Poultry Perspectives

MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Spring 2002 Volume 4, Number 1

Ammonia and Poultry Welfare

by Inma Estevez

Moisture, in conjunction with high temperature, promotes bacterial growth, which will decompose organic material producing ammonia in the process. Because ammonia production is so intimately linked to litter moisture, it is quite difficult to separate the effects of each of these two factors. The combination of ammonia and wet litter is responsible for a large number of health- and density-related welfare problems in poultry (Figure 1). For example, the occurrence of ascites, gastrointestinal irritation, and respiratory diseases has been correlated

See Poultry Welfare on page 2

PoultryPerspectives

is published by the College of Agriculture and Natural Resources, University of Maryland, College Park, Maryland.

EDITORS

Inma Estevez, Ph.D.
Roselina Angel, Ph.D.
Dept. of Animal and Avian Sciences
University of Maryland
College Park, MD 20742

HOW TO CONTACT US

Inma Estevez, Ph.D.
E-mail: ie7@umail.umd.edu
Tel: 301-405-5779
Fax: 301-314-9059

Roselina Angel, Ph.D.
E-mail: ra95@umail.umd.edu
Tel: 301-405-8494
Fax: 301-314-9059

CONTRIBUTORS

George Malone
Extension Poultry Specialist
University of Delaware
Georgetown, Delaware

B. Stewart-Brown, Ph.D.
Director, Poultry Health Services
Perdue Farms Corporation
Salisbury, Maryland

Suzanne T. Millman, Ph.D.
Director of Scientific Programs, Farm Animals & Sustainable Agriculture
The Humane Society of the United States, 2100 L Street NW
Washington, DC 20037
Tel: 301-258-3114, Fax: 301-258-3081
e-mail: smillman@hsus.org

Nathaniel L. Tablante Jr., DVM-MPVM
Assistant Professor
Virginia-Maryland Regional College of Veterinary Medicine, College Park
Extension Poultry Veterinarian
Lower Eastern Shore Research & Educ. Center, 27664 Nanticoke Road
Salisbury, MD 21801
Tel: 410-742-8788, x308
Fax: 410-742-5460
e-mail: nt22@umail.umd.edu

In This Issue

Poultry Welfare from page 1

with high levels of ammonia. At levels above 50 ppm, increased levels of keratoconjuntivitis and tracheitis have been observed. These trachea and lung lesions render the birds more susceptible to bacterial infections such as *E. coli*.

Ammonia levels have also been associated with a high incidence of contact dermatitis: foot, hock, and breast burns. If the foot lesions are serious, lameness and leg problems may result. Many of these pathologies can be quite painful and stressful for the birds, therefore control of ammonia has become an important issue in the poultry welfare guidelines established by organizations and private companies such as The American Humane Association, The National Chicken Council. In addition to the welfare consequences, ammonia levels above 50 ppm have an important affect on growth rate and performance. Ammonia levels, rather than behavioral factors, are the main reasons of depressed growth at high rearing densities.

The effects of ammonia are highly dependent on exposure time. It should therefore be noted that any effect demonstrated at rather high concentrations is likely to be present at much lower concentrations with longer exposure times.

Because of the consequences of ammonia for human health (see Malone article), many European countries have regulations regarding human exposure, which set the upper limits for acceptable ammonia concentrations. For example the limit in the UK is 25 ppm, in Sweden and Germany the limit is 25 and 20, respectively, for an 8-hour working day. Sweden also has a second limit of 50 ppm for a maximum of 5 minutes exposure.

Controlling Ammonia Production

As indicated above, ammonia is generated by microbial activity on fecal uric acid when the litter is moist, therefore any factor affecting litter moisture and manure production will also affect the rate of ammonia within the house (Figure 2).

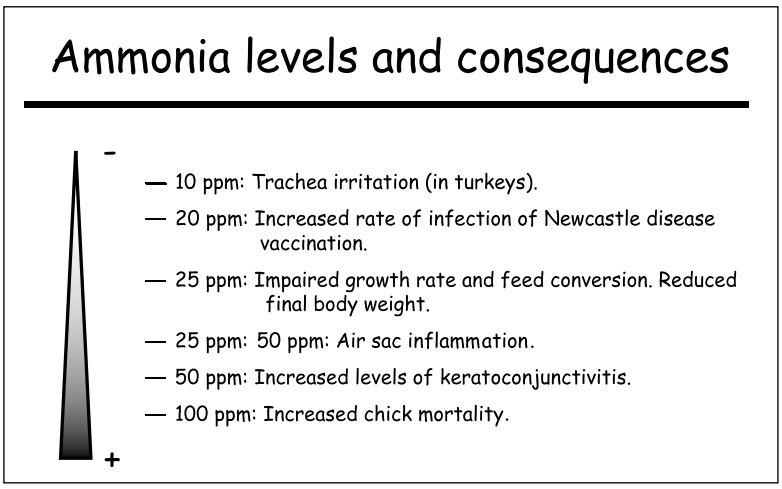

Figure 1. Main known consequences of ammonia levels to poultry health.

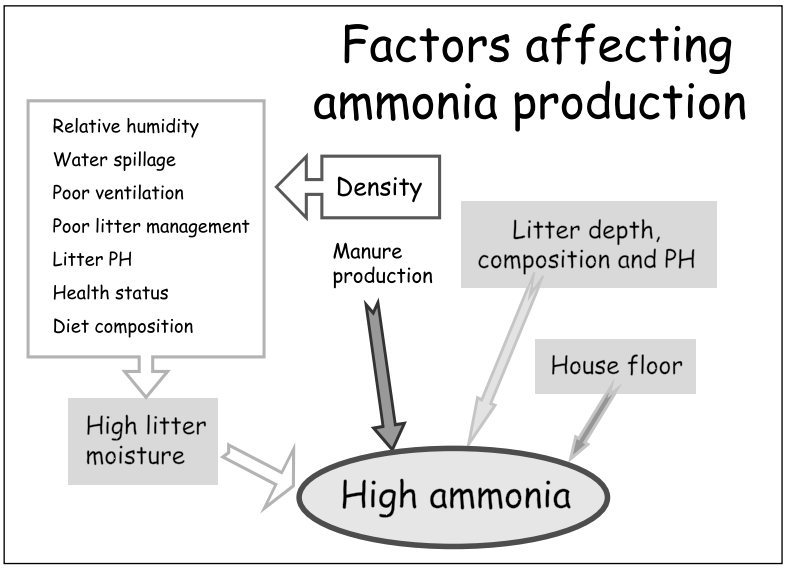

Figure 2. Factors affecting ammonia production.

Moisture. Water spillage will seriously affect litter moisture content; this is why the use of nipple drinkers is highly recommended. The majority of the chicken houses in the Delmarva Peninsula are equipped with nipple drinkers, however many broiler breeder houses still maintain the traditional bell drinkers. In breeder houses water spillage problems become more relevant because the birds tend to over drink (due to feed restriction), spilling more water and also producing "wet manure."

Diet. Diet composition may also impact on ammonia production and bird health in several ways. Approximately 18 percent of the feed content of nitrogen is released into the atmosphere as ammonia. Therefore, diets with high protein levels may have a direct effect upon the development of contact dermatitis because of the increase in nitrogen content on the manure.

Other dietary constituents can have an adverse effect on litter quality, either by causing increased water intake, which leads to wetter feces,

or by making the feces sticky. High levels of dietary sodium, chloride, or potassium all cause an increase in water intake. Soybean meal, when fed in excessive quantities, can increase water consumption because it is naturally high in potassium.

Finally, high dietary fat levels and in particular fat sources of poor digestibility make the feces greasy with fat that has not been digested or absorbed, making the litter stick to the skin more easily and making the skin more prone to lesions caused by the ammonia.

Health. Bird health status is another factor to consider. Outbreaks of diarrhea resulting from intestinal disorders may cause litter deterioration. The problem is more severe at high densities because the litter may easily become wet as a result of larger deposits of fecal content, spilled water, and inadequate ventilation. An additional factor to consider is the capacity of the litter to absorb water. The higher the capacity of the litter to retain water, the lower the impact of density on litter quality. Litter management practices that maintain a low moisture level dramatically help to lower ammonia levels in the poultry house. Litter depth has also been demonstrated to be important and, contrary to what might be expected, thin layers of litter (when using concrete floors in the house) have been demonstrated to be an effective method of minimizing skin dermatitis in poultry.

Best management practices to maintain low ammonia levels include

- using diets that reduce the level of urea and proteins,
- using nipple drinkers,
- maintaining densities based on the ventilation capacity of the building
- using litter material with high water-holding capacity, and
- minimizing overdrinking by providing pecking substrates to the birds.

Remember, any efforts to reduce ammonia levels will have a large impact on the welfare and performance of the birds.

Ammonia and Grower Health

by George Malone

Although maintaining good air quality in houses is important for poultry productivity, health and welfare, a grower's personal health comes first. Unfortunately, in our industry, air quality for personal well-being does not receive the attention it should.

Human respiratory hazards in poultry houses are not limited to ammonia. Other hazards include hydrogen sulfide, which is the greatest concern with deep pit manure storage systems; carbon dioxide; carbon monoxide; dust; bio-aerosols, including bacteria, fungi, mold, viruses, or fragments of these organisms; and dust, fumes, or vapors associated with pesticides, disinfectants, and litter treatments.* For the purpose of this article, however, the focus will be on ammonia. Other risk factors, such as dust, bio-aerosols and cigarette smoking, in combination with ammonia, have additive or synergistic negative effects on health.

Because poultry growers are exposed to multiple respiratory hazards, it is sometimes difficult to single out the individual consequences of ammonia on human health. As little as 4 ppm of ammonia may cause eye irritation and 25 ppm, mild tissue irritation in some individuals. The occupational threshold level for ammonia during an eight-hour day is generally recognized as 25 ppm; for short-term exposure (15 minutes), the threshold is 35 ppm. An ammonia concentration of 300 ppm is immediately dangerous to life, and greater than 2,500 ppm can prove lethal.

In a review of the effects of ammonia on the health of poultry growers, Whyte (1993) reported an increase in susceptibility of the respiratory system to airborne pathogens when combined with ammonia concentrations below the occupational exposure limit of 25 ppm. In a more recent dose-response study of poultry workers by Donham (2000), results suggest that respiratory function may be impaired above concentrations of 12 ppm. Ammonia, in combination with other respiratory hazards, such as dust and bio-aerosols may contribute to numerous health concerns. Growers working in poor air quality poultry housing may show symptoms such as cough, phlegm, wheezing, nasal irritation, itchy eyes, chest tightness, fatigue, headache, and fever.

Measuring Ammonia

Not knowing the levels of ammonia in their poultry houses is a problem for many growers. People who have worked in a poultry house environment for years often cannot detect levels below 50 ppm. There are several options for ammonia detection, each having advantages and disadvantages. A family member who is sensitive to low levels of ammonia may be used as a "detec-

* For a listing of respiratory hazards and selection of appropriate respiratory protection, request a copy of "Respiratory Health on the Poultry Farm," a fact sheet published by University of Delaware Cooperative Extension (2001).

tor," but this is hardly practical on a day-to-day basis and an individual's nose is not "calibrated" to distinguish exact concentrations.

Another option used by growers is colormetric tape. This paper, saturated with water, will change color in the presence of ammonia. While this is a quick and relatively inexpensive method, accuracy is poor, simply because it is difficult to distinguish concentrations (color change) between 20 to 100 ppm.

The most common ammonia-measuring device for field application is a detector tube using a hand-drawn air pump. This method provides an instantaneous reading and costs about $4 per ammonia detection tube and $300 for the pump. Dosimeter tubes, which cost, on average, $4 each, may be used to obtain ammonia concentrations when the exposure level can be extended over several hours.

Current electronic detectors are expensive (most exceeding $1,000), require calibration, and may involve periodic replacement of parts. However, with adoption of computer controllers in poultry houses and advances in electronic sensor technology, these devices may offer the most promise for precision monitoring and control in the future.

Reduce Risk

What options do growers have in limiting exposure to ammonia? One way is to reduce the concentration of ammonia and/or the exposure time. The following are some things growers can do to reduce the health risks associated with ammonia in poultry houses:

1. Increase ventilation rates. Ventilation is the primary means of controlling air and litter quality during grow-out. Between flocks with houses closed, particularly during cold weather, ammonia levels can be dangerously high. It is extremely important to ventilate the building before working in this environment.
2. Maintain desirable litter moisture. There is a linear relationship between litter moisture and ammonia release in the 15 to 40 percent range. To minimize litter-moisture content, manage ventilation and drinker and cooling systems, and maintain uniform bird density and adequate litter depth.
3. Prevent water seepage into houses. Correct outside drainage problems that allow surface water seepage in houses, and "re-dirt" houses to prevent wetting the litter base with moisture from the house pad.
4. Timely and effective cake removal. To get the greatest benefit of the layout between flocks and to air out houses, remove cake immediately following bird movement. Cake is a concentrated source of both pathogens and ammonia production. Effective removal of this material is extremely important.
5. Clean out houses. If conditions permit, a partial or total cleanout of litter, particularly going into colder weather, will reduce ammonia levels for several flocks.
6. Use litter treatments. Although the duration of ammonia control is limited, a number of litter treatments, when used appropriately, offer effective ammonia suppression during the brooding period.
7. Implement laborsaving technologies. Proper husbandry and care of birds is essential! However, consider implementing technologies such as computer controllers, which improve labor efficiency and reduce the hours spent working in houses.
8. Wear respiratory protection. Proper respiratory protection equipment is the most effective way to reduce inhalation of ammonia. Selection of appropriate equipment to limit the intake of other pollutants such as dust will aid in reducing the additive and synergistic effects of the multiple respiratory health risk in the poultry house environment.

The cost of implementing these strategies to reduce your exposure to ammonia and other pollutants in poultry houses is a small price to pay for your personal health.

References

Jester, R. and G. Malone. 2001. "Respiratory Health on the Poultry Farm." University of Delaware Cooperative Extension Safety Fact Sheet, # SF-8.

Whyte, R. 1993. "Aerial pollutants and the health of poultry farmers." *World Poultry Science Journal*, 49:139-156.

Donham, K. 2000. "Occupational health hazards and recommended exposure limits for workers in poultry buildings." Proceedings to the National Poultry Waste Management Symposium, 92-109.

Animal Welfare in Commercial Poultry

by B. Stewart-Brown

Current Position of the Poultry Industry to Animal Welfare

We in the poultry industry tend to be a little apprehensive when discussing animal welfare. Frequently that is because the conversation takes place in forums where people are coming from the various extreme viewpoints. There are sometimes hidden or multiple agendas being pursued so the subject of animal welfare can quickly become combative, resulting in a very guarded discussion.

This is an area where we might have opinions, but haven't necessarily read the research work that is being done on it. It is a common perception with the poultry production industry that the published articles, at least in the popular press, have a prejudice similar to the con-

versations—people with extreme views or with disguised agendas are authoring these papers. There is a body of information and literature that we are not as likely to be current on as say...tunnel ventilation, nipple drinker management, Marek's disease control, phosphate use, etc.

We need to change our position on these issues in the immediate future. We need to become comfortable with the terms and be willing to discuss and sometimes debate welfare issues. We need to read papers and studies on animal welfare to stay current with popular opinion as well as the views of activist organizations.

In reality, we work on animal welfare all the time. We don't call it welfare, because we don't like the term. We use terms like comfortable, normal, and content. With tunnel ventilation, birds are more 'comfortable' in heat stress periods. With lighting adjustments, birds are 'calmer' and more 'content'. With nipple drinkers, birds are 'cleaner' and 'healthier'. There is no doubt that performance and animal welfare are connected. There is also no doubt that some of the bird comfort and behavioral parameters need to be discussed and quantified when working on innovative approaches to health and management of chickens.

There are at least five things you need to consider in a discussion of animal welfare:

1. Understand and use the term "Animal Welfare" or "Poultry Welfare."
2. Understand the issues and sensitivities of arguments relating to poultry welfare.
3. Become an expert in your particular area of expertise as it relates to poultry welfare issues.
4. Be able to discuss poultry welfare issues with people that know less about it than you without being defensive.
5. Like the subject of animal welfare and embrace it; even be passionate about it.

"We need to read papers and studies on animal welfare to stay current with popular opinion as well as the views of activist organizations."

Animal welfare can be broken into two bodies of knowledge and research: 1) satisfaction of basic physical needs, and 2) encouragement of necessary behaviors. We are exceptional in Number 1. We are less familiar with, and somewhat resistant to, discussion of the issue of necessary behaviors.

Basic Physical Needs of Poultry

We have reams of data to support the fact that we are meeting the basic physical needs (feed, water, environment, management/care, and health) better than ever before. Birds are being cared for far better than we have ever done before. We all study and pursue, with passion, these five needs. We don't necessarily document and publicize our fine practices, because some of them are perceived as (and are, in fact) competitive advantages for a given company.

Presence and Absence of Behaviors

Sexually immature chickens exhibit the following basic behaviors: feeding, drinking, preening, sleeping.

Monitoring feeding and drinking behavior is a part of our normal husbandry process. We are less familiar with normal preening and sleeping behaviors. These behaviors need to be monitored and studied to help us make decisions on practices from bedding type to lighting programs.

Behaviors that need to be minimized and avoided are fear, frustration, and pain.

It will be important to read and listen for discussions of these three behaviors. There is a great tendency for people outside the science and production arenas to attribute human personalities to chickens and judge practices in this sense. This needs to

be avoided. Although there is some excellent research currently going on, additional scientific work needs to be encouraged and supported.

Issues and Sensitivities for Poultry Welfare

It is important to know some of the issues that are being discussed and debated relating to poultry welfare. Although clearly not a complete list, these are a few of the issues:

Crowding. This can be a contentious issue. It generally comes down to the ability of birds to exhibit normal behaviors. Breed differences are generally not taken into account when this is discussed in the public forum.

Feather cover. Slow feathering birds have added some complexity to this issue. Breed differences are also evident. We have paid attention to this for prevention of scratches and nutritional/health assessment.

Flightiness. Breed differences have some part to play in flightiness as does light control. In addition, human interaction and the birds' response to our presence become important factors as we work in the chicken house.

Euthanasia technique(s). There are studied and approved methods of euthanasia that we need to follow. For the most part, we use cervical dislocation—an appropriate method. Some training and practice are required to use this technique appropriately.

Litter condition. In general, this is as good as it ever has been. Water spills/leaks need to be quickly and effectively addressed.

Cleanliness of birds. This is usually a product of **litter condition** and moisture.

Air quality. Litter amendments, moisture control, and ventilation have helped us continue to improve in this important area. We have worked hard on this over the years because of the effect on bird (and human) comfort and health. Ammonia levels exceeding 25ppm will likely be scrutinized.

Life support backup. It is important to have a method that will support the birds in the event of a power failure.

Lighting. This subject is somewhat controversial. Light control affects bird health and activity and yet it is necessary to be able to inspect and work in the chicken house effectively.

Mobility-leg issues. Birds that are down need to be euthanized and not allowed to suffer. Genetics, health, nutrition, litter management, and water management will all contribute to our success.

People behavior. Birds need to be treated with appropriate respect.

"You need to be able to discuss animal welfare with others and you need to have passion about the subject."

You need to be an expert in your particular part.

Many flock service people and growers are very good at detecting abnormal behavior in their flocks. We also have extensive procedures in place that support and encourage normal behaviors and comfort. Very often the best judge of the status of welfare of a flock of birds are those workers who see them day in and day out.

Documentation of various practices will need to be formalized—without being excessive or simply "busy work." We all have full-time jobs already and the current level of paperwork can be overwhelming. However, we need to get and take credit for all that we do. The only way to do that is to properly document it.

You need to be able to discuss animal welfare with others and you need to have passion about the subject.

Although we tend to be uncomfortable discussing agriculture with people who weren't raised with animals, we need to be able to discuss the issues. We have some of the best husbandry practices and some of the best cared for chickens and turkeys in the world. We need to be proud of that. We know there are things to improve and new things to learn about the welfare of poultry.

In the "Not-So-Distant" Future...

Farms will have guidelines and will be audited on their animal welfare practices. There will be training and documentation needs. Most of these issues will be easily addressed, some current practices will continue, and a few things will need to be done differently.

Integrated companies will have guidelines and be audited. Hatcheries, growout, transport, and plant areas will have specific areas to monitor and document. Poultry welfare practice will be a part of doing business as it is today, but in a documented, discussed, and critiqued way.

These audits will likely come from the people who buy the chicken. If we do it right they will be written and reviewed by growers, service people, veterinarians, poultry scientists, nutritionists, and others who study and care for (and about) commercial chickens and turkeys.

Currently there are at least six different companies with documents either available or in development: AHA, McDonalds, Wendy's, FMI, NCC/Burger King, and UEP.

This does not take into account any documents that individual integrated companies are working on "in-house." There are many other countries that have animal welfare guidelines. Many of the guidelines from other countries and those listed here address similar issues. However, there are some differences.

Guidelines will likely be available, in some format, for each grower from each integrator in the near future. Our goal must be to make these guidelines and the auditing process truly work for the welfare of the chicken.

What Can You Do?

1. Pay attention to and participate in the discussion.
2. Keep a positive attitude about the discussion.
3. Understand that some of these practices and issues of welfare will seem inappropriate or misplaced. However, many will be good and appropriate practices—many that we now do, some that we need to work on, and some that we need to document.

The Animal Welfare Dilemma of Broiler Breeder Aggressiveness

by Suzanne T. Millman

Problems with aggression in poultry flocks are often associated with egg laying hens, whereas passive and docile behavior is usually associated with broilers. However, these differences in behavior probably relate more to differences in maturity rather than genetics, because broilers are marketed at approximately six weeks of age, when they are still juveniles. Broiler breeder producers are increasingly faced with problems of aggressive behavior during rearing, and more recently during the breeding phase.

At an animal welfare conference in 1993, concerns were raised by a poultry veterinarian about high levels of aggressive behavior displayed by broiler breeder roosters in commercial hatching egg flocks. The behavior she described was extremely unusual since it involved mature roosters attacking, and sometimes even killing, hens. This topic formed the basis of my doctorate degree at the University of Guelph, Canada under the supervision of Dr. Ian Duncan.

In addition to animal welfare concerns associated with hen injury and mortality, rising levels of aggressiveness by broiler breeder males present several problems for producers, relating to management and to profitability:

1. Hens become fearful of aggressive roosters and avoid them by remaining on the raised slatted areas of the house. As a result, flock fertility can decrease dramatically.
2. Avoidance of roosters by hens exacerbates the problem so that when hens move off the slats and into the scratch areas, groups of roosters "mob" and attempt to mate with them. During these forced mating attempts, hens are injured, and sometimes killed.

"Once a social hierarchy, or "pecking order," becomes established, aggression decreases and is replaced by visual displays of dominance and submission."

3. Hen productivity is likely to be reduced as a result of stress and injuries due to avoidance of aggressive roosters.
4. Injured hens are more prone to infection and disease, since their wounds quickly become contaminated. This can make them more likely to be condemned by processing plants at the end of the lay.

Isn't Aggression "Normal Behavior" for Roosters?

A certain amount of aggression between chickens is normal. Some chickens chase, peck, and attack unfamiliar individuals, while others behave fearfully toward strangers and avoid them. However, once a social hierarchy, or "pecking order," becomes established, aggression decreases and is replaced by visual displays of dominance (threat) and submission (crouch). This phenomenon occurs even in large flocks where chickens probably do not recognize each other as individuals, but rather develop a more general sense about their social status relative to other birds within the flock. Roosters and hens form separate social hierarchies.

Because of differences in body size, as well as appearance of combs and wattles, the dominance of roosters over hens is usually uncontested and aggression between the sexes is rare. On the other hand, aggression between roosters is common during the breeding phase, due to hormonal changes and competition for mating opportunities. Similarly, roosters can be expected to behave aggressively toward humans as they defend hens in the flock. Chickens from different genetic strains or breeds may behave differently; for example game-type roosters bred for cockfighting are much more aggressive than most other breeds.

"Chickens behave more aggressively when they are hungry and prevented from eating."

Previous research showed that chickens behave more aggressively when they are hungry and prevented from eating. Roosters will behave aggressively toward hens in these situations. To control body weight and to prevent problems of reproduction and lameness associated with obesity, broiler breeders are severely feed restricted, particularly during the rearing phase. Broiler breeders that are limit-fed according to commercial management guidelines clean up their rations in approximately fifteen minutes and display high levels of feeding motivation.

When compared with full-fed broiler breeders, limit-fed broiler breeders perform significantly more repetitive pecking at feeders and litter, suggestive of hunger and frustration that they are unable to gain access to feed. Similarly, during the rearing phase, limit-fed broiler breeders perform significantly more aggressive interactions than do those that are full fed. For these reasons, it seemed plausible that broiler breeder roosters might

behave aggressively toward hens due to hunger and frustration associated with feed restriction.

Research Shows That Broiler Breeder Roosters Are Indeed More Aggressive

In my first experiments, I tried to tease apart these two possible explanations (genetics or limit feeding) by comparing the behavior of roosters from three genetic strains: two broiler breeder strains (Ross and Peterson) and a medium hybrid laying strain (ISA Brown). During the breeding phase, half of the roosters in each strain were full fed, and the others were limit fed according to the management guidelines for each strain. Since laying strain roosters are not normally limit fed, we restricted their feed to 75 percent of what they would normally eat to make sure they were hungry, but still thrifty and able to maintain reproductive performance. Pairs of roosters of each strain were housed with twenty broiler breeder hens of the Arbor Acres strain during weeks 25 to 37, and the behavior of the birds in each pen was recorded periodically throughout the duration of the experiment.

It was a surprise that broiler breeder roosters were found to behave extremely aggressively toward hens even when the groups were so small—twenty hens and two roosters! In some pens, broiler breeder roosters repeatedly chased hens and kept them corralled into corners or nest-boxes. Some hens were injured in the same manner described by commercial flock managers, with deep cuts through the skin and into the muscle underneath the wings, and open wounds on the back of the head. By contrast, hens in pens with laying strain roosters were never injured and the groups appeared much calmer, with hens and roosters walking, foraging, and dust bathing freely together throughout the pen.

There were few significant differences between the two broiler breeder strains, but broiler breeder and laying strain roosters differed in their aggressive and sexual behavior. Broiler breeder roosters were eight times more likely to aggressively peck hens than laying strain roosters (Figure 1), and often chased hens, which laying strain roosters rarely, if ever, did. Hens avoided broiler breeder roosters, and approached laying strain roosters more often. This response by hens is likely occurring because laying strain roosters displayed three times more courtship behavior than broiler breeder roosters.

Although there were no differences between strains for mating success, broiler breeder roosters forced matings 50 percent of the time, versus 10 percent by laying strain roosters. Hen injuries likely resulted from both aggressive

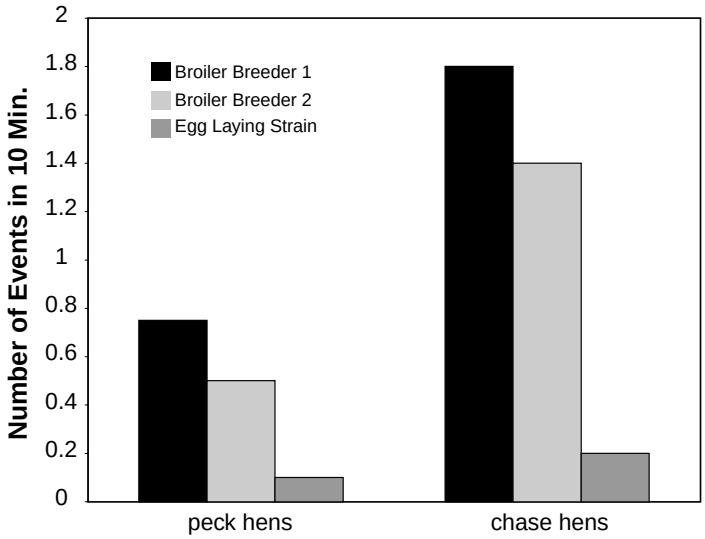

Figure 1. Frequency of aggression toward hens for three different strains of roosters (two broiler lines and a laying strain rooster).

"...limit feeding confirmed that this management practice was not the cause of rooster aggression toward hens."

attacks and from hens struggling during forced matings and mating attempts. Surprisingly, full-fed broiler breeder roosters were significantly more aggressive toward hens than those that were limit fed (Figure 2).

Aggressiveness Toward Hens Appears to be Unique to Broiler Breeder Roosters

Since broiler breeder roosters were found to be more aggressive than laying strain roosters toward both other roosters and toward hens, follow-up experiments were conducted to determine why this might be. Old English Game roosters have been bred for hundreds of years for cockfighting, and are extremely aggressive toward other roosters. When these gamecocks were compared with broiler breeder and laying strain roosters, they were significantly more aggressive toward other roosters, but rarely behaved aggressively with hens. Again, broiler breeder roosters were significantly more aggressive toward hens than were either laying strain or gamecock roosters.

Some producers have suggested that aggressiveness by roosters may result from changes in the behavior of hens. However, the Arbor Acre hens used in these experiments responded to the courtship displays of laying strain and gamecock roosters.

Hen were also tested in a Y-maze, in which each hen could walk down a corridor that branched into two arms, one containing a tethered broiler breeder rooster and the other containing a tethered laying strain

rooster. Since the roosters could not approach or chase the hens, this method provided information about hen preferences. The hens were sexually mature, but had never seen roosters before.

There were no significant differences in the preferences of hens, since they approached and mated equally often with roosters of either strain. However, after the hens had been housed with roosters for several weeks, there was some evidence that they preferred laying strain roosters. This would suggest that hens behave normally toward broiler breeder roosters, but learn to avoid them when roosters are aggressive.

Further study of limit feeding confirmed that this management practice was not the cause of rooster aggression toward hens. Although feed restriction during the rearing phase, when chickens are developing their social behavior skills, could predispose the birds to behave aggressively later during the breeding phase, laying strain roosters that were limit fed as severely as broiler breeders during rearing did not display aggression toward hens in the breeding phase. It seemed to be almost impossible to manipulate laying strain roosters so that they would behave aggressively toward hens.

How Can Broiler Breeder Aggressiveness Be Solved?

The problem is difficult to solve since outbreaks of extreme aggressiveness occur sporadically between houses at the same location, or even within the same house from year to year. One approach is to reduce the likelihood that broiler breeder roosters will respond aggressively within the flock. This can be done by reducing the number of roosters housed, so that there is less male-to-male competition and any

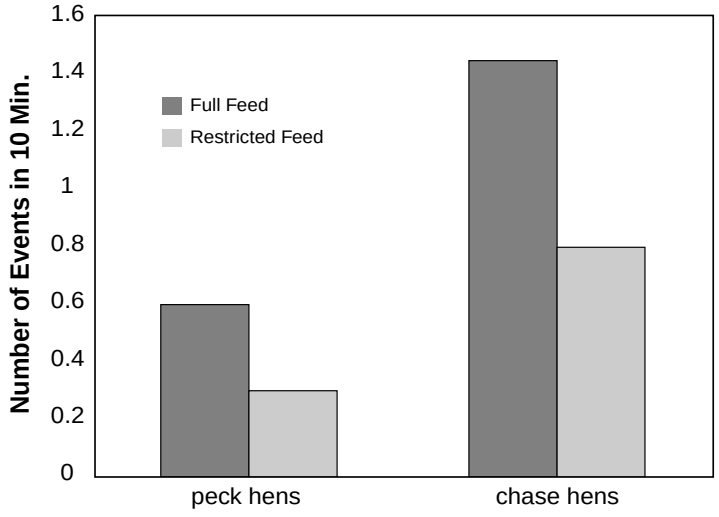

Figure 2. Effect of feed restriction on the level of aggression toward hens.

aggression will be spread over a greater number of hens.

Inclusion of panels (see previous edition of *Poultry Perspectives*, Volume 1, Number 2) that provide visual breaks within the house are a good idea, since they reduce opportunities for chasing and mobbing hens.

A second approach is to facilitate sexual behavior. Broiler breeder roosters display less courtship behavior and as a result hens are less likely to respond to their mating attempts. Provision of scratch grains or straw may induce tidbitting—a courtship display where roosters peck the ground while giving food-calls to entice the hens to approach them—and ground scratching displays by roosters, which attract the hens off the raised slatted areas. Similarly, feeding hens on the floor so that they are forced to interact with roosters frequently is a useful way of decreasing their fearfulness and avoidance of roosters.

Producers may successfully minimize effects of aggressiveness through management, and by adding to the complexity of poultry houses with objects such as straw bales for pecking behavior during rearing, or with partitions that visually break up the floor into smaller territories. However, behavior arises from both environmental factors and from the genetic predisposition of birds to respond aggressively. Hence, action by the primary breeders is necessary to exert selection pressure against aggressiveness.

Although aggressiveness was originally noted as a problem in males from one breeder company, the majority of companies have sought advice about aggressive males since our study began in 1995. For broiler breeder producers, the animal welfare problems associated with hen injury and mortality pose a dilemma because the genetic component of this behavior requires action by the primary breeding companies. It is essential that breeding programs take a more integrated approach in development of genetic stocks, so that traits relating to behavior, health, and animal well-being are accommodated.

References

Duncan, I.J.H., and Wood-Gush, D.G.M., 1971. "Frustration and aggression in the domestic fowl." *Animal Behaviour.* 19:500-504.

Mench, J.A., 1988. "The development of aggressive behavior in male broiler chicks: a comparison with laying-type males and the effects of feed-restriction." *Applied Animal Behaviour Science*, 21:233-242.

Millman, S.T., 1999. An investigation into extreme aggressiveness of broiler breeder males. Doctoral Thesis, University of Guelph, Canada.

Millman, S.T., Duncan, I.J.H., and Widowski, T.M., 2000. "Male broiler breeder fowl display high levels of aggression toward females." *Poultry Science*, 79:1233-1241.

Savory, C.J., and Maros, K., 1993. "Influence of degree of food restriction, age, and time of day on behaviour of broiler breeder chickens." *Behavioural Processes*, 29:179-190.

Promoting Poultry Health and Welfare through Flock Health Management

by Nathaniel L. Tablante Jr.

Animal welfare issues have been the focus of so much attention in recent years. In particular, some people have questioned the way chickens and other poultry species are raised under modern commercial systems. Poultry integrators, on the other hand, contend that today's poultry are better housed, better fed and, overall, better cared for than their noncommercial or backyard-type counterparts.

An issue always has two sides. Whichever side the reader takes, there is no doubt that chickens and other poultry species that are raised commercially deserve proper care and management if they are to reach their fullest potential. The ultimate goal, of course, is to provide healthy food to the consumer at the lowest possible cost and in the shortest possible time.

"The big question now is how can we best address both physical and behavioral needs of poultry?"

The well-being of poultry includes the satisfaction of basic physical needs (food, water, shelter, health, safety, and actual existence) and the encouragement of necessary behaviors. The big question now is how can we best address both physical and behavioral needs of poultry? As a poultry veterinarian, I believe one of the best solutions is through good flock health management. By providing good shelter, nutrition, vaccination and biosecurity, we can help ensure an environment where birds will be less likely to suffer from stress, injury, and disease. Here are some basic flock health management tips to promote poultry health and well-being.

Practice Good Management

1. Start clean. Purchase only strong, vigorous, healthy chicks, poults, or pullets from a reputable source (National Poultry Improvement Program participant).

2. Follow an "all-in-all-out" replacement program.
3. Regulate temperature, humidity, and ventilation to suit environmental conditions and age of birds.
4. Avoid crowding or overstocking, which can lead to stress, growth retardation, reduced feed efficiency, and decreased production.
5. Check for FLAWSS:
   - **Feed:** quality and volume
   - **Light:** intensity and duration
   - **Air:** quality (ammonia and dust), temperature, and relative humidity
   - **Water:** quality and volume
   - **Sanitation:** cleanliness of personnel, poultry houses, equipment, and premises
   - **Space:** stocking density, male to female ratio, and feeders and drinkers vs. number of birds

Practice Good Biosecurity

1. Isolation
   - Keep poultry within a fenced area and maintain a security gate at the farm entrance.
   - Do not raise different poultry species on the same premises; isolate poultry from livestock, e.g., cattle and swine.
   - Keep people, dogs, cats, and wild animals including insects, wild birds, and rodents away from poultry houses.
2. Traffic Control. Restrict entry of visitors and nonessential vehicles to your farm.
3. Sanitation. Thoroughly clean and disinfect poultry house and equipment between flocks; lock all doors, raise curtains, and leave poultry house vacant for at least two weeks before re-stocking.

Implement a Sound Vaccination Program

- Vaccinate only for diseases that are prevalent in your area.
- Follow recommended vaccination schedules and procedures.

Implement a Sound Nutrition Program

- Purchase feed or feed ingredients from reputable sources.
- Feed a balanced ration.
- Follow the recommended feeding program.

Each producer must develop a flock health management plan that is tailored to meet his or her specific needs and budget. However, the plan must contain the basic components that I have discussed. Cutting corners or taking short cuts to save money will prove costly and detrimental to poultry health and welfare in the long run.

Announcements

Poultry Scholarships

The Department of Animal and Avian Sciences is pleased to announce the call for applications for the **Kinghorne Scholarship** and the **Lillian Rummel Scholarship**. The Kinghorne scholarship is offered to undergraduate students with demonstrated interests in poultry production or avian business. The Lillian Rummel Scholarship provides up to $3,000 to undergraduate (or recently graduated) students interested in conducting research in avian behavior. Further information regarding this and other departmental scholarships can be found at the following web address: http://www.ansc.umd.edu/undergraduate/unschola.html, or by contacting Ms. Carol Dingess, Undergraduate Program Office, Department of Animal and Avian Sciences, University of Maryland, College Park, MD 20742. Phone: 301-405-1373; cd16@umail.umd.edu

"Moving Up"

Congratulations to **John Doerr** for his recent promotion to **Assistant Dean of Undergraduate Programs** at the College of Agriculture and Natural Resources. John leaves the Department of Animal and Avian Sciences but will continue to work closely with poultry faculty from his new position.

New Funded Poultry Projects

The faculty at the Department of Animal and Avian Sciences continue to be successful in raising federal monies to conduct research in poultry. New projects funded in 2001 include:

- The USDA Initiative for Future Agriculture and Food Systems Competitive Grant Program funded a collaborative project between **Tom Porter** of the University of Maryland and **Larry Cogburn** of the University of Delaware. The project, "A Consortium for Functional Mapping of Growth-Regulating Genes in Broiler Chickens," was awarded **$1,800,000** in total funding, $250,000 of this to Dr. Porter. The goal of the project is to use DNA microarrays to analyze global gene expression in

See Announcements on page 12

Announcements from page 11

the liver, fat, muscle and endocrine system of broiler chickens divergently selected for growth rate (fast- vs. slow-growing) or body composition (fatness vs. leanness).

- Behavioral and morphological traits associated with fertility in broiler breeders. Funded by USDA/NRI with $245,000. Principal Investigator: **Inma Estevez.** The goal of this project is to determine fundamental behavioral and morphological causes of reduced fertility in broiler breeders selected for high yield. Specific objectives of the study include: 1) quantify the impact of social dominance on male fertility, 2) determine the impact of male social status on semen quality and functionality, and 3) investigate the use of morphometric and behavioral traits as reliable indicators of high male fertility that can be incorporated into genetic selection protocols to improve flock fertility.

Poultry Faculty Awarded

This year's recipient of the Junior Faculty Award of the College of Agriculture and Natural Resources of the University of Maryland is Inma Estevez, Poultry Ethologist at the Department of Animal and Avian Sciences. This award recognizes excellent faculty members with exceptional accomplishments in teaching/advising, research, and/or Extension education.

Guided Tours at the Applied Poultry Research Facility

Interested in visiting our experimental facilities? Contact Inma Estevez (301-405-5779) or Roselina Angel (301-405-8494) to arrange a tour. We will also give you an overview of the Department of Animal and Avian Sciences' ongoing poultry projects.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Thomas A. Fretz, Director of Maryland Cooperative Extension, University of Maryland.

MARYLAND COOPERATIVE EXTENSION
U.S. Department of Agriculture
University of Maryland, College Park
College Park, Maryland 20742