grower as a new market must be quickly obtained to divert the truck. This has occurred in recent years at the Darlington Point Mill in NSW.

The focus paddock aimed to test for mycotoxins within standing crops to see if we could early identify potential high risk crops for mycotoxins.

Method

A composite sample from the whole paddock was collected in the following manner:

- Pre-harvest (R6 stage / 2-3 weeks prior to harvest)
- 4 – 5 locations in the one paddock (each sample spot to be 5m x 5m)
- 4 – 5 cobs from each location (quadrant)
- Total 16 – 25 cobs per paddock

Each collection of cobs from a paddock were then delivered to Corson Grain at the Darlington Point Mill. The kernels from each cob were collected and the kernels all combined from each paddock and blended and blitzed to create one sample.

The samples were then tested for Aflatoxin and Mycotoxin using the standard protocol to access samples at grain receipt.



Agronomic Results

Currently farmers are not testing grain in the paddock for mycotoxin levels but grain is tested at receipt point, with samples taken directly from the truck.

Maize samples collected prior to harvest directly from the paddock and tested for Aflatoxin and Fumonisin during the 2023/2024 harvest.

Table 1. Sample results

Farm Sample	Date to Site	Test Date	Moisture (%)	Aflatoxin (ppb)	Fumonisin (ppm)
Emma Farm 1	27/02/2024	29/02/2024	16.5	1.9	0.11
Emma Farm 2	27/02/2024	29/02/2024	25.7	1.7	0.87
Emma Farm 3	27/02/2024	29/02/2024	21.5	0.78	0.12
Emma Farm 4	27/02/2024	29/02/2024	17.5	1.5	0.28
Narrandera 1	5/03/2024	5/03/2024	19.5	1.1	3.5
Narrandera 2	5/03/2024	5/03/2024	11.4	0.91	5.5
Narrandera 3	5/03/2024	5/03/2024	25.2	1.3	0.23

Economic Results

The current limit in Australia for Fumonisin is 4ppm and for Aflatoxin 5ppb. The limits for Fumonisin will be decreasing in Europe to 2ppm and one customer has recently requested fumonisin to be <0.4ppm.

Based on the testing above one paddock may have exceeded the limit based on Aflatoxin level (Narrandera 2), but all other paddocks come in below the current Australian limit. The crop from Narrandera 2 at harvest did test below the 5ppb limit off the header. This is thought to have occurred as the test only just exceeded the limit preharvest, but during harvest as the crop was blended in the header and truck the actual level across the whole paddock was lower.

If all customers in Australia request levels below the European limits or as low as <0.4ppm then 3 of the above paddocks (Narrandera 1 and 2, and EmmaFarm 2) may have been rejected, or alternatively sent to alternative customers. The cost of a truck being rejected at crop receipt is a true cost to the grower. The actual cost though will depend upon the grower being able to quickly obtain another market to redirect the truck. In some cases the grain buyer may be able to segregate the load and send it to a market that has slightly higher mycotoxin limits.

Key Messages

It was difficult to get any key learning from this demonstration given that Aflatoxin and Fumonisin levels were low in the crops that were tested pre harvest. The one learning that did come out of it was that crops that might just exceed the current Fumonisin limit pre harvest may come in at an acceptable level at crop receipt.



Acknowledgements

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