Research into Enhancing Phosphorus Digestibility in Pig Feed

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US - Research at the University of Illinois, led by professor of animal sciences Hans H. Stein, is helping to determine how much digestible phosphorus copra and palm kernel products provide when fed to pigs, and how phosphorus digestibility can be enhanced.

Copra meal, a co-product of the production of coconut oil, and palm kernel co-products are used in many tropical countries as the main protein source in swine diets. These products are also a source of phosphorus, which is required to ensure proper bone growth, optimal growth performance, and for a number of other physiological functions in growing pigs.

Mr Stein and his team tested copra meal, palm kernel expellers from Indonesia, palm kernel expellers from Costa Rica, and palm kernel meal, which was also from Costa Rica. They compared phosphorus digestibility in these ingredients to that in soybean meal, the primary plant protein source in pig diets worldwide.

The phosphorus in plant ingredients is often bound to phytate, which renders it indigestible by pigs. Phytase, an enzyme which releases phosphorus from phytate, can be added to diets to increase phosphorus availability.

The proportion of phosphorus bound to phytate was 42.3 per cent in copra meal, 68.6 percent in palm kernel expellers from Indonesia, 71.7 per cent in palm kernel expellers from Costa Rica, 59.3 percent in palm kernel meal, and 65.7 per cent in soybean meal.

As expected, the ingredients, which contained the least phytate had the greatest phosphorus digestibility. The standardised total tract digestibility of phosphorus was 70.6 per cent in copra meal, 37.6 per cent in palm kernel expellers from Indonesia, 43.2 per cent in palm kernel expellers from Costa Rica, 57.9 per cent in palm kernel meal, and 49.6 per cent in soybean meal.

According to Mr Stein, the results indicated that phytate phosphorus concentration may be used to predict phosphorus digestibility in the copra and palm ingredients tested.

"There was a strong negative relationship between digestibility of phosphorus and the concentration of phytate-bound phosphorus," said Mr Stein. “The relationship was so strong that the concentration of phytate-bound phosphorus in the ingredients explained 89.4 percent of the variability in phosphorus digestibility among ingredients.”

Effects of microbial phytase on phosphorus digestibility were also determined.

"Addition of phytase improved phosphorus digestibility in all the tested ingredients," Mr Stein reported. The digestibility of phosphorus when phytase was added to the diets was 90.3 per cent in copra meal, 66.4 per cent in palm kernel expellers from Indonesia, 69.9 per cent in palm kernel expellers from Costa Rica, 73.5 per cent in palm kernel meal, and 81.1 per cent in soybean meal.

"Data from this experiment indicate that producers can reduce the use of inorganic phosphates and reduce fecal excretion of phosphorus by including copra meal in diets fed to growing pigs, and by adding phytase to diets containing any of the ingredients used in this experiment," Mr Stein said.

The study, "Standardised total tract digestibility of phosphorus in copra meal, palm kernel expellers, palm kernel meal, and soybean meal fed to growing pigs," was co-authored by Brenda Almaguer of Novus International in Querétaro, Mexico; Rommel Sulabo of the University of the Philippines Los Baños; and Yanhong Liu of the University of Illinois. The paper was published in a recent edition of the Journal of Animal Science, and is available online at http://journalofanimalscience.org/content/92/6/2473.full.

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