Canadian Swine Research and Development Cluster (CSRDC)
Grappe porcine canadienne de recherche et de développement (GPCRD)

FINAL PROJECT REPORT

April 2010 - December 2012

Project Title

Efficacy of feed additives to mitigate the negative impacts of mycotoxin contaminated feed on performance and health of piglets

CSRDC project #

1014

Prepared by

Frédéric Guay

Organization name

Université Laval

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Executive Summary

Briefly summarize the activities funded in this project, highlighting key achievements and results. Also, include a few sentences to answer this question: Why are the project and results significant for the target group and/or stakeholders? Explain any significant discrepancy between the achieved results and the planned results.

Activity 2.

Objective 1a. The analysis of cell viability and mortality presented in this study showed that concentration of 560 ng/ml and higher were significantly detrimental to the survival of MARC-145 and PAM cells. Cell viability and mortality showed a rapid cell death caused by PRRSV strains used in this study. Interestingly, exposure to sub-toxic DON diminished significantly cell mortality triggered by PRRSV, in a dose dependant manner. Our data also showed that specific PRRSV antigen content of infected cells was diminished as seen in the immunofluorescence experiment. This result was confirmed by qPCR indicating a lower amount of PRRSV genes after DON exposure. These results suggest that sub-toxic DON doses could inhibit PRRSV replication which may explain decreased cell mortality caused by DON in infected cells.

Objective 1b. This study demonstrated that NPTr cells are also very sensitive to the toxic effect of DON and that this effect is more pronounced at the cell viability level than the cell mortality level. In addition, the effect of DON on PCV2 infected NPTR cells was dose and genotype dependant. In fact, all the results of this study suggest that replication of PCV2b could be enhanced by the addition of DON, at sub-toxic concentrations while those of PCV2a would be rather reduced. However, high concentration of DON seems to strongly reduce viral replication of PCV2 regardless of genotypes, potentially by affecting cell survival. Interferons mRNA expression analysis reveal that IFN-β mRNA expression is inhibited in PCV2a infected cells, while it is increased in PCV2b infected cells, which could partly explain the difference in replication between the two genotypes.

Objective 2a. The main results of the study showed that ingestion of diets highly contaminated with DON greatly increases the effect of PRRSV infection on weight loss, lung injury and mortality, without increasing significantly viral replication, for which the tendency is rather directed towards a decrease of replication. Taken all together, these results suggest that PRRSV infection could exacerbate the anorectic effect of DON, when ingested in large doses. Like the ration of 3.5 ppm / kg, the ration at 1.5 ppm/kg reduces PRRSV replication, however these diets seem rather to decrease lesions in the lung, but have no significant impact on clinical signs. These results also demonstrate a negative impact on antibody response of pigs fed DON contaminated diet. DON could therefore undermine the efficacy of live attenuated vaccine against PRRSV by interfering with the humoral response of animals.

Objective 2b. In the light of our results, no clear potentiating effect of DON mycotoxin was observed under the present experimental conditions in development of PCV2 associated diseases, even if the replication of the virus was slightly increased in the group ingesting feed containing 1.5 ppm/kg of DON. However, results on growth performances tend to demonstrate a beneficial effect of DON rather than the development of clinical signs. Further experiments will be necessary to confirm this tendency, probably by using more virulent strains, or adding one another triggering agent such as PRRSV. These results also demonstrate a negative effect on antibody response of pigs fed a diet highly contaminated with DON. High concentration of DON could therefore undermine the efficacy of a live attenuated vaccine directed against PCV2 by interfering with the humoral response of the animal.

Activity 3. For this experiment, sixty piglets were used to evaluate the effect of DON (deoxynivalenol) and four dietary supplements on growth performance and nutrient digestibility of weanling pigs. We used the following six treatments: treatment 1 (positive control, feed not contaminated with DON, <0.5 ppm), treatment 2 (negative control, DON-contaminated feed, 4 ppm), treatment 3 (negative control + Integral), treatment 4 (negative control + Biofix), treatment 5 (negative control + MXM), and treatment 6 (negative control + Defusion). Weaned piglets (21 days old) were housed individually and randomly received one of the six treatments for a period

of 14 days after weaning. Growth and feeding efficiency were determined during this period, and a digestibility test performed during the last 5 days. Blood samples were taken to determine serum concentration of DON. So far, the results indicate that DON-contaminated feed decreases growth performance while Defusion supplement restores performance in piglets fed with contaminated feed.

The results showed that there are differences in the effectiveness of various feed supplements (mycotoxin inhibitor products) to counteract the negative effect of mycotoxin contaminated feeds on growth performance. In addition, the four mycotoxin inhibitor products evaluated show varying effects on the digestibility of nutrients (Ca, P, N, energy), particularly with respect to nitrogen. If these differences are corroborated in field trials, it would mean that judicious selection of commercial mycotoxin inhibitors could have a considerable impact on the profitability of the swine producer.

An additional benefit derived from this project will be the availability of a serological test for early detection of DON contamination in piglets, thus providing a means to monitor contamination and/or the effectiveness of feed supplements to counteract such contamination.

Comparison of the four commercial mycotoxin inhibitors (Integral, Biofix, MXM and Defusion) in piglets at weaning showed that there were significant growth performance responses in the presence of DON contaminated feeds. Piglets consuming feeds without mycotoxin inhibitor had a lower weight gain and feed intake than those on feed containing mycotoxin inhibitors. However, the digestibility of nitrogen, calcium and phosphorus – as measured by their capacity to be absorbed, retained and excreted – unexpectedly failed to reflect the variation in growth performance.