Strategies for detoxifying vomitoxin (DON) using innovative chemical and biological approaches in post-weaning piglets

Chengbo Yang, University of Manitoba
Joshua Gong, AAFC Guelph

Why is this project important?

The mycotoxin deoxynivalenol (DON) occurs on many commonly used cereal grains such as corn, wheat and barley, and the incidence of DON contamination of grains has been increasing in recent years. It has been estimated that direct and secondary losses due to DON may range between $50 million and $300 million each year in Canada.

Typical negative effects of mycotoxin consumption by pigs include reduced feed intake, digestive dysfunction, immune suppression and reduced growth performance. In addition, consuming DON-contaminated feed results in damage to the intestinal tract epithelial cells, which causes alteration of intestinal growth and barrier function, as well as increased susceptibility to pathogens . Damage to the intestine also results in a reduction in nutrient absorption. Once absorbed, DON inhibits protein synthesis, causes kidney and liver damage, and can suppress immune function, resulting in a decreased ability to resist disease challenges.

In general, the negative effects of mycotoxins are greater in younger animals. While strategies have been developed to reduce the effects of some mycotoxins, such as toxin binders, these have limited effect for mitigating the negative effects of DON. There is a need for effective and economical methods to reduce the impact of DON in feed and feed ingredients.

What will researchers do?

- Develop an integrated platform for rapid and low-cost measurement of mycotoxins in feed ingredients.
- Develop an effective and practically feasible method for detoxifying DON in the gut of weaned piglets.
- Conduct further in vitro studies to characterize a bacterial isolate for use in pigs.
- Determine the effect of innovative detoxifiers on growth performance, gut barrier function, nutrient absorption and immunity in weaned piglets fed with DON-contaminated feeds.

What will be the benefit of this research?

Producer profitability is an important focus in the pork value chain, as is the ability to maintain consumer demand for pork and pork products. As a result, developing and optimizing cost-effective post-weaning feeding strategies will enhance efficiency at the production level. Utilizing nutritional strategies to improve gut health and function in weaned pigs will eliminate the need for in-feed antibiotics. In turn, this will allow for more efficient marketing strategies for Canadian pork and pork products.

It is also important to note that challenges to the immune system result in significant physiological alterations to the gastrointestinal tract. Previous studies have estimated a 20-35% reduction in lean growth and a 10-20% reduction in feed efficiency for growing pigs at sub-clinical levels of disease. This decrease in performance can have a substantial impact on producer profitability, which could be mitigated through optimizing nutrition programs during times of immune challenge.

What has been done so far?

As of 2021: In order to address the recurring problem of mycotoxin contamination in the feed industry, researchers have initiated a multidisciplinary collaboration to detoxify DON by using innovative chemical and biological approaches. Two new encapsulation methods have been developed for the effective delivery of sodium metabisulfite and have been evaluated under simulated gastrointestinal conditions.

With the collaboration of Dr. Francis Lin, Dr. Yang has also developed an integrated platform for the rapid and low-cost measurement of mycotoxins in feed ingredients. The results were published and the technology generated from this study has been patented.

Collaborators

Dan Columbus	Prairie Swine Centre
Joshua Gong Qi Wang	Guelph Research and Development Centre, AAFC
Francis Lin Song Liu Martin Nyachoti Chengbo Yang	University of Manitoba

Project status

Currently in progress.
Results expected in 2023.

Additional resources and information about this project

Farmscape interviews

- Management Key to Improved Profitability, Animal Welfare, Sustainability
  April 26, 2019

Related subprojects

The work presented in this fact sheet is one of three subprojects that make up a larger, nation-wide and multi-institutional Swine Cluster 3 project titled: *Development of innovative strategies to reduce feed costs in the post-weaning period while maintaining optimal performance and health.* The three subprojects are as follows:

- Examination of the effectiveness of provision of functional amino acids to enhance pig robustness
- Strategies for detoxifying vomitoxin (DON) using innovative chemical and biological approaches in post-weaning piglets *(this fact sheet)*
- Pulse grains and organic acids to control growth performance and health of young pigs

Financial support for this project

This project is part of the Swine Cluster 3 (2018-2023) research program, made possible through financial support from Agriculture and Agri-Food Canada's Canadian Agricultural Partnership, eight provincial pork producer organizations and over 30 industry partners. Click here to learn more about the financial partners for Swine Cluster 3.