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Barb Smagner, Managing Editor

MARK YOUR CALENDAR FOR JUNE 21, 2000, CORNELL POULTRY CONFERENCE

The 2000 Cornell Poultry Conference will be held on Wednesday, June 21, 2000, at the Ramada-Inn-Ithaca-Airport. The Alltech pre-conference symposium (with complementary breakfast) will start at 7:30 a.m. and continue to 9:30 a.m. The Cornell Poultry Conference will start at 9:55 a.m. and continue to 5:30 p.m. Currently we are in the process of selecting topics and speakers for the conference. We would like you to be informed about the date of the conference early so that you can mark your calendar and make every effort you can to attend the conference which will be arranged particularly for your benefit.

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IN MEMORY OF WILLIAM J. TOLEMAN

It is with sadness that we write this note about William (Bill) J. Toleman. Bill passed away on August 14, 1999. He was 71 years old. We will sincerely miss Bill, who not only showed us caring and kindness, but also supported us unconditionally for many years both during his tenure at Cornell and after his retirement. Bill was a graduate of Cornell University, College of Agriculture and Life Sciences, received his M.S. from Michigan State University, East Lansing, MI, and also did graduate work at Cornell.

For many years Bill worked as Regional Poultry Specialist in New York State. He has helped his colleagues at Cornell and the industry in New York State immensely. After retirement, he was the Executive Director of the State Poultry Industry Coordinated Effort organization (now called New York Poultry Association) for several years. Bill enjoyed gardening, reading, hunting and dancing. He is survived by his wife Dorothy Grace Schmitt Toleman, his son Gordon, his two daughters, Dianne and Donna, his brother, and several grandchildren, nieces, and nephews. Bill made endless contributions to Cornell and to the New York Poultry Association which were enormous, and we will be forever indebted to him. We offer our deepest sympathy to Bill's family, and we want you know that we too, feel the loss.

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CAGE LAYER FATIGUE AND PROLAPSE CAN BE SEEN ON NEW YORK STATE POULTRY FARMS

Two problems which currently can be seen on commercial egg laying farms in New York State are **osteoporosis (cage layer fatigue)** and **prolapse (blow-out)**. The reasons for the incidence of these problems are not clear, because they can be seen on the farms that often nutrition and management programs for the most part are sound. Based on our observations, these incidences for the most part are not strain or age related. While in some farms one particular strain may cause more problems with regard to osteoporosis or prolapse, in another farm, the incidence of these abnormalities for the same strain are quite mild or non-existent. The information indicates that managerial factors can play an important role in the outbreak of these abnormalities. The objective of this article is to review the factors that have the potential to contribute to outbreaks of these abnormalities.

What are the symptoms of **cage layer fatigue**? The symptoms are, excessive withdrawal of calcium phosphate from the medullary, and cortical parts of particularly long bones make these bones so weak that they cannot support the body weight. The affected hens sit and are reluctant to move. Bends in the sternum and spinal column can be seen and ribs may make bends at the points of their attachment to the spinal cord and sternum. Ribs are

very fragile and with slight pressure can collapse. The birds that show the incidence may continue laying until they go down and sometimes even when they are paralyzed. It seems the use of dietary calcium for shell formation should receive priority as compared to its use for bone reformation. Also, it seems that in the current high-producing strains which for a long period of 20 weeks or more, they may lay at the rate of 90% or more, reformation of mobilized bones for shell formation cannot fully occur due to the high intensity of egg production. The problems of cage layer fatigue occur almost entirely in hens that are confined to cages. In fact, there are reports which indicate when such hens are removed from the cage and placed on the floor and in the absence of coprophagy, complete recovery can take place. This observation suggests that other factors such as lack of activity also may play a role in the occurrence of this abnormality.

Proper calcium, phosphorus, and vitamin D nutrition of growing pullets and laying hens, the presence of calcium particles in layer feeds, proper time of transfer of pullets from growing to laying houses and midnight feeding of laying hens have the potential to reduce the incidence of this abnormality in the flock.

The current commercial strains of laying hens are coming into production at 16-17 weeks of age or even earlier, reach to 50% production at 21 to 22 weeks of age and peak at 24-25 weeks of age. In other words, by the time that a flock is 24-25 weeks old, almost every hen in the flock lays an egg each day. It is known that during the early stages of egg production, laying hens are in a state of negative calcium balance. In other words, regardless of the calcium content of the diet, the calcium excretion through the shell and excreta is more than the calcium intake. Therefore, the differences should be supplied from bones. If pullets reach to the age of sexual

maturity with inadequate calcium storage in their bones, then withdrawal of calcium from their bones makes them more prone to show the incidence of cage layer fatigue, particularly during the early stages of the egg production cycle.

The data in Table 1 belongs to a previous experiment conducted at Cornell University (Keshavarz, K., *Poultry Sci.* 66:1576-1582, 1987). The control group received a growing diet with calcium content of 0.8% up to 20 weeks of age. Other experimental groups were fed a high-calcium diet (3.8%) for the period of 18 to 20, 17 to 20, 16 to 20, 15 to 20, and 14 to 20 weeks of age. From 20 to 60 weeks of age, pullets on all growing regimens were fed the same layer diet with 3.5% calcium. Body weight and feed consumption at 20 weeks of age and egg production performance during the laying period were not influenced by growing regimens. However, bone ash was significantly greater for pullets fed the high-calcium diet from 18 to 20 weeks of age and bone ash and bone calcium were significantly greater for pullets fed a high-calcium diet from 17 to 20 weeks of age, or for a longer period than the control group at the age of housing (20 weeks of age). The information indicates that bone ash and bone calcium can be increased significantly by increasing the dietary calcium a few weeks prior to the onset of age of sexual maturity. Because the age of sexual maturity is not constant and varies depending on the strains, the light regimen used during the growing period, growing dietary regimens, chronological age, etc., should not be used as criteria for increasing the dietary calcium during the late parts of the growing period. It is more appropriate to use physiological age or the age when the secondary signs of sexual maturity start appearing for increasing the calcium level. This is the age that the comb and wattle start developing in the flock. Because

the current strains are coming into production at 16 to 17 weeks of age, consequently, the use of a high-calcium diet (3.75-4%) from 15 weeks of age seems to be appropriate for optimum development of medullary bones and calcium storage. It is worth noting that the daily feed consumption is expected to be about 65 g/pullet/day (about 14 lbs/100 pullets/day) at 15 weeks of age and increases to 75 g/pullet/day (16-17 lbs/100 pullets/day) at 20 weeks of age with the current strains. Consequently, using a diet with a calcium level of 4% is expected to provide the bird with only 2.6 to 3 g Ca/day which should not cause concern regarding excessive calcium intake. A dietary available phosphorus of 0.4% during 15 to 20 weeks is expected to be quite adequate. When feed consumption is established at 100 g/hen/day (22 lbs/100 hens/day) at about 25 to 26 weeks of age, maintain the calcium level at 3.85-4% and available phosphorus at 0.4%. These will provide the hens with 3.85-4 g Ca and 400 mg available phosphorus per day and are adequate up to about 40 weeks of age. From 40 to 60 weeks of age, increase the calcium and reduce the available phosphorus levels moderately (4.1-4.2% Ca and 0.35% available phosphorus for a daily feed consumption of 22 lbs/100 hens/day or 4.1-4.2 g Ca and 350 mg available phosphorus/hen/day). From 60 weeks of age up to the end of the egg production cycle (76 to 80 weeks of age), increase the calcium level and reduce the available phosphorus further (4.3-4.4% Ca and 0.3-0.32% available phosphorus for a daily feed consumption of 22 lbs/100/day or 4.3-4.4 g Ca and 300-320 mg available phosphorus/hen/day). Adjust the levels of calcium and available phosphorus in the diet properly so that regardless of variation in the daily feed intake, the previously mentioned daily calcium and available phosphorus intake are maintained.

Particular attention should be paid to the presence of calcium in particle form in the layer diet. The presence of calcium particle in the layer diet ensures that enough calcium source will remain in the gizzard during the night hours when shell formation is in progress but birds do not have access to feed. The availability of calcium at the time of shell formation is expected to diminish the demand for withdrawal of calcium from the bones and this, in turn, has the potential to reduce the incidence of cage layer fatigue. The presence of 1/3 of the supplemental calcium in the form of particles from 20 to 40 weeks of age and 1/2 from 40 weeks up to the end of the production cycle is good insurance for securing the bone integrity and shell quality.

Solubility of supplemental sources of calcium also should receive serious consideration. This is particularly important when producers are using new sources and suppliers. The results of experiments at Cornell indicated that pulverized calcium sources with a solubility of 50% and greater are proper for use in layer diets (Keshavarz, K., et al., *J. Appl. Poultry Res.* 2:259-267, 1993).

Because calcium is deposited in bones in the form of calcium phosphate, then adequacy of phosphorus in the diet, both during the growing and laying parts, should receive serious consideration. While the use of phytase in the layer diets is encouraged for liberation of phytate phosphorus and decreasing the need for supplemental sources of phosphorus for environmental issues, the adequacy of available phosphorus in the diet should not be underestimated. The use of phosphorus sources with high phosphorus availability such as mono-dicalcium phosphate as compared to dicalcium phosphate or deflourinated phosphate is encouraged. The results of phosphorus bioavailability studies have shown that phosphorus in

dicalcium phosphate and deflourinated phosphate are only 95 and 90%, respectively, as available as in monocalcium phosphate. When animal sources of protein are used in the diet, then the reliability of suppliers and consistency of phosphorus content in various shipments should receive serious consideration.

Adequacy of vitamin D₃ in the diet is another factor that should receive serious consideration. After absorption, vitamin D₃ is transported to the liver and undergoes the first step of hydroxylation and converts to 25(OH)D₃. Then 25(OH)D₃ from the liver through the blood stream reaches to the kidney, where it is converted to the active form of vitamin D₃ (i.e. 1,25(OH)₂D₃). In this active form, vitamin D₃ is involved in the formation of appropriate proteins which are involved in active absorption of calcium from the intestine, utilization of calcium by the shell gland for shell formation, and deposition and mobilization of calcium from the bones. Currently, vitamin D₃ in its first hydroxylation form (25[OH]D₃) with a reasonable price is available to producers. Although it is logical to believe that the use of this hydroxylated form in place of normal vitamin D₃ should have beneficial effects on bone and shell formation, we were not able to demonstrate these beneficial effects as yet for (25[OH]D₃) (Keshavarz, K., Poultry Sci. 75:1227-1235, 1996). Additional work in this area is warranted. The use of a water-soluble form of vitamin D₃ once a month for a few days, particularly with trouble flocks or during the high temperature months of summer and with older hens, is a good managerial practice.

It should be noted that, not only the nutrients involved in bone formation should be present adequately in the diet, their absorption also should not be impaired due to the presence of mycotoxins in the diet. Additionally,

the gut should be healthy so that the process of digestion and absorption would be ideal.

We have shown that feed consumption increases drastically a few hours prior to anticipation of dark hours (Table 2) (Keshavarz, K., Poultry Sci. 77:1266-1279, 1998). Consequently, it is important to ensure that sufficient feed is in the feeders prior to initiation of dark hours.

The use midnight feeding should be considered as a part of management in commercial egg producing farms. When hens are provided with feed for a duration of one to two hours during the midnight hours, the period that birds do not have access to feed, reduces to 4-5 hours and this is expected to reduce the incidence of cage layer fatigue and shell quality problem in the flocks.

Daily feed consumption should be closely monitored. When due to high environmental temperatures or other reasons, the daily feed intake reduces the nutrient density of the diet including calcium and phosphorus levels should be increased properly, so that their daily intake are not affected.

The production manager should make sure that the feeding system at the farm is working satisfactorily. The results of our field studies have shown that extensive calcium separation is taking place in various phases of the feed handling systems particularly with the older systems of feed delivery where feed is not moving fast enough in the feeders. We observed calcium levels as low as 1.5% to as high as 13% along the feeding lines in our field studies. Providing a diet with an inadequate or excessive calcium level has the potential to predispose the hens to incidence of cage layer fatigue either due to inadequate calcium intake resulting from the low calcium in the diet or reduced feed intake due to low feed palatability resulting from the high calcium in the diet.

In short, changing the calcium level properly during the late stages of the growing period, using proper levels of calcium, phosphorus and vitamin D₃ in the diet, both during the growing and laying periods, the use of large particles of calcium sources, midnight feeding, ensuring the presence of adequate feed in the feeders just in the hours prior to initiation of dark hours, proper calcium solubility, proper source of phosphorus with adequate bioavailability, and proper functioning of the feeding systems, among others, are proper managerial tips that should be taken seriously into consideration for diminishing the incidence of cage layer fatigue in the flocks. When the incidence of cage layer fatigue still occurs in a flock, then it is wise to increase both the level of calcium and phosphorus in the diet. A response is not expected to be obtained by increasing either calcium or phosphorus per se, because bone formation requires the presence of both calcium and phosphorus. Additionally, provide the flock with a water-soluble source of vitamin D₃ to facilitate the absorption and utilization of calcium and phosphorus for bone formation.

Prolapse (blow-out): Some producers are also concerned about the high incidence of prolapse in their laying flocks. This is a condition when the oviduct cannot retract back completely after oviposition. Due to pecking by other birds, bleeding and infection of the protruded area of the oviduct, the affected birds usually die. The incidence occasionally can be seen on farms when managerial practices are sound. Similar to cage layer fatigue to what extent the high egg production potential of the current strains that results in use of muscles of the oviduct extensively can be a contributing factor is not known. However, the following factors are among the major contributing factors in the outbreak of this problem in the flock.

Probably the most important contributing factor is improper debeaking. Every effort should be made in doing a decent job of debeaking during the growing period. When the job of debeaking is done at an early age, a trim may be necessary at a later age during the growing period. Make sure the blades are hot enough and cauterization is complete and beaks are cut adequately. When the cut is too short or cauterization is not complete, the chance of regrowing the beak exists.

Body weight at housing time is another important factor. The management during the growing period should be proper to result in producing pullets with an average body weight according to breeder guidelines and satisfactory uniformity. We have shown that providing the pullets with a more liberal floor space or increasing the protein level in the growing diets had the potential to increase the body weight at the age of housing (18 wk) significantly (Keshavarz, K., *Poultry Sci.* 77:1266-1279, 1998). While pullets should be well fleshed with proper skeletal development, obesity should be prevented because more pressure is needed for expelling the egg out of the body at the oviposition time. Similarly, when the body weight is too light, discharge of large and double yolk eggs that occasionally can be seen with young flocks becomes difficult. These situations may result that the oviduct does not completely retract back after oviposition and contributes to the incidence of prolapse.

While light intensity at the feeder level should be adequate for stimulation of the pituitary gland and feeding activity, the use of bright light which increases the bird's activity and pecking, should be avoided. The current strains of laying hens can perform quite satisfactorily with light intensities quite lower than the traditional recommendation of 0.5 foot-candle

at the feeder level. In fact, we have seen quite satisfactory production data from commercial farms when the light intensity at the bottom tier was only as low as 0.2-.25 foot-candle. The use of red light or normal fluorescent light covered with a red filter have the potential to reduce the pecking tendency among the birds in a multi-bird cage system, particularly, when the oviduct of one hen does not completely retract back after oviposition.

Provide adequate floor space in multi-hen cage system. Probably a floor space of 60 in² per bird should be considered as minimum. Overcrowding which results in an inadequate floor, feeding, and drinking space per bird is an important contributor to many production failures including the incidence of blow-out. Adequate ventilation for reducing ammonia and keeping the temperatures of the house in the zone of thermoregulatory (comfort zone) is an important factor for maintaining the hen's productivity and reducing the incidence of problems such as prolapse.

Nutritional deficiencies and imbalances such as low-dietary protein or salt may increase the pecking tendency among the birds of one cage and accentuate mortality due to prolapse. Factors that result in increasing exposure of the vent area, such as poor feathering due to high or fluctuation of house temperature, low-protein diet or external parasites, also increase the severity of prolapse in the flock. Hysteria is another contributing factor.

Considering the aforementioned factors collectively in the daily managerial practices, expect to diminish the incidence of problems such as cage layer fatigue or prolapse in the flock considerably.

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Table 1. Effect of feeding a high-calcium diet for various durations in the latter part of the growing period on tibia weight, tibia ash and tibia calcium at 20 weeks of age¹

Treatment number	Period on high-calcium diet (week)	Tibia weight ¹ (grams)	Tibia ash ¹ (%)	Ash calcium (%)	Tibia calcium ² (mg/gram)
		NS ³		NS ³	
1 (Control)	--	5.22	53.45 ^c	34.03	182 ^b
2	18 to 20	4.60	55.67 ^b	33.65	187 ^b
3	17 to 20	5.15	59.26 ^a	34.04	202 ^a
4	16 to 20	4.84	58.93 ^a	33.71	199 ^a
5	15 to 20	5.15	58.38 ^a	33.74	197 ^a
6	14 to 20	5.38	57.91 ^a	33.79	196 ^a

^{a-c}Means within a column followed by different superscripts are significantly different ($P < .05$).

¹Control group was fed a diet containing .8% calcium from 14 to 20 weeks of age, whereas pullets of Treatments 2 to 6 were fed a diet containing 3.5% calcium for 2, 3, 4, 5, and 6 weeks, respectively.

²Moisture-free, fat-free basis.

³NS=Nonsignificant ($P > .05$).

Table 2. Average daily feed consumption pattern during 7 d with multi-hen or individually caged hens

Time (h)	Bi-hourly feed consumption (multi-hen cage)		Average (Ave.) house temperature (F)	Bi-hourly feed consumption (individual-hen cage)	
	(g/hen) ¹	(%) ²		(g/hen) ¹	(%) ²
0500 to 0700	12.5±2.2	13.2	72.6	10.6±0.9	10.8
0700 to 0900	8.2±0.7	8.6	73.3	7.0±0.9	7.1
0900 to 1100	7.5±1.4	8.0	77.8	10.0±1.3	10.2
1100 to 1300	8.8±2.0	9.3	82.3	10.3±1.2	10.5
1300 to 1500	10.3±2.3	10.8	85.9	10.2±1.4	10.4
1500 to 1700	11.7±2.9	12.4	88.0	10.9±1.4	11.2
1700 to 1900	17.6±2.2	18.6	88.6	16.9±1.8	17.3
1900 to 2100	18.1±1.3	19.1	87.4	22.0±0.7	22.5
Total	94.7±12.3	100.0	(avg. 82.0)	97.9±4.5	100.0
0500 to 1300	37.0±4.8	39.1	(avg. 76.5)	37.9±2.2	38.7
1300 to 2100	57.7±8.3	60.9	(avg. 87.5)	60.0±3.8	61.3
0500 to 1500	47.3±4.8	50.0	(avg. 78.4)	48.1±2.9	49.1
1500 to 2100	47.4±6.0	50.0	(avg. 88.0)	49.8±2.8	50.9

¹Mean ± SD.²Percentage of daily feed intake.

HUMAN-TO-HUMAN TRANSMISSION OF AVIAN INFLUENZA VIRUS (H5N1)

In a recently published paper (*J. Infect. Dis.* 2000; 181:344-348), Dr. Carolyn Buxton Bridges and colleagues from the Centers for Disease Control and Prevention in Atlanta, GA, reported finding evidence of human-to-human transmission of avian influenza virus (AIV). The authors found that 3.7% of health-care workers who came into contact with AIV-infected humans, but not with poultry, developed antibodies against the virus. In contrast, only 0.7% of health-care workers not exposed to infected humans had antibodies. During the outbreak of H5N1 AIV, 18 humans showed signs of disease and 6 died as a result of the infection. After total depopulation (1.3 million birds) of live-bird markets and chicken farms in Hong Kong, the virus has not been detected again.

Though the rate of transmission is low, we should be very concerned about the ability of AIV to go from human-to-human. The original outbreak was the first evidence that AIV may be transmitted from chickens to humans. In the paper the authors present evidence that transmission from human to human is a distinct possibility. This evidence underlines the need for constant surveillance, early diagnosis and control of diseases, before these become an epidemic in poultry, and reach the human population.

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HAVE YOU JOINED THE NEW YORK STATE EGG QUALITY ASSURANCE PROGRAM?

What are the benefits of joining the New York State Egg Quality Assurance Program (NYSEQAP)? By far, the most important benefit for the producer is protection from liability in case of a "trace-back". A "trace-back" may result from a human outbreak of *Salmonella enteritidis* where eggs or food containing eggs are involved. When the Department of Health identifies eggs as the source of SE, all producers dealing with the retailer involved in the outbreak are investigated. The environment and eggs from flocks of all farms contributing eggs to that retailer are tested for SE contamination, and eggs are placed under restriction (eggs must be pasteurized or hard-boiled). **The restriction is not lifted until after the results from the SE testing come back as negative, usually 2 to 4 weeks. The eggs from NYSEQAP-participating farms involved in a "trace-back" are not placed under restriction until after the tests come back as positive, usually more than 4 weeks.**

In time, the consumer will associate the NYSEQAP seal with fresh, wholesome eggs produced in New York State. With proper promotion, eggs displaying the NYSEQAP seal may have a marketing advantage over eggs that do not display the seal or are produced in other states. In the last two months several egg producers have joined the New York State Egg Quality Assurance Program. Their

interest is driven by the presence of more and more egg cartons displaying the NYSEQAP in stores across the state.

If you have not joined the NYSEQAP, do it as soon as possible. For information and copies of the NYSEQAP Producer Manual contact:

Dr. James Gray
Department of Agriculture and Markets
1 Winners Circle
Albany, NY 12235-0001

Fax: 518-485-7773
Phone: 518-457-3502

or
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Fax: 607-253-3369
Phone: 607-253-4031.

Joining is easy. If the flocks in your farm have been tested for *Salmonella enteritidis* (SE), you can start right away. If the farm has not been tested, you may contact Dr. Lucio to obtain more information or make arrangements to test your farm.

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ARKANSAS 99 INFECTIOUS BRONCHITIS VIRUS ISOLATED IN NEW YORK STATE

Arkansas 99 (Ark99), a variant of infectious bronchitis virus (IBV), was isolated originally from broiler chickens in Delaware in 1973. Since then, Ark99 has spread to the Southern, Northeastern, Midwestern and the Western U. S. In New York State, Ark99 was isolated in October 1999, after specific-pathogen-free (SPF) sentinel chickens were placed among layers in a flock that had a drop in egg production.

The investigation of drops in egg production has been one of the long-standing objectives of the Avian Disease Program. Early investigations by Dr. Fabricant demonstrated its presence in flocks that experienced drops in production. Drs. Lucio and Fabricant found that the virus persists for long periods of time in the cecal tonsils. Further investigations by Dr. Naqi have shown that the virus persists for many months in the chicken, even in the absence of re-infection.

Ever since Dr. Fabricant found IBV in flocks with drops in production, IBV has been isolated frequently from layer flocks in New York State. With the advent of more sophisticated techniques such as: monoclonal antibodies (MAbs) and polymerase chain reaction (PCR), Drs. Naqi, Lucio and Mohammed have isolated several IBVs that do not fall into known types of IBV. The "untypable" IBVs may be a problem because commercial vaccines may not be effective against them.

In the case of Ark99, both inactivated and live vaccines are commercially available, and the Department of Agriculture and Markets has approved the use of the live vaccine in the farm where Ark99 was isolated. The rest of the producers in New York State may use inactivated Ark99 vaccine. The use of a live Ark vaccine will add to the gene pool of IBVs present in the farm, increasing the risk of mutations.

It is interesting to note that Ark99 was isolated for the first time in 1973 in Delaware, but was not found in New York State until 1999, and it was not for lack of trying. Ever since the earliest isolations by Dr. Fabricant, IBVs isolated in New York State have been different from IBV variants found in other areas. The absence of Ark99 until 1999 speaks well of biosecurity between farms in New York State, and responsible use of vaccines by our producers.

The Avian Health Unit-Extension will continue placing SPF sentinel chickens in New York State farms to determine the prevalence of IBV and be able to give informed advice on methods of control. If you are experiencing unexplained drops in egg production, let us know.

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