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LIMESTONE
COMPANY

MINERAL WRITES

FIRST QUARTER 2003

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
Iowa Limestone Company has both potassium chloride (KCl) and potassium magnesium sulfate (K/Mg/S) available.

All products are available in both bag and bulk.

Let me begin this issue of Mineral Writes with a brief self-introduction. I'm Rich Bristol, Director of Nutrition and Technical Services at ILC. My 30 years of feed industry experience includes roles in sales and marketing, management, nutrition consulting and technical support. I look forward to interacting with you as needs and interests arise during 2003. It's a pleasure to provide you with this newsletter.

Richard H. Bristol, M.S.
ILC Director of Nutrition & Technical Services

Phytate Update

In the November issue of ***World Poultry*** magazine, Dr. Thau Kiong Chung (Roche Vitamins Asia Pacific Pte Ltd, Singapore) has an interesting report on phytase. While this research focuses on poultry, it's my belief that this information could be applicable to other species.

The article discusses the use of the enzyme *phytase* for improved utilization of phosphorus (P) through the release of bound P from phytate present in grains. This not only improves utilization of P but allows for lower formulation of P levels in the diet. Excess dietary P excreted in the manure and applied on the land is an important environmental issue posing legitimate health concerns.

The section on *Dietary Calcium (Ca):P ratios* is most intriguing. To achieve optimum ratios of Ca:P is challenging to nutritionists, but to fine-tune ration formulation requires understanding and using phytase enzymes effectively. This section stresses the reality of feeding excess Ca. Unfortunately, although excess Ca may help sales of $CaCO_3$, it compromises the efficacy of bone formation and growth performance. Excess Ca ties up phytate P by resisting enzymatic breakdown. Also, excess Ca does have a "neutralizing" effect in the intestines, thus raising the pH. Here, the resultant higher pH (less acidic) condition inhibits enzymatic breakdown of phytate and at the same time retards the absorption of minerals in general. Calcium plays such key roles in proper nutrition and animal performance, but the old adage "a little is okay, even more will be

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Aflatoxin – Bentonite

During the 2002 growing season much of the Midwest experienced drought conditions. This posed many threats to agriculture, and one of the challenges has been the potential for moldy corn. Drought-stressed corn is less resistant to fungi, thus, is at greater risk of being contaminated with aflatoxins. When the 2002 crops were harvested, a lot of the grain was stored and much will be fed to livestock. Wetter fall weather increased conditions favorable to mold formation and heightened concern regarding aflatoxins.

In November a dairy in southern Nebraska had to "dump" five days' milk (~35,000 pounds) because levels of aflatoxin coming from feeding this year's corn were identified at the milk processing plant. Levels in the feed as low as 10-20 ppb (parts per billion) may result in aflatoxins being secreted in milk. The feed in question from this dairy tested over 200 ppb. Bear in mind, these really are low numbers, but this indicates that feedstuffs containing any aflatoxins should not be fed to dairy. When feeding moldy grain, one needs to find a way to tie up the deleterious effects of aflatoxins. Sodium bentonite appears to bind toxins in corn and prevent their absorption in the digestive tract, thus, simply washing the toxins on through. Further, bentonite appears to bind only aflatoxin. The reason for this is unclear, but perhaps it is the unique relationship between the aflatoxin molecule and the molecular structure of bentonite. Dr. Merlin Lindemann, animal scientist in Virginia, conducted a study in the early 1990s. Corn contaminated with aflatoxin was fed to weaning and growing pigs. Growth rate was reduced due to lower feed intake and liver damage was predictable. When bentonite was added to the aflatoxin-contaminated diet, the pigs recovered nearly all their expected performance.

Dr. Wyatt, poultry scientist at the University of Georgia, reported chemical absorbents, in particular sodium bentonite, added to feed alleviates aflatoxicosis in poultry. He further indicated that prevention techniques are necessary. They include testing suspect feedstuffs for mycotoxin contamination, storage of feedstuffs in clean and watertight facilities, the use of chemical preservatives (mold inhibitors) to prevent mold growth and mycotoxin formation in feedstuffs, and minimal storage time of feed following feed manufacture. These measures are sound for all livestock considerations, of course.

Thus, bentonite has been observed to prevent growth depression when added to the diet of contaminated corn. In most corn-soybean rations, inclusion rates for bentonite of 0.5% to 1.0% have worked well to overcome the deleterious effects of feeding aflatoxin-contaminated grain. Considering larger animals, ruminants in particular, feeding bentonite in the grain mix at 4 ounces per head per day has been beneficial. Although the feed additive sodium bentonite is only an "anti-caking" agent in claims made, the above beneficial actions inside the animal have been well observed.

For additional information contact

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Heavy Metals in $CaCO_3$

Does ILC's $CaCO_3$ contribute to a toxicity problem concerning three "heavy metals" — iron, cadmium and vanadium? That's a question that arose recently and now has been answered with a laboratory analysis. We believe our $CaCO_3$ presents a positive profile.

I submitted a sample of our *Unical-S* to Woodson-Tenent Laboratories for an analysis of the three metals: iron (Fe), cadmium (Cd), and vanadium (V). The following descriptions of toxicities apply to poultry.

First, iron excesses in the diet can lead to rickets in the immature chicken. At a level of 4500 ppm Fe is considered *toxic*. Secondly, cadmium excess mainly affects growth in the immature bird, while egg production is adversely affected in adults. The range of *toxicity* is between 12-40 ppm Cd in the total diet. Lastly, excess vanadium can result in reduced growth rate in chicks and even death if high enough. Growth rate is affected when vanadium is in the range of 8-30 ppm, with death possible at a 200 ppm level. For the laying hen depressed albumin quality and depressed egg production can result from excess vanadium levels of between 15-50 ppm in the total diet.

What were the results of the lab analyses of our $CaCO_3$?

Iron (Fe).....0.14% (1400 ppm)
Cadmium (Cd).....3 ppm
Vanadium (V).....0.0001% (1 ppm)

Considering poultry, let's examine two stages: growing poults and adult laying hens. From day-old chicks up to 18 weeks of age, growing poults will consume between 12 and 60 grams of feed a day. One percent calcium in the diet results in approximately 0.75 to 4.0 grams of $CaCO_3$ intake per day in the above mentioned feed. The following shows the approximate contribution of each of the three metals that $CaCO_3$ has in the daily diets of growing poults.

Fe..... 90 ppm
Cd..... 0.2 ppm
V.....0.06 ppm

Adult laying hens will range from 65 grams to 110 grams of feed per bird daily. If the diets are formulated for approximately 4.5% Ca, $CaCO_3$ in the feed will be consumed at around 7 to 13 grams. The following shows the approximate contribution of each of the three metals that $CaCO_3$ has in the daily diets of laying hens.

Fe.....160 ppm
Cd.....0.35 ppm
V.....0.11 ppm

Other species' considerations follow this same scenario. Bear in mind that our products are actually fed at correspondingly low intake levels. The possible contribution to toxic levels of any of these metals from our products is insignificantly small to the point of being no concern whatsoever.

In general, our products consistently test upwards of 98% pure $CaCO_3$. That certainly does not leave room for much else, especially any level of toxicity.

Biosecurity Measures at ILC

Contamination of products is a major concern for many businesses in America. Whether contamination is in the form of possible bioterrorism or potential hazards to health, it is imperative that measures insuring biological security are taken. This is especially true in the livestock feeding industry. In our business of furnishing elemental mineral nutrients to agriculture, we continuously are aware of these concerns. Whether we quarry and process calcium or receive raw ingredients for further packaging, we market products of high purity, free of contaminations. Along with processing and packaging of products, we provide transportation services to deliver those products to customer destinations. This is accomplished by either our company-owned delivery system or scheduling outside transportation to meet customer needs.

At all plant load-out sites (bulk or bag), truck or rail, we follow and enforce a very strict clean-out policy. Our employees are well trained in proper procedures, and our policies are posted at strategic locations. Not only does this serve as a reminder to us but also targets awareness and understanding by those arriving to pick up orders. The following statements encompass this policy:

All bulk trailers must be cleaned out completely prior to arrival at our load-out facilities. Declaration and logging in of prior shipment's load is required. An ILC employee before loading inspects the trailers. It is the driver's responsibility to ensure that his trailer is cleaned out. Failure to comply will result in our refusal to load the trailer. All trailers presented to an ILC facility for bags must be cleaned and free of visible contamination. Railcars are also inspected prior to loading.

We furnish agriculture with safe, pure sources of mineral nutrients. The above measures are taken seriously and are adhered to. Nothing less is acceptable, not only to us, but to our customers as well.

(Phytate Update - *continued*)

better" is just not the case. In fact, by this thinking, Ca becomes the *problem*, not part of the *solution*.

Interestingly, however, inclusion of citric acid in the diet appears to improve phosphorus utilization. It accomplishes this by "chelating" to calcium, thus reducing some of the inhibitory effect excess calcium has on phytate breakdown. Additionally, citric acid will lower intestinal pH, perhaps alleviating this blockage of mineral absorption. It would follow that chelation of Ca to an organic source such as citric acid would help improve Ca utilization as well.

I conclude a couple of thoughts from this. The addition of phytase (enzymes) in feed is gaining emphasis and use. However, formulation of diets which result in less excess Ca would be advisable. Maybe in the future we will understand the metabolic pathways of Ca nutrition better. Then we can take advantage of potentially linking Ca with an organic source to improve its effectiveness as well as reduce its inhibitory influence on P utilization.