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1B-113 - Effect of grain type, particle size and processing condition on growth performance characteristics in pigs

Principle Investigator: Black, JL *et al*

Productivity and profitability of the pig industry is affected greatly by the efficiency of use of cereal grains, which comprise greater than 60 percent of most pig diets. Grain particles that escape digestion in the small intestines and are fermented in the hind-gut reduce the amount of energy available to the pig because approximately 15% of the fermented energy is lost as heat of fermentation and methane. Research within the Pork CRC project 1B-101 showed that 2-4 MJ/kg energy from cereal grains can be digested in the hind-gut. Additional research in project 1B-102 illustrated that undigested starch, protein and cell wall components of cereal grains at the end of the small intestine existed primarily as larger particles. The research showed also that enzyme diffusion rates decrease with the inverse square of particle size, with a 2-fold increase in particle size decreasing enzyme diffusion rate and rate of digestion 4-fold. Diffusion rate of enzymes in barley particles was found to be approximately twice as fast as enzyme diffusion rate in sorghum particles of the same size. Other research in project 1B-102 had shown that rate of starch digestion was also increased when the starch was partially gelatinized through the application of moist heat.

Conventional hammer milling of grains results in a significant proportion of large particles. Thus, an experiment was conducted to investigate the effect of regrinding large particles (>1.8 mm for barley and > 0.9 mm for sorghum) and returning them to the initially ground proportion. This resulted in a reduction in large particles, but little increase in the proportion of small particles. Re-ground and single grind samples of sorghum and barley were incorporated into a standard grower diet with grain representing 72% of the feed. Diets were fed either as a mash or after steam pelleting under typical commercial conditions. The diets were offered to young male weaner pigs at Rivalea or grower pigs at Wacol, Queensland. Re-grinding to remove the large particles significantly reduced the intake of the sorghum based mash diets with little effect on growth rate for both the weaner and grower pigs. Consequently, there was a substantial improvement in feed conversion efficiency. Effects were particularly marked for mash feeds with re-grinding resulting in 22% and 10.5% improvement in the efficiency of feed use for sorghum offered, respectively, to weaner and grower pigs. Similarly re-grinding of barley fed as a mash resulted in 15% and 8.3% improvement in efficiency of feed use for weaner and grower pigs, respectively. Re-grinding of either sorghum or barley offered as a mash resulted in a lower FCR than pelleting grain based diets after a single grind.

The experiments show that there are large effects of reducing the size of large particles on the efficiency of feed use by young pigs offered either barley or sorghum based diets. These results are particularly important for pig enterprises offering mash feeds because removal of the large particles resulted in numerically better feed conversion efficiency than traditional milling and pelleting of the diets. Nevertheless, pelleting of diets containing conventionally milled grain resulted in significant improvements in feed conversion efficiency compared with mash diets for all comparisons except barley based diets fed to grower pigs.