ilc resources

MINERAL
W R I T E S

FIRST QUARTER 2005

Optimum Ca & P Levels for Laying Hens

A year ago we reported the first half of a poultry study sponsored by Hy-Line International and ILC Resources that was conducted at the University of Nebraska by Dr. Sheila E. Scheideler and her team of poultry scientists. That portion of the overall study examined three ratios of fine to large particle calcium carbonate ($CaCO_3$) in a dietary scheme with two levels of calcium (Ca) and a standard dietary phosphorus (P) level. Those finding concluded that a blend of fine to large particulate $CaCO_3$ adequately supports egg production parameters; whereas fine particle $CaCO_3$ alone did not. The large particle $CaCO_3$ used was *Shell & Bone Builder;* whereas, the fine particle $CaCO_3$ used was *Unical-S.* In part one of this study the larger strain Hy-Line W-98 hens performed better on high Ca diets, whereas, the smaller strain Hy-Line W-36 birds performed adequately on the lower Ca diets. Based on that data, higher Ca was recommended for the Hy-Line W-98 hens compared to the W-36 hens. Most significantly, a blend of at least 65:35 fine (Unical-S) to large (Shell & Bone Builder) particle Ca is needed during peak production. After peak production, a blend of 50:50 is adequate to support good eggshell quality.

The second half of this study tested recommendations for various levels of Ca and P fed to Hy-Line W-98 and W-36 strains of laying hens. In the way of background hypotheses, Dr. Scheideler speculated that as the laying hen has been selected for earlier sexual maturity and greater egg mass, her Ca and P requirements may have changed. In recent years most research in this area of layer nutrition focused on increasing dietary Ca and decreasing dietary P intake in many flocks. This part of the study looked at the actual need for dietary Ca and P in layer flocks to optimize production in the absence of the phytase factor.

The experimental design was a factorial arrangement of two strains o f layers (Hy-Line W-36 and W-98) combined with two levels of dietary Ca — average (I) and high (II) — along with two levels of dietary P — average (I) and high (II). The table on page 2 shows the dietary configuration of this trial. All diets were formulated to meet each strain's protein, energy and amino acid needs and then varied according to Ca and P treatments. Diets were basic corn-soybean meal rations with some added fat (tallow).

(Continued on page 2)

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.

Here's what was learned.

Feed Intake: Feed intake was not affected by dietary Ca or P. The W-98 strain consumed significantly more feed than the W-36 strain after the Pre-Peak period. By strain W-98 hens fed high calcium diets consumed more feed than W-98 hens fed average Ca diets.

Table 1

Trial Two (Wks of Age)	Pre-Peak (18-20)	Peak (21-40)	Peak+ (41-50)	Post-Peak (51-60)	End of Lay (61-70)
Calcium I	3.25% Ca	3.65g/d	3.75g/d	3.85g/d	3.95g/d
Calcium I	3.60% Ca	4.10g/d	4.25g/d	4.40g/d	4.55g/d
Phosphorus I	0.45% P	420 mg/d	380 mg/d	340mg/d	300 mg/d
Phosphorus II	0.50% P	500 mg/d	450 mg/d	400 mg/d	350 mg/d

Hen Weight: Dietary Ca affected hen weighs; dietary P had little effect. Hens on higher Ca were consistently lighter than hens fed average Ca diets. Predictably, the W-98 strain had heavier hen weights than the W-36 strain.

Egg Production: Dietary Ca did not affect egg production during the Post-Peak period. By strain, the W-36 birds had greater egg production in Peak+ period versus W-98 birds. During the End of Lay, the W-98 hens produced more eggs on the higher Ca diets while high Ca diet did not benefit the W-36 hens.

Egg Weight: Higher dietary Ca improved egg weights while dietary P levels had little effect on egg production. A significant Ca by P interaction occurred during the Peak period. Either strain fed higher levels of both Ca and P laid heavier eggs versus hens of either strain fed diets of average Ca and P.

NOTE: *How does the concept of weight differ from mass? Weight is a measure of gravitational force exerted on an object; mass measures the amount of matter in an object. Egg mass is more a measure of how full the egg is versus strictly how much it weighs. Therefore, let us consider egg mass.*

Egg Mass: Egg mass was improved in both strains by higher dietary Ca. Dietary P only affected egg mass during End of Lay at which time higher P actually decreased egg mass production. Strain of hen effects on egg mass favored W-98 hens throughout the trial. The W-36 strain produced more egg mass when fed average dietary P at the End of Lay. During the same period, the W-98 strain of hens was unaffected as to egg mass production by either level of dietary P.

Percent Shell: The main difference between wet shell and dry shell measurements is the adhering albumen and membrane dry matter. In this study, the percent *wet-shell* (thus including adhering albumen and membrane) showed very little variation due to dietary levels of Ca or P. Strain had the most consistent effect, with W-36 birds showing greater percent wet shell than W-98 hens throughout the study. Interestingly, during the Peak + period, W-36 hens had higher percent wet shell on the low P diet, while the W-98 strain was unaffected by P levels. Dr. Scheideler explains that average dietary P during egg production promotes better bone turnover which correlates with better egg specific gravity and shell quality. After growth, dietary P can be reduced to account for only egg production.

Egg Specific Gravity (measure of egg density): Higher Ca produced a denser egg. In contrast, the lower P level tended to produce a denser egg during some of the trial. Higher Ca did improve egg specific gravity during Peak and Post Peak periods. The lower dietary P improved egg specific gravity during Peak + period. In the W-98 birds from Peak + to End of Cycle, there was an improvement in egg specific gravity on higher Ca diets. The W-36 hens were unaffected by Ca levels, but experienced improved egg specific gravity when fed lower P levels. W-98 birds exhibited improved egg specific gravity when fed higher levels of P. These results parallel the Wet Shell observations.

Percent Grade A Eggs: *Grade A eggs are defined as clean, unbroken, practically normal eggs as determined during official grading.* In this study, dietary P had little effect on percent Grade A eggs during the trial. However, during the Peak + period a Ca by P level effect was significant. High Ca and average P resulted in highest percent Grade A eggs. At the same time, hens fed high levels of both Ca and P had the

(Optimum Ca & P *con't on pg 4***)**

Scientific Methods: At the Bedrock of our Business

Have you ever stumbled onto an idea that seems to suggest a better way to do something? Whether the idea is for an easier method or perhaps for a better material to use, your discovery could truly lead to an improvement of existing methods and materials. Then again, the idea might have been just a good thought that doesn't pan out. How do we know? Open-mindedness, research, and testing are the logical and necessary steps in finding the answer to this question. We ought not assume that what we have discovered is *better* only because it's new, nor should we simply assume that the old methods are best just because they've always worked adequately in the past. ILC Resources is committed to open-minded research in every facet of our operation and to thorough testing of new ideas and research findings. This is a highly professional, yet common sense approach toward ensuring the *best* possible products for our customers—never content with just *good,* always researching for something *better,* and diligently testing for results that are *best.* Openness to new ideas is what propels **research**, and commitment to **testing** is what proves the viability and value of the research.

An ongoing program of research and testing sounds easy. But is it? The process involves people, and people do not always see eye to eye. We include many divergent groups from many diverse locations. Assume that all of us are knowledgeable and highly capable, each in our particular areas of specialization. Some of us might cling to an opinion that the *old* is tried and tested and should not be changed. Others might insist on perpetually running with new strategies and an opinion that cutting edge ideas are always best. In truth, success probably lies somewhere between such extremes. But opinions are not what produce results. Among us with our diverse opinions and biases, we need to agree on a common, objective approach to our research and testing. Though remaining open to disagreement, we all need to agree that our aim is for the best results.

This is where a commitment to science comes in. The *Scientific Method,* in its most general definition, is a process by which scientists collectively endeavor to construct an accurate, reliable, consistent, and non-arbitrary representation of the world, specific properties and laws of nature. *The Scientific Method* minimizes different personal and cultural beliefs that hinder objective and valid interpretations of natural phenomena. Well-defined, standard procedures are critical to minimize the influence of bias or prejudice in the experimenter when testing a hypothesis or a theory. Hence, *Scientific Method* is an integral feature of ILC Resources.

The four basic steps of scientific methodology: **(1)** Observation and description of a phenomenon or group of phenomena. Collection and assessment of much data. **(2)** Formulation of a hypothesis to explain the phenomena. For example, in physics, the hypothesis often takes the form of a causal mechanism or mathematical relation. **(3)** Use of the hypothesis to predict the existence of other phenomena, or to predict quantitatively the results of new observations. **(4)** Performance of experimental tests of the predictions by independent experimenters and properly performed experiments.

Correctly adhering to the scientific method with experimental tests may lead to confirming the hypothesis or to ruling it out. Objectivity is an important element, obviously. When testing any idea or theory, we need to resist a preference toward any particular outcome. The most fundamental, blatant error would be to mistake the hypothesis for an actual explanation of a phenomenon without properly performing experimental tests to prove or disprove validity. Untested assumptions (based on past experience, mere opinions, common sense, so-called logic, etc.) could tempt us to believe we do not need to test before implementing changes. Only our firm commitment to the Scientific Method will preclude potentially wrong, possibly disastrous conclusions "validated" without sufficient proof.

A hypothesis is a limited statement regarding cause and effect in specific situations. One may say

(Scientific Methods *con't on pg 4***)**

Optimum Ca & P *(con't from page 3)* lowest percent Grade A eggs. Also during this period, a Ca by strain effect on percent Grade A eggs was significant. The W-98 birds responded to lower dietary Ca with an increase in Grade A eggs. Comparatively, W-36 hens responded with better grades on high Ca diets. Interestingly, a P by strain effect was detected that exhibited similar reversal results between strains. The W-98 strain had best grades with average dietary P while W-36 hens did not show any preference for high versus average P for egg grades.

Percent Cracked Eggs During Grading: Percent of cracked eggs showed little effect due to strain, dietary Ca or P during grading. During End of Cycle, however, feeding average P increased percent cracked eggs; whereas, dietary Ca had no effect on percentage cracked eggs during the study.

Summary: Most of the dietary Ca, strain and strain by Ca effects reported in this study correspond to previously reported effects during the first part of this research. *(Refer to article in First Quarter 2004 Mineral Writes.)* Increasing dietary Ca was beneficial for egg weights, egg mass production and egg specific gravity. Dietary P did not significantly affect many of the measured parameters. There was an advantage to feeding average P on egg production late in the laying cycle. Considering strains, W-36 hens benefited from average P with improved egg specific gravity and percent shell. The W-98 hens had better grades when fed average P. Dr. Scheideler concluded that average levels of dietary P are adequate to maximize egg production while also supporting improved egg shell quality.

Much of this article was taken directly from the scientific report Dr. Sheila E. Scheideler presented last autumn to Hi-Line International and ILC Resources. ILC Resources gratefully acknowledges this excellent research work done at the University of Nebraska. We also express gratitude for the support and co-sponsorship of this study by Hy-Line International.

It becomes evident that careful attention needs to be given to particle size patterns of feeding $CaCO_3$ in laying hen production, as we saw in the first part of this study. In this second part, we also see the importance of examining Ca and P levels during stages of the laying cycle. And further, it is equally imperative to differentiate dietary formulations of Ca and P based on strain of birds being fed. Fine tuning diets to optimize production parameters is essential to successful egg production. We are committed to helping evolve this quest for understanding. ■

Scientific Methods *(con't from pg 3)* "calcium carbonate is beneficial to making strong eggshells from laying hens" or "limestone will improve a farmer's soil for next year's crop production." If one *intuitively* believes either or both of these statements without *testing* to prove them, errors may occur that could cause failure. To further this illustration, feeding Unical-P (finely ground powdered $CaCO_3$) to laying hens more than likely will fail to produce good eggshell quality, even though it is good calcium. By proper testing and truly proving what works, we know from research that it takes a blend of particle size $CaCO_3$ ranging from fine *granular* $CaCO_3$ (Unical-S) to large particulate sized $CaCO_3$ (Shell & Bone Builder) to produce good eggshells. Powder will not. On the other hand, if we spread large pebble sized limestone on soil, we will not improve conditions for better crop production because large particle $CaCO_3$ will not neutralize low soil pH effectively. It takes finely ground powdered $CaCO_3$ to *maximize* proper neutralizing of acid soil. Therefore, both of these examples of hypothetical statements, without proper and adequate testing are not valid even though they may sound right. We must be committed to testing.

Our company, which supplies $CaCO_3$ for a variety of purposes, remains dedicated to doing research and testing when we have first assured ourselves that correct hypotheses have been stated and proper administration of the *Scientific Method* has been applied to prove sound recommendations. We adhere to this approach through our internal *Quality Assurance* efforts. We believe nothing less than scientific research is right, and our customers deserve that commitment from us. Our dedication to excellence is why we are considered such a reputable source for mineral ingredients. We will continually support pertinent meaningful research at the university level using academic institutions with indisputable reputations for following the Scientific Method. They test and test again, and analyze test results to assure validity before arriving at helpful recommendations. We will back only this approach with research sponsorship. ■