

## **INTERVIEW: Over 25 Years on and Still Room for a Better Understanding of the Potential of Feed Enzymes**

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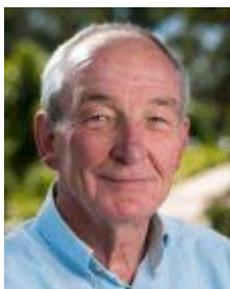
**18 December 2014 - Danisco Animal Nutrition recently celebrated 25+ years of enzyme 'firsts' at the recent EuroTier show with a seminar on the "future of feed enzymes".**

Introductory remarks by Rabobank's Nan-Dirk Mulder - Senior Global Animal Protein Analyst & Associate Director - touched on the different food security concerns of the emerged and emerging worlds. His presentation was followed by a talk by DuPont Industrial Science's Senior Staff Scientist, Dr. Charlotte Horsmans Poulsen, on the role feed enzymes could play in the context outlined by Mulder.

Dr. Peter Selle - Adjunct Associate Professor at the Poultry Research Foundation within The University of Sydney, Australia - generated the most debate by raising the question of whether phytase represents mature or immature technology. Selle commented that since 1996, phytase has become 80% cheaper in relative terms and that the efficacy of phytase feed enzymes has improved as well, but our understanding of both phytase and phytate was really still in its infancy.

Shortly after EuroTier, Feedinfo News Service touched base with Dr. Selle on this topic and asked him to discuss what he sees the future holding for phytase.

**[Feedinfo News Service] Dr. Selle, why was it important for you to take part of the Danisco Animal Nutrition "Future of Enzymes" event held at EuroTier? Why have you associated yourself with Danisco Animal Nutrition?**



**Dr. Peter Selle**  
Poultry Research Foundation  
The University of Sydney  
Australia

**[Peter Selle]** Although I have been working with phytate and phytase since 1992, I remain intensely interested in this area of monogastric nutrition because it is so multi-faceted. I have also enjoyed a great working relationship with Danisco Animal Nutrition and their Australian distributor, Feedworks, for over ten years. The Poultry Research Foundation has recently completed two rather groundbreaking studies with Danisco Animal Nutrition and Feedworks looking at the impact of phytase on sodium digestibility in four segments of the small intestine. The results of these studies, which Danisco Animal Nutrition supported, have tremendous implications for absorption of nutrients in general, especially glucose. The opportunity to talk about phytate and phytase at EuroTier in Hanover, and in particular about this research which could have far reaching implications for human health as well as animal production was an offer too good to refuse.

**[Feedinfo News Service] In Hanover, you said that "the**

**acceptance of phytase will be determined by the cost of phytase, the cost of inorganic phosphorous, cost of phosphorous disposal and the possible 'extra phosphoric' benefits of phytase - especially in terms of improved protein utilization". Could you expand on this comment?**

**[Peter Selle]** Since 1996, which was when phytase became commercially available in Australia, a lot has happened. The cost of the main inorganic phosphorus sources, dicalcium phosphate (DCP) and monocalcium phosphate (MCP) have gone up around four fold, and the cost of phytase is less than half what it was. The use of MBM in feed has been banned since 2000 in the EU. We can still use MBM in non-ruminant diets in Australia but its price has also escalated. In real terms, it now costs at least 80% less to include phytase in diets than it did in 1996. And while we may feel like we are stumbling about a little in the dark when it comes to a full understanding of phytate now, but in 1996 there was very little light at the end of the tunnel.

**[Feedinfo News Service] Can you talk about the Australian phytase market in general? Has phytase consumption peaked in Australia?**

**[Peter Selle]** I doubt if phytase consumption has peaked, but I guess it has plateaued. After an extended lag phase of around five years after its initial introduction, the acceptance of phytase really accelerated in the last decade. We are at a point that now that about 96% of our broilers are consuming phytase-supplemented diets; the penetration is less for pigs and layers but still high, with an overall penetration of about 87.5%. However, if we are taking the industry standard of 500 FTU/kg as a marker, then the acceptance of phytase in the chicken-meat industry would be in excess of 120%. This is because elevated phytase inclusion rates are being adopted to increasing extents and for pigs, layers and broilers the effective market penetration is around 112.5% overall.

**[Feedinfo News Service] Market growth for phytase is mainly expected to come from increased dosing by the current main users: pig and poultry. But, according to you, can phytase become "staple" in the aqua, pet or ruminant sectors too?**

**[Peter Selle]** I can certainly imagine it will become a "staple" in aquaculture due to the need to replace fishmeal with soy protein and the like. I can't really comment about pet food and the ruminant sector although I do feel that in equine thoroughbreds there could be a compelling case for phytase use due to bone issues. That said, I do think phytase will essentially remain a "pig and poultry" product. In Australia at least, it seems that growth can only come from increasing production of pork and chicken meat and guessing the size of these increases is crystal ball territory. The status of the pig industry is highly dependent on the value of the Australian dollar which at the moment is declining which is good news for pig producers. Egg consumption has increased in recent years and I imagine chicken meat consumption will continue to edge upwards. Also, increased usage is coming from increases in phytase inclusion levels from the industry standard level of 500 FTU/kg to more like 1000 FTU/kg.

**[Feedinfo News Service] In a February 2014 interview with Feedinfo News Service, Dr. Gwendolyn Jones, Technical Services Manager at Danisco Animal Nutrition, spoke about the benefits of the Danisco Animal Nutrition Optimize Feed® Service, which enables customers to calculate the optimum dose of phytase enzyme needed. She argued that not all phytase products require a very high dose to achieve the same effect in the animal. Simply put, what is the phytase user's best option: super-dosing or cost-effective phytase dosing?**

**[Peter Selle]** I am not in favour of the term 'super-dosing'. To me it suggests 2000, 3000 or even 4000 units without any consideration being given to factors such as the species, diet and age of the animal; these should all be considered. Our chicken meat industry in particular is essentially vertically integrated and this fact impacts on the approach nutritionists take with phytase implementation. I have always thought that the standard phytase inclusion rate should have been 750 rather than 500 FTU/kg and that 1000 FTU/kg phytase is justified for broilers. Dosing at this level has also been shown to be beneficial in young pigs. I also would be inclined to suggest that integrators adjust nutrient specifications for phosphorus, calcium and sodium to accommodate dietary phytase inclusions and then integrated producers take the protein and energy effects of phytase as increases in performance.

**[Feedinfo News Service] Unpublished data from the Poultry Research Foundation showed that a recently released bacterial phytase significantly outperformed the original fungal phytase. Could you expand a little more on the significance of these findings?**

**[Peter Selle]** This refers to a 2012 study with Danisco Animal Nutrition. Just as an example at 500 FTU/kg the bacterial phytase improved FCR at 40 days post-hatch by 3.06% in relation to the fungal phytase (1.553 vs 1.602) which was statistically valid. My gut feeling is that the very recent bacterial phytases are substantially better than the original fungal phytase, although in some respects it pains me to say that given that I cut my teeth on the original phytase!

**[Feedinfo News Service] You also argue that our comprehension of phytase still needs to be improved. But is there much margin for further understanding?**

**[Peter Selle]** I would argue that there is an enormous margin to improve our comprehension of phytate and also phytase. It is only now, nearly 25 years down the track that we are beginning to appreciate how important sodium recovery and absorption along the small intestine really is and the part that phytate and phytase play in this. The amount of sodium entering the duodenum as sodium bicarbonate probably hinges on how rapidly IP6 phytate is degraded to IP4 and IP3 etc; because this effectively prevents the formation of protein-phytate complexes. For me, the prevention of protein-phytate complex formation is key. Protein-phytate complexes are refractory to pepsin digestion so it follows that their presence in the gut triggers a hyper-secretion of pepsin and HCl. The greater the secretion of HCl the more sodium bicarbonate needs to be secreted into the gut as a buffering agent. So it is possible that phytase reduces the secretion of endogenous sodium into the gut and it certainly enhances the absorption of sodium from the gut.

In general, we still do not have a really good handle on just how much phytate is degraded by phytase and that is absolutely fundamental. We do know that the latest *Buttiauxella* phytase have an optimal pH which better matches the chicken's digestive tract, offering a high and fast rate of phytic acid degradation compared to *E.coli* phytases at 500 FTU/kg feed. These improved savings, achieved as a result of enhanced phosphorus, calcium, energy and amino acid release, can be also amplified at higher doses (>500 FTU/kg feed).

**[Feedinfo News Service] According to you are there areas of phytase research that may have been overlooked?**

**[Peter Selle]** Besides sodium, there is also the influence of phytate and phytase on the digestive dynamics of energy (starch) and protein. It seems that phytase increases the digestion rate of protein to a greater extent than starch and that this 'narrowing' of starch:protein digestion rate ratios is beneficial. Also, is the 'protein effect' of phytase more to do with protein digestion or amino acid absorption? The same question applies to starch and glucose and I think the answers may be quite different. And the digestive dynamics of starch and protein should not be considered separately but in tandem and then fat is a third part of the jigsaw and it can have an influence. Another topic which really interests me is the differential between the isoelectric point of a given protein and the pH in the proventriculus and gizzard. I suspect that the greater the differential the greater is the anti-nutritive effect of the protein-phytate complex. But this is entirely speculative – but to me at least a very interesting possibility.

**[Feedinfo News Service] What are the challenges of tomorrow that phytase producers must seek to address when formulating new phytase products?**

**[Peter Selle]** The biggest challenge that I can see it is in developing a phytase feed enzyme that can degrade IP6 phytate to innocuous lower esters extremely rapidly. This may not be correct but my feeling is that phytase has to degrade phytate prior to the de novo formation of binary protein-phytate complexes in the gut. There is evidence to the contrary but once the phytate molecule is enveloped by a layer of aggregated protein then it would seem to be very hard target for phytase to degrade it. The research we are doing with Danisco Animal Nutrition, Feedworks and others, is looking at the impact of phytase on the recovery of sodium along the small intestine and the knock on effects for glucose absorption potentially groundbreaking implications.



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