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SWINE NEWSLETTER

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Molds, Mycotoxins, Grain Storage, and Swine Feed

In some areas of the United States, grain harvested in 2001/2002 was contaminated with molds and mycotoxins. Mycotoxins are compounds produced by mold growing on crops under stress. Crop stressors include suboptimal temperatures, lack of nutrients, drought, or insect damage. Three types of mold produce most mycotoxins in North America: *Aspergillus*, *Penicillium*, and *Fusarium*. Some mycotoxins of major concern in North America include aflatoxin, zearalenone, ochratoxin, and deoxynivalenol (DON) or vomitoxin. Ideal conditions for mold growth differ depending on mold type. Aflatoxin-producing molds grow best in hot, dry conditions (2002), whereas vomitoxin-producing molds grow best in cold, damp conditions (2001).

Mycotoxin contamination cannot be predicted based on measurement of mold spore counts. However, mold detected by black light analysis may indicate a potential problem and dictate follow-up actions. Since mycotoxins exert effects on animals at very low levels (ppm or ppb), testing at certified laboratories is recommended if contamination is suspected. Selected mycotoxins and maximum tolerance levels are shown in Table 1.

Table 1. Maximum Tolerance Levels of Selected Mycotoxins

Toxin	Mold source	Class of swine	Maximum tolerance level
Aflatoxin	*Aspergillus*	Breeding Nursery Growing Finishing	100 ppb 20 ppb Not determined 200 ppb
Vomitoxin (DON)	*Fusarium*	All classes	1 ppm
Zearalenone	*Fusarium*	Breeding Nursery Growing Finishing	2 ppm 1 ppm 1 ppm 3 ppm

Adapted from the Pork Industry Handbook.

The tolerance levels listed in Table 1 were developed under the assumption that a single mycotoxin was present in the diet. However, single mycotoxin contamination rarely occurs in practice. Very low levels of multiple mycotoxins exert synergistic effects, magnifying clinical signs vs. a single toxin (Table 2). When evaluating mycotoxin contamination, the combination of toxins present, not just the level, becomes very important.

Proper storage and handling are critical in maintaining good quality grain. As grain is harvested, it should be cleaned (foreign material and broken kernels removed) to improve airflow, and dried uniformly to prevent pockets of moisture that allow mold growth. Grain harvested too dry results in more broken kernels, increasing the probability of mold growth. Mold inhibitors prevent growth of mold, but do not detoxify mycotoxins. Thus, mold inhibitors should be added to grain at harvest.

Table 2. Effect of Mycotoxin Combination on Weight Gain of Pigs

Aflatoxin, µg/g	Ochratoxin A, µg/g	Initial body wt, lb/pig	Final body wt, lb/pig	Wt gain, lb/pig
0	0	34.1	74.1 [a]	40.0 [a]
2	0	35.0	64.7 [a]	29.7 [b]
0	2	35.4	65.8 [a]	30.4 [b]
2	2	36.5	54.1 [b]	17.6 [c]

Adapted from Huff et al., 1988. J. Anim Sci. 66:2351.
[a,b,c] Means within a column with different superscripts differ (P<.05).

Mycotoxin-binding products such as silica clays do a good job detoxifying aflatoxin. However, clay does not generally bind vomitoxin. Under laboratory conditions (optimal pH and temperature), yeast cell wall products partially detoxify vomitoxin, but there is no data demonstrating efficacy of yeast products under field conditions. If possible, feed vomitoxin-contaminated grain to cattle. If not possible, mix contaminated grain with clean grain to decrease total vomitoxin concentrations below 1 ppm and feed to gestating sows and grow-finish pigs. Avoid feeding zearalenone contaminated grain to the breeding herd because of its estrogenic effects (Table 3).

Table 3. Clinical Guide to Mycotoxin Effects in Pigs

Toxin	Class of swine	Dietary level	Clinical effects
Aflatoxin	Grow-finish	<100 ppb	No clinical effects
		200-400 ppb	? ADG and ? F/G
		400-800 ppb	Microscopic liver lesions; immune suppression
		800-1200 ppb	? ADFI and ADG; rough hair coat
		1.2-2 ppm	Anorexia; depression; some deaths
		>2 ppm	Death in 3-10 days
	Sows/gilts	500-750 ppb	No effect on conception; farrowed normal piglets that grew slowly
Vomitoxin (DON)	Grow-finish	1 ppm	Some reduction in ADFI
		5-10 ppm	25-50% reduction in ADFI; vomiting
		20 ppm	Complete feed refusal; vomiting
Zearalenone	Prepubertal gilts	1-3 ppm	Swollen, red vulvas; prolapses
	Cycling sows	3-10 ppm	Anestrous; pseudopregnancy
	Pregnant sows	>30 ppm	Early embryonic death if fed 1-3 wk post-mating

Adapted from Osweiler, 1999 (In: Diseases of Swine. Eighth Edition, pp. 731-742. Edited by B.D. Straw, S. D'Allaire, W.L. Mengeling, and D.J. Taylor).

Contaminated grain bins can cause recurring mycotoxin problems in livestock systems. Moldy grain caked to the sides of bins will contaminate the next crop stored. Thus, grain bins should be pressure-washed prior to refilling. If mold growth is detected in stored grain, bins should be checked for leaks. Small holes or rust patches indicate damaged areas that need to be repaired.

In general, feed bins are a greater source of mold and mycotoxin contamination than grain bins. Mold prefers moist conditions for growth. This may occur when bins sweat and feed cakes to the sides. Ingredients in feed prone to caking include fat, soybean meal, meat and bone meal, bakery byproducts, corn byproducts, compacted wheat midds, and high moisture ingredients. Akey recommends power-washing feed bins a minimum of twice per year. At the very least, producers should completely empty feed bins between groups of pigs. This will limit mold and mycotoxin contamination of feed, improving consumption, growth performance, and efficiency.