

MINERAL Writes

Third QUARTER 2012

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Novel Phytase Available with Positive Effects in Broiler Production

CALCIUM

Feed-grade calcium products are available in a wide variety of particle sizes, from liquid suspendable products to large particle products for laying hen diets.

DICALCIUM PHOSPHATE

Both 18.5% and 21% phosphorus products are available.

SODIUM BENTONITE

Bentonite products are available in a wide variety of particle sizes suitable for any purpose.

POTASSIUM

ILC Resources has potassium magnesium sulfate (K/Mg/S) available.

All products are available in both bag and bulk.



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Phytase has been added to broiler diets for some time in order to make phytate phosphorus more available. In addition to its contribution to phosphorus, it is also effective in making other minerals and amino acids more available. In a study published this year, scientists in New Zealand have found a new microbial phytase from *Aspergillus oryzae*; the phytase is expressed by synthetic genes in the microbe. It was incorporated in low-phosphorous corn-soybean meal-based diets for broilers. Overall, the inclusion of this phytase into the diet not only increased phosphorous absorption, but also increased bone mineral content and density and amino acid digestibility in broiler chickens.

Background

Phytate is the main phosphorous reserve in plants and generally is not readily bioavailable (to monogastrics) when plants are consumed. Phytate will also bind amino acids and proteins and, in monogastric diets, the digestibility and absorption of those nutrients can be affected. Phytases are the enzymes that break down phytate or dephosphorylate phytate. Phytases can either be of

fungal origin, like those from *Aspergillus* or *Peniophera* species, or of bacterial origin, such as *Escherichia coli*. Phytases from both origins are added to broiler diets. In addition to phosphorus, phytases have also been proven to improve the bioavailability of other minerals (calcium, magnesium, potassium and zinc) and amino acids (specifically threonine).

Another classification of phytases is based on the first phosphate group in the phytate molecule that are attacked by the phytase. A 3-phytase initially attacks the carbon atom in the third position and a 6-phytase initially attacks the carbon in the sixth position. Phytases of different sources and/or even if they are from the same source may have different pH optima, heat stability and catalytic properties. The new phytase from *Aspergillus oryzae* is a 6-phytase.

Research

The study, *The Effect of a Novel Phytase on Growth Performance, Apparent Metabolizable Energy, & the Availability of Minerals & Amino Acids in a Low-Phosphorus Corn-Soybean Meal Diet for Broilers*, examined the effect of

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Is Aglime Part of Your Fertilizer Regimen?

Is aglime part of your fertilization program? Lime is a key ingredient in improving soil fertility. Its application influences soil pH and, as a result, influences nutrient availability in the soil and soil conditions. The same impact on crops, such as hay, can be found even on a smaller scale when lime is applied to your yard and garden.

As aglime is broken down its effectiveness is also water dependent. Lime will be slower to incorporate into the soil in dry weather. Particle size of the lime being applied also influences how quickly and how

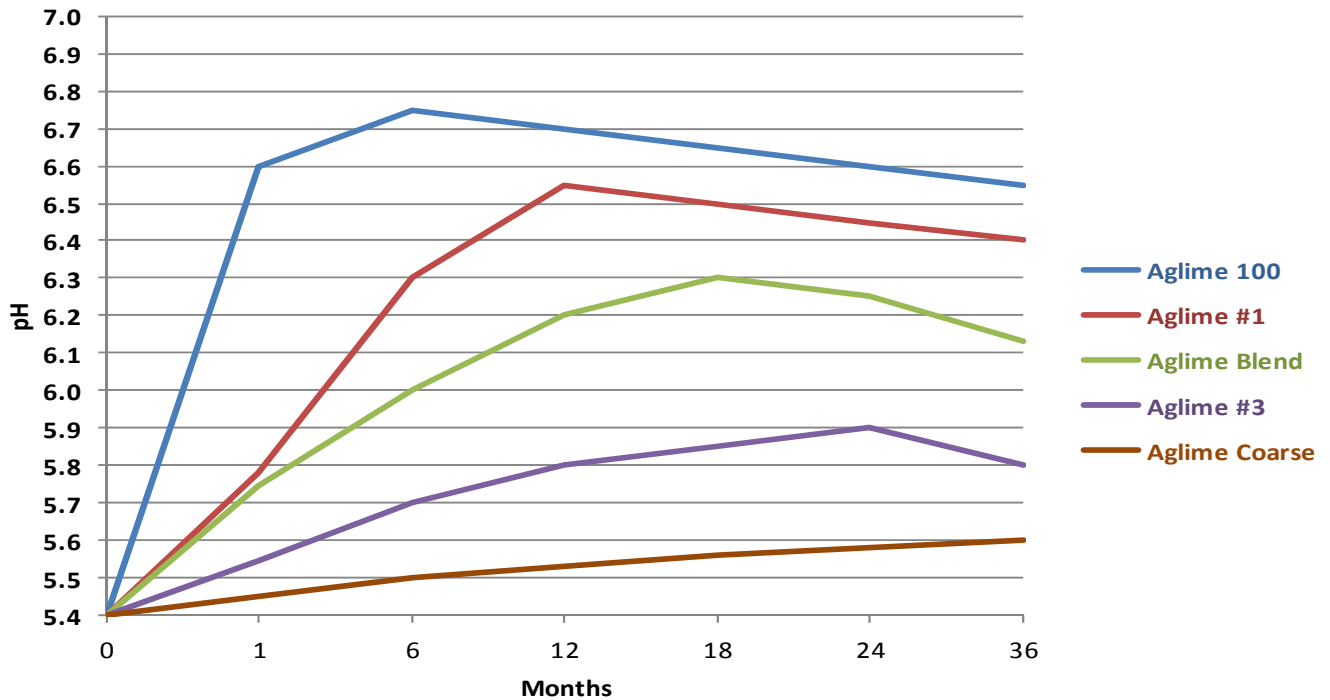
much the pH will be increased. The following table shows how the various types of ILC aglime products raise and maintain soil pH over a period of zero to 36 months. The products are listed from top to bottom as the finest to the most coarse particle size on the right side of the column.

Most soils are acidic, with a normal pH range between 5.2 and 5.8. It should be noted that some hay fields have an optimum pH of greater than 6.0 and less than 7.0. At low pH levels soil tilth, root development and fertilizer efficiency are affected. Nitrogen uptake

has been shown to be reduced by 30-35%, phosphorous uptake can be reduced by 45-50%, and potassium uptake reductions can be as much as 10-15%. Most hay producers (and homeowners) may not test their soil for nutrient composition and pH levels, but it may be worthwhile to test soil conditions periodically.

The nutrients of calcium and magnesium found in aglime are also available to plants/hay in your yard or in the field. On a large scale, proper fertilization (phosphorous, potassium, nitrogen and lime) impacts production and is a significant cost of

Change in Soil pH Over time -- Post Aglime Application



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Aglime and Fertilizer — Continued from p. 2

operation. Since fertilizer efficiency is influenced by soil pH, the value of adding aglime cannot be underestimated.

With an adequate amount of phosphorous and optimum pH levels, the plant can increase the calcium and magnesium concentration in the leaves by taking those nutrients from both the soil and the aglime. Photosynthetic activity and plant development are also enhanced by these nutrient sources. Phosphorous is essential to the development of new plant roots and tillering. The addition of phosphorous also significantly increases the plant's nitrogen use efficiency.

Potassium is a very important nutrient in fertilizer that allows plants to survive in cold weather and sustain productivity during droughts. At a low soil pH level, when potassium uptake is reduced, the plants and crops may be even more susceptible to heat stress and lower productivity. Potassium and calcium are both involved in many metabolic processes in the plant. Nitrogen is usually the most limiting element in plant development. Nitrogen is utilized in chlorophyll development, yield production and forage quality (percent of crude protein).

Information on soil testing and ideal soil conditions for various environments is available from your local agronomy specialist, county extension office agents and master gardeners. We at

ILC Resources are happy to offer our assistance to these professionals and yourselves in identifying the best options to address your specific application needs. If you are interested in collecting your own soil samples, it is recommended to break a large field into 10-15 acre sections and collect random core samples down to a depth of six inches from each section. The 10-15 core samples should be mixed together. Submit about one pint of the combined samples for testing.

The best time to apply lime is immediately after the growing season or crop removal. This allows time for the lime to react to the soil, adjusting the pH levels before the next growing season. How the lime reacts to the soil is dependent on the type of lime used. The limiting factor on the neutralizing power of lime is the percentage of calcium and magnesium in the product. Particle size also influences the release of the lime and how it will react to the soil. Particle size is within our control and can be adjusted to meet the desired goal. If a fast incorporation and reactivity is desired, a smaller particle size is preferred. Larger particulates will result in a slower breakdown effect of the lime in the soil.

For your fields or even your front yard, aglime is a great additive to incorporate into your soil. It changes your soil pH which will influence nutri-

ent availability and efficiency. At optimum levels, the nutrients then enable the plants to also utilize the calcium and magnesium for enhancing plant development and growth. The significant impact aglime has on nutrient efficiency and uptake in soil makes it too important to ignore and not use to reduce production costs and improve yields.

Information for this article was taken from "Improving hay production – Does proper fertilization pay off?" by Rocky Lemus, in Issue 5, on May 15, 2012 of *Progressive Forage Grower*.



We are proud to announce that ILC Resources is now **Safe Feed Safe Food Certified** at our plants in Alden, IA & Weeping Water, NE.

Novel Phytase Available — Continued from p. 1

dietary inclusion of this new 6-phytase on phytate phosphorous availability, mineral retention, bone mineral density and amino acid digestibility. The complete study can be found in volume 91 of *Poultry Science*, 2012, pages 1118-1127.

As a result of including the novel phytase into a low-phosphorous diet, broiler weight gain and feed intake increased by eight percent. The increase may be attributed to an increase in metabolizable energy as a result of improved amino acid digestibility. The bone mineral density and bone mineral content increased by 24% and 35% respectively on the phytase supplemented low-P diet. The true ileal P absorption increased 11-14% after supplementation with 250 to 1,200 U/kg of phytase. However, the ileal phytate P and total P absorption and ileal absorbed phytate P and total P content did not increase as dietary phytase concentrations increased.

Minerals such as calcium, magnesium, iron, copper, potassium and sulfur are bound or complexed to phytate. It is presumed that these bindings occur in the crop because the pH is the most acidic and the phytate-mineral complexes are the most soluble. In this study, the phytase supplementation increased calcium and magnesium retention by 16% and 15% respectively. The scientists postulate that the efficacy of the phytase to release the complexed (bound) minerals from the phytate relates to the

solubility of the phytate-metal complexes in the digestive tract. The solubility is a function of the pH in the gastrointestinal tract and molar ratio of minerals to phytate.

Amino acid bioavailability is reduced by phytate as a result of several mechanisms. One way is when phytate directly binds with free amino acids directly. The second mechanism is when the amino acids and phytate phosphate groups bind to each other through positively charged amino acid side chains or through divalent cation bridges. Those complexes reduce the effectiveness of digestive enzymes. Phytate may inhibit a range of digestive enzymes as a third mechanism reducing the bioavailable amino acids, (specifically trypsin and pepsin), thus reducing protein digestion. The extent to which amino acid bioavailability improves by the addition of supplemental microbial phytase depends on the concentration of dietary phytate, proteins present in the diet, and concentration and source of the phytase. All of those factors will affect the hydrolysis of the phytate by the supplemental microbial phytase. In this study, dietary phytase increased the apparent ileal digestibility of threonine, serine, glycine, isoleucine, tyrosine, and histidine by 14, 6, 9, 6, 9 and 7% respectively.

Why is this research important?

As feed costs continue to rise, it is prudent to remember the vital role phytate/phytase will

play as a source of key nutrients and minerals for animal growth and development. It will provide producers with a viable alternative to supplemental minerals and nutrients as they face economic and environmental challenges to produce more with less (land, feed, chemicals, etc.). The potential phytase has and the necessity of this enzyme will also demand continued consideration as competition for food increases among the world's increasing population.

In conclusion, supplemental dietary phytase, regardless of source (fungal or bacterial) and class (3-phytase or 6-phytase), is known to improve the bioavailability of phytate phosphorous. The new 6-phytase derived from synthetic genes of *Aspergillus oryzae* was proven to improve bone mineral content and bone density and increase the bioavailability of certain amino acids. Phytases continue to be a vital part of monogastric diets and contribute significantly to the absorption of phosphorous and other important nutrients like calcium and magnesium, resulting in more energy being released for weight gain and production development.

ILC Resources' mission statement declares:

"ILC is committed to providing the highest quality products and to be striving for continuous improvement. We are dedicated to consistently exceed our customers' expectations of service and quality at every opportunity." *Our people make this happen.*