ilc resources

MINERAL WRITES

FOURTH 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
ILC Resources has both potassium chloride (KCl) and potassium magnesium sulfate (K/Mg/S) available.

All products are available in both bag and bulk.

An Act of Bioterrorism Spawns Enactment of Bioterrorism Act

On June 12, 2002 President Bush signed into law *The Public Health Security and Bioterrorism Preparedness and Response Act of 2002*. This Act is part of the United States' response to the September 11, 2001 terrorist attacks. However, the Bioterrorism Act is not limited to just bioterrorism. The Act's provisions are intended to prevent and respond to both intentional and unintentional foodborne illness outbreaks. Certainly the recent anthrax issue plus BSE concerns have added credence to this response. Now that this is law, who is responsible for enforcement of its provisions? What does this Act entail? How does it affect our business and who we do business with?

First of all, the FDA (Food and Drug Administration) has had enforcement authority for food since it was created in1938. Thus, the FDA is responsible for enforcing the Act's provisions. The new requirements under the Bioterrorism Act are the most significant expansion of the FDA's enforcement authority since its inception.

Secondly, the Act encompasses four key requirements:

1. Registration of U.S. and foreign food facilities
2. Prior notice to FDA of importation of food
3. Record keeping
4. Administrative detention

FDA's implementation of *facility registration* final rule was published October 10, 2003. At the same time, the final rule for *prior notice of imports* was also published. The final rule concerning *administrative detention* is expected in December 2003. Thus, FDA's implementation of the Bioterrorism Act is underway.

Facility registration requires any domestic or foreign facility that manufactures or processes as well as packages and stores food for human or animal consumption in the U.S. to register with FDA before December 12th of this year. This pertains to all facilities, not just collectively by the companies owning them. Simply interpreted, this requirement sets in place a vast encompassing database for our nation to communicate rapidly with the human and animal food chains should any *act of bioterrorism* present itself. This registration basically identifies names, addresses, phone numbers, and

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types of manufacturing &/or processing facilities serving our food sources. This registration pertains to not only U.S. facilities but foreign facilities that supply inputs to the U.S. food chain.

Prior notice to FDA of importation of food requires that food from foreign manufacturers cannot be imported into the U.S. unless their facilities are registered. This basic requirement means that FDA must be given prior notice of each article of food that is imported or offered for import into (or through) the United States. The purpose of this is threefold. One, it provides FDA with advanced notice of food imports so FDA can decide whether to inspect. Secondly, it enhances the FDA's ability to deter, prepare for, and respond to acts of bioterrorism and other public health emergencies. And thirdly, in the event of an emergency, it will enhance the FDA's ability to prevent entry of unsafe foods and to facilitate product tracking.

Record keeping will entail documenting the handling of products from their raw state through finished marketable product. Paper documentation of business transactions takes place in every business. These regular records show where inputs came from and where finished products go.

Finally, *administrative detention* basically involves enforcing action against noncompliance of the above requirements. Whether this goes into such seriousness as seizure of food products, injunction action, criminal prosecution, refusal of import at time of Customs entry, or facility inspection action certainly will depend on the circumstances surrounding an infraction. Compliance with the requirements of the Act should render this aspect as a non-issue.

Each of these requirements is multifaceted and some are not only quite detailed but perhaps complicated as well. This does provide an overview, however.

How will this Act affect current business? Perhaps we do not yet know for sure. The overall purpose of the Act is indisputably important. It will signify more governmental authority and control. It should also be viewed as a positive move toward additional assurances of continued food safety. By this action one can envision concerns being allayed from many sources, such as BSE or anthrax as examples.

ILC Resources has already taken the first step in required compliance by registering facilities. Point 2 will be of limited application in our business, but easily adhered to nonetheless. Point 3 is already in place just by keeping good business records. We do not consider Point 4 to be of concern because of compliance with the other three.

In a "perfect-world" implementation of the *Bioterrorism Act* would not be necessary. Unfortunately, we must take action to protect our way of life in America. Our food system, whether applied to the animals in our care or us as humans, is vital to our existence. In order to preserve our freedoms, we must subject ourselves to these types of authoritative actions.

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Calcium's Role in Nutrition

Here are a few gleanings from some research literature on the role calcium plays in nutrition. One might use the information to not only more completely understand calcium's impact on performance but also its significance to the skeletal system along with some of the complexities of eggshell production. This is by no means an exhaustive treatise on calcium's overall contribution to nutrition, however.

The major minerals that form the inorganic matrix of bone are calcium (Ca) and phosphorus (P). The extent of bone mineralization affects bone strength (Reichmann and Connor, 1977). Poor mineralization has been associated with increased risk of fractures (Blake and Fogelman, 2002). Weak bones, especially legs, often result in reduced feed intake, thus, lower weight gains as well as quality and number of eggs laid in layer operations (Rowland, 1967; Orban, 1999). A recent study (Onyango, 2003) documented that weight gain, feed intake, and feed efficiency increased as levels of dietary Ca and P increased.

We know that calcium affects such things as bone structure, blood coagulation, nerve transmission, muscle contractions, and hormonal secretions (Brown, 2002). Phosphorus is a constituent of bone, nucleic acids (DNA, RNA), and high-energy compound. It also is involved in a variety of enzymatic reactions necessary in digestion of foods and absorption of nutrients. Inadequate amounts of Ca or P will adversely affect these as well as other important processes that are all part of growth. Both bone mineral content and bone mineral density increase as levels of dietary Ca and P increase (Onyango, 2003). Environmental concerns over excess deposits of phosphorus on land and water sources have forced a decrease in the feeding of phosphorus and/or the form of phosphorus being fed to poultry and livestock. Although this emphasis is legitimate, dietary adequacy of both calcium and phosphorus are vital too.

In the domestic hen, the *shell gland* extracts calcium from the blood and transfers it to the egg. Intestinal absorption of calcium plays an important role in providing the amount of calcium needed to perform this task (Franco and Beck, 2003). The hormone estrogen has a complex relationship with calcium metabolism. Estrogen increases blood calcium levels by indirectly increasing renal activity resulting in vitamin D formation, which is able to mediate intestinal absorption of calcium and phosphorus. As the hen ages, however, her ability to absorb and utilize calcium decreases more rapidly than does phosphorus. This mechanism, although critical for the larger proportionate demand for calcium in layer nutrition, would tend to be similarly active in other species as well. Thus, mature older dairy cows and beef brood cows may exhibit similar trends. Perhaps this in part is reflective of the phenomenon *osteoporosis* in humans. One comment in a recent research study with older laying hens said "the skeletal integrity of hens of this age should be examined to determine whether there is an interaction between bone calcium and the ability of the gut to transport calcium" (Franco and Beck, 2003). One would think possibly the mechanisms described above showing decreasing efficiency of calcium absorption in hens might have extrapolative correlation with aging sows, for instance. If so, they may need to have dietary calcium levels in relationship to phosphorus adjusted as number of parities increase.

In broilers there is a prevalent condition called TD (tibial dyschondroplasia) that results in an abnormal increase in the size of cartilage in the large leg bone (tibiotarsal bone - *"drumstick"*). In severe cases, birds may be lame, leg bone may bow, or backward bending of the leg bone may result. Genetics influences the condition, but so does the relationship of calcium to phosphorus. Dietary supplementation of vitamin D (cholecalciferol metabolites) to low-calcium or even adequate calcium

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Manipulating Shell Quality & Egg Weight

A recent article published in the magazine World Poultry (No. 8, volume 19, 2003) reported research conducted by Heiko Tiller with Lohmann Tierzucht in Cuxhaven, Germany. The study involved manipulating egg weight and shell quality with phase feeding tailored to the laying hen's age and level of production.

Some statements appear obvious, but in fact, are critical to success. The key to realizing shell stability is providing a balanced supply of important nutrients to meet the hen's daily requirements. This will take into account proper protein intake, especially dietary amino acid profiles with particular consideration to sulphur amino acids. Also, energy intake must match targeted egg weight levels. Energy levels need to vary according to type of hen, thus type of egg, in-house temperature, and battery management. The report emphasizes the need for specific dietary levels of linoleic acid, an essential fatty acid that cannot be synthesized by poultry. Excess linoleic acid is deposited in the egg yolk and causes egg weights to increase. Reducing linoleic acid content in the diet by phase feeding is important for manipulation of egg weights. Lastly, the article summarizes the importance of calcium/phosphorus supply for shell stability.

The eggshell is made up of mostly calcium. Converting dietary calcium into eggshell is a complex physiological process in the laying hen. This process involves calcium, phosphorus, sodium, chloride and vitamin D_3. Careful attention to dietary ratio of calcium to available phosphorus is key. The hen's age influences this greatly. As laying hens age calcium is absorbed less efficiently than phosphorus, thus shifting this ratio. Phase feeding allows for adjusting these nutrients accordingly with advancing age. This research further reports that the hen's calcium requirement changes in the course of the day. Calcium requirements increase during the second half of the day and remain high until egg laying on the next day. Shell formation occurs mainly during the dark phase of the day when no food and hence no calcium is ingested. Some highly soluble calcium is important along with slowly released (low solubility) coarser calcium. With increasing age, the proportion of slowly released (low solubility) larger particle sized calcium should be increased. The report strongly recommends a minimum amount of fine particle (high solubility) calcium in all phases. The study's conclusion was that "with increasing egg output and improved consistency in the laying rate the producer has to ensure that the changeover to the next phase with higher dietary calcium content is made in good time to safeguard shell stability."

These research findings add additional credence to the use of ILC Resources' products such as *Shell & Bone Builder* in layer diets, along with finer particle sized calcium carbonate such as *Unical-S* or maybe even *Fre-Flo*.

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diets can reduce the incidence and severity of TD (numerous researchers in the 1990s, plus Roberson 2003). At the same time, similar supplementation of vitamin D (25-hydroxycholecalciferol) can improve phosphorus utilization as well (Applegate 2000, Angel 2001, Edwards 2002). Incidence of TD was reduced by supplementation of phytase enzyme, resulting in improved livability in male broilers (Scheideler, 2000). Even an immune response to inflammatory challenge can alter calcium metabolism by triggering bone to be reabsorbed, thus increasing free ionizable calcium (Mireles, Foster Farms research nutritionist).

Calcium and phosphorus are interrelated closely in proper development of skeletal growth. Mechanisms influencing adequacy are the amount of each in diet, relationship of one to the other, hormonal effects, vitamin interactions, and even immune response mechanisms. All are intertwined to produce either successful results if adequate or detrimental results if inadequate.

This random collection of calcium facts is intended to spark additional thought as to the important role calcium plays in nutrition. Its relationship to other nutrients, especially phosphorus, is indisputable. Much is known, but much more needs to be discovered as well.