Feeding Fusarium Contaminated Grain

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At current feed prices, feeding diets containing 2 ppm of DON results in a reduction of $2.00/hog marketed to your operation (results calculated using the Prairie Swine Centre/George Morris Centre Enterprise model).

Fusarium head blight occurs when the right combination of environmental conditions exist. This includes rainfall immediately prior to heading in addition to ample heat and humidity throughout the flowering period. Several species of Fusarium have been identified to cause head blight of which a few produce mycotoxins. Throughout western Canada Fusarium graminearum is the most common, and represents the principal toxin producing DON (deoxynivalenol or vomatoxin).

With the 2013 harvest well on its way to completion pockets of fusarium have been reported in wheat throughout western Canada. It's important for pork producers to keep in mind the impacts of feeding DON contaminated grain, in addition to sampling procedures that can help minimize the impact of DON within their operation.

Research at the University of Manitoba has indicated that DON levels exceeding 1 to 2ppm have been shown to suppress feed intake in addition to reducing average daily gain. While different livestock respond differently to levels of DON in their diets, in pigs it is efficiently absorbed, poorly metabolized, and excreted slowly when compared to other livestock. Therefore making pigs quite susceptible to DON.

What can be done about feeding DON contaminated grain to pigs?

Agriculture Canada has set forth the following guidelines in feeding DON contaminated grain to swine:

(guidelines for DON intake are based on a 100% dry matter basis for the complete ration)

- feeding DON at levels above 1ppm in complete feed will result in some degree of feed refusal
- 5% feed refusal can be expected when levels of 1-2ppm are reported
- 25% feed refusal can be expected when DON exceeds 4ppm
- Vomiting is a rare occurrence, however can occur when DON is present at extremely elevated levels, greater than 20ppm
- Try and avoid feeding DON contaminated grain to weanling pigs, as they are more susceptible to elevated levels of DON. Feed refusal has been reported with levels less than 1ppm in weanling pigs
- Effects of DON on reproductive performance are not fully understood, therefore as a precautionary measure DON levels should be keep under 1ppm to minimize potential impacts on performance

Sampling and testing is another crucial component in determining a safe feeding program. When sampling grain, the general rule of thumb is, the more samples the better. Test results for DON will always experience a degree of variation because the mycotoxin we are testing for is not evenly distributed throughout storage, in addition DON will vary throughout the field.

The Bottom Line

At current feed prices, feeding diets containing 2 ppm of DON results in a reduction of $2.00/hog marketed to your operation (results calculated using the Prairie Swine Centre/George Morris Centre Enterprise model).

When feeding pigs with any level of known DON in the complete feed one should take great care and watch animal performance, as a reduction in feed intake may indicate DON levels are higher than what test results may report.

This information and more on feeding DON or mycotoxin contaminated grain can be found in the PorkInsight database. www.prairieswine.com/advanced-search/

Mycotoxins in Swine Diets
http://www.prairieswine.com/wp-content/uploads/2010/07/DON-Factsheet.pdf

Feeding Fusarium Contaminated Grain to Livestock
http://www.prairieswine.com/feeding-fusarium-contaminated-grain-to-livestock/

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Table 3. Nutrient content and variation of ingredients in a typical swine finishing diet in Western Canada.

Ingredient	%[1]	$/mt[2]	Mcal/kg	Lys	Met	P
Wheat	24	293	3.800 ± 0.15	4.8 ± 0.04	2.5 ± 0.02	4.0 ± 0.03
Barley	25	257	3.150 ± 0.35	4.8 ± 0.05	2.0 ± 0.03	3.9 ± 0.04
Peas	30	257	3.504 ± 0.23	16.3 ± 0.18	2.1 ± 0.03	4.2 ± 0.06
Corn DDGS	10	372	3.355 ± 0.17	8.6 ± 0.08	6.2 ± 0.08	5.6 ± 0.11
Canola meal	8	320	3.779 ± 0.02	10.1 ± 0.05	3.8 ± 0.05	7.0 ± 0.14

[1]Diets contained mineral and vitamin premixes, limestone, lysine and threonine but it was assumed these ingredients did not alter the variation of the above nutrients in the final ration.
[2]Saskatchewan 2013.

For example, the NRC Nutrient Requirements of Swine (2012) has no estimation for the variation in energy content within different classes of wheat. The DE content of corn and corn DDGS is based upon 4 and 11 observations, respectively. Interestingly, data for AA availability is generally more complete, however ingredient composition and utilization was identified by the committee as a priority area for future research (NRC 2012). The relevance of "book values" for either nutrient content or the variation associated with reported averages has to be considered by each individual mill or producer. Local conditions can significantly affect nutrient content.

In a study conducted several years ago, (but probably still relevant, especially with changing climates) Suleiman and co-workers (1997) showed, using a large number of samples of barley grain, alfalfa and silages grown in Alberta, that the current NRC dairy (1989) values did not accurately predict nutrient content. The average concentration of Ca was 100% and CP 30% higher than the NRC values while Cu and Zn were only 18 to 40% of reported values. The authors concluded that, in Alberta, locally derived nutrient values should be used for ration (dairy cattle) formulation and moreover, the high CV's observed indicated that frequent analysis was required (Suleiman et al. 1997).

Prioritizing analyses however, can significantly reduce associated costs. This can be accomplished by calculating the contribution of each ingredient to nutrient variation and then, based on ingredient cost, the cost of the variation (Duncan 1988). Variation of nutrients in a ration can be estimated from variation of each ingredient by (Duncan 1988):

$SD = \sqrt{(X^1S^1)^2 + (X^2S^2)^2 \ldots\ldots (XnSn)^2}$

SD = SD of the nutrient in the ration
Sn = SD of the nutrient in the nth ingredient
Xn = fraction of total nutrient contributed by the nth ingredient

Table 4. Cost of nutrient variation in a Western Canadian swine finishing diet, 2013.

Restriction	Cost of unit/$mt[1]	SD[2]	Cost of variation, $/mt[3]
DE, Mcal	0.079	0.12	0.009
Lysine, g/kg[4]	0.040	0.06	0.002
Methionine, g/kg[4]	0.110	0.02	0.002
Phosphorus, g/kg[4]	0.063	0.003	0.0002

[1]Only considering ingredients in Table 5.
[2]Standard deviation of the nutrient in the finished feed calculated as described above.
[3]SD time the cost.
[4]Total amino acids and phosphorus.

The contribution of each ingredient to final nutrient variation in a swine finishing diet was calculated using the data in Table 3. This calculation considers the cost of the variation in each nutrient, not the cost of the nutrient per se. Synthetic amino acids and minerals were assumed to have a negligible variation and were thus not included. As illustrated in Table 4, the cost of variation in energy is 3 to 4 times the cost of variation in other nutrients. Expending analytical dollars on the energy content of energy supplying ingredients would yield the highest return.

Logistical considerations

Table 4 indicates that variability in the cost of energy contributed more to the cost of variation in an example swine finishing diet than variation attributable to lysine, methionine and phosphorus combined, implying that analyzing high energy yielding nutrients for energy content would be a judicious use of resources to minimize ration costs associated with variation. However as well known by feed mill managers and producers mixing their own diets on farm, analyzing an ingredient and then segregating it until the results of the analysis are returned is very seldom a practical option. Advances in near-infrared spectroscopy (NIRS) however, are allowing the prediction of several nutrients, including energy (Zijlstra et al. 2011), rapidly enough that the use of these instruments may effectively mitigate some of the logistical problems of trying to adjust ration formulations to attain a consistent nutrient profile. Development and maintenance of calibration curves for various ingredients, however, remains an industry challenge.

The Bottom Line

The variation in ingredients available for use in livestock rations is real, of economic importance and unlikely to decline. The cost and risk associated with this variation depends among buyers and sellers. Understanding the source of the variation is important. If the perceived variation can be attributed to sampling or laboratory technique it can be reduced. If the variation is real it must be managed.

Reference for this article can be obtained by contacting Prairie Swine Centre at denise.beaulieu@usask.ca