Feed enzyme boost in AGP-free feeds

The pressure to re-think pig nutrition and health management in the absence of AGPs is intensifying in many EU countries as the feed industry moves towards their total ban, expected in the year 2006.

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Pig producers in Denmark during the past two to three years have followed Sweden's historical lead by totally removing antibiotic growth promoters (AGPS) from their pig feeds. Other EU countries are increasingly adopting this approach to meet specific market demands and are now relying on alternative, cost-effective strategies to maintain performance while, at the same time, keeping certain chronic diseases under control.

The use of feed enzymes is becoming a major part of these alternative strategies, frequently used in conjunction with specific organic acids in the feed. These two products work in different ways, but synergistically.

Organic acids meet the requirements to control feed hygiene and gut pH and offer, potentially, some degree of direct anti-microbial action depending on the product concerned and its level. Enzymes, in contrast, work by reducing substrate availability for bacteria in the small intestine, reducing the risks of bacterial proliferation in this part of the gut.

While it is well known that enzymes can improve nutrient digestibility in the small intestine *(Figure 1),* resulting in better feed utilisation and growth rates in all age groups, research has also shown that they have a strong positive influence on both the level and composition of the microbial populations in the gut *(Figure 2).* This becomes particularly important as more attention is focused on bacterial species that can give rise to human health problems, so-called 'zoonotic' organisms such as *Salmonella.*

Figure 2. Microbial loading in the digesta of pigs fed wheat-based diets (0= few microbes present; 4 = high levels of microbes present).Gut samples from a trial at the University of Halle-Wittenberg, Germany with microbial scores measured at VTT Biotechnology and Food Research, Finland.

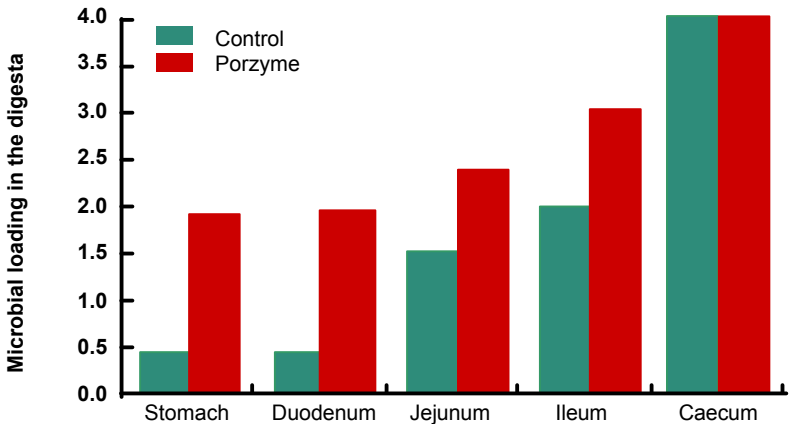
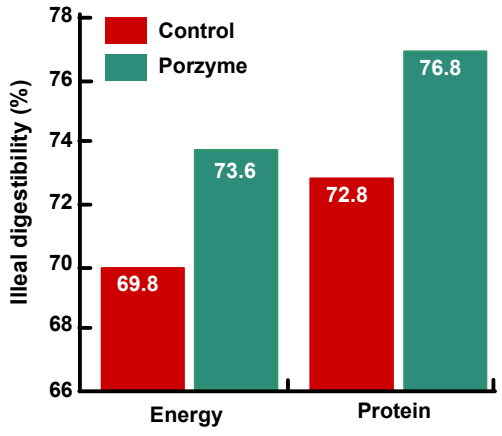


Figure 1. Effect of an enzyme product on the ileal digestibility of protein and energy (mean of 8 estimations).

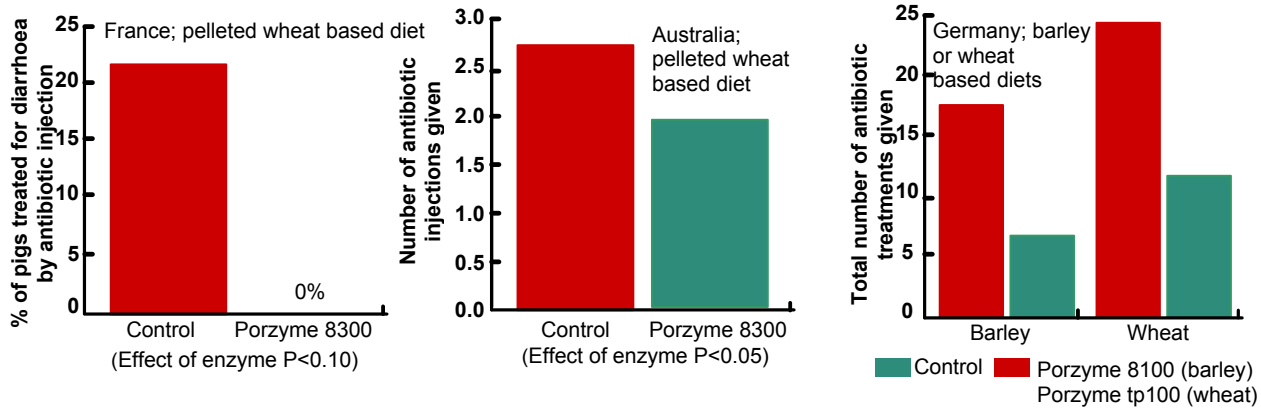


Current research attention

Enzymes deal specifically with certain fractions of the diet that normally interfere with the digestive process. These include certain fibre fractions in many raw materials and other residual anti-nutrients in vegetable proteins, such as trypsin inhibitors and lectins. By targeting these anti-nutrients, enzymes such as carbohydrases (e.g. xylanase and beta-glucanase) and proteases are able to speed digesta flow and improve nutrient release and absorption, leaving less residual nutrients to fuel bacterial proliferation in the small intestine.

In contrast, in the hindgut, enzymes have also been shown to stimulate bacterial fermentation rates and, as a consequence, volatile fatty acid production. Short

Figure 3. The number of antibiotic injections needed to counter digestive problems in pigs offered antibiotic growth promoter-free diets, with or without the enzyme product addition.



chain sugars (e.g. xylo-oligomers), produced as a consequence of fibre breakdown by xylanase in the gut, also appear to favour the growth of beneficial bacterial groups at the expense of other, less desirable, organisms. Both of these effects are beneficial in the absence of AGPs, and are receiving much current research attention.

The net effect of these benefits has been shown recently in studies in France, Australia and Germany. The trials showed a reduction in the use of antibiotic injections to counter digestive problems when the diets, which did not contain AGPs, were supplemented with enzymes (Figure 3).

Recent studies at an experimental station of the Danish Bacon and Meat Council showed the benefits of Porzyme xylanase on the production economics of both meal and pellet-fed pigs and, interestingly, showed a numerical reduction in the proportion of Salmonella-positive pigs (Table 1).

Danish experiences

The Danish feed group DLG has taken advantage of feed enzyme technology in recent years as part of its strategy to deal with the enforced removal of AGPs from all pig feeds in Denmark since January 2000. DLG's primary aim has been to formulate diets that cause as little stress as possible to the pig's digestive system, an approach that has become even more important following the AGP ban.

As well as using high quality and highly digestible raw materials, which have increased feed utilization and reduced the risk of diarrhoea, DLG has also found that enzymes used in all ages of pig have consistently produced an improved diet digestibility, leading to improved gut health. This consistency of response has raised enzymes above many other additives that can potentially be used in pig feed.

Xylanase, in particular, appears to have positive effects on both coliform bacteria and *Salmonella* in the gut and combining it with an acidifier in DLG's piglet diets has given synergies, which have proved particularly beneficial.

Composing AGP-free diets has proved to be no easy task to cope with all farm situations, but enzyme use has certainly enabled DLG to solve a number of the associated nutritional problems. PP

Table 1. Effects of Porzyme xylanase on pig performance (32-102 kg,) economics of production and the incidence of Salmonella positive pigs.

	Pelleted feed (with fine ground wheat)		Mash feed (with coarse ground wheat)		P value	
	Control	+Porzyme	Control	+Porzyme	Pellet versus mash	Porzyme
Daily gain(g)	882	901	828	839	*<0.05*	*0.08*
Daily feed Intake (kg)	2.34	2.33	2.53	2.48	*<0.05*	0.24
Feed:gain	2.66	2.58	3.06	2.96	*<0.05*	*<0.05*
Production value, DKK[1]	655	695 (+6%)	431	469 (+9%)	*<0.05*	*0.05*
% of Salmonella positive pigs	30.6	24.1	17.6	13.0	*<0.05*	0.27
Relative risk of a pig being Salmonella positive[2]	1	0.69	0.45	0.30		

[1] Gross margins per pen place per year based on the same feed price and an average 5 year pig price (i.e. excludes Porzyme cost.) Including this cost gave benefits of 3-4% above the corresponding controls.
[2] Expressed relative to pelleted control group after adjustment for infection pressure in each housing section

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