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Mortality Patterns Associated with Commercial Broiler Production

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INSIDE

Introduction

Flock mortality has a major influence on size of the settlement check after harvest and so is one of the greatest worries of any broiler grower. While differences in breeder flock status, genetic strain, hatchery conditions and management practices mean that two consecutive flocks on a particular farm will seldom have similar mortality patterns, the examination of data from numerous flocks can help to identify specific mortality patterns. These patterns allow the comparison of mortality trends in the current flock with historical averages. Recently compiled data from our facility may assist you in identifying mortality patterns commonly associated with commercial broiler production.

Facilities and Management Practices

Mortality data were gathered from 38 consecutive flocks of straight run broilers from October 1996 through June 2003 at the Applied Broiler Research Unit. Half of the 38 flocks were grown to 49 days or less while the other half were grown longer than 49 days. The youngest flock was 39 days at harvest with the oldest harvested at 57 days. All flocks were grown for the same integrator under a standard broiler industry contract. Management practices were the same in all houses. Flocks consisted of various genetic strains and breeder flock ages throughout the study, a common industry practice. The four houses on the farm were each 40 x 400 ft.; two with tunnel ventilation and two cross-ventilated. Berry et al. (1991), Xin et al. (1993) and Tabler and Berry (2001) provide a complete description of the houses involved.

Mortality Patterns

The average mortality patterns observed are shown in Figure 1. (See page 2.) Since no significant differences were observed between houses, only average date are shown. These data show that broiler mortality usually peaks at approximately 3 to 4 days after placement, declines until approximately day 9 or 10 then stabilizes until approximately day 30. After day 30 a gradually increase is seen until approximately day 40 to 45. After day 45, mortality rates increased until harvest. The pattern is similar to results reported by Xin et al. (1994); however, their data indicated a slightly higher 2-week mortality, somewhat lower 8-week mortality, with similar 6-week mortality on 10 consecutive flocks of 8-week male broilers.

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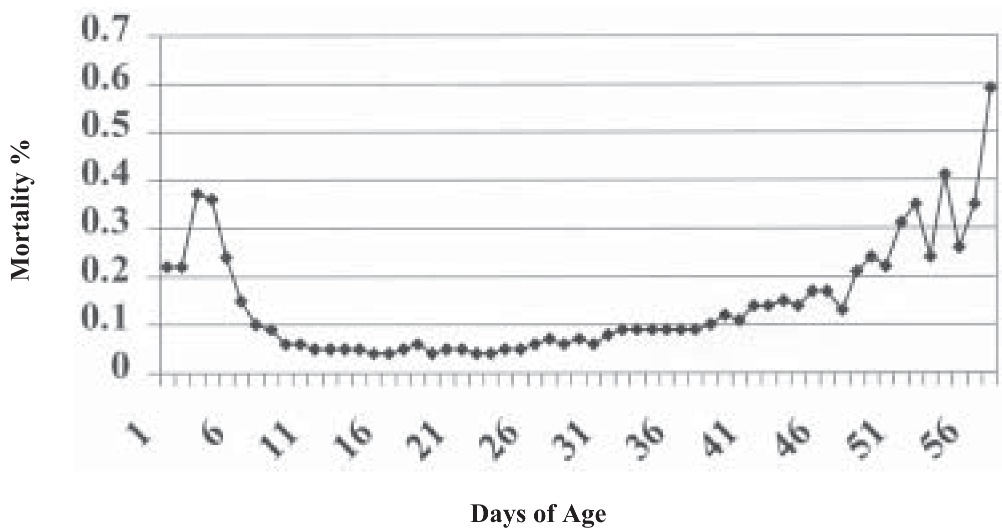
Figure 1. Average mortality for straight run broiler flocks.

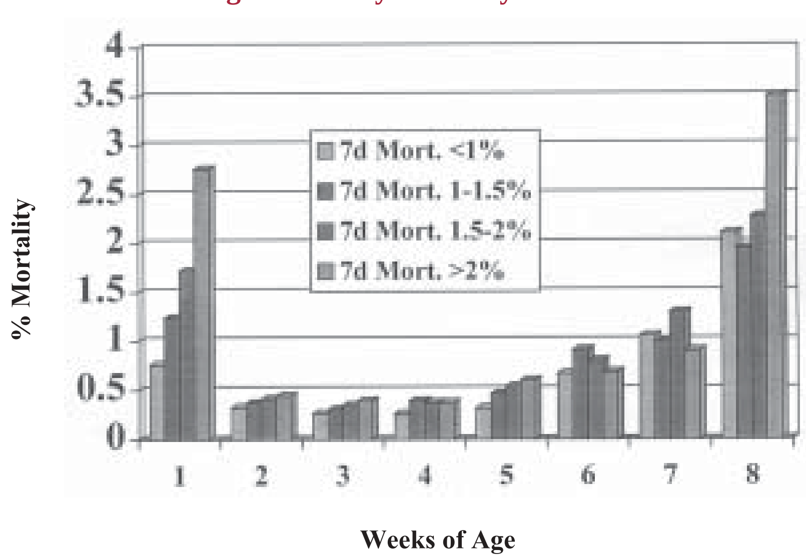


Early Mortality and the Importance of Culling

The peak in mortality at day 3 to 4 may coincide with the disappearance of the yolk sac in the intestine of chicks. Chicks that for whatever reason do not begin to eat and drink may survive the first few days with the yolk sac alone, but once this food source is depleted the chick will soon perish. At 3 to 4 days of age experienced growers can usually distinguish chicks that are destined to succumb from those that are off to a good start by their size and vocalization patterns. While chicks that are off to a good start are active, avidly eating feed and move away quickly when approached, cull birds will often stand by themselves, chirp and refuse to move away as the grower comes near. When cull birds are found they should be immediately removed and humanely destroyed by an approved method (Watkins, 2003). The longer these birds remain in the flock the more detrimental they become to the feed conversion ratio. In addition, removing cull birds at this early stage will improve flock uniformity, making management of feeder and drinker height much easier as the flock ages. It is extremely difficult to properly manage feeder and drinker height with numerous bird sizes in a house. However, culling programs vary among integrators so consult your service technician before implementing dramatic changes to your current culling practices.

The data in Figure 2 illustrate the relationship between early mortality and late mortality. Flocks that lost the most birds early, tended to lose the most birds late. In addition, when first week mortality was high, uniformity was often a problem, and feed conversions were frequently less than desirable. These flocks required additional time, effort and a management skill to achieve an acceptable level of performance. However, it should also be noted that only a small percentage of flocks had a first week mortality of >2% and those flocks were generally not back-to-back.

Figure 2. Early mortality and flock health



Late Mortality

Mortality after about day 45 was most likely due to heart attacks, ascites and leg problems since these diseases generally increase dramatically late in the life of the flock. Clearly death losses late in the flock can have serious negative consequences on both feed conversion and pounds of sellable meat. To some degree, these problems can be reduced with proper feeding and lighting programs. Integrators may change these programs periodically so stay in close contact with your field service technician as to the proper program to follow.

Summary

Mortality in broiler flocks represents lost income to growers and integrators alike. Even though mortality is an everyday part of broiler production, growers should tailor management programs to reduce its overall effect on flock performance. An aggressive culling program early in each flock that humanely removes substandard birds as they appear can improve overall flock uniformity and performance with a minimal negative effect on feed conversion ratio. Allowing cull birds to remain in a flock increases the difficulty in feeder and drinker management throughout the flock. Also, if these birds succumb or are culled late in the flock, they have a much greater negative impact on feed conversion because they have eaten more feed (which is now lost) than they would have if removed at 1 or 2 weeks of age. Management programs later in the flock are often designed slow growth slightly to reduce late mortality due to ascites, heart attacks, and leg problems.

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Water Sanitation: Evaluation of Products

Introduction

Cleaning water lines between flocks is an important step in providing optimum drinking water for poultry production. Even producers with excellent daily water sanitation programs can still benefit from aggressively cleaning water systems between flocks. Introduction of water additives such as electrolytes, vitamins, or vaccine stabilizers can provide food for unwanted organisms such as *E. coli*. In addition, the reduction of water flow in drinking systems in order to provide the right pressure for young chicks and the warm temperatures in poultry houses also creates a favorable climate for microorganisms to build a biofilm or sticky matrix. Once established, a biofilm can be very difficult to remove and if left uncontrolled, this slime can steadily build up to the point that the daily sanitation program becomes limited in its effective-

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ness.   Even producers who use rural or city water supplies can still develop microbial problems with poultry house water systems particularly if they inject products into their water system via medicators that pull from an open bucket.

It is possible for producers to keep lines clean and reduce bacterial growth by thoroughly sanitizing the system between flocks with either sanitizers that are different from those used in the daily sanitation program or by using the daily sanitizer at an even higher concentration. However, it is important to remember that not all cleaners or sanitizers are designed for use in water lines and equipment is sensitive to certain types or levels of chemicals. For example, using a concentrated bleach solution can actually destroy regulators and nipple drinkers. [Therefore choosing the right cleaner for water line sanitation is an important step because not only is the system not very well designed for a thorough cleaning, but also because of the need to minimize equipment damage.] Once birds are placed in the facility, a producer becomes limited on the type and concentration of daily sanitizer that the birds can and will consume. Therefore, by starting birds on very clean lines, a producer can optimize the effectiveness of the daily sanitation program and possibly minimize the cost of the program at the same time.

Cleaner / Sanitizer Study

Different water line cleaners and sanitizers were evaluated at the University of Arkansas Poultry Research Farm. A very high level of the bacteria, *Pseudomonas,* was seeded into miniature water line systems (four feet long) that were equipped with six nipple drinkers, a regulator and stem pipes. By using the miniature lines, it was possible to simulate conditions that might be encountered on a typical poultry farm, but at the same time use the different cleaners in three different water lines. *Pseudomonas* was chosen because it is commonly found in poultry houses and because of its ability to thrive in water systems. The *Pseudomonas* mixture was allowed to settle into the lines for approximately four days so that the organism would become well established in the water system, creating a worse case scenario of contamination in a relatively clean water line system. After four days, a sample of water was taken from each line to determine the number of *Pseudomonas* organisms present. The products tested were mixed with distilled deionized water, flushed into the line systems where they remained 24 hours. After 24 hours, another sample of water from the line was taken and cultured to determine the number of *Pseudomonas* organisms that survived. The treatments evaluated are outlined in Table 1[1].

Test Results

All products tested effectively removed *Pseudomonas* from the water lines (Table 2). Flushing the lines with water (the control) did not remove the bacteria. However, this was not a high-pressure flush, which can be very helpful in removing any buildup in the lines. These results show the durability of bacteria such as *Pseudomonas* and why water lines should be cleaned.

However, using the 12.5% bleach solution at a 1% rate is risky since strong bleach solutions can have a detrimental effect on equipment. In fact, it is always best to check with equipment suppliers for their recommendation of products to use for line cleaning. The Proxyclean product was used at a rate of 3%. If products must be added via medicators, this strength of solution can be achieved only by having an injector pump with a variable setting or by pumping the solution straight from the container with two in-line medicators. Most Proxyclean use has been at a rate of 1% or pumping the product straight from the container. This adds one ounce of concentrated product to every gallon of water. The Agri Zone product can also be used at a more concentrated rate. It can be pumped straight from the medicator container and added at a rate of one ounce per gallon of water.

Summary

The bottom line is that water systems can be successfully cleaned between flocks and this thorough cleaning can slow or eliminate the development of bio-films. There is one important point to remember about this project. These lines were fairly new and therefore had little opportunity for bio-films and sediment to become built-up in the systems. This allowed the cleaners to have maximum exposure to the bacteria and led to excellent results. Systems that have not been cleaned in several months or have no daily sanitation program may not be as easy to clean and may require more than one clean and flush procedure to eliminate bacteria, algae and bio-films. If lines are very dirty or a water tests indicate high levels of bacteria (greater than 100,000 colony forming units/ml) at the end of the line, then a producer should use a very aggressive cleaning strategy between flocks. Cleaning should then be combined with a very thorough flush of the system to remove the killed bacteria and algae. Dead algae can release toxins that could be harmful to the birds so it is very important to flush the system thoroughly after cleaning. Combining the thorough flush with a good daily sanitation program can help reduce the threat that bacteria, algae, viruses and mold exert on poultry performance.

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[1] Use of trade names does not imply endorsement by the authors or the University of Arkansas to the exclusion of others not mentioned

Table 1. Description of Treatments Evaluated

Treatment Name	Treatment Description	Preparation Procedures	Final Concentration
Control	------------------------Lines flushed with two gallons of de-ionized water-----------------------------		
Agri Quat S	Quaternary ammonia product	1.75 oz/5 gal	0.0061 oz/gal
Agri Zone	A mineralized oxygen product	1 oz /gal of stock then 1 oz stock/gal of water	0.024 oz/gal
Aqua Max	Organic acid mix	1 oz/gal of water	1 oz/gal
Citric Acid	Organic acid	64 oz/gal of stock then 1 oz stock/gal of water	0.39 oz/gal
ProxyClean	50% hydrogen peroxide stabilized with sodium nitrate	3.84 oz/gal of water	3.84 oz/gal
PWT or Poultry Water Treatment	Sodium bisulfate water acidifier	16 oz/2.5 gal of stock then 1 oz stock/gal of water	0.039 oz/gal
12.5% Sodium Hypochlorite	Strong bleach, household bleach is 5.25%	1.28 oz/gal	1.28 oz/gal
12.5% Sodium Hypochlorite	Strong bleach, household bleach is 5.25%	4 oz/gal of stock then 1 oz stock/gal of water	0.024 oz/gal

Table 2. Results of Cleaning Water Lines With Different Products

Product	Rate	*Pseudomonas* count before treatment (CFU/ml)[1]	*Pseudomonas* count 24 hrs after treatment (CFU/ml)	pH 24 hrs after treatment
Control (no treatment)	----------	1,700,000	3,030,000	6.22
Agri Zone Flush	0.27 oz/gal	5,820,000	0	7.40
Agri Quat S	0.0061 oz/gal	4,350,000	0	5.87
Aqua Max	1 oz/gal	4,800,000	0	2.91
Citric Acid	0.39 oz/gal	2,280,000	0	3.32
ProxyClean	3.84 oz/gal	2,900,000	0	3.04
PWT	0.039 oz/gal	2,200,000	0	2.61
12.5% Sodium Hypochlorite	1.28 oz/gal	1,600,000	0	8.55
2.5% Sodium Hypochlorite	0.024 oz/gal	2,810,000	0	6.44

[1]Colony Forming Units/milliliter

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Odor and Air Emissions From Poultry Facilities

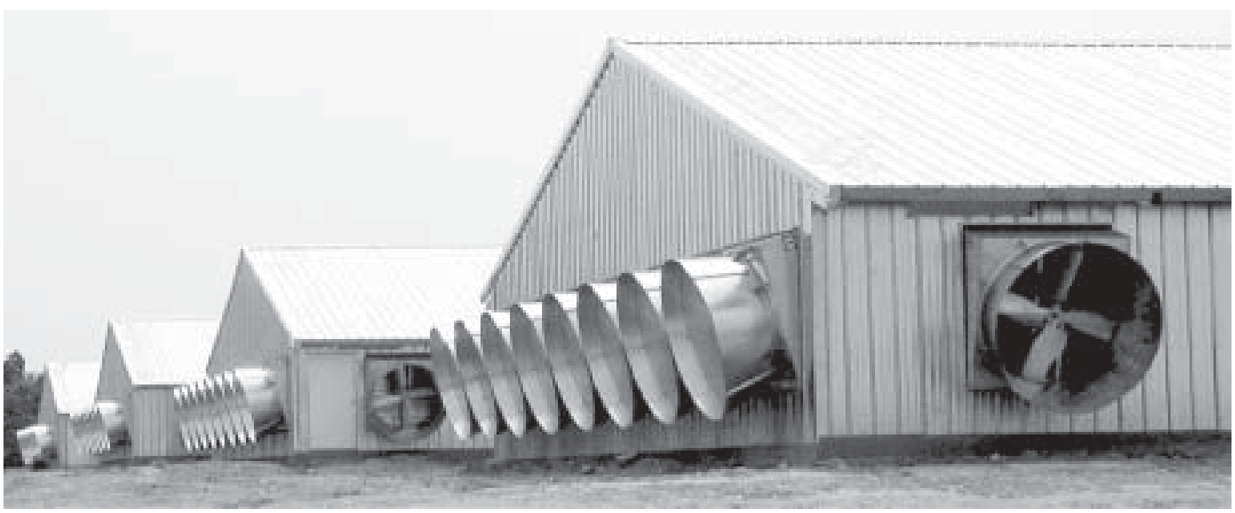
Introduction

In Arkansas, production agriculture is a $4 billion annual industry, three-fourths of which comes from livestock, mainly poultry (EPA, 1998). Modern production agriculture is increasingly regarded as a major source of air pollutants. The trend toward larger and more concentrated animal production coupled with the general public's increasing intolerance of odors mandates the control of odors, gases, and dust.

Types of Emissions

Animal feeding operations (AFOs) have become increasingly consolidated, specialized, and regionally concentrated in the last decade (Sweeten et al., 2004). Air quality concerns are becoming a major environmental issue. Primary sources of odors, gases, and dust from production agriculture units include:

- Livestock operations (poultry and swine buildings; open cattle feedlots)
- Manure storage facilities
- Land application of manure



Management practices are an important factor in determining emissions from animal feeding operations; perhaps of equal or greater importance than the specie itself (Powers and Bastyr, 2004). Many of the foul-smelling compounds emitted from animal production operations are as a result of decomposition of livestock and poultry wastes in the absence of air (anaerobic decomposition). Aerobic decomposition (decomposition in the presence of air) generally produces fewer odorous by-products than anaerobic decay, but aerobic decay can enhance volatilization of gaseous compounds that produce some odors and degrade environmental quality (Powers, 2003). While little information is available on the environmental impact of odor and airborne contaminates, as many as 100 compounds have been identified in air samples collected from animal production facilities (Miner, 1995). However, it is estimated that one third of the methane produced each year comes from industrial sources, one third from natural sources and one third from agriculture, primarily animals and manure storage units (Powers, 2003).

Odor from animal feeding operations is not caused by a single compound, but is rather the result of a large number of contributing compounds including NH_3, volatile organic compounds (VOCs), and H_2S (National Academy of Sciences, 2003). A further complication is that odor involves a subjective human response. What is objectionable to some is not to everyone. The most common odor complaint by the public associated with poultry production is related to land application of manure. When manure is land applied, it is typically applied to an area up to 700 times the surface area of the original storage, creating a large but short-term downwind odor plume (Heber and Jones, No Date). For odor to be detected, odor-producing compounds must have been produced, released and transported downwind. A complex mixture of gases produce the odor associated with a poultry operation. Some of the principal classes of odorous compounds are: amines, sulfides, volatile fatty acids, indoles, skatoles, phenols, mercaptans, alcohols, and carbonyls (Powers, 2003). Ammonia creates strong odors near manure storage areas and poultry buildings themselves, but is not a significant component of odor downwind from a poultry farm. Ammonia is highly volatile and moves upward in the atmosphere quickly when released.

Dust, while a problem in its own right, can also carry gases and odors. Dust is generated from feed, manure, and the birds themselves. A large portion of odor associated with exhaust air from mechanically ventilated poultry houses is dust particles that have absorbed odors from within the houses. Factors determining the amount of dust include cleanliness of the houses, bird activity, temperature, relative humidity, ventilation rate, and stocking density.

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Concerns Over Air Emissions

The issue that most often brings air emissions to the attention of public officials is the frequency of complaints about strong and objectionable odors voiced by neighbors of large animal feeding operations. Equally important are the various substances in air emissions that contribute to environmental degradation (National Academy of Sciences, 2003). Concern is understandable since between 1982 and 1997, the number of animal feeding operations in the United States decreased by 51%, while livestock production increased 10% (Gollehon et al., 2001). This indicates that there are fewer farms with more animals on those farms than in the past; and hence, more animal waste in a smaller area.

Currently, there is no comprehensive, sound, science-based set of data on emissions from AFOs. An understanding of AFO air emissions and their effects will require the expertise of numerous scientific disciplines, including animal nutrition and physiology, farm practices, atmospheric chemistry, meteorology, air monitoring, statistics, epidemiology and toxicology, agricultural engineering, economics, and other related disciplines. Emission rates can vary with changes in the management of the animals, their feed or weather conditions and may vary tenfold or more during periods as short as an hour or long as a year. This variability in AFO air emission rates is perhaps the most serious impediment to generating a sound, reliable database (National Academy of Sciences, 2003).

The EPA has a variety of needs for more accurate estimates of air emissions from AFOs, including the following:

- General monitoring of the nation’s air quality
- Determining what pollutants are in the nation’s ambient air, their concentrations and their sources
- Identifying the emissions that may have the greatest adverse effects on human health or the environment
- Improving regulatory approaches
- Assessing effectiveness of various abatement technologies and strategies

USDA has a similar need for accurate information, but focuses more directly on the kinds of management actions that farmers can take to mitigate emissions at the farm level (National Academy of Sciences, 2003).

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Management Strategies

As mentioned earlier, land application of manure generates the most consistent and noisy odor complaints. Land application offers acres and acres of volatile compound generation versus the relatively contained sources of air emissions from manure storage and livestock housing. Thus, keeping poultry manure in the house or in dry storage is the first line of defense against odor and gas emission complaints (Wheeler, 2002). Also consider topography and air drainage patterns when considering constructing new or purchasing existing facilities in hilly areas. In such areas, during the evening hours there are often periods of little or no wind. In these still periods air near the ground will begin to cool and, because cool air is heavier than warm air, it drifts down slope. Poultry houses scattered across hills are in the path of this air moving down slope and any odors generated by these facilities may be picked up and carried down wind to towns or communities located in the valleys below.

A wide variety of manure management technologies and strategies have been considered over the last 30 years (ASAE, 1971). The systems currently in place are those that proved the most cost-effective and reliable at achieving their objectives. For the most part, those objectives have not included minimization of emissions, but have centered on water quality protection, nuisance avoidance, animal environment protection, and worker health protection. (National Academy of Sciences, 2003).

Be a Good Neighbor

Even though there is no comprehensive, science-based set of data on emissions from AFOs, almost all producers realize that the lack of data has not stopped complaints or legal actions against production units. Thus, producers must continue to deal with the situation.

Shelterbelts of trees or shrubs have been used extensively in some parts of the country for snow and wind protection. Shelterbelts around poultry operations can offer improved aesthetics of production facilities and may help reduce any environmental impact (actual or perceived) of the operation since many people tend to "smell" with their eyes. Shelterbelts may also offer odor reduction by creating turbulence that encourages the mixing of odorous air with fresh air, promoting the settling of dust where wind speeds are lower, physical interception of dust and particulates or adsorption and absorption of odor compounds on the foliage of trees or shrubs (Wheeler, 2002).

One of the best ways to lessen complaints about any animal production facility is to run a clean, neat, tidy operation. Make it a point to know who your neighbors are and develop a good relationship with them. Personally tell your neighbors what your plans are so that they do not hear information secondhand that may or may not be accurate. Stay or become involved with community activities and attend public meetings related to area farming practices. Make the general population aware that you are concerned about the environment and are open to new ideas. Always check with neighbors before spreading manure to make sure you do not disrupt someone's family reunion or weekend events. Farming is a business and all businesses need customers. Most likely your neighbors go to the store and purchase the same product you produce. Therefore, it is important to keep your neighbors/customers happy.

An effective strategy to reduce gas, odor and dust emissions from livestock and poultry operations will likely be site specific since no one practice will work at every operation. Plan on using a variety of strategies with the goal being to reduce the overall generation of emissions from your operation. To some producers it may not seem like that big of a problem just yet; however, as rural and urban populations increasingly share more and more land with one another, odor and air emissions from livestock facilities has the potential to make the issue of land application of animal wastes pale in comparison. Recall all that has happened with land application rules and guidelines over the past 5-10 years. Ten years ago land application of wastes did not seem like a big problem. Now consider what could happen with air emission standards. The time for modern production agriculture to address the issue has come.

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Arkansas Turkey Growers Face Variety of Challenges

Introduction

Arkansas turkey growers produced 29.5 million turkeys in 2002 (USDA, 2003), making the state third in turkey production behind North Carolina and Minnesota. As any grower can verify, raising commercial turkeys is no easy task. In comparison to broiler chickens, turkeys are extremely difficult to start, the brooding period is a much more stressful time for both poult and grower, and turkeys remain on the farm for a much longer period increasing the likelihood that something may go wrong before the flock sells. Let's look at some of the challenges faced by Arkansas turkey growers and how to meet these challenges.

Summertime Temperatures

Turkeys are generally most comfortable when temperatures range from 70-79° F (Anonymous, 2003). Feed intake and growth may be affected as temperatures rise above 80° F and temperatures exceeding 90° F, can result in heat exhaustion or heat prostration. High temperatures are particularly stressful when coupled with high humidity levels.

Heat stress is always a concern of Arkansas turkey producers during summer months and can produce significant losses if growers are not properly prepared. Several factors affect heat production and the turkey's ability to deal with heat. The digestion of food, the growth process and bird activity all create heat, which the turkey must dissipate (Nixey, ND). As the temperature increases, feed consumption decreases and turkeys begin to pant which negatively affects the performance and profitability of the flock.

A turkey's first objective is simply to stay alive. Turkeys are warm-blooded and must maintain a relatively uniform body temperature of 105-107°F over a wide range of environmental conditions. If heat produced by the bird is greater than heat that is lost, the bird's body temperature rises; if it rises 9-11°F and reaches 116° F the turkey dies from heat prostration. Several methods exist for the turkey to lose heat (Cereno, 1998):

1) Radiation - body surface temperature is cooler than air surrounding it
2) Conduction - bird comes in contact with and loses heat to a cooler surface (litter)
3) Convection - cool air contacting body surface is warmed and rises, carrying away heat
4) Water vaporization - a bird's nasal cavity is a heat exchanger and helps rid the body of excess heat through evaporative cooling
5) Fecal excretion
6) Egg production

How efficiently turkeys can lose heat will depend on air temperature, humidity, air movement over the bird, and stocking density. Turkeys pant to increase the rate of heat loss by evaporative cooling. However, older, heavier birds produce more internal heat and are less able to cool themselves through convection and evaporation. The extra weight might be why higher temperatures are more stressful on toms than hens (Anonymous, 2003). Also, be aware that birds suffering respiratory problems will have a reduced ability to cool themselves through panting. In addition, the more birds in the house, the more heat they generate and they will tend to absorb each other's radiant heat load.

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Air movement (ventilation) is critical if turkeys are to survive summer conditions. Maximize natural ventilation by keeping grass and weeds cut around buildings. Do not park tractors or equipment alongside houses as this restricts air movement through the buildings. You are better off with grass around your houses to absorb heat (if you keep it cut) instead of bare ground because bare ground will reflect heat back into the houses. Make sure your fans are properly maintained. Keep blades, shutters and safety grills free of dirt and debris. Change fan belts at least once per year. Worn or loose belts can reduce fan efficiency by 20-30 %. Turn fan thermostats down low enough that the fans will run late enough after sundown to give the birds a chance to cool off. Flush water lines regularly to provide cool water to the turkeys; cool water allows the turkey to transfer body heat to the water they drink. If you have a generator, make sure it is maintained and ready in event of a power failure. If you don't have a generator, seriously consider purchasing one. They are a somewhat expensive investment if the power stays on, but a generator can pay for itself in one afternoon if the power goes off for an extended period.

Some growers supplement the drinking water with vitamins and electrolytes to reduce heat stress. Vitamins in the water are a good way to insure turkeys are getting what they need during hot weather when feed intake may be reduced. Electrolytes help maintain adequate blood pH which becomes elevated when turkeys pant for extended periods. Always talk to your service technician before starting any supplementation program since they know what works and what doesn't. Turkeys normally decrease their activity level and stay away from feeder pans to avoid creating additional internal body heat when the weather is hot. Thus, keeping birds as quiet as possible during the heat of the day and considering an intermittent lighting program to encourage nighttime feeding may help. However, turkeys must be offered a period of complete darkness because it is during this time that the tibia (leg bone) grows at its optimal rate (Monk, 1998). Sprinkling turkeys with water can help fight heat stress when temperatures exceed 80-85℉. However, the amount of water used will vary greatly with condition of the house and the birds and producers should avoid using too much water since it can increase humidity to dangerous levels. Again, consult your service technician before changing your lighting program or starting a sprinkling program.

Pathogen Load

Management programs that will allow turkeys to perform to their genetic potential should be the goal of all producers. Obviously, pathogens can reduce turkey performance and should be controlled. Unfortunately, with the technologies currently available to the industry, complete eradication of the pathogen load in live production is not possible. We can, however, make every attempt to reduce the microbial population through Best Management Practices that include a strict biosecurity program.

Be aware of comings and goings on your farm and make it a rule that no one gets on your farm who doesn't belong. Feed truck drivers and technical service personnel must have access, but after these folks are accounted for, the list becomes extremely short. Friends, neighbors or other visitors have no vital purpose around your operation and should be excluded. It is up to you to enforce this. You may politely make visitors aware that it is not that you are antisocial, but you have thousand dollars and many hours of "sweat equity" invested in your operation and you cannot afford to have a disease challenge on your farm. Each farm has its own unique microbial population that the turkeys "become accustomed to," but visitors tend to introduce organisms that are not common to your operation and lead to production or disease troubles. You must minimize traffic flow on your farm, the risk is simply too great to do otherwise. Therefore, take necessary steps to ensure that the only visitors to your farm have a good reason to be there.

The live production process in the turkey industry is a combination of management practices, bird health, the nutrition program and the unique farm environment (Figure 1). Nutrition, like management, must be focused on insuring that the turkey can perform to its genetic potential. Proper bone development is vital in insuring that turkeys achieve their full genetic potential. Any factor that negatively influences bone development will result in stress when the turkey attempts to walk, leading to decreased activity, reduced feed intake, and diminished growth rates (Monk, 1998).

The farm environment directly impacts bird performance. A favorable environment optimizes growth and strengthens the bird's ability to resist disease. The environment also influences the microbial population unique to each farm. Published research has demonstrated that birds in "clean" environments grew 15% better than those in dirty environments (Fernandez, 1998a). If bird health is compromised, the turkey will likely never reach its genetic potential regardless of your management program. Fernandez (1998b) indicated a vector control program and a clean water supply are also critical to reducing pathogen loads.

Effective rodent control programs involve a rational, systematic baiting procedure, preventive facilities management and constant monitoring. Rodents are often vectors that transmit disease organisms from one flock to the next. Even if facilities are cleaned and disinfected, the presence of rodents can jeopardize sanitation efforts. Darkling beetles are another vector which has been implicated in many poultry diseases. Beetles have been found to be a source of transmission for *Salmonella*, Marek's Disease, *E. coli*, Infectious Bursal Disease, Newcastle Disease, *Clostridium* and numerous other diseases (Watkins, 2001). Approved insecticides are available for use after house cleanout for beetle control.

The role of water is certainly underestimated in both turkey and broiler production. High quality drinking water is critical for a healthy environment in both turkey and broiler facilities. Fernandez (1998b) indicated that 45 of 95 (47%) of untreated water samples from various turkey farms were contaminated with bacteria. The most common bacteria found were *Pseudomonas*, followed by *E. coli*. *Bordetella* (which causes turkey coryza). *Bordetella* has also been isolated from the inside of nipple drinkers and from the rubber seal in the water line regulator in houses with *Bordetella*-positive turkey flocks (Watkins, 2002). Thus, it is important to reduce the microbial load in the water system by treat water lines during house cleanout, and sanitizing watering equipment during house preparation (Fernandez, 1998b).

Other Challenges

Pathogen load and heat stress are only two of numerous challenges faced by Arkansas turkey growers. Producers must also be alert for coccidiosis which causes economic loss through poor performance and secondary infections. Coccidiosis in turkeys is difficult to diagnose compared to chickens since , in turkeys, visible lesions are rarely seen and an accurate diagnosis requires the use of a microscope. Clinical signs include, weight loss, decreased rate of gain, listlessness, and loose droppings (possibly with blood or mucus), but these are the same symptoms that a variety of other diseases or ailments may exhibit.

The proper house environment during winter is also a major challenge. Houses are usually closed tightly and ventilation is at a minimum during cold weather to conserve fuel. Be aware, however, that adequate ventilation is necessary to guarantee sufficient air exchange, provide needed oxygen, and prevent carbon dioxide (CO_2) buildup in the house. Carbon dioxide levels are always a concern in turkey production facilities. In research trials, seven times the normal level of CO_2 did not significantly affect livability at 14 days, but average body weights were up to 15% poorer in non-ventilated houses (Fernandez, 1998b). Equally important was the deterioration of bird uniformity that accompanied the depression in weight. Proper winter ventilation is critical if the flock is to perform up to its genetic potential.

Summary

Turkey growers must be constantly vigilant of conditions within the turkey house. High summertime temperatures are always a threat, especially when accompanied with dangerous humidity levels. Significant costs in lost performance and/or mortality can be expected if measures are not taken to reduce heat stress. Proper winter ventilation is also important to provide an environment that will allow the turkey to perform at its best. Steps must also be taken to control the pathogen load in turkey production facilities. Practice stringent biosecurity and do not allow anyone on your farm unless they have a reason to be there. Monitor bird health and contact your service technician at the first sign of a possible disease outbreak. Turkey production requires that numerous challenges be met along the way to producing a healthy, profitable flock. To be successful, Arkansas turkey producers must meet and overcome these challenges on a daily basis.

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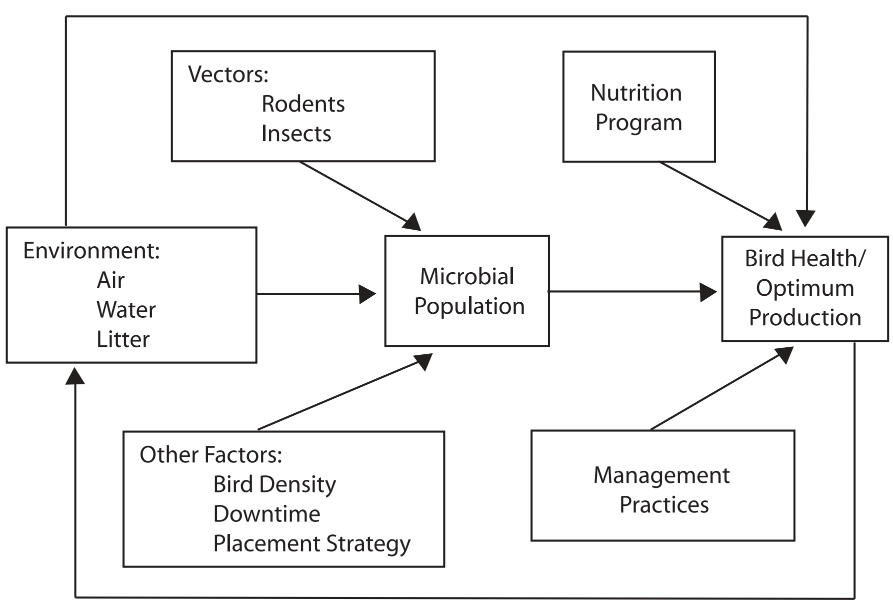
Figure 1. Relationships between bird environment and bird health



Adapted from Fernandez, 1998b.

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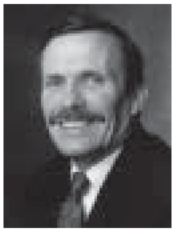

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