

Phytase enhances other

MANY studies have been conducted with swine and poultry that have shown the effectiveness of the phytase enzyme to release phytate-phosphorus in diets containing corn, soybean meal, dried distillers grains with solubles and wheat middlings.

The result was a reduction in the quantity of phosphorus that is excreted via manure into the environment. A significant amount of phytate-phosphorus was being excreted into the environment before phytase, because phytate-phosphorus is poorly utilized by non-ruminant animals.

There are several types of microbial phytase. The 3-phytase is able to hydrolyze the ester bond at carbon 3, whereas the 6-phytase hydrolyzes the ester bond at carbon 6. Both result in the release of phytate-phosphorus.

Previous research on the effect of phytase on ileal amino acid digestibility in pigs has not been consistent, with the effects ranging from no improvements to between 2% and 4%.

It appears that there are tremendous opportunities to improve the apparent ileal amino acid digestibility in swine diets with exogenous phytase supplementation.

Part 1 of NAHMS swine study issued

THE U.S. Department of Agriculture's National Animal Health Monitoring System (NAHMS) has released "Part I: Baseline Reference of Swine Health & Management in the United States, 2012," the first report from its "Swine 2012" study focusing on operations with 100 or more pigs in the nation's top 13 pork-producing states.

NAHMS provided the following highlights from the report:

- More than three-fourths of sites had no breeding animals (weaned pigs only), primarily either a grower/finisher unit (42.7%) or a wean-to-finish unit (19.9%). Less than 20% of sites had a breeding herd with gestation and farrowing.

- Sows and gilts were mated almost exclusively via artificial insemination, with less than 3% being serviced via pen mating.

- Nursery pigs originated from different sources, including on-site farrowing (34.0%), other sites belonging to the operation (35.0%) or other sites not belonging to the operation (29.5%).

- More than 96% of grower/finisher pigs were managed in an all-in/all-out manner. For pigs that entered the grower/finisher phase, 4.1% died.

- Nearly 95% of sites with a wean-to-finish phase sourced their pigs off site, and more than 93% of those sites used only one off-site source.

- Almost one-fourth of all sites permitted non-business visitors to enter swine facilities, and the majority of those sites required non-business visitors to change into clean boots and coveralls before entering swine areas.

- More than half of sites with dead preweaned pigs composted the mortalities, with the majority doing so on site. Almost half of sites with weaned pig deaths composted the carcasses. ■

Bottom Line

with
JOHN GOIHL*



To achieve consistency in results, a phytase enzyme must be able to release the phytate-bound phosphorus but also increase nitrogen and amino acid digestibility.

Researchers indicate that such a phytase enzyme must be able to commence and sufficiently hydrolyze most of the phytate-bound nutrients in the upper region of the digestive tract. For example, in the stomach, the environment is acidic, with protein and phytic acid possessing a net positive and negative charge, respectively, resulting in a protein phytic acid interaction.

Researchers S.A. Adedokun, A. Owusu-Asiedu, D. Ragland, P. Plumstead and O. Adeola at Purdue University and DuPont conducted a study with a 6-phytase derived from *Buttiauxella* spp. expressed in *Trichoderma reesei*, with a pH profile of 2.0-6.5.

The researchers hypothesized that this 6-phytase would improve the apparent ileal digestibility and total tract digestibility of amino acids, nitrogen and calcium, in addition to phosphorus, in swine diets. The objective of the study was to evaluate the efficacy of graded levels of this 6-phytase in cannulated weaned pigs.

Sixteen pigs at an average weight of 15 kg were fitted with a simple T-cannula approximately 6 cm

1. Apparent ileal dry matter, nutrient and energy digestibility

Measurement, %	Treatment			
	1	2	3	4
Dry matter	62.9	67.8	66.7	66.2
Nitrogen	73.8	78.4	76.6	76.6
Calcium	62.5	73.9	70.5	70.4
Phosphorus	46.4	57.8	64.2	62.9
Energy	66.4	69.5	68.6	70.4
Ileal digestible energy, kcal/kg	2,820	3,008	2,977	2,930

2. Apparent total tract dry matter, nutrient and energy digestibility

Measurement, %	Treatment			
	1	2	3	4
Dry matter	79.4	83.2	82.3	82.3
Nitrogen	80.2	85.2	84.2	83.7
Calcium	45.4	60.7	60.3	64.6
Phosphorus	30.0	52.6	59.2	66.1
Sodium	84.0	92.3	89.0	87.3
Magnesium	5.5	21.6	16.8	17.4
Potassium	72.3	79.3	81.2	80.6
Chloride	94.3	95.1	93.8	92.4
Energy	80.3	83.3	82.8	82.9
Digestible energy, kcal/kg	3,607	3,864	3,789	3,784

3. Apparent amino acid digestibility values

Measurement, %	Treatment			
	1	2	3	4
Isoleucine	80.7	83.6	83.4	84.4
Lysine	84.3	86.9	86.1	87.0
Methionine	86.6	87.1	86.8	88.2
Threonine	75.9	79.4	77.2	77.6
Tryptophan	77.3	81.6	79.0	77.7
Valine	77.3	80.9	80.0	81.2
Total amino acids	80.3	83.2	82.1	83.1

anterior to the ileo-cecal-colonic junction. All pigs were fed a diet appropriate for this bodyweight from 12 hours post-surgery until the start

of the study.

The study consisted of two periods of nine days each, with fecal collection in the morning and

Most scientists believe in engaging public

SCIENTISTS say they are facing a challenging time, and 87% believe that scientists should take an active role in public policy debates.

In addition, a sizable share believes that engaging with the public and news media can advance the careers of scientists, according to a new survey by the Pew Research Center, in collaboration with the American Association for the Advancement of Science (AAAS).

The survey of 3,748 U.S.-based AAAS scientists found that 71% of those surveyed believe the public has either some or a lot of interest in their specialty area, and 53% say there is a lot or some debate in the news about their field.

Scientists in this sample are engaged with the public and media in a variety of ways: through interviews, social media and blogging. Many scientists report that media coverage of their research and social media use is part of their work, and they think that some news coverage poses problems for science. A sizable share also believes that gaining coverage and participating in social media can further their careers.

According to AAAS, key results of the Pew survey include:

- 43% of AAAS scientists say it is "important" or "very important" for scientists in their specialty to get news media coverage of their work, up from 37% in a 2009 survey.

- 22% say it is either "very important" (4%) or "important" (18%) for career advancement in their discipline to promote their findings on social media such as Facebook or Twitter.
- At the same time, 79% of AAAS

scientists believe it is a major problem for science that news reports do not distinguish between well-founded and not-well-founded scientific findings. Further, 52% say simplification of scientific findings is a major problem for science in general.

"Science topics are increasingly becoming part of the public debate, and scientists clearly feel they should be in the arena," Lee Rainie, Pew Research Center director of internet, science and technology research, said. "These views link to a broad feeling in the science community that things are not as good as they used to be, that the research funding environment is more precarious and that policy decisions in key areas like land use and environmental quality are not often based on the best science."

Other survey findings include:

- Scientists regularly engage with the public and the media. Fully 98% of AAAS scientists say they have some level of interaction with citizens, and 51% have at least some contact with reporters about research findings. Mid-career and older scientists are more likely than others to speak to reporters.

- Nearly half of AAAS scientists (47%) use social media to talk about science or read about scientific developments. Some 24% say they blog about science and research. Blogging is something that equally spans the generations under age 65, but younger scientists are more likely to use social media.

- Scientists who are more engaged often use multiple methods and platforms to connect with the public.

About 41% of AAAS scientists report that they "often" or "occasionally" do at least two of these four activities: (1) talk with non-experts about science topics, (2) talk with the media, (3) use social media or (4) blog.

- Traditional information and peer networking activities are the most common ways scientists stay up to date. Eighty-four percent of AAAS scientists read journal articles outside of their primary fields or scientific disciplines, and 79% say they attend professional meetings, workshops and lectures.

- Digital communications are also a common part of scientists' learning activities as they connect with peers, with 58% getting email alerts from journals in their specialty, 56% getting emails from general science journals, 32% belonging to email list-servs, 19% following blogs by experts their fields and 12% following tweets or other postings in social media by experts in their field.

Some of the findings from the second of several reports analyzed data from a pair of surveys the Pew Research Center conducted in collaboration with AAAS.

These findings are for immediate release and are available at www.pewinternet.org/2015/02/15/how-scientists-engage-public.

The Pew Research Center is a non-partisan fact tank that informs the public about the issues, attitudes and trends shaping the U.S. and the world. It does not take policy positions.

AAAS is the world's largest general scientific society and includes members from all scientific fields. ■

nutrients' digestibility

evening of days 5 and 6 and a 12-hour ileal digesta collection on days 7, 8 and 9. All collected samples were frozen for later analysis.

Each period consisted of four blocks of pigs, with four pigs per block. Each pig received a different diet in each of the two periods.

The experimental diets were based on corn (approximately 25%), soybean meal (approximately 13.5%), wheat middlings (approximately 3.5%) and corn dried distillers grain with solubles (approximately 3.5%) and were formulated to be marginally deficient in non-phytate phosphorus but adequate in all other nutrients.

The 6-phytase (*T. reesei*) was added at three levels for the four treatments: (1) zero added phytase, (2) 500 units of added phytase per kilogram of diet, (3) 1,000 units of phytase per kilogram and (4) 2,000 units of phytase per kilogram.

Pigs received a daily feed allowance of approximately 4.5% of the bodyweight of the lightest pig within each block that was divided into two equal allotments for a 7 a.m. and 7 p.m. feeding.

Between periods 1 and 2, all pigs were fed the "rest diet" — which contained no phytase — for five days before starting period 2. The pigs weighed an average of 22.1 kg at the start of period 1 and 30.3 kg at the

start of period 2.

Table 1 summarizes the apparent ileal dry matter, nutrient and energy digestibility values. Table 2 summarizes the apparent total tract dry matter, nutrient and energy digestibility values. Table 3 summarizes the apparent amino acid digestibility values.

The pigs were all in good health throughout the study. They had an average daily gain of 4.3 kg and 7.3 kg and a gain:feed of 0.49 and 0.59 for periods 1 and 2, respectively.

The analyzed value of phytic acid in each diet was 11 g/kg of diet. The analyzed activities of the four treatments were 187, 596, 939 and 2,081 phytase units per kilogram of diet for treatments 1, 2, 3 and 4, respectively.

The researchers provided the following interpretations of these results:

- The addition of phytase improved apparent ileal digestibility of dry matter, nitrogen, calcium and phosphorus in treatments 2, 3 and 4 compared to treatment 1. Treatment 2 produced the largest improvement, compared to treatment 1, for those measurements, except for phosphorus, which was highest in treatment 3.

- Very similar results were shown for the apparent total tract digestibility as for apparent

ileal digestibility, except calcium and phosphorus had the highest digestibility in treatment 4.

- The apparent amino acid digestibilities improved with the addition of supplemental phytase. The greatest improvement for the amino acids was shown in pigs on treatment 4, except for threonine and tryptophan, where the highest digestibility was for pigs on treatment 2.

The use of phytase in non-ruminant diets has reduced the excretion of phosphorus via the manure and decreased feed costs. The recent advances in enzyme technology have made it possible to develop enzymes with a high level of activity in acidic environments and that have more than one active site, which has the potential to release not just one nutrient but several.

The release of other nutrients, minerals, amino acids and energy from the phytate molecules could be made available to the animal for absorption, which increases the feeding value of the diet. Achieving this with one enzyme, such as the phytase used in this study, may improve efficiency and reduce feed costs.

In order to obtain increased release values of nutrients, it is important for the exogenous phytase to be resistant to the low pH in the stomach of the pig and be able to

initiate phytate hydrolysis early enough in the stomach so as to minimize the formation of binary protein-phytate (at an acidic pH) and ternary protein-mineral-phytate (at close to a neutral pH) complexes.

Enzymes that have high activity levels in the stomach and are able to survive the acidic environment of the stomach as well as protease degradation will be the goal to enhancing nitrogen and amino acid digestibility in swine diets.

The Bottom Line

The results of this study showed that the 6-phytase used in the study not only increased calcium and phosphorus utilization but also enhanced the ileal digestibility of energy, nitrogen and several amino acids in the diet of growing pig.

Reference

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Hogs need robust immunity to reach heavier market weight

By KAREN LEHE*

AS slaughter weights trend heavier and hog prices increase, the benefit of reducing late-finishing mortality also grows.

When pigs die in late finishing, the revenue that would have been generated is lost, and the cost of feeding the animal to market weight already has occurred. Choosing the right vaccine to reduce the risk of late-finishing mortality allows producers to reap financial benefits.

A vaccine's duration of immunity (DOI) provides guidance on how long a vaccine is expected to be efficacious. Vaccines with a DOI that covers the entire growing period are expected to provide longer

protection — and potentially reduce mortality — in late finishing. This is critical for diseases such as porcine circovirus type 2 (PCV2), which can linger for as long as five months after a pig is infected.

This increases the risk of the virus shedding and infecting other pigs, plus it opens the door to co-infections, such as with porcine reproductive and respiratory syndrome, *Mycoplasma hyopneumoniae* and swine influenza virus.

Circumvent G2 vaccine provides a DOI of five months for PCV2, has options to use it as a one-dose or two-dose protocol and can be utilized in pigs as early as three days of age with the two-dose option.

The vaccine can provide such long-lasting protection against disease because it stimulates a

robust "Primary Burst" — which is the immune system's first and critical response to a disease challenge.

When a new, unfamiliar disease antigen is presented, it's met by a specialized white blood cell called a macrophage. The macrophage collects the invader and delivers the component proteins of the antigen to the nearest lymph node.

Within the lymph node, specialized white blood cells, called T cells, are activated by the antigen proteins. The T cells recognize the antigen and are programmed to defend against it.

The more robust the Primary Burst, the more T cells are activated. The more T cells recognize the antigen, the longer and stronger the immune response will be. When real-world disease exposure occurs, T cells at the site of exposure

respond quickly. This is called cell-mediated immunity — a strong, rapid immune response.

Signs of a robust Primary Burst that can occur in the first 8-36 hours post-vaccination include moderate inflammation, mild fever and lethargy. These reactions are the body's natural response to building strong immunity against the antigen.

The timing of vaccination and how long it takes to market all pigs in a group should be the first considerations for estimating the benefit of a longer DOI.

Seasonality also should be kept in mind because pigs typically grow more slowly in the summer months.

Finally, consider that early vaccination of pigs extends the time the vaccine will need to provide protection. ■

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