Alltech®
MYCOTOXIN
MANAGEMENT

FROM THE INSIDE OUT:

MYCOTOXINS IMPACT GUT HEALTH AND PERFORMANCE OF PIGS

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The hidden threat of mycotoxins in animal feeds has gained wider recognition over the past decade.

Mycotoxins are secondary metabolites produced by a variety of mould species that can be found growing on crops in the field, or on stored feed materials post-harvest. It is common for feedstuffs to be contaminated with multiple mycotoxins, as many moulds have the potential to produce multiple toxic metabolites, and many moulds can grow under similar environmental conditions.

Additionally, animal feeds containing several grain sources can bring together a variety of mycotoxins. Mycotoxins cause a variety of symptoms in pigs, ranging from feed refusal and lowered growth performance, to altered reproductive capacity, and immunity problems.

However, what may be the first target of mycotoxins, and one of the most influential effects on pigs, is the effects on gut health. Many mycotoxins have cytotoxic and pro-oxidative properties which can damage gut tissues and alter intestinal functions. These impacts on gut health can subsequently affect the performance of pigs.

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INTESTINAL DAMAGE BY MYCOTOXINS

The gastrointestinal tract may be the first organ to encounter mycotoxins when pigs are exposed to contaminated feed. Not only will the intestines serve as an entry route for mycotoxins into the rest of the body, but the direct effects of mycotoxins on the digestive system can have significant effects on pig health.

Upon consumption of mycotoxins, there may be inflammation and necrosis of the gastrointestinal tract, as well as changes to intestinal enterocyte functions and even gut level immune responses (Alizadeh et al., 2015). These effects can lead to poor performance and a loss of productivity.

The trichothecene mycotoxins, such as deoxynivalenol (DON or "vomitoxin") or T2-toxin, can cause some of the greatest effects on the intestinal tract. Research shows that exposure to DON can impair glucose transport systems across the gut wall in the jejunum, which may in turn alter nutrient absorption (Awad et al., 2004). Consumption of contaminated feed can also reduce villus height and surface area in the jejunum (Alizadeh et al., 2015; Figure 1).

Additionally, the presence of DON may reduce the occurrence and rate of proliferating cells in the intestine. These cells are important in growing animals for the development of the gut and maximum nutrient uptake. Compromising their proliferation can influence the animal throughout the entire growing period.

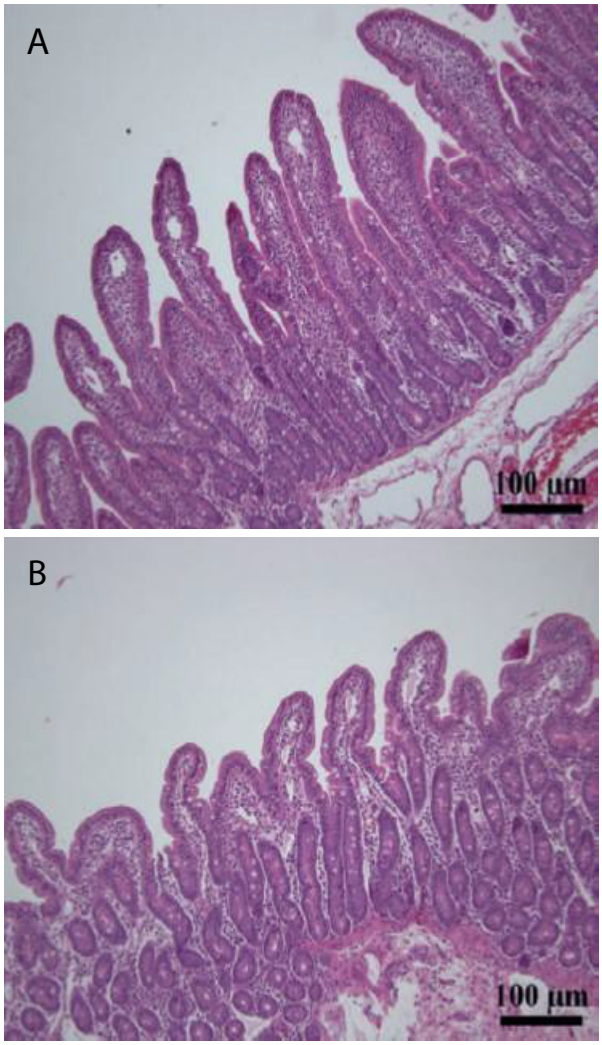

Figure 1. Photomicrographs of piglet jejunum tissue after feeding either control (A) or 0.9 mg/kg deoxynivalenol (B) diets for 10 days. Villus height was significantly reduced ($P < 0.001$) and crypt depth significantly increased ($P < 0.01$) in pigs fed DON diets (adapted from Alizadeh et al., 2015).

Mycotoxin exposure can cause oxidative damage to many parts of the body including intestinal epithelial cells. In piglets, lipid peroxidation in the jejunum has been documented (Van Le Thanh et al., 2015). Research also shows that mycotoxins such as DON can lower total antioxidant capacity (Wu et al., 2014). Externally, the increase in oxidative stress may manifest as an increase in feed conversion rate (FCR) and a reduction in performance.

An important, and often misdiagnosed, action of mycotoxins is the effect on the intestinal microflora. An impaired balance of the intestinal flora can have many adverse effects on the health of the host.

Several Fusarium mycotoxins can be linked to altered microflora and an increase in gut pathogens. Waché et al. (2009) found that low level doses of DON can result in altered gastrointestinal microflora. Consumption of fumonisin may also impact intestinal microbial populations, with research showing an increase in pathogenic E. coli colonization of the small and large intestines during challenge by this mycotoxin (Oswald et al., 2003).

With the ever-increasing concern about antibiotic use, mycotoxins could play an even greater role in gut health.

THE LINK BETWEEN MYCOTOXINS AND PROFITABILITY

When mycotoxins impact pigs through damages to the intestinal tract, immune system or endocrine system, the result can be lowered growth and a subsequent decrease in profitability. Predictions generated by the Alltech Mycotoxin Management program using the new Alltech PROTECT Calculator™, a program based on a summary of scientific literature, now provide a new understanding of how mycotoxins may influence swine producer profitability.

Based on the average mycotoxin risk level from data collected from the 37+® Analytical Laboratory for 2016 North American complete swine feeds (November 2016 through February 2017), nursery pigs may have a potential loss of daily gain by 34 g/day, a 1.3% increase in feed conversion ratio (FCR) and an overall loss in margin over feed (Figure 2).

Further estimates for the effects of mycotoxins on grow finish pigs can be calculated based on the same mycotoxin risk. In this case, grow finish pigs may have an average estimated loss of daily gain by 53 g/day and a 1.7 percent increase in FCR (Figure 3).

This loss in gain may equate to a total decrease of 4.8 kg (10.6 lbs) in carcass drag per pig. These effects on lowered gain and reduced carcass weight can certainly impact producer profitability.

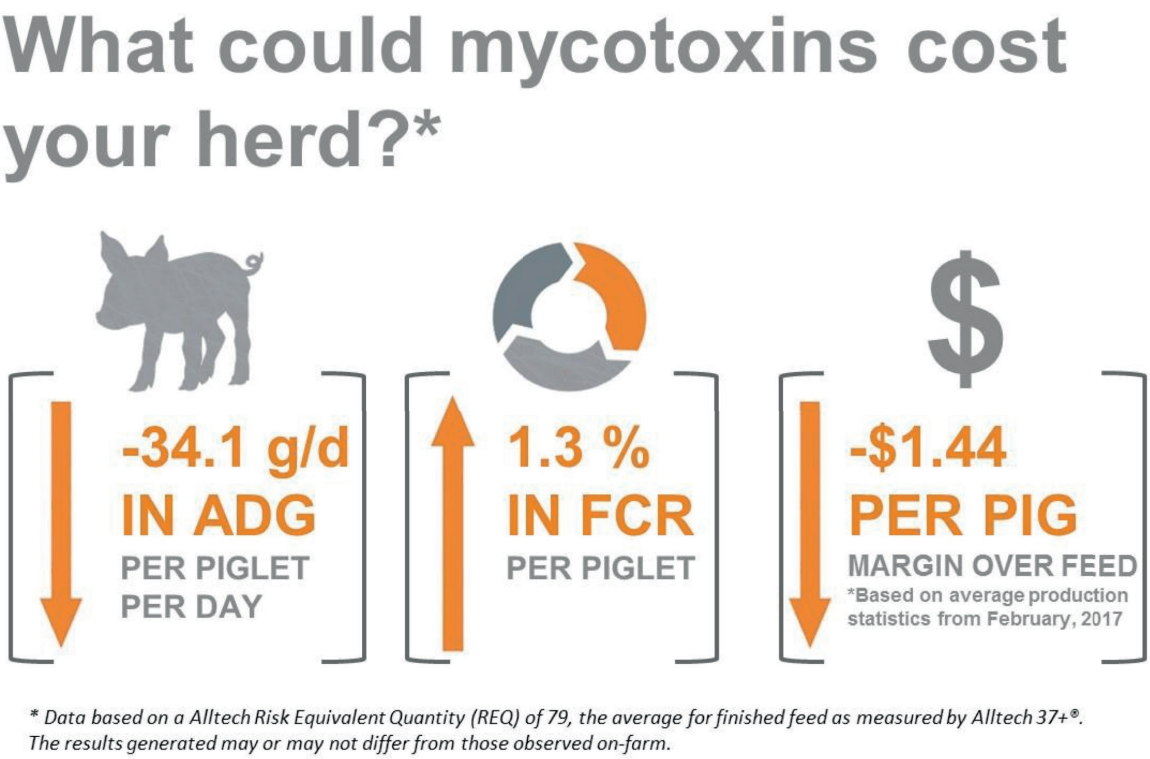

Figure 2. Potential impact of mycotoxins on nursery pigs based on the average mycotoxin risk level of North American complete swine feeds from November, 2016 to February, 2017 (data collected from the Alltech 37+® Analytical Laboratory) as generated by the Alltech PROTECT Calculator™.

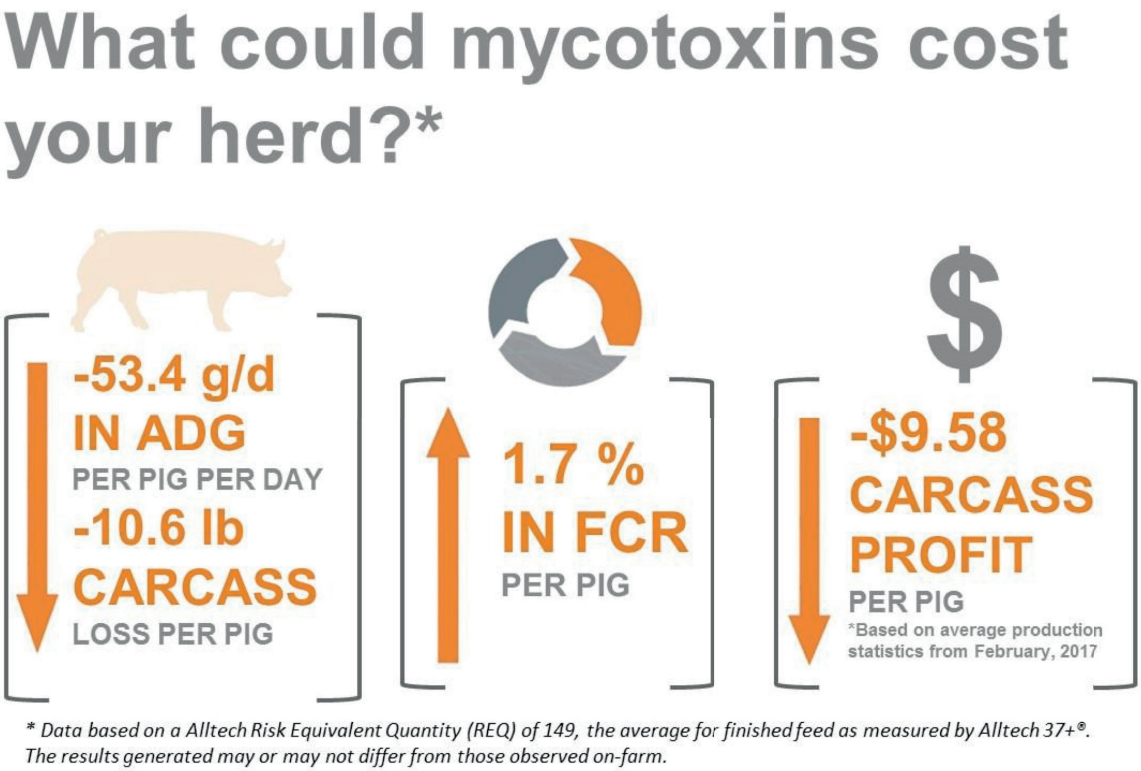

Figure 3. Potential impact of mycotoxins on grow finish pigs based on the average mycotoxin risk level of North American complete swine feeds from November, 2016 to February, 2017 (data collected from the Alltech 37+® Analytical Laboratory) as generated by the Alltech PROTECT Calculator™.

CONCLUSIONS

Consumption of mycotoxins by pigs can have strong impacts on gastrointestinal health, including changes to cellular protein synthesis, a decreased villus height or increased crypt depth and increases in oxidative stress (Maresca, 2013; Alizadeh et al., 2015). The irritation and injury caused by these mycotoxins can reduce digestion, leading to increased nutrient availability for disease-causing pathogens.

Analysis of the 2016 North American corn harvest showed 42% of the grains sampled were at a higher risk for nursery pigs and 12% a medium risk. Over 96% of samples were shown to contain multiple mycotoxins, especially those produced by Fusarium moulds.

The mycotoxin risk from the 2016 harvest is due to the poor climatic conditions that occurred in many regions during crop growth and harvest. The impact of these conditions may become even more apparent after storage. As a result, producers should be aware of both the current and future risk and how this may impact their pigs.

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