There is still a lot to learn about enzymes

Phytase's mode of action is well known, and still more applications are being discovered, including the use of phytase in conjunction with other enzymes. Dr Gary Partridge takes a look into the past, present and future of feed enzymes.

By Roger Abbott

A degree in zoology and a PhD on the way resistance to Warfarin poison developed in Welsh 'super rats' may seem an unusual start for a world renowned pig and poultry nutrition expert, but it's the path British feed enzyme pioneer Dr Gary Partridge trod after leaving school.

"The only contact I had with agriculture then was that I caught the rats on a layer farm in mid-Wales," he quips.

Armed with these two degrees and his limited farming experience, Partridge joined the Aberdeen-based Rowett Institute as a researcher, where he says he gained his background knowledge in animal nutrition working with rabbits and other 'exotic' farm animals for the first five years.

"It was only after that project that I moved over to pigs and spent the rest of my 11 year career at the institute investigating the problems associated with developing diets for post-weaned pigs," says Partridge, who has spent the past 20 years at DuPont/Danisco, where today he is global development and technical director (animal nutrition) and specialises in swine.

In the early days when Partridge started his adventure with pig nutrition, feed enzymes were an exciting, yet relatively unknown quantity, and Partridge began some early work on the their use at the Rowett. He became so successful in this area of research that he caught the eye of the premix company BP Nutrition UK (which later became part of Nutreco) who hired him as a specialist pig nutrition advisor, helping producers and feed companies to design cost-effective diet programmes for their pigs.

"That was where I really started learning my trade – on the job at the sharp end of pig production, advising both pig feed producers and pig farmers – and I can tell you it was a steep learning curve," says Partridge. "It was also where my interest in the use of enzymes in pig diets and the effect they had on the animals really accelerated."

Phytase

"It was also the time when we started hearing more about the wonders of phytase (and phytate, the anti-nutrient it destroys), which was a novel idea that made good scientific sense, but was far too expensive then to be used by most pig farmers in any sort of practical or commercial way," says Partridge, who has become a familiar face on the major international pig industry conference circuit.

In fact, he says, the only reason that pig farmers started to use phytase in those early years was because the authorities in some European countries, like the Netherlands, saw the environmental advantages of it (because it reduces the amount of phosphorus in the manure, which meant that producers needed less land for spreading).

In the mid-1980s, the Dutch government was the first to introduce the 'P Tax' to limit the amount of phosphorus (P) that could be disposed of on land by farmers in order to protect the environment. So, in effect, pig farmers and their feed suppliers had to use phytase in their feed to comply with the regulations, even though it initially cost extra money in feeds to do so. They were quickly followed by the Germans, but in those pioneering days people in other countries such as the UK and Ireland still found it too expensive for their farmers and did not start using phytase – now one of the most popular feed enzymes – until later.

"The initial challenges for nutritionists really were to try and reduce these costs for farmers, as well as endeavour to increase the benefits for production,

BIOGRAPHY

Dr Gary Partridge joined DuPont/Danisco in 1994 and he is now its global development and technical director, specialising in swine. Based in Marlborough, Wiltshire, UK. Before joining Danisco Animal Nutrition, he was a senior researcher at the Rowett Institute in Aberdeen, Scotland before moving on to a technical specialist role in a premix company in the UK that later became a part of Nutreco. He penned numerous scientific peer-reviewed publications and abstracts, and many trade press articles. Over the years, he has also given presentations on feed enzyme technology and betaine application in farm animal nutrition around the world. A member of the British Society of Animal Science and the Nutrition Society, he is co-editor of the textbook *Enzymes in Farm Animal Nutrition*.

as well as the environment, so that use of phytase became more cost effective," says Partridge.

The routine use of feed enzymes to achieve cost efficiencies in animal production only gained true acceptability in the early 1990s, he notes. "Once the industry had reached that point and it all started to make more economic sense, as well as helping the environment, we nutritionists were able to start looking in detail at other possible benefits for the pigs – and we are still learning."

He points out that nutritionists' understanding of the role of phytate in animal nutrition, for example, was growing all the time.

"We now know that phytase activity is not just about releasing phosphorus for the pigs; we are starting to see that new highly bio-efficacious phytase enzymes can quickly reduce the anti-nutrient effects of phytate in animal diets by degrading it and thereby increase the availability of energy as well as amino acids which the pigs can use to improve productive performance.

"This offers producers the potential to further reduce the cost of feed, particularly when the price of energy and protein/amino acids in diets is high."

Partridge says he expects many more improvements to be discovered in the next few years as he and his colleagues continue to learn about the role of various anti-nutrients in pig performance and, importantly, the gut microbiota.

"There is still plenty of room to grow by using other enzymes in conjunction with phytase," he says. However, he is sure that phytase would always be the first choice feed enzyme, effectively a 'backbone' of enzyme usage, with other feed enzymes linked in to help modify diets to improve production, in a cost-effective way.

Partridge feels this is especially true in the short to medium term future as political scenarios changed and politicians became more aware of the public's environmental pollution concerns.

In addition, he says there was still plenty of work to be done on the use of other key enzymes such as xylanase, beta-glucanase, amylase and protease in pig diets, offering further opportunities to use raw materials that won't be used in human diets, to improve pig feeds. "Our company is also trying to discover more about the various qualities and quantities of substrate in raw materials, how they can be targeted with specific enzyme activities and subsequently used in pig diet formulations."

One of the key benefits of using well-researched feed enzymes is the reduction in the variability in the feeding value of major feed raw materials, which in turn can cause variability in animal performance, he says.

Feed enzyme usage also improves the degree of precision in feed formulation and helps reduce production costs. It is generally recognised that the lower the ingredient feeding value, the greater the potential for enzyme response.

In support of DuPont's role in the animal feed industry, Partridge says that its animal nutrition and bio-refinery businesses were already collaborating to develop ways to make use of so-called side streams from bio-ethanol production and investigate their potential as lower cost animal feed alternatives for the future.

He points out that advances in this area could help reduce the price volatility that has caused so many problems for the animal feed industry and producers in recent years, by reducing the cost and improving the sustainability of animal protein production.

In other words, there are still exciting times ahead for Partridge and his colleagues as they strive to produce the ultimate cost-effective pig diets to ensure healthy, productive pigs and help the global pig industry to continue to thrive. **PP**