CORNELL
POULTRY POINTERS
Cornell Cooperative Extension

Vol. 48 No. 4. October 1998 Barb Smagner, Managing Editor

PEST AND PESTICIDE USE ANNOUNCED

The recent passage of the Food Quality Protection Act, FQPA, has made pesticide use assessment critical. The EPA is currently re-evaluating ALL registered pesticides to accurately determine exposure. Insecticides available for pest management in poultry are already few in number, and with the implementation of FQPA, we expect that several currently registered products will be lost.

The Pesticide Management Education Program in conjunction with the Veterinary Entomology Program at Cornell University will be surveying New York poultry producers this winter. The survey will determine pesticide use and alternatives to chemical pest control in poultry production systems. This information is critical in keeping pesticides registered for use on poultry, as well as determining the critical needs that must be met in controlling poultry pests. The EPA will use the results obtained in this and other surveys to estimate actual pesticide use. In the absence of such survey information, it is likely that "worst case" use patterns will be adopted. This makes it imperative that New York producers provide accurate and up-to-date information on pesticide use.

The survey questionnaire will be mailed to producers in the month of November. If you do not receive a copy of the survey, but would like to participate in this endeavor, please contact the Pesticide Management Education Program at Cornell University (607/255-1866). Pesticide applicator license recertification credits are available to New York producers who fill out the survey questionnaire. Individual producer responses are confidential.

P. Kaufman
Department of Entomology
Cornell University

CONTENTS

JEFF KIRBY NAMED NEW YORK FARM BUREAU ADMINISTRATOR

[Press release dated October 23, 1998, Glenmont, NY.]

New York Farm Bureau General Counsel and Legal Department Director Jeffery Kirby has been named the organization's Administrator, Farm Bureau President John Lincoln has announced.

"I am pleased to announce that the New York Farm Bureau Board of Directors has unanimously approved the selection of Jeffery Kirby as the organization's new Administrator," President Lincoln said. "On behalf of myself and the entire New York State Farm Bureau Board, we look forward to a continued strong, team-oriented relationship with Jeff in advancing Farm Bureau's mission to serve and strengthen agriculture."

Mr. Kirby has served as NYFB General Counsel and Legal Department Director for more than 14 years. He has also served as the farm organization's Assistant Administrator for the past year.

Jeff Kirby grew up on a 180-acre farm in Delaware County. He is a 1980 graduate of Cornell University's College of Agriculture and Life Sciences, where he earned a Bachelor's Degree in agricultural economics and business management. He earned his law degree from Vermont Law School in 1983.

"I am extremely pleased to accept this challenging position," said New York Farm Bureau Administrator Jeff Kirby. "I am look forward to continuing, and improving, the excellent work that Farm Bureau already does on behalf of its member farm families, and on behalf of New York agriculture in general."

Mr. Kirby and his wife Debra, have two daughters, Kaelin and Alexandra.

New York Farm Bureau is the statewide lobbying/trade organization that represents more than 28,500 member farm families. The organization is known to its members and the public as 'The Voice of Agriculture.' New York Farm Bureau is dedicated to solving economic and public policy issues challenging the agricultural industry.

FOOD WHOLESOMENESS AND THE CONSUMER

As consumers seem to grow less concerned about cholesterol, and egg consumption slowly increases, antibiotic and bacterial contamination of food occupy the consumer's mind more and more. Just as the idea that eggs are a cholesterol bomb is slowly fading, the consumer, and what is worst the medical community, are being bombarded by media information about food safety. Food poisoning and antibiotic abuse seem to be the fad. It is not uncommon to see newspapers and magazines with headlines alluding to food-safety.

The poultry industry works very hard at producing a wholesome product, but has so far failed to convey this fact to its customers. For example, why not take advantage of the fact that the great majority of New York's poultry farms are free of Salmonella enteritidis, and do not make indiscriminate use of antibiotics?

A well-managed consumer education campaign may help the New York poultry industry.

A consumer educated about the benefits of buying eggs that carry the NYSEQAP label is likely to demand it from stores and supermarkets. New markets may open for those that sell NYSEQAP eggs, as retailers abandon producers that do not meet the NYSEQAP standards. Consumers may buy more eggs if told that they are antibiotic-free.

Examples of aggressive food-safety campaigns are the approach of the Food Safety Authority in Ireland and the British Egg Industry Council (BEIC). The Irish campaign is challenging supermarket chains to buy eggs from salmonella-free suppliers. The BEIC is introducing the Lion mark, that aims to give the consumer the greatest degree of confidence in eggs that are obtained from hens vaccinated against Salmonella enteritidis. Several farms are promoting their products as "natural", from animals that receive feed free of animal protein and antibiotics.

If your farm meets NYSEQAP standards, and is not using antibiotics why not tell your customer? You may even consider dropping animal-by-products from the feed.

B. Lucio
Dept. of Microbiology and Immunology
College of Veterinary Medicine
Cornell University

CAN THE DAILY REQUIREMENT OF LAYING HENS FOR PROTEIN, PHOSPHORUS AND CALCIUM BE REDUCED BY MANIPULATION OF TIME OF ACCESS TO THESE NUTRIENTS?

Protein and phosphorus (P) are amongst the most expensive nutrients of a layer's ration. Additionally, considerable quantities of nitrogen and P are excreted annually by commercial laying hens to the environment. Consequently, any approach that could have the potential to reduce the dietary requirement of laying hens for these nutrients by increasing the efficiency of their utilization would have a significant impact in reducing the environmental pollution attributed to the excretion of these nutrients and the costs of egg production.

One approach for reducing the dietary requirement of laying hens for protein and P is the use of low-protein, amino acid-supplemented diets and microbial phytase in the diet, respectively. These approaches have been the subject of numerous investigations in recent years with promising results and considerable practical application. Investigation on these approaches for reducing the dietary requirement of laying hens for protein and P are among the on-going research in our laboratory.

The following project was initiated to examine a different approach for reducing the dietary requirement of laying hens for protein and P. We hypothesized that the current practice of feeding laying hens with one diet containing constant levels of nutrients throughout the daily photoperiod may not result in efficient use of nutrients. Our hypothesis was based on the knowledge that various components of the egg (yolk, albumen and shell) are formed during distinct time periods. Although albumen and yolk have almost equal protein content, the proteins of yolk are synthesized continuously in the liver and are accumulated in the growing follicles until ovulation takes place. Consequently, it is unlikely that the time of the daily intake of protein would have a noticeable effect on the rate of yolk protein synthesis in the liver. On the other hand, albumen proteins are synthesized in the oviduct and must be secreted from the magnum on the ovulated ovum (yolk) during a time period of 3 to 3.5 h when the ovum resides in this section of the oviduct. The results of a number of radioisotope studies have indicated that the rate of albumen protein synthesis in the oviduct tissues is drastically increased during the period when the ovum is in the magnum than when it is in any other section of the oviduct. Because in the current high prolific hens, the time coincides with the residence of yolk in the magnum in the morning h, it is logical to believe that laying hens may have a higher protein requirement during the morning which coincides with the time of extensive albumen protein formation than during the afternoon and evening h. In fact, this notion is substantiated by the results of a number of feeding experiments.

On the other hand, it is well established that the time coincides with formation and deposition of shell in the afternoon and evening h. In fact, it has been reported that when the opportunity is provided hens can regulate their daily Ca intake on an hour-by-hour basis based on the physiological need for Ca for shell formation. Additionally, it has been shown that Ca intake increases drastically during the afternoon of the days that ovulation is taking place and Ca intake is minimal during the morning h. Additionally, the previous investigations have indicated that when hens had ad libitum access to a low-Ca diet (1%) and oyster shell which were provided in separate feeders, the consumption of oyster shell increased substantially during the afternoon and evening h. Based on this information, it appears that laying hens have a higher Ca requirement during the afternoon and evening than during the morning h.

With regard to P, it appears that hens need a higher P requirement during the morning than the afternoon and evening h. Investigations on this subject have indicated that when hens are given a choice to consume from a high- and a low-P diet, the hens preferentially consume more from the high-P diet during the morning than the afternoon h. The higher P during the morning is needed to replace bones that resorbed during the night when the shell is being formed.

The above information indicates that providing the hens with one diet containing a constant level of protein, P, and Ca (among other nutrients) during the daily photophase may not result in efficient use of these nutrients. Providing the hens with one diet might result in wasteful use of nutrients due to their over-consumption during the time when the physiological need for these nutrients are minimal (such as high level of protein in the diet during the afternoon and evening h) or over-consumption of feed for adequate intake of nutrients during the time when the physiological need for nutrients are maximal (such as a higher Ca need during afternoon and evening h for shell formation). In fact, the results of choice-feeding studies have indicated that self-selection of ingredients would result in a voluntary restriction of nutrient intake by laying hens.

The following experiments were conducted to determine whether the daily requirement of laying hens for protein, P and Ca can be reduced by providing the hens with adequate levels of these nutrients only during those h of the day when the physiological need for these nutrients for formation of various components of the egg are increasing. If the results of this study are successful, this could have the potential to help diminish the pollution problems associated with nitrogen and P excretion of laying hens and to help reduce the costs associated with egg production.

We conducted three protein, two P, and two Ca experiments to find answers to the objective of the study. Because the results of protein, P, or Ca experiments were similar, for brevity, the results of one experiment related to each nutrient are presented here.

One additional point needs to receive consideration. The results of our initial experiments indicated that when hens are exposed to 16 h of daily photoperiod, only 40% of daily feed intake was consumed during the morning (5:00 a.m. to 1:00 p.m), and the next 60% during the afternoon (1:00 p.m. to 9:00 p.m). The disproportionate consumption of the morning and the afternoon diets was an impediment for arriving at definite conclusions regarding the objectives of the study. The results of an additional experiment which involved both young and old hens and were housed in individual- and multi-cage systems, indicated that when the daily photoperiod was kept at 16 h (5:00 a.m. to 9:00 p.m.) about 50% of the daily feed intake was consumed from 5:00 a.m. to 3:00 p.m. (10 h) and the next 50% during 3:00 p.m. to 9:00 p.m. (6 h). Feed consumption was relatively constant up to 5:00 p.m. and then drastically increased from 5:00 to 9:00 p.m. Based on the information obtained from this study, in all the subsequent experiments, the morning feeds were delivered from 5:00 a.m. to 3:00 p.m. and the afternoon feed from 3:00 p.m. to 9:00 p.m. in an effort to maintain the morning and the afternoon feed consumption closer to each other for arriving at a definite conclusion pertaining to the objective of the study.

PROTEIN EXPERIMENT

The objective of this experiment was to determine whether the daily requirement of laying hens for protein can be satisfactorily reduced by providing the hens with an adequate level of protein only during the morning h which appears to coincide with the period of extensive albumen protein synthesis in the oviductal tissues. Five dietary treatments were used in this experiment. The hens on T_1 (positive control) were fed a 16% protein diet which contained all the essential nutrients to satisfy the NRC (1994) requirement throughout the daily photophase (5:00 a.m. to 9:00 p.m.). The hens of T_2 (negative control) were fed a diet with 10% protein throughout the daily photophase. The negative control was supplemented with adequate levels of methionine and lysine to satisfy the requirement for these amino acids according to NRC (1994). The negative control diet was deficient in several essential amino acids. The birds of T_3 were fed the 16% protein diet during the morning (5:00 a.m. to 3:00 p.m.) and the 10% protein diet during the afternoon (3:00 p.m. to 9:00 p.m). It was anticipated that the production performance of hens of T_3 would be comparable to hens of the positive control, because the hens of T_3 were receiving a diet with an adequate level of protein during the morning which coincides with the period of extensive albumen formation in the oviduct. The hens of T_4 were fed the 10% protein diet during the morning and the 16% protein diet during the afternoon h. It was anticipated that the performance of hens fed T_4 would be inferior to those of T_1 and T_3 because they were receiving an inadequate protein diet (10%) during the time of anticipated extensive protein synthesis in the oviduct. The hens of T_5 were fed a 13% protein diet both during the morning and the afternoon. This diet was prepared by mixing 50% of the 16% protein diet with 50% of the 10% protein diet. Consequently, the daily protein and amino acid intake of hens of T_5 was expected to be similar to hens of T_3 and T_4, providing the hens of T_3, T_4 and T_5 were consuming 50% of their daily feed intake during the morning and the next 50% during the afternoon for a daily feed intake of 100 g/hen/d. The 13% protein diet was marginally deficient in several amino acids (tryptophan, isoleucine and valine) according to NRC (1994) suggested requirements.

Feed consumption and production performance were reduced significantly due to the use of a 10% protein diet, although this diet was supplemented with adequate levels of lysine and TSAA. This was probably due to an inadequate intake of several essential amino acids. Feed consumption and production performance of hens fed a 16% protein diet during the morning and a 10% protein during the afternoon (T_3) or vice versa (T_4) and the hens fed a 13% protein diet continuously (T_5) were significantly improved as compared to the negative control. However, production performance of these groups were consistently inferior to hens of the positive control group (T_1). The hens of T_3 consumed a similar protein level to hens of T_1 during the morning and considerably lower protein level than T_1 during the afternoon hours (8.6 vs 8.3 g in the morning, 7.6 vs 3.8 g in the afternoon for hens of T_1 vs T_3, respectively). However, their production performance was inferior to hens of T_1. Additionally, the hens of T_4 were receiving very small quantities of protein during the morning and a considerably higher protein level during the afternoon than the hens of T_3 (3.2 g during the morning and 9.2 g during the afternoon for hens of T_4). If, in fact, adequate protein intake only during the morning h was crucial for satisfactorily maintaining production performance, then one would expect to observe a similar performance for hens of T_1 and T_3, but a superior performance for hens of T_3 than T_4. However, this was not the case. The results of this experiment which were consistent with the results of two other protein experiments negate the notion that production performance can be maintained satisfactorily by providing the hens with an adequate level of good quality protein only during the morning h. The information from the protein experiments clearly indicated that a supply of adequate protein with balanced amino acids make up both during the morning and the afternoon h are needed for satisfactorily maintaining the production performance of laying hens.

PHOSPHORUS EXPERIMENT

The P experiment was conducted with two objectives: 1.) to determine whether shell quality can be improved by partitioning the daily phosphorus requirement in a manner that most parts are consumed during the morning, and the least part is consumed during the afternoon h. This approach has the potential to stimulate bone mobilization for shell formation. Reducing dietary phosphorus during the afternoon can reduce the plasma level of phosphorus, and this, in turn, stimulates bone mobilization for maintaining the homeostasis of the plasma phosphorus level. As a result of this, more Ca becomes available for shell formation, and 2.) to determine whether the daily P requirement can be reduced by providing an adequate level of P only during the morning which coincides with the period of active bone formation. Six dietary treatments were used in this experiment. The birds of T_1 which served as the positive control were fed a diet with 0.25% available P (AP) continuously during the morning (5:00 a.m. to 3:00 p.m), and the afternoon hours (3:00 p.m. to 9:00 p.m.). Available phosphorus content of this diet was adequate to fulfill NRC (1994) suggested requirements for a daily feed intake of 100 g/hen/day. The hens of T_2 were fed a diet with 0.4% AP during the morning and 0.1% AP during the afternoon. The hens of T_3 were fed a diet with 0.1% AP during the morning and 0.4% AP during the afternoon and served as a negative control for T_2. The birds of T_4 were fed a diet with a similar level of AP as the control group (T_1) during the morning (0.25%), and only 0.1% AP during the afternoon. The purpose of this dietary treatment was to determine whether the efficiency of P utilization can be improved, and as a result of this, the daily P requirement can be reduced by providing sufficient P only during the morning which coincides with the time of bone reformation. The hens of T_5 were fed a diet with 0.1% AP during the morning and 0.25% AP during the afternoon and served as a negative control for T_4. The hens of T_6 were fed a diet with 0.175% AP both during the morning and afternoon and served as a control group for T_4 and T_5.

With the exception of hens of T_5 (which were consuming a low level of P in the morning and adequate level of P in the afternoon), production performance was not influenced by hens fed the other P regimens. The daily AP intake of hens on T_1 to T_3 were similar (about 250 mg/hen/d). The hens on T_1 were consuming an equal quantity of AP (~125 mg AP) both during the morning and the afternoon h. In contrast, the hens of T_2 were consuming about 200 mg AP during the morning and only 50 mg during the afternoon, while a converse situation existed for the morning and the afternoon AP intake of hens of T_3. In contrast to reports in the literature, shell quality was not improved when the least part of the daily P need was provided during the afternoon (T_2), and it did not reduce when most parts of the daily P need was provided during the afternoon (T_3). A similar result was observed when shell quality of hens of T_4 to T_6 which were receiving marginal daily AP intake are compared (160-170 mg/hen/d). Bone ash and P retention (expressed as percentage) were not influenced by dietary treatments.

It is worth noting that the daily AP and total P intake of hens fed T_4 to T_6 were significantly lower than hens fed T_1 to T_3 (~ 166 vs 250 mg/hen/d). However, as was mentioned before, with the exception of T_5, production performance and shell quality were not different among the dietary treatments. This information suggests that the daily AP requirement of laying hens may be lower than the NRC (1994) suggested value of 250 mg/hen/d. The daily P excretion of birds of T4 to T_6 were considerably lower than those for hens of T_1 to T_3 (260 vs 340 mg/hen/day). Therefore, it appears that the potential exists for fine-tuning the daily P requirement of laying hens by using a lower level of AP than the NRC (1994) suggested requirement, and as a result of this, diminishing the feed cost and environmental pollution attributed to P excretion.

The results of the P experiment indicated that: 1.) shell quality cannot be improved by providing most part of the daily P requirement during the morning and the least part during the afternoon, 2.) the daily P requirement may be reduced by providing the hens with an adequate level of P only during the morning and low level of P during the afternoon, and 3.) the NRC (1994) suggested requirement for AP requirement of laying hens appears to be overestimated.

CALCIUM EXPERIMENT

The Ca experiment was conducted with two objectives: 1.) to determine whether shell quality can be increased by providing most parts of the daily Ca need during the afternoon and evening (3:00 p.m. to 9:00 p.m.) which coincides with the period of active shell formation and deposition, and 2.) to determine whether the daily Ca requirement can be decreased by providing an adequate Ca level only during the afternoon and evening h. Providing the results were successful, it would allow formulating more dense diets during the morning due to the use of less Ca supplements in the diet. Eight treatments were used in this experiment. All the diets were isocaloric and isonitrogenous and with the exception of Ca contained similar levels of the other nutrients. The birds of T_1 served as the positive control and were fed a diet with 3.5% Ca diet during the morning and the afternoon. The birds of T_2 were fed a diet with 2.5% Ca during the morning and 4.5% Ca during the afternoon in order that most parts of the daily Ca need would be consumed during the afternoon h. The birds of T_3 were fed a diet with 4.5% Ca during the morning and 2.5% Ca during the afternoon and served as a negative control for T_2. The pattern of Ca levels in T_4 and T_5 were similar to T_2 and T_3, respectively, but in more extreme levels. The birds of T_6 received a diet with similar Ca level to T_1 during the afternoon (3.5%), but a diet with considerably lower Ca level than the T_1 during the morning (1.5%). The objective of this dietary treatment was to determine whether the daily Ca requirement can be reduced by providing an adequate Ca level only during the afternoon which coincides with the time of shell formation. The birds of T_7 received a diet with 3.5% Ca during the morning and 1.5% Ca during the afternoon, and served as a negative control for T_6. The hens of T_8 were fed a diet with 2.5% Ca both during the morning and the afternoon, and served as a control for T_6 and T_7.

Morning, afternoon and total daily feed consumption and other production traits were not different for hens fed 2.5% Ca in the morning and 4.5% Ca in the afternoon or 4.5% Ca in the morning and 2.5% Ca in the afternoon than the control group (T_2 and T_3 vs T_1). The total daily Ca intake was not different for hens of T_2 and T_3 as compared to the control group (T_1). However, shell quality was significantly lower for hens fed 4.5% Ca during the morning and 2.5% Ca during the afternoon than those fed 2.5% Ca during the morning and 4.5% Ca during the afternoon or the control group (T_3 vs T_1 and T_2). The hens on this treatment (T_3) were receiving significantly more Ca during the morning and less Ca during the afternoon than the control group (T_1). On the other hand, the birds on 2.5% Ca during the morning and 4.5% Ca during the afternoon (T_2) were receiving significantly more Ca during the afternoon and less Ca during the morning than the control group (T_1). These results indicated that when the daily Ca requirement is partitioned in a manner that Ca intake during the afternoon exceeds the normal need for this period (T_2 vs T_1), it does not produce a beneficial effect on shell quality. On the other hand, when the partitioning of the daily Ca need results in inadequate Ca intake during the afternoon than the requirement for this period (T_3 vs T_1), it causes adverse effects on shell quality. The pattern of morning and afternoon Ca intake of hens of T_4 and T_5 were similar to those of T_2 and T_3, respectively, but in more extreme levels. Production performance and shell quality of hens fed 1.5% Ca during the morning and 5.5% Ca during the afternoon (T_4) were not different than the control group (T1), although their daily Ca intake was significantly greater than the control group. The morning Ca intake of this group (T_4) was quite lower and their afternoon Ca intake was quite higher than the morning and the afternoon Ca intake of the control group, respectively. In fact, the hens on the T_4 diet were consuming only 0.71 g Ca during the morning and 3.33 g Ca during the afternoon h as compared to a morning and afternoon Ca intake of 1.67 and 2.08 g, respectively, for the hens of the control group. However, consistent with the results of T_2, this extreme alteration in the pattern of morning and afternoon Ca intake did not have a beneficial effect on shell quality. The hens of T_5 received 5.5% Ca during the morning and 1.5% Ca during the afternoon. While feed consumption was not affected due to consumption of a diet with high-Ca level (5.5%) during the morning, it was reduced significantly due to consumption of a low-Ca diet (1.5%) during the afternoon as compared to the control group (T_5 vs T_1). As a result of this, total daily feed consumption, production traits and shell quality were significantly lower for hens of T_5 than the control group (T_1). The pattern of morning and afternoon Ca intake of this group was similar to hens fed T_3, but in more extreme levels. The inferior shell quality of this group was most likely due to a very low level of Ca intake during the afternoon, although the involvement of a lower total daily Ca intake as a factor in the production of eggs with inferior shell quality by this group cannot be ruled out. Birds fed 1.5% Ca in the morning and 3.5% Ca in the afternoon or vice versa (T_6 and T_7, respectively), consumed significantly less feed during the low-Ca feeding h than those of the control group (T_1). As a result of this, total daily feed consumption of these groups were lower than the control group. The inferior production performance of these groups most likely were attributed to their lower daily feed consumption. The total daily Ca intake was not different for hens of T_6, T_7, and T_8. However, the afternoon Ca intake was considerably lower for the birds of T_7 than those of T_6 and T_8. This resulted in production of eggs with lower shell quality for birds of T_7 than birds of T_6 and T_8. As was mentioned previously, a similar shell quality pattern was observed among the birds of T_3 and T_1. This information indicated that while adequate Ca intake during the afternoon is crucial for maintaining shell quality, an additional intake above the level that is needed for this period, does not produce a beneficial effect on shell quality. This information rejected the notion that providing most parts of the daily Ca intake during the afternoon has the potential to improve shell quality. Furthermore, while the afternoon Ca intake of T_1 and T_6 were very close to each other, the morning Ca intake of T_6 was considerably lower than T_1. The inferior shell quality of T_6 as compared to T_1 also rejects the hypothesis that providing adequate Ca only during the afternoon would reduce the total daily Ca need for maintaining optimum shell quality. Additionally, with the exception of T_4, consumption of a diet with 1.5% Ca in the morning or in the afternoon resulted in reducing feed intake during those periods than the control group. This observation is inconsistent with the reports that hens have an appetite for Ca and their feed intake is increased when they are fed a low-Ca diet. The previous information from our laboratory indicated that consumption of a diet with inadequate Ca level for 24 h adversely affected shell quality. The results of the current Ca experiment refined the previous findings and indicated that if the pattern of Ca intake in commercial operations, due to Ca separation, provides the hens with inadequate Ca intake only during the afternoon and evening h, it could have the potential to produce adverse effects on shell quality. These results warrant that every effort should be made to minimize Ca separation in various phases of the feed handling systems in commercial operations.

Three explicit conclusions can be derived from the Ca experiment: 1.) the higher feed consumption during the afternoon as compared to the morning is not due to an increased appetite for Ca during the afternoon for shell formation, 2.) partitioning the daily Ca intake in a manner that most parts of the daily Ca requirement are consumed during the afternoon, the time coincides with shell formation, is not effective to increase shell quality, and 3.) the daily Ca requirement cannot be reduced by providing the hens with an adequate level of Ca only during the afternoon and low-Ca diet during the morning h.

The current experiments were conducted to determining whether the daily requirement of laying hens for protein, P and Ca can be reduced by providing the hens with adequate levels of these nutrients only during those h of the day when the physiological need for these nutrients for formation of various components of the eggs are increasing. The results of three protein, two P, and two Ca experiments on this subject failed to support the notion of the project and indicated that for satisfactorily maintaining the production performance, an adequate intake of these nutrients both during the morning and the afternoon are required. The results of choice-feeding experiments on this subject have been quite successful. It appears that the success under the choice-feeding situation is due to the existence of more flexibility for hens to select the ingredients (nutrients) at the proper times to fulfill the physiological demand for egg production. Choice-feeding approach, although demonstrated to be successful, cannot have practical application under current commercial egg laying farms. The current study was conducted under conditions that, if the results were successful, they could have practical application. The approach selected for the conduct of the current study eliminated the flexibility of hens for selecting ingredients (nutrients) and forced the hens to consume from one type of feed during a period of time. Apparently the approach selected was too severe and probably was the reason for failure in getting successful results. Nevertheless, the concept remains valid with a great deal of potential to improve the utilization of nutrients that under the current feeding practices of laying hens are wastefully utilized. Efforts should be made to find a more appropriate approach than the one used in the current study to achieve successful results.

K. Keshavarz
Department of Animal Science
Cornell University

THE EVER-RECURRING THREAT OF EMERGING DISEASES

After a successful battle against H7N2 avian influenza virus (AIV) in Pennsylvania, the poultry industry in North America faces two new challenges: velogenic viscerotropic Newcastle disease (VVND) in California, H5N2 AIV in New Jersey, and Pullorum disease in Canada.

Velogenic Viscerotropic Newcastle Disease (VVND). VVND, a highly pathogenic form of Newcastle disease, causes up to 100% mortality in susceptible flocks, and is difficult to control solely with live-virus vaccines. VVND is a constant scourge of the poultry industry in the Middle East, Mexico, Central and South America. Poultry producers in these countries are forced to use a combination of inactivated oil-emulsified and live-virus vaccines on their chicks, sometimes as early as one day of age. The vaccine's cost and the respiratory problems associated with more aggressive live NDV vaccines, take a heavy toll on the cost of egg and poultry production. This is why it is so important to eradicate VVND. The last time California faced VVND, in 1973, the cost of control efforts was close to $56 million.

VVND emerged in a small flock of chickens in downtown Fresno, California. The disease was promptly identified by the Fresno Branch of the California Veterinary Diagnostic Laboratory System. The rapid response in diagnosis and destruction of affected chickens averted wider dissemination of the disease, and loss of national and international trade of poultry products for California.

According to "Lab Notes" from the California Veterinary Diagnostic Laboratory System, on May 24, 1998, 10 chickens from a 48-bird backyard flock of game chickens began showing signs of disease. The Fresno Branch of the California Veterinary Diagnostic Laboratory System received the sick chickens on May 26, and by May 29, the diagnosis of VVND had been made. The chickens on the premises were placed under hold order by the California Department of Food and Agriculture. By June 10, the premises had been depopulated, cleaned and disinfected.

H5N2 Avian Influenza Virus (AIV). While the Pennsylvania poultry industry successfully wrestled with H7N2 AIV, a game bird farm in Princeton, NJ broke with H5N2 AIV. The disease was diagnosed on October 13, 1998 by the University of Pennsylvania New Bolton Center. The flocks currently in the farm: 32,000 pheasants, 25,000 quail and 5,000 chukar partridges are under quarantine. Since the nearest commercial flock is 5 miles away, the chance of air transmission is greatly reduced, although transmission by mechanical means (humans, trucks, crates, etc.) is still a possibility.

The New Jersey isolate is of low pathogenicity, but it has, as other H5N2, the potential to mutate to a more pathogenic form. During the 1983 Pennsylvania and 1994 Mexico outbreaks, low pathogenicity H5N2 AIV mutated to a very virulent form, causing heavy mortality and loss of production.

Pullorum disease (PD). In October 1998, PD was detected in 1,050 chickens in 10 Canadian flocks that were humanely destroyed with governmental compensation to the owners. PD has been but eradicated from the developed countries. Its resurgence endangers Canada's international trade of poultry products. PD causes high mortality in young chicks, and was one of the diseases that impeded the development of the poultry industry before it was eradicated. In order to maintain its international trade, British Columbia will have to test more than 20,000 chickens to meet the terms of an international agreement that calls for a voluntary, three-year exporting ban of poultry products if the disease is not eradicated within one year from the time it was discovered.

These outbreaks underline the importance of disease surveillance, rapid diagnosis and rapid response in eradication efforts by official agencies. However, poultry producers have to do their part by tightening biosecurity at the farm. Viruses are transmitted before a diagnosis is made. Your chickens may get infected even before the chickens where the virus originated show signs of disease!

Always verify that trucks and crates brought into the farm have been washed and disinfected, do not allow unnecessary visitors into the farm, and have clean boots and coveralls available for maintenance personnel and visitors.

B. Lucio
Dept. of Microbiology and Immunology
College of Veterinary Medicine
Cornell University

PROBLEMS WITH EXCESS PHOSPHORUS IN THE RUNOFF? ALUM MAY HELP!

Phosphorus runoff decreases when aluminum sulfate (alum) is added to poultry litter. For many farmers one of the constraints of using poultry litter as fertilizer is the phosphorus released. Phosphorus may leach to nearby waterways, affecting water quality and aquatic life.

When ARS soil chemist Philip A. Moore added alum to poultry litter at two farms he found that alum application improved broiler feed conversion and produced heavier chickens while reducing phosphorus by 70%.

Detailed information on managing poultry manure appears in the June '98 issue of Agricultural Research magazine, and is also available on the World Wide Web at: http://www.ars.usda.gov/is/AR/archive/jun98/manu0698.htm

B. Lucio
Dept. of Microbiology and Immunology
College of Veterinary Medicine
Cornell University

DEVELOPMENTS IN RESEARCH

The following are extracts of some of the papers presented at the annual meeting of the Poultry Science Association at The Pennsylvania State University in August 1998.

• Lee et al. (University of Arkansas) reported the results of an experiment in which the egg production performance of pullets reared in litter floor pens was compared to those reared in cages. The growing period was divided into two phases; with phase one being from day-old to 6 wk and phase two from 6 to 19 wk. During phase one, the floor-reared pullets were provided with 0.8 $ft.^2$ floor space per bird and during phase two, with 1 $ft.^2$ floor space per bird. The cage raised pullets were provided with 25 $in.^2$ floor space per pullet during phase one and with about 46 $in.^2$ floor space per pullet during phase two. During the laying period, about 62 $in.^2$ floor space was provided per pullet. Production performance records were collected during the laying period (19 to 51 wk of age). Egg production performance and feed efficiency were greater for pullets raised in cage than in litter floor pens. However, albumen height was greater for pullets raised in litter floor pens than in cages. Housing type during the rearing period did not have an influence on days of age to sexual maturity, laying period, feed consumption, final body weight, egg weight or eggshell strength.

Comments: The results of this experiment indicates that if production performance can be used as an indication of bird's well-being, no difference can be seen for birds grown in litter floor pens as compared to cages. (K. Keshavarz)

• Balander et al. (Michigan State University and Alltech, Inc., Kentucky) reported the results of a field study in which the effect of Eggshell 49 on shell quality of old hens (73 wk of age) was investigated. The control groups were fed a commercial layer feed, while the test groups were fed the same diet containing 2 lbs/ton of feed Eggshell 49. There were seven cage rows in the house with approximately 100,000 birds. Each cage row contained 4 tiers. Three cage rows were fed from one feed bin containing Eggshell 49, while the other four rows were fed the control diet from a different feed bin. The period of test was 16 wk. In 9 out of 16 observations (one measurement of egg specific gravity per week), specific gravity was significantly greater for hens fed Eggshell 49 than the control group. In the other 6 observations, no significant differences were observed between the control and the test groups. The investigators noted that hens fed Eggshell 49 had significantly better specific gravity during the hot weather (July) portion of the trial.

In another report (Miles, University of Florida), a 12-wk experiment was conducted to determine the influence of Eggshell 49 on egg shell quality in laying hens grouped based on their shell quality to high- and low-shell quality groups. The hens were 60 wk old at the start of the experiment. The hens in each egg shell quality group were fed either a corn-soy diet or the same diet supplemented with 3.3 lbs Eggshell 49/ton of feed. Eggshell 49 did not influence egg weight, egg production, feed consumption or feed conversion in any treatment group. Overall, hens fed Eggshell 49 deposited significantly more shell on their eggs than those that weren't fed the supplemented diet (5.57[a] vs 5.43[b] g, respectively). Within the high- and the low-shell weight groups, the birds in the low-shell weight groups fed Eggshell 49 deposited significantly more shell whereas those in the high-shell quality group did not. Similar results were observed for percent shell for overall and within the shell quality groups. The investigator concluded that Eggshell 49 promotes more shell deposition on eggs, particularly for hens laying poor shell quality eggs. **Comments**: In both field and laboratory tests, we also observed numerical improvements in several indices of shell quality due to use of Eggshell 49 in the diet during the summer months. On the other hand, Dale et al. (1998, J. Appl. Poultry Res. 7:219-224) did not observe a beneficial effect from Eggshell 49 on shell quality of old hens. (K. Keshavarz)

• Pheko et al. (McGill University, Mac Donald Campus) reported the results of a 16-wk study with laying hens in which the effect of flaxseed, probiotic and their combination on production performance and omega-3 and cholesterol content of eggs was investigated. The hens were 26 wk of age at the start of the experiment. Dietary treatments did not have a significant effect on egg production (92%), egg weight (64 g), Haugh units (82%), yolk size (17.5 g), and shell thickness (0.4 mm). The use of 15% flaxseed resulted in a significant increase in omega-3 fatty acids from 1.05% in the control group to 8.05% in hens fed the flaxseed. There was also a 10% increase in the omega-6 family of fatty acids, while a 14% reduction in omega-9 fatty acid was detected in the group fed the 15% flaxseed. Plasma level of cholesterol for the flaxseed and the control groups remained similar during the period of study, while the probiotic treatment group reduced the initial plasma cholesterol level of 160 mg/100 ml to 110 mg/100 ml by the end of 16 wk. Probiotic also was effective in reducing the plasma level of triglycerides. The cholesterol level of egg yolk was reduced by 16%. The investigators concluded that the use of flaxseed and probiotic in layer feed can be of critical importance to the poultry industry in meeting the high demands of the consumer for products high in omega-3 fatty acids and low cholesterol eggs.
Comments: The results of this experiment are consistent with several other reports indicating that the use of flaxseed is effective in increasing the omega-3 content of egg yolk. The effect of probiotic in reducing the egg yolk cholesterol observed in this study is particularly important. Although the authors did not elaborate on the name or the specification of the probiotic used in this study, a 16% reduction of egg yolk cholesterol, means a drop of cholesterol level of a large- sized egg from a normal value of 190-210 mg to 160-176 mg. (K. Keshavarz)

• Elswyk et al. (Omega Tech, Colorado) reported the result of a study with the objective of determining the maximum level of a marine microalgae (*Schizochytrium*) that can be used safely in the layer diet. This microalgae has been proposed as an alternative to fish oil and flaxseed for enrichment of eggs with omega-3 fatty acids. Four levels of the micoalgae were used in the diet to provide a docosahexaenoic acid (DHA) intake of 0, 165 mg, 495 mg, and 825 mg/hen/day. Diets were fed for four months. Feed conversion and body weight were significantly improved due to use of mid-DHA or high-DHA levels of microalgae as compared to hens fed the control diet or low-DHA level of microalgae. Egg production was highest for hens fed the highest level of DHA. However, egg weight was significantly reduced (1 g) for hens fed all levels of microalgae used. No histological or pathological abnormalities were detected. Yolk level of DHA was significantly increased by all levels of DHA from microalgae. The results of this experiment indicated that the microalgae used in this experiment is safe for laying hens up to five times the previously investigated inclusion rate and provides for a significant increase in yolk DHA content.

Comments: Most of the previous experiments have dealt with the use of flaxseed or fish oil for enrichment of eggs with the omega-3 fatty acid family. Although both of these sources are effective to increase the omega-3 level of egg yolk, there are some limitations with regard to use of each of these sources. For example, the use of flaxseed can mainly increase the alpha linolenic acid (C18:3, omega 3, 6, and 9) content of the egg. The hen's body (and the human body consuming this type of egg) should elongate this fatty acid to those (EPA, DPA, and DHA) which particularly are important for their health benefit effect. Neither hens nor the human body appears to be well converters of linolenic acid to EPA, DPA, and DHA. With regard to fish oil, the level that can be used in the diet in hen's feed is limited due to the production of fishy-flavored eggs. Marine algaes appear to be attractive sources for the enrichment of eggs with the long-chain omega-3 fatty acid family with no known limitations attributed to their use in the hen's diet. (K. Keshavarz)

• Broomhead et al. (University of Missouri) conducted an experiment to compare the efficacy of phytase supplied by phytaseed, a transgenic canola meal containing the *Aspergillus niger* gene to that of the commercial microbial phytase, utilizing turkey poults as the experimental animal. The basal diet containing 0.3% available phosphorus was supplemented with phytase from the two sources at levels of 0, 250, 500, and 2,500 unit/kg diet. The period of the experiment was day-old up to 35 days of age. The results of the experiment, based on growth, feed consumption and feed efficiency, tibia and toe ash revealed that phytase from phytaseed was as effective as phytase from microbial phytase in improving phytate phosphorus utilization. In a separate experiment with broiler chicks and using performance and digestibility data, Zhang et al. (Virginia-Maryland Regional Veterinary College) concluded that phytaseed was as effective as microbial phytase in restoring performance of birds fed a low-phosphorus diet.

• Kersy et al. (University of Arkansas, Pioneer Hi-Bred Int., Iowa, and USDA, Indiana) reported that a quantity of high available phosphorus corn (HAPC) was developed using the low phytic acid allele of the normal corn which contained 0.27% total phosphorus, with 0.17 nonphytate phosphorus (npp), as compared to normal corn which contained a similar quantity of total phosphorus but only with .03% npp. The results of a 3-wk broiler study involving various measurements (body weight, feed conversion, phosphorus excretion, tibia ash, etc.) indicated that phosphorus in HAPC is as available as phosphorus in dicalcium phosphate.

Comments: Currently, the commercial industry is using microbial phytase in the diets of various classes of poultry. The results of the aforementioned studies indicate that in the near future, plant sources of feed ingredients which are selected for having high available phosphorus (such as high available phosphorus corn) or transgenically are modified for having high phytase activity may become available to the poultry industry for commercial use. (K. Keshavarz)

• Leske and Coon (University of Arkansas) reported the results of an experiment in which the effect of microbial phytase on total and phytate phosphorus retention of seven feed ingredients was investigated. Young broiler chicks were used as the experimental animal in this study. Total and phytate phosphorus intake and excretion were determined in digestion trials. Phytate phosphorus retention without the addition of phytase for corn, soybean meal, wheat, wheat middlings, barley, defatted rice bran, and canola were 30.8, 34.9, 30.7, 29.1, 32.2, 33.2, and 36.7%, respectively. Microbial phytase increased the phytate phosphorus retention to 59, 72.4, 46.8, 52.2, 71.3, 48, and 55.8%, respectively. Total phosphorus retention was significantly increased by microbial phytase. A bioassay was also conducted with laying hens. Corn and defatted rice bran was included at 60% of the test diets. Soybean meal represented 38% of the test diet. Ten individually caged laying hens at peak production were fed each test diet for three days followed by three days excreta collection. Microbial phytase was used at 300 and 600 units/kg diets. Retention of phytate phosphorus of soybean, corn, and defatted rice bran without phytase addition were 23.9, 23, and 36.1%, respectively. Microbial phytase increased the phytate phosphorus retention of soybean, corn, and defatted rice bran to 64.5, 51.6, and 50.9%, respectively. Total phosphorus retention was increased significantly due to the addition of microbial phytase to the diets.

Comments: In formulating commercial feed for poultry, we assume that only 30% of phosphorus of the plant sources is available. The remaining 70% is considered to be in phytate form and unavailable to poultry. The results of these experiments indicated that assuming a value of zero for the availability of phytate phosphorus of plant origin may not be correct. This, in turn, may explain, in part, the variation in reported values regarding the phosphorus requirement of poultry when available phosphorus is used as the criteria for determining the phosphorus requirement. (K. Keshavarz)

• Nernberg et al. (University of Manitoba, Canada) conducted an *in vitro* and an *in vivo* experiment to determine the effect of Ca on phytate hydrolysis in canola meal and wheat-canola meal diets supplemented with microbial phytase. In the *in vitro* study, canola meal was supplemented with Ca carbonate to provide Ca:phytate molar ratios of 4, 5, 7.5, 10, and 12.5. Each sample was supplemented with phytase levels of 1,000, 2,000, and 3,000 units/kg. The samples were subjected to incubation simulating the conditions of the gastrointestinal tract of the chicken. Complete hydrolysis of phytate phosphorus was achieved at the 4 and 5 molar ratios with 2,000 and 3,000 units/kg phytase. Phytate hydrolysis was reduced linearly with increasing the molar ratios of Ca:phytate at all levels of phytase supplementation. The highest molar ratio (12.5) resulted in reduced phytate hydrolysis by 60, 50, and 10%, respectively, for treatments containing 1,000, 2,000, and 3,000 units phytase/kg. A two-week chick study was conducted to determine the effect of supplementing a canola-wheat diet containing a low-level of 0.25% non-phytate phosphorus with two levels of Ca (0.7 and 0.8%), two levels of vitamin D3 (1,000 and 5,000 IU), and two levels of phytase (0 and 1,000 units/kg) on performance, phytate and Ca digestibilities, toe ash content, and phosphorus excretion. The adverse effect of 0.8% Ca on performance was alleviated in the presence of phytase in the diet. Lowering the Ca and non-phytate phosphorus levels had an adverse effect on bone ash content. Phytase and Vitamin D_3 supplementation of 0.8% Ca diet resulted in a toe ash percentage similar to that of the positive control. The presence of phytase increased Ca and phytate digestibilities with maximum digestibility for phytate (55.4%) and Ca (61.2%) was observed for high Ca diet (0.89%) containing the combination of phytase and vitamin D_3. The addition of phytase to 0.3% non-phytate phosphorus diets reduced phosphorus excretion by 35%. The results of this study indicated that supplementation of low-phosphorus wheat-canola meal diets with phytase increased phytate phosphorus utilization and the level of Ca in the diet is a critical factor affecting phytate hydrolysis.

• Boiling et al. (University of Illinois) from their previous experiment concluded that the addition of 300 units of phytase/kg diet support maximum performance of laying hens (20 to 70 wk of age) fed a corn-soybean meal diet containing 0.1% available phosphorus (AP). It was the objective of this experiment to determine if a supplemental phytase level of lower than 300 units/kg diet is adequate for a commercial strain of laying hens fed a corn-soybean meal diet containing no supplemental phytase (0.1% AP). Treatments consisted of a corn-soybean meal diet (0.1% AP, 3.8% Ca and 17% protein) supplemented with 0, 100, 200, 250, and 300 units phytase/kg diet. Additional treatments were the control diet supplemented with 0.05% phosphorus from inorganic source (0.15% total AP), and a positive control containing 0.45% AP. The experimental diets were used from 20 to 40 wk of age. No significant differences among the treatments were observed during the first 8 wk of the experiment. By 28 wk of age, the 0.1% AP diet without supplemental phytase resulted in significantly reduced egg production and body weight compared to other dietary treatments. Feed consumption, feed efficiency and egg yield were subsequently depressed in hens fed 0.1% AP diet by 32 wk of age. No other significant differences in performance were observed among treatments. The investigators concluded that the addition of 100 units phytase/kg diet to the 0.1% AP diet yield maximum performance. The mean daily AP intake of hens fed 0.1% AP, 0.15% AP, 0.45% AP, and 0.1% AP plus phytase diet was 91, 152, 464, and 103 mg, respectively. The results of this experiment indicated that phytase increases the utilization of phosphorus in corn-soybean meal diets for laying hens and that corn-soybean meal diets containing 0.1% AP plus 100 units phytase/kg diet or 0.15% AP support maximum performance.

• Bryant and Roland (Auburn University) reported the result of an experiment in which the effect of adding various levels of available phosphorus (AP) and phytase on egg production performance of 21-wk-old Hy-Line W36 hens was investigated. The experimental design was a 3 x 4 factorial arrangement of the treatments with four levels of AP (0.1, 0.2,0.3 and 0.4%) and three supplemental levels of phytase (0, 300 or 600 units/kg diet). Hens were fed the experimental diets for 42 wk. During phase 1 of the experiment (21 to 36 wk of age), there was a significant linear decrease in specific gravity with increasing the dietary AP levels. Egg production, egg weight and feed conversion were not influenced by dietary treatment during phase 1 of the experiment. In phase 2 (37 to 52 wk of age), there was a significant linear increase in egg production with increasing the AP levels and the diets containing phytase had significantly higher egg production. There were no significant effects on specific gravity, egg weight or feed consumption. In phase 3 (53 to 62 wk of age), there was a significant linear increase in egg weight with increasing AP level (from 61.8 g at the 0.1% AP level to 63.1 g at the 0.4% AP level). The interaction between AP and phytase for egg production was significant for phase 3 of the experiment. At the 0.1% AP there was a significant quadratic response in egg production to phytase but there were no significant phytase effects on egg production at higher AP level. Phytase or AP did not affect specific gravity or feed consumption in phase 3. Results indicated that 0.1% AP was adequate for phase 1, and 0.1% AP plus phytase was adequate for phase 2 and phase 3 of the experiment. For the entire period of the experiment, there was a significant linear increase in egg production with both increasing the AP levels (83.6% at 0.1% AP up to 86.7% at 0.4% AP) and increasing levels of phytase (83.9% at 0 units/kg 86.1% at 600 units/kg). Overall responses indicate that dietary AP can be reduced to 0.1% with 300 units phytase/kg diet without negative effects. However, due to the linear improvement overall with increasing levels of AP and increasing phytase levels, the best performance was obtained by feeding the highest levels of AP and phytase.

Comments: Although the results of several experiments have indicated that production performance of laying hens can remain satisfactorily due to using a diet with 0.1% AP plus 300 units microbial phytase/kg diet, we do not feel that producers should reduce the AP level to such a low level under commercial practices. Strains, environmental temperatures, feed quality, Ca level in the diet, health status of birds, among others, may influence the daily AP requirement for a satisfactory performance. (K. Keshavarz)

K. Keshavarz
Department of Animal Science
Cornell University

Cornell Cooperative Extension