

Deoxynivalenol (Vomitoxin) and Zearalenone in Feedstuffs

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Virginia crop specialists are reporting a higher than normal incidence of “scab” infection in the 2009 wheat crop. Scab, more formally called *Fusarium* head blight, is a fungal disease of wheat and barley caused by *Fusarium graminearum* or the sexual stage of this fungus, *Gibberella zeae*. The incidence is greater in wheat and barley when humid, rainy weather predominates during the spring months as the grain matures. Scab infected small grain typically has lower test weight and may be discounted at buying points. The fungus can also infect corn grain in the field, especially when cool, wet weather delays harvest of mature corn in the fall.

Another possible quality problem associated with scab infected grain is the presence of *Fusarium* produced mycotoxins. Scab infected wheat has increased potential to be infected with a mycotoxin called deoxynivalenol, also referred to as DON or vomitoxin. Among food producing animals, swine are particularly susceptible to adverse reactions to feeds containing vomitoxin. Pigs consuming complete feeds with a concentration of vomitoxin above 1 ppm¹ may have reduced feed intake and as a consequence, slower growth rate. As levels of vomitoxin in complete feeds approaches 5 ppm, major reductions in feed intake will occur and vomiting and complete feed refusal may occur at levels approaching 10 ppm. Therefore the suggested maximum level of vomitoxin in complete diets for all classes of swine is 1 ppm.

Other species of livestock and poultry are not as acutely sensitive to vomitoxin as pigs, but negative effects can occur if consumption levels are high. This is reflected in published Food and Drug Administration (FDA) advisory levels for maximum vomitoxin concentration in grains and grain products:

FDA Recommended Maximum	Description of Destination or End-Use
1 ppm	Finished wheat products for human consumption.
5 ppm	Grain and grain by-products destined for swine diets, but not to exceed 20% of the final diet and for other animals (except cattle and chickens), but not to exceed 40% of the final diet.
10 ppm	Grain and grain by-products destined for ruminating beef and feedlot cattle older than 4 months and for chickens, but not to exceed 50% of the final diet.

Another mycotoxin that may also be produced by *Fusarium* fungi is zearalenone. This mycotoxin may be found in grains independently or in conjunction with vomitoxin or other mycotoxins. A unique characteristic of zearalenone is that it has estrogenic properties and

consequently may disrupt normal reproductive function in the animal. Young developing gilts may display hyperestrogenic symptoms when consuming feeds with zearalenone concentrations as low as 1 ppm. These symptoms include enlargement and reddening of the vulva and enlargement of the uterus and udder. Higher dietary levels in mature breeding swine may cause reproductive failure, early embryonic death losses, expression of estrus (heat) during lactation, and extended estrous cycles. Estrogenic disruptions in cattle and poultry have also been reported with high levels of zearalenone consumption. For swine, maximum recommended levels of zearalenone in complete diets are: young growing pigs 1 ppm; breeding gilts and sows 2 ppm; finishing pigs, young and old boars 3 ppm (Diekman and co-authors, Pork Industry Handbook fact sheet 07-06-05, 2005).

If there are indications a source of wheat or barley grain has been affected by scab, there is reasonable justification to test for vomitoxin and zearalenone. A number of rapid immunoassay test kits have become available to do screening tests for threshold levels of economically important mycotoxins, including vomitoxin and zearalenone. These test kits require only a few stock reagents and simple lab equipment to perform; they are being used with increasing regularity at large grain buying points and feed mills. Screening and quantification testing is also available at commercial and university toxicology labs. The Virginia-Maryland Regional College of Veterinary Medicine Toxicology Lab, College of Veterinary Medicine, Virginia Tech, Blacksburg, VA 24061 offers fee based mycotoxin screening tests. Contact Dr. Blair Meldrum (bmeldrum@vt.edu) or Barbara Wise (bcwise@vt.edu) for fees and details.

Grain sampling research at the Virginia Tech Tidewater AREC (J. of Swine Health and Production, 2006. Vol. 14:149-152) indicated substantial variation in the concentration of aflatoxin within a mass of grain. It seems reasonable that similar variation would occur with vomitoxin and zearalenone. Multiple subsamples from several locations within a given load or bin should be collected, thoroughly mixed in a clean container and a representative sample taken and properly labeled for shipment to the laboratory.

Another important consideration relates to the addition of certain feed additives to mitigate the negative effects of mycotoxins on pig performance. There is a strong body of research demonstrating that dietary addition of certain pelleting aids and feed flow agents including sodium bentonite and hydrated sodium calcium aluminosilicate products, sharply reduces the negative effects of aflatoxins on pig performance. However, there is no published evidence indicating similar protective effects when the diet is contaminated with vomitoxin or zearalenone.