

## SYMPOSIUM CONCLUSIONS

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The overriding impetus for this symposium is the realisation that demand for feed grains in the livestock industries is increasing at a faster rate than any increases in supply due to greater yields per hectare. Some reductions in the demand for grain can occur through decreased feed wastage and increased efficiency of grain use through more accurate diet formulation. A better definition of the nutritional quality of grains and factors that influence their utilisation in the pig *in vivo* also has potential to improve the utilisation of grains, as well as to open alternative avenues for grain marketing and price setting. Collectively, these improvements will enhance the productivity, profitability and sustainability of the pig industry.

When examining ways to sustain supply and improve utilisation of feed grains by the pig industry, Black (1997) commented that it was vital to understand the chemical characteristics and nutritional chemistry of feed grains to improve the efficiency of pig production. Consequently, the Premium Feed Grains for Livestock program was established in 1997. The broad objectives of the programme (modified from Black, 1997) were as follows:

1. Identify the reasons and magnitude of differences in the nutritional values of commonly-used feed grains for pigs, poultry and ruminants. Improvements in feed grain quality may then be achieved through strategies such as plant breeding, processing and feed manipulation (e.g., liquid feeding), and strategic enzyme use;
2. Develop and assess the use of rapid tests of nutritional quality; and
3. Develop and upgrade computer simulation models that accurately predict the consequences of grain characteristics, grain processing and storage on animal productivity and profitability.

It is evident from the data presented by van Barneveld *et al.* (2001) that some of these objectives are now being met. A cross-species comparison allied to detailed chemical analyses of grains permitted some conclusions to be made regarding grain quality, with the cell wall quantity, size and structure having a significant influence on the amount of 'available' energy the pig can derive from a given grain. Nevertheless, comparison across grain types indicated that gross chemical composition only partly explains energy digestion in pigs. As such, van Barneveld *et al.* (2001) showed succinctly that determination of energy digestion at the end of the small intestine is a more sensitive indicator of net energy than DE content. The industry must now develop technologies to implement and take advantage of these findings, perhaps using a ratio of ileal to faecal energy digestion. Van Barneveld *et al.* (2001) also demonstrated that cell size in sorghum may be restricting the digestion of energy in the small intestine of pigs presenting opportunities to investigate grind size and the application of proteinases and cellulases with this grain. Nevertheless, an appreciation of the entire system of pig production is required when considering such findings. For example, fine grinding of sorghum might increase the digestibility of energy at the terminal ileum, but what are the consequences for the pig with regard to gastric ulceration?

A key component of enhanced ileal digestibility of energy is the cell wall of the grain, particularly with regard to the starch component. Autio (2001) highlighted the potential of light microscopy and other techniques to study, both before and after feeding, the cell wall structure of grains. These techniques can be harnessed to study, for example, the effects of different processing (e.g., particle size) and feed treatment (e.g., liquid pre-treatment of grain) methodologies on the utilisation of grains. If these *in vitro* methods prove to be sensitive indicators of energy digestibility, particularly at the ileum, then the

logical extension of these techniques is an 'energy yield' prediction of feed grain quality based on histological characterisation of grains.

The paper presented by Choct and Cadogan (2001) in this symposium reviewed current knowledge and understanding of enzyme applications in the pig industry. It is evident that mechanism(s) of action, apart from phytase, are relatively poorly understood and likely to hinder the expansion of enzymes into the pig industry. In the young pig for example, this is related in part to a lack of understanding in basic digestive physiology. The rationale and emphasis for enzyme also requires addressing (or readdressing) since, and as shown in this paper, voluntary food intake is often a better indicator of an enzyme's efficacy than growth rate and FCR. Clearly further research is needed in the area of supplementary enzymes, especially concerning interactions between the substrate, the structure of the substrate and digestive and absorptive physiology. Consideration needs to be extended also to include the effects of agronomic and geographical factors on enzyme usefulness and the potential gut 'health' benefits of oligosaccharides that result from enzyme hydrolysis of feed grains.

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