Poultry 'enzyme cocktail' saves more than just chicken feed

June 27 2013, by Robert Burns

In Dr. Jason Lee's study on the effects of feed with various combinations of enzyme additives and available phosphorus, 500 male chicks were individually weighed at seven and 14 days. Lee also analyzed the chicken litter the chicks produced for residual phosphorus. Credit: Texas A&M AgriLife Research photo by Robert Burns

(Phys.org) —Dr. Jason Lee compares the enzyme additives he's testing in chicken broiler feed to the probiotics now commonly added to human food, such as yogurt.

Like probiotics, the enzymes he's testing improve digestibility of the food the chicken eats, acting within the gut, said Lee, who is a poultry scientist with Texas A&M AgriLife Research at College Station.

"And like probiotics, the enzymes naturally occur in nature," he said.

The analogy is imperfect, he said, as the probiotics added to yogurt and other foods to aid digestion are live bacteria, while enzymes are not alive at all, but merely simple proteins.

Improving digestibility of poultry rations is important for commercial producers for two reasons, Lee said.

The first reason is improved digestibility means improved feed efficiency – less feed is required for each pound of weight gain.

Digestibility of soybean meal by poultry is already high, 80 to 85 percent, according to Lee.

"But we want to make that much higher," he said.

According to the National Chicken Council, in 2010, U.S. companies produced nearly 9 billion chickens for meat consumption, most of which were broilers, with a small percentage from breeding stock and spent hen egg-layer flocks. This equates to more than 5 billion pounds of meat, most of which was consumed domestically.

"The poultry industry is very competitive," he said. "With feeds sources such as soybean meal and corn going up every year, only a small percentage of increase in efficiency can mean big savings to the industry."

The second reason why improving feed efficiency is important is

environmental, Lee said.

Nine billion birds produce large amounts of manure, which when mixed with spilled feed, feathers and bedding material, is called "chicken litter."

Chicken litter is primarily used as fertilizer, but because nitrogen is less concentrated than chemical fertilizers, transportation costs usually limit its use to nearby farms. And the nitrogen in chicken litter can be lost quickly, according to Lee.

Nitrate runoff is usually not a problem with chicken litter fertilizer as it

is with manure from other confined animal operations. But phosphorus can be, he said.

"Phosphorus is an essential nutrient required for proper bone development and for efficient poultry production," Lee said. "The failure to meet a bird's requirement of phosphorus can lead to many bird-health problems, including reduced bird performance, increased leg disorders and increased bird mortality."

To avoid these bird health problems, companies used to include a "a safety margin" of phosphorus when formulating feeds, Lee said. The over-supplemented could lead to the excess ended up in the chicken litter used as fertilizer. Crops can only use so much phosphorus in a given time, and this excess ending up in the water table through run-off.

Environmental concerns, as well as rising costs of inorganic phosphate sources has motivated producers "to consider alternative strategies to reduce the total phosphorous concentrations in broiler diets," Lee said.

The main strategy utilized to decrease the levels of phosphorus required in broiler diets is the use of enzymes that utilize the phosphorus in plant sources, such as corn and soybean, according to Lee.

A form of phosphorus called phytate can account for as much as 70 percent of the total phosphorus found in plants, he said. However, poultry do not have the ability to digest phytate. But ruminant animals such as beef cattle have bacteria in their rumens that naturally produce an enzyme called phytase that allows them to convert the phytate into organic phosphorus.

Phytase can be relatively cheaply and easily produced and added to poultry feed, but that solves only one aspect of the problem.

"Another anti-nutritive factor found in cereal grains used in broiler diets include the presence of non-starch polysaccharides – NSP, which are fibrous material found

in plant cell walls," Lee said. "Chickens lack the digestive capacity of ruminant animals and the presence of NSP in the diet increases intestinal viscosity resulting in decreased digestibility of the diet."

Fortunately, according to Lee, another enzyme, carbohydrase, can help increase

digestibility of high fiber broiler diets. Both enzymes need be added at low rates, typically from 0.25 to 1 pound per ton of feed.

But a question remained: Which strains of the two enzymes were best combinations for chicken health and feed conversion efficiency?

To determine this, Lee has been conducting studies comparing how multiple levels of phytase affects the bio-availability of phytate with and without non-starch polysaccharides. The feed tested was a combination of corn and soybean meal with added vitamins and micronutrients – a standard poultry ration.

The relationship between the effects of the two enzymes turned out to be more complicated than expected. Non-starch polysaccharides increased the bioavailability of phosphorus but at only one of the three levels of phytase concentrations tested.

The results of his study will give commercial poultry producers information they need to fine-tune feed mixture to reduce phosphorus runoff from chicken litter without endangering flock health, Lee said.

Provided by Texas A&M University