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Feature article

Keys to Successful Brooding

Brooding is a crucial time for successful broiler management. If chick performance suffers during the first two weeks due to a poor brooding environment, the reduced growth rate and/or increased feed conversion ratio that occur early in development cannot be recovered by the end of the growout. Chicks exposed to low floor temperatures and/or high atmospheric ammonia concentrations may experience a depressed immune system and increased occurrence of ascites and are known to have impaired live performance. Failure to provide a good brooding environment can indeed be costly to both the grower and the integrator.

Importance of Temperature Control

For survival and growth, new-born chicks must be kept warm.

The problem with not maintaining proper brooding temperatures starts with the fact that new-born chicks have little or no ability to regulate their body temperature. That is, as air temperature decreases, the internal temperature of the chick is also reduced. In one research experiment, 175 chicks were placed after hatching in two treatment groups, either reared in a constant temperature of 95° F, or first exposed to a temperature of 65° F for two hours, and then to a constant 95° F. After four days, the internal temperature of chicks subjected to that brief cold exposure was only 100.5 °F, vs 102 °F for the control group reared at a constant 95° F.

Because the chick's entire metabolism depends on having the right temperature to function, cold exposure in the first few days especially can be a serious threat to the bird's survival. The chick's digestive system, along with other functions, gradually matures during the first two weeks. After that, its feather development, a competent nervous system, and increased body weight help enable the chick to maintain its proper body temperature and continue growth within a reasonable range of surrounding air temperatures.

Too-cool air temperatures also prevent chicks from getting adequate feed and water. Their response to getting cold is to huddle together to conserve warmth, so they are unable to get to feeder lids and drinkers. Proper maturing of the digestive and immune systems depend in the first few days on the chick getting all the nutrients and antibodies provided in the yolk sac, and after that getting adequate nutrients from feed. If chicks are unable to get enough feed and water, mortalities will occur. Further, chicks that survive may experience a suppressed digestive and immune system, which will limit their growth and survival potential throughout the growout.

Getting chicks off to a good start is extremely important. Early growth losses cannot be made up later.

In a cold stress environment, almost all feed that a chick does manage to consume will go to the attempt to maintain body heat, instead of going to muscle development or weight gain. If the cold stress continues very long, the chick is forced to begin breaking down carbohydrates and fats in its own body tissues in the attempt to maintain body heat. It is important to realize that brooding chicks need very warm conditions. To humans, 80° F feels warm; but chicks will feel cold at this temperature. One research study compared broiler chicks reared at 80° F with chicks reared at 90° F. After 10 days, live body weight for the 90° F group was 0.24 lb and feed conversion 1.14. The chicks in the 80° F group weighed in at only 0.20 lb, and feed conversion soared to 1.42.

Additionally, brooding at temperatures that are too low can increase the incidence of ascites, or "water belly." University studies have shown increases in ascites as high as 11% in broiler flocks raised in too-cool brooding environments.

Energy-Saving Videotape –

Now available from Auburn University: *Wintertime Broiler House Ventilation for Reduced Fuel Costs.* This 42-minute video details energy saving methods and best wintertime ventilation techniques. Contact Jim Donald, Biosystems Engineering Dept., 228 Tom E. Corley Bldg., Auburn University, Alabama 36849 (334-844-4181). More information on the tape is available on the Auburn poultry website www.poultryhouse.com.

Temperature Management

Because brooding chicks need a temperature at or above 90° F, supplemental heat in the brooding chamber is needed for good flock performance even in warm weather, and especially during the night. For example, a field study was conducted with two broiler operations in the Southeastern U.S. under similar management practices, except that one farm provided no supplemental heat. Final body weight of birds was similar between the two farms, but the farm that maintained optimum floor temperature by providing supplemental heat had a feed conversion ratio six points lower than the farm without supplemental heat.

Chicks usually need supplemental heat even in warm weather, and especially during nighttime when temperatures drop.

Forced-air furnaces and brooders, either pancake style or radiant, are the two basic methods of providing heat to chicks. Both methods are effective if managed properly. Furnaces produce heat in the form of hot air. Hot air rises toward the ceiling. As a result, the floor temperature will normally be much lower than the ceiling temperature. To achieve optimum temperature at bird level without burning excess propane, the grower must find ways to bring warm air down from the ceiling area. Air-mixing fans mounted under the ceiling have been found to work well in reducing air stratification. Either paddle fans, or axial vane fans that blow air horizontally, can be used. University of Georgia researchers found that ceiling fans increased floor temperature by 5° F, and resulted in approximately 30% less propane gas used at the end of the brooding phase.

Minimum ventilation using static pressure-controlled sidewall or ceiling air inlets or vent boxes can also help to break up temperature stratification in the brooding chamber. When the ventilation system is running, cool outside air is brought very uniformly through the inlets and thrown along the ceiling toward the center of the house, which pushes the hot air produced from furnaces or brooders toward the floor. This action also results in lowered propane consumption. Growers should be aware that using static pressure-controlled inlets successfully requires a tight house. A useful test of house tightness is to close all doors and air inlets, then turn on one 48-inch or two 36-inch fans and measure the resulting in-house static pressure. A sufficiently tight house will register about 0.15 inches pressure on a photohelic gauge in this test. If the static pressure tests lower than this, the house needs to be tightened up by installing curtain flaps, caulking cracks, and making sure fan shutters and doors shut and seal properly.

Air-mixing to bring warm air down to bird level keeps birds more comfortable and saves fuel.

Both pancake and radiant brooders provide most of their heat in the form of infrared light. Infrared light radiates heat to objects instead of heating the air. Thus floor temperature under the brooder will be higher than the surrounding air temperature. The effect is that heat is delivered where it is most needed, and it is not necessary to fully heat the entire house in order to provide the right temperature at chick level. The difference between pancake and radiant brooders is that pancakes are designed to provide a relatively uniform “comfort zone” directly under the brooder; radiant brooders are larger and designed to create circular bands of temperatures, warmest directly under the brooder. Compared with furnaces, brooders reduce the likelihood of cold drafts chilling birds. Brooders usually require more maintenance and management effort than furnaces. Gas consumption will almost always be higher in a house that is furnace brooded.

Brooders provide warmth directly to chicks, reduce the problem of cold drafts, and save fuel.

Successful use of brooders requires the right propane gas pressure, something which has been found lacking on many farms. The two most common problems are inadequate pipe sizing and an under-sized regulator. The distance from the liquid propane tank to the furthest brooder and the total heat output load determine the optimum pipe sizing. The low-pressure gas regulator should be oversized to at least 130% of the maximum required heat output to avoid any problems. In addition, propane tanks must be properly sized and not allowed to get too low on propane in cold weather. Cold slows down the vaporization process. And the liquid-to-gas vaporization capacity of a tank is reduced as the surface area of the tank wetted by the liquid propane goes down. In colder climates, two tanks may be better than one, to increase the total wetted surface for good vaporization.

Proper sizing of gas plumbing pipes and regulators is essential for adequate heat output and efficiency.

Improper location of temperature sensors and/or setting of minimum ventilation rate can also lead to a poor environment for the young chick. If temperature sensors are placed too close to the brooders, it can be difficult to obtain optimum floor temperature. If radiant brooders are placed down the middle of the house, the temperature sensors should be placed between the feed and water lines, which is about 9-10 feet from the brooders. At placement, the temperature sensors should also be about 3-4 inches from the floor. The minimum ventilation timer must be set properly for the age of the birds, and the ventilation temperature thermostat must be set

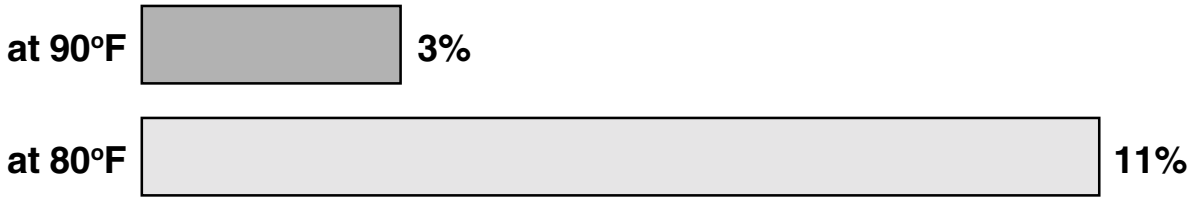
IMPORTANCE OF TEMPERATURE MANAGEMENT DURING BROODING

Bar charts below show typical results of brooding at proper temperature vs brooding at temperature below optimum for chick development and growth. Given consistent proper temperature (near or above 90°F), young chicks are able to devote almost all of the feed energy they take in to growth. Chicks that are too cool may consume as much or more feed but gain less weight and are more subject to health problems.

WEIGHT, first 10 days

FEED CONVERSION, first 10 days

ASCITES, first 10 days



above the needed floor temperature so that chicks are not chilled by the thermostat overriding the minimum ventilation timer and turning ventilation fans on when they are not needed.

Controlling Ammonia

In addition to maintaining optimum floor temperature, providing the chick with high quality air is also important. Ammonia concentration is the most commonly seen air quality problem. Concentrations over about 25 ppm during brooding are known to reduce resistance to infections, increase condemnations, and hurt flock performance. Studies have shown that the feed conversion ratio of broilers increases in direct proportion to ammonia content. It is important to realize that ammonia arises out of the litter, and it is the first few inches above the litter where concentrations will be highest and most damaging to chicks. Flock performance will be compromised by high ammonia levels at chick level well before a grower can smell the problem and before symptoms such as bird blindness can be seen.

Placing temperature sensors at floor level is critical to avoid over-ventilation and bird chilling.

Litter treatments to inhibit ammonia formation are now used widely in the industry. These treatments have worked well when used in conjunction with proper minimum ventilation. Ammonia production in the litter increases as litter moisture content increases, and proper ventilation is essential to take moisture out of the litter and out of the house. Without proper ventilation, increasing moisture and ammonia concentration in the litter causes the litter treatment to rapidly exhaust itself and become ineffective.

Broilers consume about one and a half to two times as much water as feed, but they only retain about 20% of the water, thus the other 80% is excreted. A broiler chick excretes about 0.06 ounces of water per hour in the first week, and about 0.11 ounces per hour in the second week. These are small amounts, but with 20,000 to 25,000 chicks in a house, the ounces add up to large amounts of water. Growers must understand that proper ventilation to remove this moisture depends on the age/size of the bird, and this is why minimum ventilation fan run time changes from week to week. A typical ventilation timer setup during brooding is to set one 48-inch or two 36-inch fans to run 30 to 45 seconds out of a five-minute interval in the first week, and increasing the time to approximately 1.25 to 1.5 minutes out of five during the second week.

Litter treatments work well only in conjunction with proper ventilation to remove moisture.

The Bottom Line

Because the first ten days to two weeks are critical for development of the chick, brooding is the most critical time in the life of a flock. More flock performance is lost due to improper brooding than from any other single cause. If growers are looking for maximum return on their investment and management time, they should spend the time and effort needed to provide the right brooding setup for chicks. And they should follow through by monitoring chicks closely and making the adjustments needed to provide the best possible brooding environment for their birds.

By W.A. Dozier, III, Ph.D, Extension Poultry Scientist, University of Georgia, and Jim Donald, Professor and Extension Engineer, Auburn University

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