

Mycotoxin Update

Mycotoxins are produced by actively growing mold and can have detrimental effects on pig performance and reproduction. Molds can be present and growing without the production of mycotoxins, and mycotoxins can be present even when mold growth is not readily visible. The most commonly occurring mycotoxins in grains include aflatoxin and *Fusarium* toxins. Aflatoxins at high levels do impact pig performance, however they are only produced under conditions of high environmental temperature and, thus, are not generally a toxin of concern in the Midwest. *Fusarium* and T-2 mycotoxins in small quantities have the following adverse effects on swine production and reproductive function.

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| 1. Fumonisin | Reduced feed intake leading to lower weight gains
Levels near 10 ppm are of concern. |
| 2. Deoxynivalenol (DON, Vomitoxin) | Feed refusal, reduced growth, weight loss, diarrhea.
May lead to infertility or death.
Levels near 0.5 ppm in nursery pigs and 1.0 ppm in the breeding herd are of concern. |
| 3. Zearalenone | Estrogenic effect causing enlarged vulvas, prolapsed uteruses or rectums, and reproductive failures leading to abortions, infertility, and small and weak litters.
Levels near 0.3 ppm for breeding swine and nursery pigs and 0.5 ppm for feeder pigs are of concern. |
| 4. T-2 | Skin lesions, digestive tract inflammation, feed refusal, vomiting, and possibly infertility and reduced milk production. Levels near 0.1 ppm for nursery pigs and 0.3 ppm for breeding swine and feeder pigs are of concern. |

However, in real-world situations more than one of these mycotoxins are likely to be present at a time. When combinations of mycotoxins occur in swine feeds, it has been shown that levels below the listed threshold values can result in adverse effects on pig performance and reproductive function.

Factors Leading to Mycotoxin Production

- Plant or grain stress at any stage of production or harvest (pre or post-harvesting, processing, transporting or storing).
- Pre-harvest environmental conditions such as damp weather, high temperatures, insect damage, hail damage or drought.
- Genetic factors such as poor variety resistance to mold growth, poor fertility, high stand density or weed competition.

Methods of Detection

Visual appearance of grain or feed is not a conclusive indicator. However, some feed signs that may indicate the presence of mold/mycotoxins include:

- Caking or lumping of feed
- Poor flowability
- Moldy/musty smell
- Grain is warm or there are signs of heating
- Dark or water-damaged color
- Obvious mold growth

The suggested and best method of detection is HPLC analysis (high pressure liquid chromatography). This type of analysis allows for the accurate detection of mycotoxins in grains and feeds as well as accurate determination of toxin levels.

North Dakota State University is an example of a lab that uses this type of analysis to detect and report levels of *Fusarium* (Fumonisin, DON, Zearalenone) and T-2 mycotoxins.



Multi Mycotoxin Screen

This screen costs around \$90 per sample and is done in three parts. The trichothecenes portion analyzes the TMS derivatives of Deoxynivalenol (DON), T-2 Tetraol, Fusarenone-X, 3-Acetyl DON, 15-Acetyl DON, Diacetoxyscripenol (DAS), T-2 Triol, T-2 toxin, Iso T-2 toxin, Scirpentriol, Nivalenol, 15-Acet-Scirpentriol, Neosolaniol, HT-2 toxin, Acetyl T-2, Zearalenol, and Zearalenone. The second is analysis of Aflatoxins, and the third is Fumonisin.

Mycotoxin Analysis

At least 500 grams of sample is needed for the three portions. Aflatoxin and Fumonisin analysis cannot be performed on forages. Feed samples are dried if necessary, ground, and extracted with Acetonitrile/Water. The sample is then filtered and dried. The residue is derivatized and an internal standard is added. The product is then analyzed by GC/MS for the trich. screen, and HPLC for the Aflatoxins and Fumonisin.

Visit the NDSU website at <http://www.vdl.ndsu.edu/inform/toxic/toxserv.htm> for further details.

Recommendations for Grains/Feed Containing Mycotoxins

- Complete removal of the grain or feed
- Dilution of the feed/grains with “clean” grain or feed
- Clean and screen all suspect grains (remove broken kernels and foreign material)
- Include adsorbents to bind mycotoxins (MTB 100, Zeobind, Geobond, etc)

Research with Adsorbents

Vita Plus conducted an in vitro (controlled environment outside a living organism) experiment to evaluate the mycotoxin binding potentials of Zeobind, Kaolin and MTB 100. It was found that these products have excellent binding capacities for aflatoxins and zearalenone, however none of these products showed efficacy against either DON or T-2 toxins.

Methods of Prevention

The prevention of mycotoxin formation is key, since there are no options that offer 100% protection against the production concerns caused by mycotoxins.

- Removal of damaged and high moisture plant materials and weed residues
- Proper handling methods (screening, cleaning, and minimizing seed coat damage)
- Proper drying methods
- Controlled storage environment
- Physical treatment (heat) if grain is suspect

Conclusion

Growing conditions and handling, cleaning and storage methods of grains are the leading factors that impact the formation of mycotoxins. Preventing the formation of mycotoxins is the best method of treatment; however not all of these factors can be controlled. Frequent grain and feed sampling and submission to NDSU is recommended to monitor mycotoxins and their levels. If mycotoxins are present, finding a new, clean source of grain is the best solution, although it may not be practical. The inclusion of an adsorbent and/or blending “clean” grain with the contaminated grain is an option that can bind and dilute the mycotoxins and potentially reduce the financial impacts of mycotoxins on pig performance, but there are no guarantees.

References

R.S. Adams et al. 1993. Mold and Mycotoxin Problems in Livestock Feeding. Penn State College of Agriculture Sciences Cooperative Extension. DAS 93-21 p. 1-16.

T.K. Smith. 2003. An Update on Mycotoxins in Swine Feeds. Vita Plus Swine Summit, March 27.

