

2003 Mid-Atlantic Animal Nutrition Conference

by Danny M. Hooge

The 50th anniversary Maryland Nutrition Conference, also called the 1st Mid-Atlantic Nutrition Conference, sponsored by the University of Maryland and the Maryland Feed Industry Council was held March 27-28, 2003 in Timonium. Organizers called the meeting this year's meeting the "Maryland and Mid-Atlantic Nutrition Conference." The educational program was planned by three committees (monogastric, ruminant, and equine nutrition) comprised of collaborators from educational institutions in Delaware, Pennsylvania, Virginia, West Virginia, and New Jersey, as well as Maryland. Dr. Gerald Combs, Sr., prominent poultry nutritionist, retired but now serving as adjunct professor at University of Southern Mississippi (Hattiesburg), and his son Dr. Gerald Combs, Jr., an animal and human nutritionist, were guest speakers at the conference.

Emerging Animal Feed Issues

According to Dr. Mamduh Sifri, ADM Animal Health and Nutrition (Quincy, IL), "it is logical to believe the expansion of animal agriculture in the USA will be limited; consequently, the pressure for delivering new products at increasingly lower prices will continue to mount. Conventional food-chain integration has provided some industry relief; however, ...the market continues to be significantly segmented in the global sense for all supply-chain elements that influence feed and food production. ... It seems natural that this kind of segmentation will not last long and that new arrangements will emerge gradually. Those businesses that succeed will include comprehensive partnerships (alliances, joint ventures, or other arrangements) that will circumvent current market structure for unique advantages".

Some pertinent emerging animal feed issues that should be addressed are: 1) environmental pollution and animal waste management, 2) health of animals and caretakers, 3) precision use of medications and growth promotants, 4) natural strategies and alternatives to medicines, 5) animal and human welfare in production systems, 6) utilization of alternative and byproduct (co-product) ingredients, 7) rendered byproducts of animal origin, 8) assessing nutrient requirements in view of genetic changes, ingredient sources, energy costs, and economics, and 9) "renewability" of animals and nutrient sources.

Selenium in Animal Nutrition

Dr. Gerald Combs, Jr., Division of Nutritional Sciences, Cornell University (Ithaca, NY), and Grand Forks (SD) Human Nutrition Research Center (USDA-ARS), discussed contributions of animal nutrition to human health as it relates to the selenium story. In just five decades, the nutrient selenium was discovered to be dietary essential, characterized for use in feeds, elucidated in terms of its fundamental metabolic roles, and found to be effective in reducing carcinogenesis. The opportunity to gain deep and fundamental understanding through experimentation with animal models, and more recently with cultured cells, yielded practical benefits in animal nutrition and provided the basis and rationale for clinical trials with humans.

The dietary requirements of animals for supporting expression of selenocysteine enzymes are generally satisfied by dietary selenium levels of 0.1-0.2 ppm, although 0.3 ppm is permitted under current U.S. feed regulations. These were established based on the common practice of using inorganic salts, particularly sodium selenite, in animal feed supplementation. These inorganic forms yield only H₂Se and methylated excretory products metabolically, supporting only the selenocysteine proteins, and therefore have minimal effects on tissue selenium levels at uptakes above these required levels. These are unsatisfactory for producing animal-based functional foods that deliver anticarcinogenic forms and amount of selenium in normal servings. New problems and opportunities exist for the animal nutritionist to determine the amounts and forms of dietary selenium (particularly selenomethionine and the methylated compounds, CH₃-selenomethionine, and CH₃-selenocysteine) that are most effective in supporting safe enrichment of selenium in milk, meat, and eggs to make them useful products for reducing cancer risk.

While many important questions remain about the efficacy, specificity and safety of selenium compounds, it will be appropriate for animal producers not to default to the pharmaceutical and supplement industries for the implementation of this knowledge because there are clear opportunities to develop animal-based functional foods containing selenium. This calls for continued attention and diligence on the part of the animal nutrition community, which, after all, gave birth to this field.

Past Progress and Future Challenges

Dr. Gerald Combs, Sr. reviewed the rise and development of the Maryland Nutrition Conference and spoke of how over the last 50 years at least 950 specialists have delivered addresses to the industry. He recalled that the first significant production of broiler chickens occurred in Maryland and Delaware beginning in 1929, with 5,000 to 6,000 bird houses each containing 10 coal-burning stoves, and addition of cod liver oil (vitamin D) to feeds began in 1930 allowing confinement rearing without necessarily having exposure to sunshine. The feed consisted of a concentrate in mash form fed along with cracked corn and hard grit. Skim or clabber milk was provided when available. Greens of all sorts such as grass clippings, lettuce, cabbage, and kale were cut for broilers to eat. He reminisced about his own visits to many of these farms where losses in the early days commonly approached 40 to 50% due to faulty diet and disease, especially coccidiosis, pullorum, and rickets.

After vitamins A and D were added, other vitamin and mineral deficiency problems became evident (curled toe paralysis, slipped tendon or perosis, crazy chick disease). In the late 1930s and early 1940s it was discovered that heat treating soybean meal and adding methionine greatly enhanced growth in corn-soy diets. By the late 1940s commercial vitamin premixes were available though vitamin requirement levels were not well known. Many advances over the years, which continue to be refined upon today, included for example, antioxidants, acid-base balance, mycotoxin effects and prevention, medications, calorie:protein ratio, Maryland nutrient recommendations, enzymes, mineral bioavailabilities, and so on.

The immediate future should yield much progress as genetic engineering techniques are applied to both plants and animals in solving specific problems. For promoting world peace, any successful international nutrition plan should recognize the need for: 1) sustainable agricultural

food production systems to the extent practicable in every country, and 2) the essential role food producing animals to optimize the use of all available resources.

Agri Stats Broiler Industry Perspective

Michael Donohue, Vice President of Agri Stats, Inc. (Fort Wayne, IN), stated that with tough economic times in the integrated broiler industry, producers are trying to redefine what factors drive profitability -- a question simple yet difficult to answer. From 1995 to 2001, total broiler production expanded by close to 25% to meet U.S. and world consumer demand by increasing live weights, improving yields, quickening line speeds, and to a lesser extent, building new production facilities. U.S. per capita consumption of broiler meat increased by only 11.2% over the same time period. With disruptions in exports, opportunities for maintaining or increasing profitability becomes difficult.

Rapid increases in feed ingredient costs greatly influence profitability in the short term, but over the long run the effect is diminished. In 1996, as corn and soybean meal prices rose, broiler live production cost increased from \$ 0.25 to 0.32 per lb, and meat profits dropped from \$0.05 down to \$0.02 per lb. Today, the meat product mix (for example, tray pack versus bulk commodity) and price per lb of meat (the market, as well as flexible pricing versus booking on forward pricing) affect net dock sales price. When these factors are acceptable, those companies that are profitable have efficient live production systems that lead to good live cost and also have high yields and efficient processing plant operations leading to competitive plant cost.

Feed Processing and Broiler Performance

"Not many producers consider moisture and its effect on milling when formulating feed; however, adding water to feed will decrease the cost of making pellets and could improve feed conversion and growth rates," according to Dr. R. Scott Beyer, Kansas State University. Just 0.5%-added moisture can increase mill throughput and improve pellet quality. Pellet quality (that is, intact pellets) greatly improves broiler growth and feed conversion. Although pellet quality can be improved through increased starch gelatinization (starches gelatinize and help bind particles together), gelatinization *per se* does not necessarily improve broiler performance based on Kansas State University research with processed corn. Gelatinizing starch through commercial feed milling processes does not improve nutrient utilization of broilers during the 0 to 3-week starter phase.

In other research using mash or pelleted broiler chicken feeds with 0.75 to 1.15% digestible lysine at 0.10% increments, pelleted feeds with 0.95% or more lysine generally gave better live performance than that of mash feeds with higher lysine levels. Particle size needs further research because it affects the anatomy and physiology of the digestive system, microflora, and pH. Small particle size makes better pellets but reduces gizzard size, as the muscular organ is not needed as much in nutrition.

Low Protein Diets for Caged Laying Hens

Dr. Curtis Novak, Virginia Tech, Blacksburg, and Dr. Sheila Scheideler, University of Nebraska, Lincoln, reported results of an extensive study with Hyline W-98 hens using corn, soy, and corn gluten meal based diets containing various levels of supplemental methionine, lysine, threonine, and tryptophan. Reducing protein intake from 18.9 down to 16.3 g/hen/day during Phase 1 (20-

43 weeks) and from 16.3 down to 14.6 g/hen/day during Phase 2 (44-63 weeks), by formulating for lower crude protein using supplemental amino acids, maintained normal egg production. Feed conversion per gram of egg mass was improved linearly as dietary protein decreased. Egg weight was reduced when feeding the lowest levels of protein (14.4 and 13.8 g/hen/day for phases 1 and 2, respectively) compared to higher levels of protein.

Egg components were affected by protein level but not by total TSAA:lysine ratio. Wet albumen, dry albumen, and albumen solids percentages all linearly decreased when protein intake decreased, and this may have been associated with the reduced egg weight. Egg specific gravity, a measure of egg shell quality, but not egg breaking strength, was linearly decreased with low protein diets, and this relationship warrants further investigation. Other researchers have indicated that decreasing protein level decreases shell quality. Increasing the total TSAA:lysine ratio increased the shell quality, possibly due to more sulfates in the shell matrix having calcium-binding ability. Haugh units were increased in Phase II by lower protein intakes, similar to other reports. Low protein diets have potential to reduce feed costs, lower protein (nitrogen) excretion, and maintain hen performance.

Assessing Corn Energy Content and Enzyme Effects

Dr. Thomas H. D'Alfonso, Danisco Animal Nutrition, Marlborough, UK collected 93 commercial corn (maize) samples globally and analyzed them for dry matter, starch, protein, oil and gross energy content (averages 89.1%, 68.8%, 8.1%, 4.4%, and 4,523 kcal/kg, respectively, with CV% of 1, 3, 9, 13, and 1). Each corn sample was mixed at 55% of the diet and fed with or without Avizyme 1502 to one pen (per treatment) of 25 male broilers to 28 days of age. The commercial enzyme blend contains xylanase, amylase, and protease. Ileal digestible energy (IDE) was computed using the relative proportion of titanium dioxide marker in the feed and feces, based on digesta analyzed from the terminal ileum of six birds per pen for gross energy content. Ileal digestibilities for starch, protein, oil, and "other" components of corn were, respectively: 86.3%, 81.6%, 90.2%, and 11.4%. Enzyme supplementation improved these values to 91.3%, 82.4%, 90.7%, and 13.0%. Overall, there were relative improvements of 5.0% in corn energy and of 2.9% in feed energy utilization.

The live performance of broilers fed different sources of corn without enzymes was variable with feed conversion ratios ranging from 1.43 to 2.67 and averaging 1.81 (one outlier, 3.36 removed; French corn with 25% moisture). Weight gain ranged from 680 to 1301 g, with one outlier of 375 g removed, averaging 909 g. The addition of enzymes significantly improved feed conversion ratio to 1.73 average ($P < 0.01$) and weight gain to 915 grams average. Feed conversion ratio had CV 16% without enzymes and CV 12% with enzymes, indicating more consistent performance with the supplement.

Broiler Breeder Nutrition Update

Canadian scientist, Dr. Steve Leeson, University of Guelph, stated that "there has been virtually no change in true digestibility of diets over the last 20 years, and so increased growth of broilers is merely a consequence of increased feed intake. However, increasing appetite is obviously a challenge in feeding parental breeder lines." Although there is always a question about changing nutrient requirements of breeders with genetic gains, there is little evidence or foundation for strain specific diets even with strains developed for breast meat yield versus classical strains.

This consensus is shown in the similar adult breeder nutrient specifications for Cobb, Hubbard, and Ross strains.

The energy requirement of breeders can be estimated from the daily heat production reported by Spratt *et al.* (1990; Poultry Science 69:1334-1347) to be 280 kcal for a 3 kg caged breeder, plus 86 kcal for egg production and 21 kcal for growth. Presumably, breeders on the floor will have slightly higher maintenance needs due to increased activity. For estimating "effective environmental temperature", Dr. Leeson suggested to multiply daytime high temperature (C) by two, add night time low (C), and divide this amount by three. This calculated temperature could be used to adjust feed allocation. In addition to influencing feed requirements, temperature will also influence feed clean-up time which research has shown to differ from 3 to 6+ hours based on whether the breeders are cold or hot.

The aim of any breeder nutrition program is ultimately assessed in terms of broiler performance. There are reports of +5 g to +10 g increases in 42 to 45 day broiler body weights for each 1-g increase in chick weight. Therefore, egg size and chick size as well as hatching egg numbers should be used as criteria to assess breeder performance. A 28-week-old breeder dietary protein to metabolizable energy ratio (g protein:100 kcal) of about 5.52 has been found to optimize chick weight when a range of 4.19 to 7.63 protein:energy was evaluated.

Alternative Feed Ingredients for Broilers and Layers

"Economic conditions continue to place increasing pressure on the nutritionist to reduce feed costs, while at the same time several underutilized feed ingredients are attracting increased attention," emphasized Dr. Nick Dale, The University of Georgia, Athens. Staggering quantities (by some estimates 8,000,000 tons per year) of new generation distillers dried grains with solubles (DDGS) from ethanol plants in the U.S., derived almost exclusively from corn, are projected to be available in the near future. The nutrient profile of today's DDGS is generally similar to table values with the exception of metabolizable energy which is higher (2,779 kcal/kg versus 2,480 kcal/kg in NRC 1994) and sodium which is highly variable (0.48% in NRC 1994). Maximum dietary DDGS levels appear to be about 15% for broilers and 10% for caged layers.

Other alternative ingredients show promise. Rust-resistant pearl millet suitable to the Southeast, with about 12% protein and 3,350 kcal ME/kg, has been shown to replace a portion of corn and soybean meal in broiler feeds without any adverse effects on weight, feed conversion, or carcass yield. Use of unground (whole) millet at 10% in broiler feeds is being evaluated. Cottonseed meal has been shown to be an effective ingredient in breeder pullet feeds to 18 weeks as higher intake of feeds containing the lower available lysine product than soybean meal is desirable. Peanut meal, widely used in many parts of the world, has about 2,700 kcal ME/kg, and is suitable for poultry. Freshwater fishmeals made from offal of catfish or tilapia (fillets removed) also have potential. With all alternative products attention must be given to consistent supply, transportation logistics, and flow characteristics as well as nutritive value.

Distillers Dried Grains with Solubles for Turkeys

Dr. Sally Noll, University of Minnesota, St. Paul, analyzed four samples of new generation DDGS and submitted them to Dr. Carl Parsons at the University of Illinois for amino acid digestibility using cecectomized broilers, and is conducting turkey TME tests in Minnesota.

Protein contents varied from 25.5 to 30.7%, with fat 8.9 to 11.4%, fiber 5.4 to 6.5%, phosphorus 0.62 to 0.78%, sodium 0.05 to 0.17%, and potassium 0.79 to 1.05%. Digestible lysine was generally much improved over previously published values in three of the four sources. In the Midwest, canola meal is often used in combination with meat and bone meal in turkey diets to replace some of the soybean meal. Utilization of DDGS in these various turkey diets needed to be evaluated and emphasis given to protein quality and amino acid balance as they affect performance and breast meat yield. In a summer pen trial with male turkeys, inclusion of substantial levels of canola meal and/or DDGS with a 5% level of poultry byproduct meal had no effect on growth performance. Breast meat yield was sensitive to amino acid quality as reflected by the depression in yield when the combined diet of canola and DDGS (12%) were fed. In a second male turkey trial in winter using corn, soybean meal, poultry byproduct, and DDGS (8%) diets formulated at 90, 95, or 100% (NRC 1994) threonine levels, the 90% threonine levels reduced both body weight and breast meat yield. Dr. Noll cautioned that combined use of DDGS with other byproduct ingredients may lead to deficiencies of isoleucine and/or arginine, so levels of these amino acids should be given attention. In conclusion, DDGS was found to be an acceptable source of protein in the diets of heavy toms at moderate levels of inclusion.

Danny M. Hooge, Ph.D., PAS
Hooge Consulting Service, Inc.
8775 North Cedar Pass Road
Eagle Mountain, Utah 84043
danhooge@fiber.net