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INSIDE

Managing Today's Broiler Breeder Female

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Introduction

Managing the modern broiler breeder female so that she will produce a large number of high quality hatching eggs is a delicate combination of both art and science. Over the past few decades, broiler breeders have undergone intensive selection for faster growth rate, increased yield and improved feed conversion. Although these traits are measured at the **broiler level**, they impact the breeder hen in ways we often do not consider. The objective with broiler breeders is to have them consume an "ideal" amount of nutrients within a given time period to produce a bird whose weight, body condition and frame allow the reproductive organs to mature and function at their best. How do we combine art and science to manage the sexual maturation of today's broiler breeder female?

Photostimulation

One of the most critical time periods in broiler breeder hen management is the time from photostimulation (lighting) to peak production (Robinson, 1995). This period is characterized by relatively fast weight gains, in addition to changes brought about by the development of a functioning, hormone-producing ovary. Lighting the breeder pullet flock is generally considered the cue to initiate puberty, although the response to lighting can be modified by the feeding program.

At photostimulation, light energy passes through the skull of the breeder pullet into the brain and "illuminates" the hypothalamus. The hypothalamus in the brain is much like the main circuit breaker in a house; it controls a variety of body processes including reproduction. The brain acts in concert with the liver, skeletal system, ovary and oviduct to make up the reproductive system in the breeder hen. After the hypothalamus receives a photostimulatory signal (long day length above a certain threshold of intensity), the hypothalamus secretes specific hormones that travel to the anterior pituitary portion of the brain (Robinson, 1999). The anterior pituitary produces hormones known as Luteinizing hormone and Follicle Stimulating hormone that travel to specific tissues in the ovary to stimulate ovarian function.

One of the first responses seen when looking at the ovary of the pullet after lighting, is that the tiny ovarian follicles begin to increase in size. These small follicles produce large quantities of estrogens. Estrogen causes most of the reproductive transformation associated with puberty. Firstly, estrogen increases the production of yolk precursors in the liver of the bird. Visibly, the liver can be seen to enlarge and become paler as it increases in fat content for production of egg yolk lipids. Secondly, the oviduct increases in size, as it must be ready to receive ovulated follicles by the time the ovary has mature follicles ready to ovulate. Thirdly, estrogen results in changes to bone composition, so that calcium can be mobilized daily to facilitate egg shell formation. Finally, estrogen, together with male sex hormones, results in changes to plumage, comb size and sexual receptivity to males (Robinson, 1995).

Traditionally, flocks receive photo stimulation when they are 20-22 weeks of age resulting in onset of egg production at approximately 24-25 weeks of age. This program tends

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to maximize egg numbers, but may result in eggs that are smaller than standard early in the laying cycle. It also often results in egg production before hens are capable of producing a quality germ cell. Lighting birds later than 20-22 weeks allows females to become larger and more mature at the onset of production. Unfortunately, lighting birds later will likely also delay egg production until 25-26 weeks. However, this may or may not affect the total number of hatching eggs produced.

Ovulatory Cycle

Yolk is deposited into follicles as they proceed through the hierarchy to become mature. Two requirements must be met for the follicle to ovulate. First, the follicle must send a hormonal signal to the hypothalamus through the release of progesterone that signals that it is mature. Second, the hypothalamus must receive the signal from the mature follicle during a 6 to 8 hour period of the day in which the hypothalamus is responsive to the progesterone signal (Robinson, 1999). Follicular maturation typically takes longer than 24 hours, which means, consequently, that the ovulatory cycle is set back slightly each day as eggs are laid progressively later in each day similar to the sequence shown in Table 1. Hens that have slow rates of follicular maturation (26-28 hours or more) lay short (2-3 day) sequences. On the other hand, hens that lay very long sequences typically have maturation rates of 24 hours, or perhaps less. Sequence length changes throughout the egg production year with the longest sequences seen at the time of peak production at about 30-35 weeks of age. All hens lay one characteristically long sequence of eggs known as the “prime sequence” which in broiler breeders is usually about 20 eggs in length (Robinson, 1999).

Feed Requirements

While feeding programs differ across the country due to differences in integrators, complexes, weather conditions, seasons and genetic strains of birds, it is important to be continually adjusting the feeding program to provide the nutrients needed for optimum performance. Breeders require these nutrients for body maintenance, growth and egg production.

Body maintenance requirements, which include maintaining body temperature and systems within the bird that allow for digestion, respiration, excretion and immune response, range from 50 to 75% of a hen’s daily needs. As with most animals, body maintenance needs have priority, since the breeder hen must maintain her own body to survive. While the growth needs of hens during the post-peak production period do not contribute greatly to the hen’s daily nutrient requirements, pre-peak growth can be substantial. Nutrient needs for reproduction are a function of the number and size of eggs produced. In general, egg production exerts more influence on nutrient requirements than does egg size. This is part of the reason a service technician always has his/her calculator in hand and adjusts the feed allocation on each visit to the farm. This is an attempt to maximize egg numbers and keep hen body weight on target, since overwieght hens produce fewer eggs than trimmer hens.

Flock Uniformity

Flock uniformity is critical to proper feed allotments. If there is a great deal of variability in body weight, and all birds have equal opportunity to eat, the small birds will over-consume and larger birds will under-consume in relation to their nutrient requirements (Robinson, 1999). Uniformity issues are most critical at the time of photo stimulation and will usually result in poor peak performance as well as significant problems in post peak periods. In non-uniform flocks, birds receive the same feed al-

Table 1. Times of oviposition for individual hens laying 2- to 7-egg sequences[1].

Sequence Length	Time of Oviposition						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
2 eggs	09:28 AM	01:30 PM					
3 eggs	08:08 AM	11:26 AM	02:40 PM				
4 eggs	08:20 AM	09:45 AM	01:45 PM	03:37 PM			
5 eggs	07:56 AM	09:03 AM	10:45 AM	01:11 PM	03:05 PM		
6 eggs	07:20 AM	07:59 AM	09:04 AM	10:11 AM	12:56 PM	03:40 PM	
7 eggs	07:47 AM	08:15 AM	09:20 AM	09:40 AM	11:36 AM	01:09 PM	03:24 PM

[1] Adapted from Robinson, 1999.

lotment, but feeds are formulated for birds in lay. Since birds in lay have higher nutrient requirements than non-laying birds, non-laying birds will over consume relative to their requirements and get fat, which will hinder future performance. Clearly, uniformity is necessary to obtain peak performance in breeder females.

Summary

Properly managing the sexual maturation of the modern broiler breeder female is critical to obtaining a high peak and large overall number of quality hatching eggs. The most critical management period for broiler breeders is from photo stimulation (lighting) to peak production. Management deficiencies during this period are always costly and often cannot be compensated for at a later date. Broiler breeders require nutrients for maintenance, growth and egg production. Maintenance needs are met first and until that happens, growth and egg production are reduced. Adjusting the feed allotment throughout the lay cycle controls bird nutrient intake. Intake must be strictly controlled to prevent hens from becoming overweight resulting in decreased egg production. Flocks must be uniform in weight and body condition in order to properly allocate feed allotments. Uniformity is especially critical at the time of lighting. Flocks that vary excessively in uniformity are nearly impossible to properly manage from a feed allotment standpoint. This will have a negative impact on performance and may lead to a low, flat peak and decreased overall production. Remember that the key to managing the modern broiler breeder female is a combination of 1) correct body weight and uniformity, 2) light stimulation, and 3) feed stimulation. A sound, consistent management program must be in place that will address each of these areas in order to be successful.

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Litter Amendments as a Tool for Optimizing Poultry House Clean Out[1]

Introduction

Cleaning and disinfecting poultry houses can be a crucial step in providing a healthy environment for a profitable poultry business particularly when disease issues are present or unexplainable poor performance consistently occurs in flocks. However, research has shown that many times when we clean out the litter in a poultry barn and then wash and disinfect the barn, the number of bacteria or microbes living on the floor of that barn might still be very high, particularly if the floor is still damp or wet when new bedding is added. The reasons for this include the high level of organic matter or litter that is still present, the soil or dirt floor and the fact that poultry houses just aren't designed for thorough cleaning and disinfecting. Most of the disinfectants with the exception of formaldehyde have little effectiveness in the presence of dirt, manure and debris. While not all microbes that are classified as bacteria, yeast, molds or viruses cause disease, it can be difficult and expensive to isolate the ones that are a threat. Therefore, the goal of any good sanitation program should be to reduce the numbers as drastically as possible of all microbes present in the poultry house, particularly in the two key areas that can have a huge impact on bird health — the floor and the drinking water. By paying close at-

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tention to how these areas are cleaned and sanitized, producers have the greatest chance of breaking disease cycles.

Pad Treatment Evaluation

One method that is becoming popular for minimizing disease-causing organisms is treating the floor or pad with an acidifying litter amendment. Litter amendments such as AlClear®, Poultry Guard® or PLT® contain sulfuric acid or a substance that will convert to sulfuric acid if moisture is present. By dropping the pH of the floor to below 4, it creates a hostile environment where very few microorganisms can survive. Work done by Hardin and Roney at the Alabama Diagnostic Laboratory showed that by dropping the pH to 4 or below, such troublesome bacteria as *E. coli*, *Clostridium* and *Salmonella* can be reduced to undetectable levels. Therefore acidifying the pad is like a shock treatment that can be almost equivalent to returning the pad or floor to the bacterial status of a new poultry barn.

Many producers have asked which of the acidifying litter treatments are most effective as pad treatments. To answer this question an experiment was conducted in a turkey brood house that had been washed and disinfected after the litter was removed. Each treatment was assigned to four 30-square-foot plots. The treatments were PLT[2], Poultry Litter Treatment, at rate of 100 pounds/1000 square feet; Poultry Guard[3] at a rate of 100 pounds/1000 square feet; and the high acid liquid aluminum sulfate, AL+Clear A7[4], at a rate of 25 gallons/1000 square feet. Four plots were left untreated. The untreated plots served as a baseline for what happens on a clean disinfected floor when no treatments are applied. Prior to application of products, soil samples were taken to determine the initial pH and moisture level of the soil, and the plots were then swabbed to determine the amount of aerobic (oxygen loving) bacteria as well as yeast and mold counts. Yeast and mold were measured because they are acid tolerant and this usually makes them especially hardy. After application of the products, the plots were re-swabbed at two, 24 and 48 hours. At the 48-hour sampling time, shallow soil samples were again taken so that a final soil pH and moisture level could be correlated to the effectiveness of the treatments.

Table 1 shows that before any treatment was used, the aerobic bacteria counts that were picked up on the sterile sponges ranged from six to 10 million colony forming units of bacteria. While the exact type of bacteria found in this test is not known, millions of bacteria still living on the floor of the barn 24 hours after the house has been washed and disinfected is an indicator that the sanitation program could be better. After the litter amendments were applied to their plots, the counts dramatically dropped to less than 200 colony forming units of bacteria for each of the treatment groups and remained below this level 48 hours after treatment. The untreated plots had aerobic bacteria levels starting at six million and the counts continued to increase to 28 million colony-forming units at the 48-hour sampling time.

The results for yeast and mold were very similar with all treatments effectively reducing the levels as compared to the untreated plots (Table 2 and 3). Before treatments, yeast and mold levels were around 15,000 to 21,000 colony forming units per sponge, and post treatment, all litter amendments dropped the counts to below 100, while the counts for the untreated plots continued to remain in the thousands. Looking at the pH and moisture levels pre and post treatments gives us good clues as to why the litter treatments might be an effective tool in dropping the microbial counts (Table 4). The pH level of the untreated floor was in the range of 7 or slightly above. Results from the Hardin and Roney test show that this pH level is very favorable for many things to grow and thrive. When the litter amendments were top dressed on the surface, the soil pH dropped to 3 or below. Again this harsh pH range favors little microbial growth. The information about the soil moisture may be the key clue as to why the untreated plots continued to have high levels of microbial growth. Most microbes need moisture in order to thrive and grow. With the thorough wash-down, there were at least 500 or more gallons of water added to the poultry house. The floor even three days after the wash-down still had 21 to 26% moisture. Had we continued to test the moisture level of the soil for several more days it may have dried out with the result of less microbial activity present. Certainly the drier the environment, the less likely that things like *E. coli* or *Salmonella* will be able to survive.

Summary and Conclusions

These results indicate that litter treatments that acidify the pad or floor to a pH level of 3 or less can be used to reduce microbial levels. While the microbial levels of aerobic bacteria, mold and yeast that were measured in this trial do not tell us whether the microbes are harmful or not, it is still the goal of sanitation programs to clean the house as thoroughly as possible. Good sanitation procedures are the key to breaking disease cycles. Unfortunately poultry houses aren't very cleanout friendly, and sometimes when disease issues become a dominating factor in a poultry operation, it may be time to take drastic measures to assure that all disease-causing organisms are reduced as much as possible and to do so in a manner that will help enhance bird health and growth.

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Hardin, Boyd E., and C.S. Roney, Effects of pH on selected poultry bacterial pathogens, Alabama Dept. of Agriculture and Industries, State Diagnostic Lab, Boaz, AL. ◆

[1]The use of trade names in this publications does not imply endorsement by the Cooperative Extension Service, the Center of Excellence for Poultry Science or the University of Arkansas of the products mentioned, nor criticism of similar products not mentioned.

[2]PLT, Manufactured by Jones-Hamilton Company

[3]Poultry Guard, Manufactured by Oil Dri

[4]AL+Clear A7, Manufactured by General Chemical

Table 1. Bacterial counts on the floor of a turkey brood house before and after treatment with three litter amendments

	Pre Treatment[1]	2 Hours Post Treatment	24 Hours Post Treatment	48 Hours Post Treatment
	APC Colony Forming Units/sample			
Control	8,525,000a	6,825,000a	22,300,000a	28,250,000a
AL Clear A7	7,917,500a	164b	192b	108b
PLT	6,732,500a	66b	91b	22b
Poultry Guard	10,202,500a	6b	14b	4b

1. Numbers with different letters were statistically different at the P=.0001 level.

Table 2. Mold counts on the floor of a turkey brood house before and after treatment with three litter amendments

	Pre Treatment[1]	2 Hours Post Treatment	24 Hours Post Treatment	48 Hours Post Treatment
	Mold Colony Forming Units/sample			
Control	21,000a	21,750a	13,750a	30,425a
AL Clear A7	26,500a	131b	9.5b	54b
PLT	21,750a	6.75b	11.25b	9.00b
Poultry Guard	15,350a	7.25b	8.25b	4.75b

1. Numbers with different letters were statistically different at the P=.0001 level.

Good sanitation procedures are the key to breaking disease cycles.

Table 3. Yeast counts on the floor of a turkey brood house before and after treatment with three litter amendments

	Pre Treatment[1]	2 Hours Post Treatment	24 Hours Post Treatment	48 Hours Post Treatment
	Yeast Colony Forming Units/sample			
Control	11750a	20850a	8250a	3750a
AL Clear A7	6700a	27b	1b	10b
PLT	6950a	4b	4b	3b
Poultry Guard	3150a	8b	4b	3b

1. Numbers with different letters were statistically different at the P=.0001 level.

Table 4. The pH and moisture content of the floor of a turkey brood house before and after treatment with litter amendments

	Pre Treatment	48 Hours Post[1] Treatment	Pre Treatment	48 Hours Post Treatment
	pH of soil sample		Moisture % in soil sample	
Control	7.49	7.27a	23.85	20.28
AL Clear A7	7.28	3.05b	21.23	26.20
PLT	7.17	2.61b	20.13	21.58
Poultry Guard	7.10	2.46b	19.80	25.23
SEM	.46	.20	4.61	4.97
P Value	.9388	.0001	.9218	.8064

1. Numbers in each column with different letters were statistically different at the P value given.

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Are Hummingbirds a Biosecurity Threat?

Introduction

Hummingbirds are truly amazing creatures. The ruby-throated hummingbird, which is most common in Arkansas, weighs about 1/10th of an ounce (3 grams), has a wing beat of 40 to 80 times per second and a heart rate of an amazing 1,200 beats per minute (20 per second) when feeding. Their normal flight speed is about 30 mph, but during escape attempts they can fly at speeds of 50 mph. Hummingbirds are thought to have 8x binocular vision, so that they can see a feeder from about 3/4 of a mile (Anonymous, 2003a). The diet of hummingbirds is primarily nectar, but they will consume small insects and spiders. Hummers will eat about twice their body weight each day and require about 7,000 calories each day, which is over three times the amount required by humans (Harris and Nauman, 2000).

The ruby-throated hummingbird is a migratory bird that spends spring and summer in the United States and Canada, while spending fall and winter in Central America and Mexico. Hummingbirds migrate across the Gulf of Mexico twice a year (spring and fall), with each trip taking 18 to 24 hours. They arrive on the U. S. Gulf coast in late February or early March and are believed to advance northward at a rate of about 18 miles per day (Anonymous, 2003a). Hummingbirds mate and raise young in the U.S., but tend not to gather in large groups except during migration and are not especially social. Hummingbirds mass along the Gulf coast to store up to half their body weight in fat for the 18-to-24-hour non-stop flight back to Mexico and Central America. (Harris and Nauman, 2000). The bulk of the hummingbird population returns southward in early to mid November, but the grueling migration process takes a heavy toll on the hummingbird population, particularly on very young and very old birds. There are always fewer birds in the spring migration than there are in the fall migration (Anonymous, 2003a).

While hummingbirds are certainly fascinating to watch and discussions of their habits and characteristics are interesting, what do hummingbirds have to do with biosecurity? Can hummingbirds transmit disease? Is it a biosecurity risk to feed hummingbirds? While these are all valid questions, there are few clear-cut answers. Whether or not hummingbirds are a biosecurity risk is a judgment call. Thus, the remainder of this article will be aimed at presenting both sides of the issue so that the reader can decide for him/herself on this issue.

Reasons Hummingbirds MAY be a Biosecurity Threat

Hummingbirds ARE birds and as such are likely to be susceptible to or carry any number of diseases, including Avian Influenza (AI) and Exotic Newcastle Disease (END). Hummingbirds spend the winter months in Central America and Mexico, where foreign diseases (including END) are often found. Because of their speed, quickness and small size, humans rarely touch hummingbirds, but their excreta is deposited on the ground and would tend to be concentrated around feeders since their tremendous metabolic rate requires constant feeding. Although the diet of hummingbirds consists mainly of nectar, they do consume insects, and insects are known to carry a wide variety of diseases. While few hummingbirds have been tested for disease transmission, and objective laboratory results are difficult to find, West Nile Virus has been isolated from ruby-throated hummingbirds (Anonymous, 2003b).

Reasons Hummingbirds MAY NOT be a Biosecurity Threat

Neither the National Veterinary Services Laboratory in Ames, Iowa, nor the California Veterinary Diagnostic Laboratory (CVDL) in San Bernardino, Calif., have isolated Avian Influenza (AI) or Exotic Newcastle Disease (END) from hummingbirds. In addition, officials in neither laboratory recall reading literature reports of AI or END isolations from hummingbirds. In view of the fact that CVDL is presently dealing with an END outbreak, it would appear that if hummingbirds were a serious threat it would have been reported. Hummingbirds arrive in the spring and early summer when heat and sunlight tend to reduce virus numbers in the environment, so the chances of infection are reduced. Furthermore, since the diet of hummingbirds is primarily nectar, they tend to frequent flowers and would have little contact with other birds. While hummingbirds battle around feeders, they tend not to congregate in large flocks so the chances of bird-to-bird disease transmission are reduced. Also, the extremely rapid metabolic rate of hummingbirds and their intense need for frequent food sources might reduce tolerance for illness. Sick hummingbirds would be likely to be quickly incapacitated and die, so that poultry and other birds are less likely to be exposed of sick carrier hummingbirds. In fact, there is, at this moment, no direct evidence linking hummingbirds to exposure of poultry to END or AI.

Whether or not hummingbirds are a biosecurity risk is a judgment call.

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Coming Events

- **Breeder Roundtable**, June 23, 2003, University of Arkansas, Fayetteville, Ark., Dr. Keith Bramwell (479) 575-7036
- **Poultry Science Association Annual Meeting**, Madison, Wis., July 6-9, 2003, Poultry Science Association (217) 356-3182
- **Annual Poultry Science Youth Conference**, July 15-18, 2003, Fayetteville, Ark., Gary Davis (479) 575-7526
- **Hatchery Breeder Clinic**, July 15-16, 2003, Marriott Marquis Hotel, Atlanta, Ga., U.S. Poultry and Egg Association (770) 493-9401

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Feed Intake Critical to Growth Rate of Turkeys

Introduction

Arkansas is ranked third in turkey production nationally, outpaced only by Minnesota and North Carolina. Each year the primary turkey breeders supply the industry with birds that are genetically capable of faster growth rates and improved feed efficiencies. It is up to the integrators and growers to do the rest.

Starting Early

Given proper conditions, the turkey grows at a remarkably fast pace. It will have multiplied its hatching weight by more than 20 times by 28 days of age. By 20 weeks of age, males will have multiplied their original poult weight by almost 300 times (Nixey, 1989). To achieve this feat in a normal manner requires considerable demands on nutrient intake.

Nutritional demand is high when poults arrive at the farm, so it is critical to maximize feed intake from day one.

Nutritional demand is high when poults arrive at the farm, so it is critical to maximize feed intake from day one. In fact, recent reports indicate poults that experience poor early growth never fully regain the weight they have lost by market age (Mitchell, 2002).

Management and Environment

Turkeys require your managerial skills to provide them with an environment that will allow them to utilize feed to their full potential. Possibly the most critical time for your management skills to be at their sharpest is during the first six weeks of the young poult's life. If poults receive a poor start during this period, it doesn't matter how good your management program is later on; you simply will not be able to re-capture what has been lost in terms of growth and performance. Feed intake and utilization is more critical during the first six weeks of life than at any other period in the growout.

Excellent management and high-quality feed must work in combination to reach expected performance levels. In most cases, you have high-quality birds in your houses and high-quality feed in your bins. When that is the case, your management skills will be the determining factor to how well the flock performs. The importance of the brooding period, especially the first two weeks, cannot be overemphasized. Temperature (both air and floor), litter conditions, ventilation, humidity, dust, ammonia, CO_2 and other air quality parameters should be at recommended levels at all times. Proper assistance with feeders and drinkers must be provided to newly arrived poults. Proper assistance means being there when needed but also leaving them alone when they need to rest. Follow integrator guidelines but be aware that you cannot manage your farm simply "by the book." It doesn't matter how good "the book" actually is, sooner or later you will be faced with situations that aren't in the book. For those situations, on-the-job training will have to get you through. No one knows your farm better than you, so take advantage of that fact. You know how your houses react to changing weather conditions and how your birds respond to different conditions. Changing conditions should prompt you to take action in a timely manner and in response to what your turkeys are telling you. By doing so you will more likely keep a steady, consistent environment which is more beneficial to the turkeys than wide swings in temperature and air quality variables which put stress on the respiratory and immune systems.

Summary

Primary turkey breeders supply the commercial turkey industry with birds that, each year, are genetically capable of improved feed efficiencies and faster growth than the year before. Excellent on-farm management is required throughout the life of the flock, if optimum feed intake is to be achieved allowing birds to perform to their genetic potential.

Managerial skills of individual turkey growers play a key role in keeping feed intake high from day one. The importance of the first two weeks of the brooding period must not be taken lightly. This period sets the stage for performance throughout the entire flock. Poults must receive a good start if we expect them to meet expectations at harvest time. Pay close attention to air and floor temperature, litter conditions, ventilation rates and air quality parameters at all times. Make adjustments as needed and in a timely manner to prevent little problems from becoming worse. By staying on top of things, it will be easier to maintain a quality, consistent environment at all times. A quality environment will reduce bird stress and help maintain high feed intake necessary for optimum performance.

Managerial skills of individual turkey growers play a key role in keeping feed intake high from day one.

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Effect of Summer Heat Stress on Poultry Breeding Stock

Introduction

As the hot summer months approach producers' attention is turned to management methods designed to maintain productivity during elevated ambient temperatures. For broiler and turkey meat producers, getting the birds to continue eating and efficiently converting their feed source to weight gain is the overall objective. The effects of heat stress have been well documented in relation to feed consumption, weight gain and house efficiency in broilers. In extreme heat situations, keeping birds alive becomes the most critical element, especially in older meat-type birds.

For producers of broiler breeders, the volume of feed the birds consume is restricted, so even during elevated temperatures the birds will often still consume the feed provided to them. This is especially true for broiler breeder males that will generally eat all the feed provided them in less than an hour during both summer and winter months. During this time of the year, however, the birds' energy needs are reduced, and therefore, they do not require as much feed for maintenance as they do during the winter months. The problem with breeders is maintaining egg production, fertility, hatchability and ultimately the number of quality chicks produced. We, as an industry, have come a long way in the utilization of quality equipment in the breeder houses and therefore in reducing in house temperature spikes. Twenty years ago it was estimated that there was an average 15% drop in fertility in broiler breeders during the summer months. Due to improvements in housing, the reductions in fertility due to heat stress may not be so dramatic today. Nevertheless, the industry generally sees the lowest fertility and hatchability during the hot summer months.

Why does this occur?

There is undoubtedly a connection with elevated temperatures and reduced mating frequency, which naturally reduces fertility. However, there is also evidence that elevated temperatures reduce sperm production and overall semen quality. To determine the role that the male and female broiler breeder plays in the reduction in hatchability during heat stress conditions, a study was conducted to measure various reproductive parameters. Broiler breeders males and females were separately exposed to one of three temperatures (70º F, 85º F, or 90º F) during an eight-week test period and artificially inseminated weekly. Although various semen characteristics were not affected by heat stress in this study, the ability of the sperm cells from heat-stressed males to gain access to the site of fertilization was reduced in heat-stressed groups. Additionally, the duration of the ability of sperm cells to fertilize eggs was also reduced in both the 85º F and 90º F heat stressed groups of males. However, the effect of heat stress on fertility was less significant when only the hens were exposed to the elevated temperatures. When comparing hatchability of fertile eggs from both heat-stressed males and females, there was reduced actual hatchability, although this was not significantly different.

In summarizing this work, it is apparent that elevated temperatures affect the males ability to produce fertilized eggs using artificial insemination as a means to produce fertile eggs. This means that the physiology of the male reproductive system is hindered and the production of viable semen is reduced. Interestingly, when these males were subjected to 85º F or 90º F for as little as 12 hours, fertility was reduced for the next four to five weeks. Breeder house temperatures in the 85 to 90 degree range for periods of time during the summer are common in many breeder houses, especially those that have not been updated with modern evaporative cooling systems. Therefore, it is easy to see why hatchability is often at its lowest during the summer months.

The problem with breeders is maintaining egg production, fertility, hatchability and ultimately the number of quality chicks produced.

Preventing heat stress in breeders

Here are a few of many items that should be considered that may help reduce the incidence of heat stressing breeders.

- Air velocity is most important in keeping birds cool in the summer. Any adjustments made to thermostat settings should be made with the idea of maintaining temperature while not sacrificing wind speed.
- Turn fan thermostats down low enough during the daytime hours to ensure that they will run long enough into the evening to give birds a chance to cool off. During extreme heat, run all fans throughout the night to allow birds to cool off completely.
- Run a lower static pressure during hot weather to get the maximum volume of air movement from exhaust fans.
- Remove shutters from any fan that runs continuously. This will increase airflow through the fan by as much as 30 percent.
- Make sure fan belts are tight and new. A loose belt can reduce fan efficiency by 30 percent or more. Even tight belts that are worn and old pulleys can reduce fan efficiency by 20 percent.
- Make sure roof or sidewall ventilation openings are clean and unobstructed.
- Inspect emergency generators, automatic curtain (or sidewall) drops and alarm systems to ensure they are functioning properly. Failure of this equipment to function properly will most likely result in catastrophic losses.
- Water is critical during hot weather. Inspect the watering system frequently to ensure water flow is consistent and unrestricted.
- Water in a closed watering system will quickly approach the temperature of the air around the pipe. Water consumption will decrease when the temperature of the water rises above 85 degrees. Flush the closed watering system two to three times each day during the hottest part of the day to remove warm water from the system. However, the birds will generally demand enough water to keep fresh water in the pipes.

References

McDaniel, C.D., R.K. Bramwell, J.L. Wilson, and B. Howarth Jr., 1995. Fertility of Male and Female Broiler Breeders Following Exposure to Elevated Ambient Temperatures, Poultry Sci. 74:1029-1038. ◆

G. Tom Tabler • Applied Broiler Research Unit (Savoy) Manager
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Applied Broiler Research Unit Performance Report

Unit Description

The first flock at the Savoy Broiler Unit was placed on November 19, 1990. The unit contains four 40 x 400 foot broiler houses. Each house contains Cumberland pan feeders, Ziggity nipple waterers and about 1.5 million BTU propane heating capacity for brooding. Each house is equipped with a computer controller which controls fans, brooders and curtains for temperature control. Houses are also equipped with temperature monitoring equipment (about 80 sensors per house), an electronic water flow monitoring system, weigh bins for feed delivery to the house, sensors for the monitoring of fan run time and devices to determine gas flow from storage tanks.

Houses 1 and 2 were built with steel trusses with R10 insulation in the ceiling while houses 3 and 4 were constructed with wood trusses, R19 ceiling insulation and drop ceilings. Houses 1 and 3 are conventionally ventilated with misters for summer cooling, but 2 and 4 are tunnel ventilated. House 2 contains a "sprinkler" cooling system for summer cooling. The system was developed at the University of Arkansas and utilizes a landscape sprinkler system to deliver a coarse, cooling mist to the backs of the birds. House 4 utilizes evaporative cooling pads to cool the inlet air.

Information Key

Variable	Units	Explanation
HSE	No.	House number
FEED CONV	LB/LB	Feed conversion or pounds of feed per pound of gain
HEAD PLACED	No.	Number of chicks placed in the house at the beginning of grow-out
HEAD SOLD	No.	Number of birds sent to the processing plant
LIV	%	Livability or Head sold/Head placed * 100
AGE	D	Age of birds at processing in days
AVE BIRD WT	LBS	Average live bird weight at processing
COND	%	Percentage of birds condemned by the government inspector at the plant. Condemned birds are not fit for human consumption.
FEED COST	$	Feed costs in dollars
CHICK COST	$	Chick costs in dollars
MED COST	$	Medication costs in dollars
TOTAL COST	$	Total costs in dollars
COST/LB	Cent	Total costs per pound of live bird weight in cents per pound
PAY/LB	Cent	Payment received from the poultry company in cents per pound
F.A.	$	Fuel allowance — a payment provided by the poultry company to help defray heating fuel costs
GAS USAGE	GAL	Propane usage in gallons
ELECT	KWH	Electrical usage in kilowatt hours

PRODUCTION SUMMARY: FLOCK 67 (June 4 – July 19, 2002)

HSE	FEED CONV	HEAD PLACED	HEAD SOLD	LIV	AGE	AVE BIRD WT	COND[2]	FEED COST	CHICK COST	MED COST	TOTAL COST	COST/LB	PAY/LB	F.A.[1]	GAS USAGE	ELECT USAGE
(No)	(LB/LB)	(No)	(No)	(%)	(D)	(LB)	(%).	($)	($)	($)	($)	(Cent)	(Cent)	($)	(GAL)	(KWH)
#1	2.03	24264	23083	95.13	45	4.21	0.65	9888	4124.88	41.82	14055	14.549	3.9376	0.00	178	4736
#2	1.93	24238	23600	97.37	45	4.64	0.65	10566	4120.46	41.82	14729	13.547	4.9391	0.00	213	5846
#3	2.02	23868	22834	95.67	45	4.51	0.65	10383	4057.56	41.82	14483	14.170	4.3162	0.00	261	4492
#4	2.04	24748	23983	96.91	45	4.39	0.65	10745	4207.16	41.82	14994	14.341	4.1457	0.00	627	563
FARM	2.01	97118	93500	96.27	45.00	4.44	0.65	41583	16510.06	167.28	58260	14..138	4.3485	0.00	1378	20709

[1] F.A. — Fuel Allowance

[2] Condemnation percentage was not kept separate by the plant.

Comments on Flock 67

Bird placement was 24,000 head per house for a stocking density of 0.67 sq.ft.per bird. Condemnation percentage was 0.65%. Mortality at harvest was: House 1 – 1,181; House 2 – 638; House 3 – 1,055; and House 4 – 765. Ranking was 5th out of 23 growers. This was a summer flock (selling July 19) and again House 2 with Dr. Ivan Berry's unique sprinkler cooling system outperformed all other houses by a wide margin. Feed conversion rankings were; House 2 – 1.93; House 3 – 2.02; House 1 – 2.03; and House 4 – 2.04. Bird weight by house were: House 2 - 4.64 lbs.; House 3 - 4.51 lbs.; House 4 – 4.39 lbs.; and House 1 – 4.21 lbs. As is often the case since adding the unorthodox cooling system in House 2, it managed to produce the heaviest bird and, at the same time, had the lowest (best) feed conversion. Down time was 17 days. Caked litter removal was: House 1 – 2 loads; House 2 – 5 loads; House 3 – 6 loads; and House 4 – 4 loads. A lightening storm damaged the circuit board on House 4's controller and a load cell on House 2's weigh bin that had to be replaced. Also, most likely damaged at the same time, but unknown to us at the time, was the phone dialer and alarm system for the entire farm. This fact will come back to haunt us on the next flock with disastrous consequences.

PRODUCTION SUMMARY: Flock 68 (August 5 – September 18, 2002)

HSE	FEED CONV	HEAD PLACED	HEAD SOLD	LIV	AGE	AVE BIRD WT	COND[2]	FEED COST	CHICK COST	MED. COST	TOTAL COST	COST/LB	PAY/LB	F.A.[1]	GAS USAGE	ELECT USAGE
(No)	(LB/LB)	(No)	(No)	(%)	(D)	(LBS)	(%).	($)	($)	($)	($)	(Cent)	(Cent)	($)	(GAL)	(KWH)
#1	1.85	22696	21748	95.82	44	4.64	0.66	9349	3858.32	22.50	13230	13.195	4.8459	0.00	184	4162
#2[3]	2.09	22708	21672	95.44	44	4.24	0.66	9575	3860.36	22.50	13458	14.753	3.2880	0.00	81	4766
#3	1.92	23448	22582	96.31	44	4.46	0.66	9652	3986.16	22.50	13661	13.668	4.3728	0.00	88	4385
#4[4]	4.37	23303	9203	39.49	44	4.87	0.66	9786	3916.51	22.50	13770	30.920	-12.8798	0.00	146	4779
FARM	2.27	92155	75205	81.61	44.00	4.50	0.66	38362	15666.35	90.00	54118	16.108	2.800	0.00	499	18092

[1] F.A. — Fuel Allowance

[2] Condemnation percentage could not be divided by house.

[3] ~14,000 chickens in House 4 and 500 in House 2 were lost to a power failure at 1:00 a.m. on September 17.

[4] Columns do not sum to farm total. Because of lost birds in houses 2 and 4, the farm was paid guaranteed minimum of 2.8 cents per lb in each house.

Comments on Flock 68

Placement was 23,000 birds per house for a stocking density of 0.70 sq. ft. per bird. Condemnation percentage was 0.66%. Mortality at harvest was: House 1 – 948; House 2 – 1,036; House 3 – 866; and House 4 – 14,763. Needless to say, we were on the bottom of the list ranking 12th out of 12 growers. This was actually a better flock of birds than the previous flock up until 1:00 a.m. of the day they were coming to catch them. The catch was scheduled for 4:00 p.m., however, at 1:00 a.m. someone took out a power

PERFORMANCE REPORT — continued on page 14

pole about 1/2 mile from the farm. The power went off but the phone dialer and alarms did not. I woke up at 1:20 a.m. (I never sleep good when the birds are big and the weather hot) and realized the power was off, but by the time I got to House 4, it was too late for most of the birds. You can take it from me that 15-20 minutes is all the time it takes to smother chickens. House 2 and 4 (the two tunnel houses) were in tunnel (and had been for two weeks) when the power went off. The curtain drops did release in both houses and the curtains in House 2 dropped correctly; we lost only about 500 birds in that house. However, in House 4 the curtains only dropped about 2-3 inches on each side of the house, smothering approximately 14,000 birds before I could get the curtains down. According to the time clocks, the power went off at approximately 1:00 a.m. and I had the curtains down before 1:30 a.m., but that is how fast bad things can happen with big chickens and no power. We had never had a generator before and had lived dangerously for a number of years; however, after this disaster, we have a generator now.

PRODUCTION SUMMARY: Flock 69 (November 4 – December 16 (Hs 3 & 4) and December 17 (Hs 1 & 2)

HSE	FEED CONV	HEAD PLACED	HEAD SOLD	LIV	AGE	AVE BIRD WT	COND[2]	FEED COST	CHICK COST	MED. COST	TOTAL COST	COST/LB	PAY/LB	F.A.[1]	GAS USAGE	ELECT USAGE
(No)	(LB/LB)	(No)	(No)	(%)	(D)	(LBS)	(%).	($)	($)	($)	($)	(Cent)	(Cent)	($)	(GAL)	(KWH)
#1	1.88	20610	20096	97.51	43	4.65	0.57	8756	3503.70	37.50	12337	13.276	4.6292	416	1280	2817
#2	1.99	20585	19921	96.77	43	4.24	0.57	8419	3499.45	37.50	11956	14.227	3.6783	416	1313	2137
#3	1.83	21054	20448	97.12	42	4.69	0.57	8764	3579.18	37.50	12381	12.987	4.9180	416	1258	1811
#4	1.87	20949	20435	97.55	42	4.65	0.57	8911	3561.33	37.50	12510	13.227	4.6781	416	1036	1868
FARM	1.89	83198	80900	97.24	42.50	4.56	0.57	34889	14143.66	150.00	49183	13.406	4.4990	1664	4887	8633

[1] F.A. - Fuel Allowance
[2] Condemnation percentage could not be divided by house.

Comments on Flock 69

Placement was 21,000 birds per house for a stocking density of 0.76 sq. ft. per bird. Condemnation percentage was 0.57%. Mortality at harvest was: House 1 – 514; House 2 – 558; House 3 – 664; and House 4 – 606. Ranking was 4th out of 27 growers. Houses 3 and 4 were much better chickens than Houses 1 and 2 this time causing a split catch, with 3 and 4 being caught one day earlier than 1 and 2. Caked litter removal was as follows: House – 3 loads; House – 6 loads; House 3 – 5 loads; and House 4 – 3 loads. A new 130kw generator and automatic transfer switch was purchased and installed during this flock. The final connections were made after the flock was sold since electrical power had to be killed at the pole for several hours to finish installation. Thanks to the men and women of Ozarks Electric Cooperative for all their assistance in turning power off and on at the farm for us when needed.

PRODUCTION SUMMARY: Flock 70 (January 3- February 14, 2003)

HSE	FEED CONV	HEAD PLACED	HEAD SOLD	LIV	AGE	AVE BIRD WT	COND[2]	FEED COST	CHICK COST	MED. COST	TOTAL COST	COST/LB	PAY/LB	F.A.[1]	GAS USAGE	ELECT USAGE
(No)	(LB/LB)	(No)	(No)	(%)	(D)	(LBS)	(%).	($)	($)	($)	($)	(Cent)	(Cent)	($)	(GAL)	(KWH)
#1	1.89	21879	20954	95.77	42	4.25	0.79	8417	3719.43	37.21	12173	13.790	3.5672	416	2040	2938
#2	1.97	21878	20657	94.42	42	3.81	0.79	7770	3719.26	37.21	11527	14.744	2.6129	416	2042	1905
#3	1.89	21797	20822	95.53	42	4.01	0.79	7877	3705.49	37.21	11620	14.034	3.3233	416	2246	1824
#4	1.87	21784	20779	95.39	42	4.32	0.79	8420	3703.28	37.21	12160	13.646	3.7107	416	2082	2005
FARM	1.90	87338	83212	95.28	42.00	4.10	0.79	32484	14847.46	148.84	47480	14.032	3.3248	1664	8410	8672

[1] F.A. — Fuel Allowance
[2] Condemnation percentage could not be divided by house.

Comments on Flock 70

Placement was approximately 22,000 birds per house for a stocking density of 0.73 sq. ft. per bird. Condemnation percentage was 0.79%. Mortality at harvest was: House 1 – 925; House 2 – 1,221; House 3 – 975; and House 4 – 1,005. After several flocks of good birds, the quality slipped somewhat on this flock. Both early and overall mortality were higher than on previous flocks. Size and uniformity were also problems throughout the flock. Ranking was a disappointing 15th out of 17 growers. Even though we had more birds this flock than last, this flock ate 48,110 lbs. less feed than the previous flock. That is a full trailer less feed, and it shows in the average weight and feed conversion columns. Weight is light and feed conversion high indicating what feed they did eat was not utilized. Caked litter removal after flock 70: House 1 – 5 loads; House 2 – 8 loads; House 3 – 6 loads; and House 4 – 5 loads.

PRODUCTION SUMMARY: Flock 71 (February 27-April 10, 2003)

HSE	FEED CONV	HEAD PLACED	HEAD SOLD	LIV	AGE	AVE BIRD WT	COND[2]	FEED COST	CHICK COST	MED. COST	TOTAL COST	COST/LB	PAY/LB	F.A.[1]	GAS USAGE	ELECT USAGE
(No)	(LB/LB)	(No)	(No)	(%)	(D)	(LBS)	(%).	($)	($)	($)	($)	(Cent)	(Cent)	($)	(GAL)	(KWH)
#1	2.03	20703	17808	86.02	42	3.63	0.48	6560	3519.51	37.50	10117	15.747	1.8487	0.00	1220	2757
#2	1.85	20698	19787	95.60	42	4.27	0.48	7807	3518.66	37.50	11363	13.509	4.0871	0.00	1041	1600
#3	1.78	21586	20736	96.06	42	4.49	0.48	8291	3669.62	37.50	11998	12.939	4.6565	0.00	1219	1627
#4	1.87	21379	19832	92.76	42	4.19	0.48	7755	3634.43	37.50	11427	13.813	3.7833	0.00	1188	1586
FARM	1.87	84366	78163	92.65	42.00	4.16	0.48	30414	14342.22	150.00	44906	13.868	3.7284	0.00	4668	7570

[1] F.A. — Fuel Allowance
[2] Condemnation percentage could not be divided by house.

Comments on Flock 71

Placement was approximately 21,000 birds per house for a stocking density of 0.76 sq. ft. per bird. Condemnation percentage was 0.48%. Mortality at harvest was: House 1 – 2,895; House 2 – 911; House 3 – 850; and House 4 – 1,547. Quality and uniformity were again serious problems throughout the flock. Birds were again very light weight at harvest and feed conversion was high. The flock as a whole ate 41,400 lbs. less than the previous flock. However, there were approximately 3,000 fewer chicks placed this flock vs. last flock. Ranking was again disappointing at 14th out of 19 growers. This flock was made worse by the fact that House 1 broke with gangrenous dermatitis at 4 1/2 weeks. We lost roughly 2,000 birds in that house in the last 10 days of the flock. All four houses were cleaned out after the flock sold, and the farm, as a whole, generated 100 spreader truckloads of litter. It had been roughly 18 months since our last cleanout. The breakdown by house for litter was as follows: House 1 – 29 loads; House 2 – 25 loads; House 3 – 22 loads; and House 4 – 24 loads. The floors in all 4 houses were treated (sprayed) with a combination of aluminum sulfate and sulfuric acid in hopes of preventing further outbreaks of dermatitis. We will keep you advised of our situation. ◆

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