

taken were body weight gain (BWG), gain to feed ratio (GF) and percent of foot ash (FA) at 4, 8, and 15 d of age. A significant linear response ( $P < 0.05$ ) was observed in growth performance and FA in birds receiving graded levels of PP at all ages, confirming the sensitivity of the procedure. No significant differences were found in FA percent between groups receiving TP or DP at all ages (13.5 vs 13.3% at 4 and 8 d, and 14.5 vs 14.3% at 15 d, respectively). As expected, the group receiving the RP had significantly reduced BWG, GF and FA percent (11.5, 10.5 and 12.9% at 4, 8 and 15 d, respectively), confirming the ability of the assay to detect low phosphorus availability. Results of this research did not demonstrate evidence of a reduced bioavailability of TP for chicks at 4, 8 or 15 d of age, suggesting this ingredient can successfully be employed in pre-starter diets for broilers.

**Key Words:** Phosphorus availability, Defluorinated phosphate, Dicalcium phosphate

**230 Effects of dietary nonphytate phosphorus level on roaster performance and phosphorus excretion.** M. E. Persia\*<sup>1</sup>, R. Angel<sup>2</sup>, and W. W. Saylor<sup>1</sup>, <sup>1</sup>University of Delaware, Newark, <sup>2</sup>University of Maryland, College Park.

Reducing supplemental nonphytate phosphorus (nPP) fed to growing poultry can reduce environmental impact and diet costs in concentrated poultry regions. An experiment was performed to determine the effects of reduced dietary nPP on leg bone mineralization and associated losses during commercial processing, as well as bird performance and P excretion, which will be presented here. Five levels of dietary Ca and P were fed to 12 replicate pens of 47 male commercial broiler chicks from hatch until d 57. Calcium and P levels were formulated to result in differences in leg bone mineralization without affecting final body weight to avoid confounding effects during processing. Roasters were fed the same diets for the pre-starter and starter phases after which Ca and P levels were reduced in grower, finisher and two withdrawal phases resulting in a control treatment and four treatments of varying but moderate Ca and P. Total P and Ca intakes for the five treatments were as follows: control, 46 and 65; moderate high, 38 and 48; moderate low, 35 and 44; low high, 37 and 46 and low low, 34 and 39 g/bird, respectively. Unfortunately, ventilation failure in one wing of the house resulted in increased mortality so performance and litter data from only six replicate groups will be discussed. No differences were noted in bird weight gain, feed efficiency or dry litter weight for any dietary treatment. The reductions of dietary Ca and P resulted in 28 to 48% reductions in litter P

between the control-fed birds and the groups fed moderate levels of Ca and P. There were 12 to 28% reductions in litter P resulting from reductions in dietary Ca and P among the moderate treatments. Percent P retention was increased with decreasing dietary Ca and P. Feeding reduced amounts of Ca and P, especially in later phases, reduces Ca and P intake and P excretion, without reducing roaster performance.

**Key Words:** Roaster, Litter phosphorus, Performance

**231 Mintrex™ Zn organic trace mineral (zinc bis[2-hydroxy-4-methylthiobutyrate]) can travel intact to the small intestine, and is equivalent to Alimet® feed supplement as a methionine source.** J. Richards\*, C. Atwell, J. Hume, and J. Dibner, *Novus International, Inc., St. Louis, Missouri.*

Organic trace minerals should travel intact through the upper gastrointestinal tract (GIT) and deliver their minerals in protected form to the small intestine for absorption. Mintrex™ Zn Organic Trace Mineral is a chelate of two 2-hydroxy-4-(methylthio) butanoic acid (HMTBa) ligands per atom of zinc. We tested whether Mintrex Zn can pass intact through the upper GIT and whether the HMTBa in Mintrex Zn is a source of methionine activity. Broilers were gavaged with equimolar amounts of 14C-HMTBa in the form of Mintrex Zn (zinc bis(2-hydroxy-4-methylthiobutyrate)) or Alimet® (HMTBa) and rested 1-4 hours. Tissues (duodenum, jejunum, liver, leg muscle and pancreas) were collected, homogenized, and the protein fraction was precipitated and pelleted. Pellet and supernatant fractions were scintillation counted and corrected by 14C-Mintrex and 14C-HMTBa standards. Pellet counts represent HMTBa that was absorbed, converted to l-methionine and incorporated into protein. Total (pellet + supernatant) counts represent total tissue uptake of HMTBa. Previous work has shown that free HMTBa is absorbed mainly in the upper GIT. Total duodenal counts were greater for Mintrex than for HMTBa at all time points, indicating that Mintrex can travel intact through the acidic upper GIT to the small intestine for absorption. Total counts in other tissues were not different between sources. Likewise, Mintrex provided more methionine activity to the duodenum than did HMTBa; but when compared in the other tissues and across all tissues there was no difference in the methionine activity provided by the two sources. Furthermore, the kinetics of incorporation into protein were generally similar between sources. Thus, Mintrex Zn and Alimet are equivalent sources of methionine activity.

**Key Words:** Mintrex, Zinc, Methionine

## Reproduction Symposium: Optimizing Reproductive Output From Female Broiler Breeders

**232 Reviewing our course: Development of the modern broiler.** J. H. van Middelkoop\*, *Spelderholt Institute, The Netherlands.*

In the older days selection for growth rate was mass selection without any pedigree. Hatching egg production was obtained by using a good producing strain or cross. Since selection circumstances were not uniform and breeders were used its entire lifetime natural selection was included in breeding for the next generation. Pretty soon primary breeders did improve both uniformity of selection circumstances and selection procedure. This allowed breeders to increase progress of the selected traits. However the better the geneticist can distinguish the best birds for the selection traits the more they need to watch for unwanted genetic drift. Genetic changes in breeding are a cumulating effect of each selection per generation. This is valid for both wanted and unwanted traits. Primary breeders tend to standardize and to minimize phenotypic variation in the flock to be selected due to the environment as much as possible. However the lesser variation in selection environment the larger the risk that selected birds cannot adapt in other environments. This reality refers to the risk of shifts in unnoticed traits, or even worse in unnoticed shifts. Changes in traits can remain unnoticed or deviate from anticipation when the environment in commercial operations differ from the selection environment – a potential result of executing selection in pure line while crosses are sold as final product. Examples are sensitivity to ascites and leg problems.

The high selection pressure executed for a few highly heritable broiler traits implies a big risk of losing genetic variation needed for genetic driven egg performance in commercial environments. Selection environment of broiler breeder hens is total different from commercial rearing practice. Primary broiler breeders try to set the best rearing conditions for selection of broiler traits. In contrary the opposite is done with regard to create the best environment for hatching egg selection. This increased the risk of ending up with breeder hens with poor reproductive traits or difficult to manage. Special attention will be paid to the reason why and when restricting broiler breeders started in commercial operations and how this in turn unconsciously made primary breeders selecting broiler breeders which has to be restricted. It was not a decision but it just happened.

**233 Is chick quality a price we have to pay for yield?** M. J. Wineland\*, *North Carolina State University, Raleigh.*

The broiler of 2005 is vastly different from that what many of us knew when we were youngsters. The improvements due to nutrition and genetics have developed a broiler that attains a heavier weight, at a younger market age, and converts feed much more efficiently. Twenty years ago breeder managers had the responsibility of producing hatching eggs, today their goal is still the same but they must attempt to reach their goal with the high yielding bird that is known

for considerably fewer eggs. The breeder manager has placed much greater emphasis on the small details of breeder management to coax eggs from the hens. The management of parent breeders of higher yielding breeds had received more immediate attention while the performance of chicks from these breeds received lesser attention. The determination of chick quality has been examined for some years. Poor quality chicks could simply be defined as chicks not performing as expected. Today's industry is looking for fractions of improved performance in production to increase their competitiveness. What are the indicators that you can use, beyond the chicks general appearance. The most thorough technique was that reported by Cervantes. This evaluation was a invasive and time consuming technique. Hill and others have been promoting a much quicker evaluation tool using chick length. However the evaluation tools for determining chick quality are just that, only tools. If chick quality is truly an effect of the genetic and nutritional improvements, then people must be able to understand how quality is influenced by the physiological processes of these embryos and chicks that are altered by the management practices imposed. This presentation will examine how breeder chicks and broiler chicks differ from the chicks produced when we were youngsters and how the management techniques of yesterday need to be altered to manage the physiological processes of the high yield chicks in today's poultry industry.

**234 Reproductive strategies of breeder hens.** R. A. Renema\*, *University of Alberta, Edmonton, AB, Canada.*

The introduction of new genotypes to meet consumer demands has improved the growth potential of the bird, but has also created difficulty in the management of the broiler breeder hens. Broiler breeders must have the genetic potential for efficient growth as well as the ability to effectively reproduce. Overfeeding can accelerate the sexual maturation process and elevate ovarian large yellow follicle numbers in birds of similar body weight. Likewise, females given lower than usual or higher than usual feed allocation divert more energy to carcass growth and less to reproductive processes. The primary influence on how many large, yolky follicles form on the ovary is body weight. But when you compare birds of the same size, the one consuming more feed will have more large follicles. Refinements in feeding programs are becoming increasingly important with the development of high breast-yield strains, and with continued increases in the growth potential at the expense of reproductive potential.

Most current strains are capable of early maturing if a mature physical state has been achieved. This means that the biggest impact of altering the growth profile to achieve a body weight target at early or typical ages may be on frame size,

which subsequently has a role in determining egg size. Feed allocation, particularly early in the pullet phase, can have a permanent effect on bone length and overall frame size. On a daily basis, the broiler breeder hen must compile the demands of growth and reproduction with actual feed intake. Each hen appears to have a different balance between the pull to lay eggs or to grow. Most have a specific balance between these two pulls on their individual nutrient allocation. In general, breeder hens either lay very well but don't grow, or grow very well while laying poorly. However, in every population there are also sub-groups that do not fit the model. The hens we may value the most in the barn are the highly efficient "superhens" that can lay eggs well while continuing to grow well relative to the population.

By thinking about what is driving the reproductive effectiveness of different groups of hens within the flock, hopefully we can work towards making better flock management decisions. Breeding companies have put a lot of emphasis on achieving early body weight targets in pullets because of the long-term implications for frame size. While genetic selection programs tend to be similar, it is important to know if there is a wide range of responses to specific management methods, or if our new breeder varieties act similarly. Sensitivity to over-feeding, altered growth profiles, or photostimulation ages are key components of this type of analysis. Identification of differences would underscore the need to move towards strain-specific management.

**235 Tying it all together: Final comments.** M. J. Zuidhof\*, *Alberta Agriculture, Edmonton, AB, Canada.*

The study of poultry genetics has followed its own evolutionary path. Until humans discovered that we could manipulate poultry characteristics through breeding, natural selection governed the survival of specific traits. Eventually, "standards of perfection" were developed that referred to specific visual characteristics. In the past century, performance traits have received huge emphasis, then cost, now profit, and we are launching into an age where traits relevant for socioeconomic reasons are becoming paramount. The challenge of "Optimizing Reproductive Output from Female Broiler Breeders" is certainly complex. We understand some of the biological basis of reproductive challenges imposed by non-natural selection pressure for growth, but enormous challenges remain that will be exacerbated by moving biological and socioeconomic targets. What role should poultry research play in the continued relationship between poultry and society in the future? Time will demonstrate the value of nonlinear thinking, systems-level approaches, and collaborative synergies.