The Prevalence and Effects of Mycotoxins in Pigs

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1. Introduction

There are well over 400 known fungal metabolites, mycotoxins, that can have a negative impact on swine health and performance. These impacts can be additive or synergistic and cover a broad variety of production traits. Typically, DON is a major mycotoxin of concern in swine production due to is' impact on feed intake (FI). DON is a prevalent (95% of samples) mycotoxin in swine finished feeds across North America. However, according to Alltech's Harvest Analysis and Analytical Services Lab Summary, finished feeds contained 5.81 mycotoxins/sample. There is also Fusaric Acid present in 92%, Fumonisin in 75% and T-2 in 48% of the samples respectively. This indicates that there can be complex mixtures of mycotoxins and evaluating the negative impact needs to encompass more than one mycotoxin.

1.1 Evaluating Multiple Mycotoxins

Government regulators, nutritional suppliers, genetic suppliers and consultants have all set or utilize guideline limits for mycotoxin(s) in feedstuffs for sale or inclusion into finished feeds. There is some agreement and some disagreement involving these guidelines. Many have been developed using *in vitro* data and

studies investigating only one mycotoxin. All sources of mycotoxin survey data indicate that there is not just one mycotoxin present and research indicates that negative effects due to mycotoxins can be subtle and not all dramatic. Therefore, only considering dramatic or maximum negative impact of mycotoxins may not be correct for optimum pig performance and health.

Alltech has developed a method to assess and evaluate the level of all mycotoxin(s) present in feedstuffs or finished feed. The Risk Equivalent Quantity (REQ) accounts for all the mycotoxin(s) present, places a value and sums the values to calculate a REQ. It should be noted, that when a pig consumes a mycotoxin, no matter how low the level, it cannot forget the consumption. At the least, mycotoxins will have additive effects and many will also contribute synergistic effects as well potentially magnifying the effects of other mycotoxins at lower levels.

2. Mycotoxin Survey North America for 2016 Crops

The Analytical Services Lab at Alltech conducts mycotoxin analysis using LC-MS/MS technology and procedures, and has an ISO/IEC 17025:2005 accreditation by Perry Johnson Accreditation, Inc. and is recognized internationally by the International Laboratory Accreditation Cooperation. The analysis for 38 individual mycotoxins is carried out on feedstuffs and finished feeds. Summaries of the numbers and prevalence of mycotoxins for grains and grain by-products are shown in Table 1. Corn and wheat contain DON, 72% and

61% of the samples, as the most prevalent mycotoxin followed by Fusaric Acid and Fumonisin. Ergot was present in 21% of the wheat samples.

Table 1. Number and prevalence of mycotoxins in feedstuffs in North America survey

Feedstuff	Avg. Mycotoxins/Sample	Prevalence of Mycotoxins
Corn	3.28	DON, Fusaric Acid, Fumonisin
Wheat	2.28	DON, Ergot, Fusaric Acid
DDGS	7.45	DON, Fusaric Acid, Fumonisin
Wheat Shorts	3.91	DON, Ergot, T-2

The distribution of risk for feedstuffs and finished feeds is shown in Table 2. 58.4% and 65.5% of the corn samples are at moderate and high risk for grow/finish (G/F) and nursery pigs respectively, while wheat is at 80.5% and 80.4% moderate and high risk for G/F and nursery pigs respectively. These grains typically make up a large portion of a finished swine feed and a large percentage of this risk will be transferred into the finished feeds.

Table 2. Number, range and prevalence of mycotoxins in finished feeds for nursery and G/F pigs

Phase	Avg. Mycotoxins/Sample	Range Mycotoxins/Sample	Prevalence of Mycotoxins
Nursery	5.64	2 - 10	DON, Fusaric Acid, Fumonisin
G/F	6.07	0 - 14	DON, Fusaric Acid, Fumonisin, T-2

Nutritionists, consultants and managers are under pressure to continually lower feed costs. Therefore, they are looking at by-product ingredients such as DDGS and wheat shorts. These processed grain by-products concentrate the mycotoxin present in the grain into a smaller mass of processed ingredient. DDGS will typically contain 3X the mycotoxin that was in the original grain. The result of

inclusion of by-products, such as DDGS and wheat shorts, is a less costly diet but the mycotoxin content of the finished feed will be higher due to adding in more mycotoxin than was removed from the original grain ingredient. DDGS on average contained 7.45 mycotoxins/sample with over 95% of the samples at moderate and higher risk to nursery and G/F pigs. Wheat shorts were similar with over 90% at moderate and higher risk.

Finished feed samples submitted in the same time-period contained 5.81 mycotoxins/sample generating moderate to high risk for nursery and G/F pigs at 95% and 94% respectively. Table 2 lists the average number of mycotoxins per sample and the range for nursery and G/F pig finished feeds, as well as the prevalence of the mycotoxins present. Nursery feeds average 5.64 mycotoxins/sample with a range of 2 – 10 measurable mycotoxins. The G/F samples contained slightly more measurable mycotoxins on average, 6.07, with a greater range of 0-14 mycotoxins. The prevalent mycotoxins were the same for each phase, with DON, Fusaric Acid and Fumonisin being most prevalent. T-2 was prevalent in nearly 60% of the G/F feed samples. The greater number of mycotoxins in G/F versus nursery feed may be due to the inclusion of more by-product feedstuffs.

3. Multiple Mycotoxins Negative Impact on Pig Performance

Mycotoxin risk is often defined as the maximum amount of a mycotoxin that can be fed before seeing dramatic effects such as feed refusal, vomiting, diarrhea, respiratory disease and increased secondary infections. Research has shown us

that mycotoxins can have subtler impacts on swine and therefore, maximum amounts may not be the best approach when feeding mycotoxin infested feedstuffs and feeds. Often the impact of mycotoxins is not seen until closeouts are ran and by then it is too late to correct the negative impact on ADG (Average Daily Gain), FCR (Feed Conversion Ration) and days as well as many other economic traits.

A review of the literature has identified studies that have investigated nursery and G/F pig performance with an identified level of mycotoxin(s) and the resulting reduction in ADG and/or FCR. By placing the levels of mycotoxins used in the challenge and placing them into a REQ calculation it is then possible to utilize varying REQ as an estimate of mycotoxin(s) impact on performance. Table 3 shows the REQ range of low, moderate and high for nursery and G/F feeds from the first 8 months of 2017, and the reduction in ADG and FCR as a percentage difference from target or expected performance for each phase.

Table 3. Performance reduction by total mycotoxin (REQ) for low, moderate and high risk for nursery and G/F pigs

Phase	REQ	ADG	FCR
Nursery	Low	-1.0%	0.4%
Nursery	Moderate	-2.0%	0.6%
Nursery	High	-9.0%	1.6%
G/F	Low	-1.5%	3.4%
G/F	Moderate	-3.3%	3.9%
G/F	High	-14.5%	6.8%

Mycotoxin impact on nursery pig ADG is shown to range from a -1.0%, -2.0%, and -9.0% respectively for low, moderate and high REQ risk. If there is an

expected ADG of .381 kg/day that would result in 3.81 g, 7.62 g and 34.29 g less gain /day for low, moderate and high REQ respectively. This would result in a 45-day nursey with pigs that weighed 171.4 g, 342.9 g and 1,543.1 g less weight /pig fed low, moderate and high respectively. The negative impact on G/F pigs with 118 days finishing period with and expected ADG of .843 kg would be -1.49 kg, -3.28 kg, and -14.42 kg /pig for low, moderate and high respectively. So, if you were to consider only additive effects, a low REQ challenge in nursery and G/F for 163 days feeding period, a pig would be 1.66 kg lighter and 3.62 kg lighter for moderate and 17.47 kg lighter for high risk. This could result in 2 to 20 days longer to reach target market weight of 124 kg.

FCR may also be impacted by mycotoxin risk. Research has shown that known levels of mycotoxins can negatively impact FCR in nursery pigs from .4% for low risk to 1.6% for high risk. This could result in a .05 kg/pig to .80 kg/pig additional feed when the target FCR is 1.53. In G/F this range could mean an additional 9.12 kg feed for low risk REQ to 18.24 kg/pig for a high REQ to produce the targeted 101 kg/pig gain.

The impact of mycotoxins can also be affected by management, environment and pig health status. The economic value of the decreased gain and additional feed will vary, but it is important to understand that mycotoxins at low risk can still have a negative impact on pig performance and result in less economic gain.