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Environmental Factors to Control When Brooding Chicks

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The main objective in brooding chicks is to efficiently and economically provide a comfortable, healthy environment for growing birds. Temperature, air quality, humidity and light are critical factors to consider. Failure to provide the adequate environment during the brooding period will reduce profitability because of reduced growth and development, poorer feed conversion, and increased disease, condemnation and mortality.

Figure 1. Managing the house and chick correctly during the brooding period will get chicks off to a good start.

Temperature and Chick Physiology

Maintaining the correct temperature is critical in chick brooding, especially during the first two weeks of the chick's life. Early in life, the chick is poorly equipped to regulate its metabolic processes to adequately control its body temperature. As a result, the young chick is dependent on environmental temperature to maintain optimal body temperature. If the room temperature decreases, the chick's body temperature will decrease. Likewise, if room temperature increases, the chick's body temperature will increase. Chilling or overheating during this crucial period can result in poor growth, feed conversion and increased susceptibility to disease. Proper brooding practices must maintain the chick's body temperature so that it does not have to use energy to lose heat by panting or generate heat through metabolism.

Research has shown that the chick develops the ability to regulate its body temperature around 12 to 14 days of age. The chick can be easily stressed if its body temperature decreases or increases by as much as one degree. Once the body temperature changes the bird will try to compensate and in most cases this means that it will have a negative effect on performance. The body temperature of a day-old chick is about 103°F (39°C), but by about five days of age body temperature is 106°F (41.1°C), the same as the adult. Extreme temperatures (high or low) often result in chick mortality, but even mild chilling or overheating can affect the performance of young chicks without causing death. While chicks are more tolerant of high temperatures than adult birds, high temperatures for extended periods of time increase mortality and have negative impact on performance.

Research has shown that chicks that are subjected to cold temperature have impaired immune and digestive systems. As a result, cold stressed chicks have reduced growth and increased susceptibility to diseases. Cold stressed chicks will exhibit higher incidence of ascites, a metabolic disorder that results in reduced performance, increased mortality and increased condemnations at the processing plant. In research studies where groups of chicks were brooded at either 80°F or 90°F, the chicks reared under the warmer temperature had better weight gains, feed conversion and livability. Chicks brooded under 80°F experienced reduced growth compare to the high brooding temperature treatment. The chicks reared under those temperatures did not catch up in body weight and as a result weighed less at market age than birds that were brooded properly. Not only do chicks exposed to low brooding temperatures have reduce growth rates, but they will consume more feed to keep themselves warm, reducing feed efficiency and increasing feed costs.

Temperature and Chick Performance

One of the goals during brooding is to maintain chicks within their comfort zone, which is where they are not using energy to gain or lose heat to maintain body temperature. When birds are kept in environmental temperatures above or below their comfort zone, more energy must be expended to maintain body temperature. This extra energy will ultimately be supplied by the feed consumed. Therefore, the energy from the feed will be used to maintain body temperature instead of growth and development resulting in poorer feed conversion. Thus, the environmental temperature plays a major role in determining the cost of producing a pound of meat or a started pullet.

Proper brooding not only consists of maintaining proper temperature but also the use of good husbandry practices. Brooding temperatures will vary depending on whether the heat source is air furnace, conventional brooder or radiant brooder (Table 1). Note that the temperatures in Table 1 refer to air temperatures that are designed to provide a 90°F (32°C) floor temperature. When brooding chicks, floor temperature is crucial. Research suggests that average floor temperature should be 90°F (32°C) on the day that chicks are placed in the house. Forced air furnaces require higher temperature settings because they heat the air which heats the floor. A conventional pancake brooder directs approximately 40 percent of its heat to the floor and 60 percent to the air. Radiant brooders project approximately 90 percent of their heat to the floor and 10 percent to the air. Because pancake and radiant brooders direct more heat to the floor, the air temperature required to get the desired floor temperature is less than that required for forced air furnaces.

Table 1. Recommended Air Temperatures During Brooding for Broilers by Heat Source[1]

	Air Temperature		
Day	Forced Air Furnace[2]	Conventional Brooder[3]	Radiant Brooder[4]
0	93°F (34°C)	90°F (32°C)	88°F (31°C)
3	90°F (32°C)	88°F (31°C)	86°F (30°C)
7	87°F (31°C)	86°F (30°C)	84°F (29°C)
14	83°F (28°C)	85°F (29°C)	82°F (28°C)
21	78°F (26°C)	80°F (27°C)	77°F (25°C)

[1]Temperatures based on those used currently by broiler companies
[2]Measured at chick height.
[3]Measured at chick height, one foot from edge of brooder canopy.
[4]Measured at chick height, four feet from edge of brooder canopy.

Broiler houses are specifically designed to allow the environment directly around the chick to be closely controlled. In commercial broiler growing operations, broiler houses are insulated and equipped with mechanical ventilation systems to maintain house temperatures within 5 degrees of the desired temperature regardless of outside temperature. Optimum chick brooding temperatures have been developed through many years of research and field experience.

The best method to monitor chick comfort is to observe chick behavior and regulate the temperature accordingly. When observing a broiler house, chicks should be distributed evenly across the house.

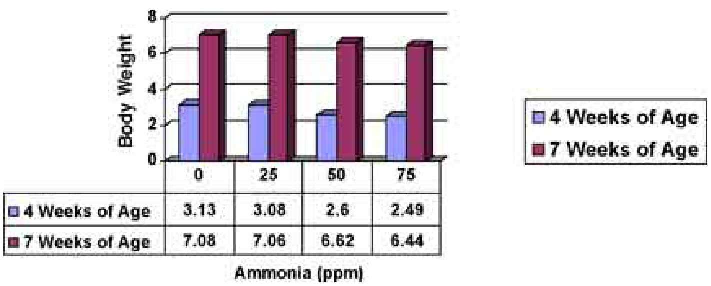
Figure 2. When house adequate house temperature is obtained and chicks are well managed, they should be distributed throughout the house and not huddling together or sitting mostly in the feed pans.

Chicks that are cool can be seen huddling together (even next to the side wall) and will tend to sit in feeder pans. Chicks that are hot will move away from the brooders and furnaces, will pant and will stretch out on the litter in efforts to cool themselves. Many houses have environmental controllers that monitor house temperature and turn brooders and furnaces on and off as needed. The controllers also monitor the amount of time a heat source operates. This information can be used to locate areas of the chick environment that might experience excessive air leaks or drafts. For example, if the brooders/furnaces near the tunnel curtain have more run time than others in the house, it may indicate air leaks around the curtain or end wall door.

Relative Humidity

The ability of air to hold moisture depends upon its temperature. Warm air can hold more moisture than cold air. The term relative humidity refers to the percent of water saturation of air at any given temperature. The level of humidity influences the ability of the bird to cool itself through panting and influences ammonia production.

It is recommended that relative humidity be maintained between 50-70 percent throughout the growout period, including the brooding period. Ammonia production occurs due to the microbiological breakdown of fecal material in the litter. Dusty conditions in the poultry house are associated with relative humidity below 50 percent. Relative humidity of 70 percent or greater provides environmental conditions suitable for microbial growth in the litter. As the microbial population increases, more ammonia is generated from nitrogen sources found in bird fecal material. Ammonia is a gas that has a negative impact on bird health and performance. Research shows that increased ammonia impairs the immune system and increases respiratory disease in birds. High ammonia levels during brooding reduces growth rate, which is not gained back during the remainder of the growout. Ammonia production can be reduced through the control of relative humidity which in turn is regulated by ventilation. Managing the poultry house ventilation rates to keep relative humidity between 50 and 70 percent is recommended to minimize ammonia production and dust.



	0	25	50	75
4 Weeks of Age	3.13	3.08	2.6	2.49
7 Weeks of Age	7.08	7.06	6.62	6.44

Figure 3. Exposure to ammonia concentrations as low as 25 ppm for the first 28 days can have a negative effect on body weight at both 4 and 7 weeks of age (Miles et al., 2004).

Ventilation

Ventilation is needed to regulate temperature and remove carbon dioxide, ammonia, other gases, moisture, dust and odors. Fresh air must be introduced uniformly, mixed well with house air, and circulated properly throughout the house. The flow pattern within the building is very important. Air movement into the house is accomplished via negative pressure. Fans remove air from the house creating a negative pressure. Air enters through inlets located in the walls or ceiling and is directed across the ceiling to mix the air.

Mixing of the incoming outside air and the inside air prevents the cooler air from settling near the litter and chilling the birds. Inlet openings and air speed coming through the inlet is important in ensuring that air moves along the ceiling. If the inlet opens too

Figure 4. Higher light intensities during brooding will encourage chick activity. The increase activity will help chicks find feed and water sources thus getting them off to a good start.

much or if the speed of the air entering through the inlet is too low then the cool air will fall to the floor more quickly. Not only with this cause a problem of bird chilling, but can create cool spots on the walls and floor. As warm air contacts these cooler spots condensation will form creating wet spots. These wet spots can lead to increase litter caking as well as more ammonia production.

Figure 5. Air entering through the inlets is directed along the ceiling. This allows the air to warm up to brooding temperature before coming into contact with the chicks. This also increases the moisture holding capacity of the air so that when the warm air does fall down to chick level it will pick up and hold more moisture from the litter helping to maintain litter conditions in the house.

Circulation fans should be used to break up temperature stratification and provide a more uniform temperature throughout the poultry house. Moving the warmer air to bird level not only helps maintain bird body and floor temperatures, but also helps remove moisture from the litter.

Fan operation is controlled by temperature to maintain the desired temperature. Some fans are operated by a timer to regulate relative humidity and maintain good air quality when the house is at the desired temperature. The house environmental controller operates the fans based on temperature and timer settings. The controllers will open air inlets located in the side walls or ceiling to ensure uniform air entry into the house. The amount the inlets open is determined by static pressure.

Lighting During Brooding

Light is an important factor during brooding that should not be ignored. Chick activity is greater in bright light intensity than in low light intensity. During brooding the light should be at the brightest intensity to encourage chick activity thus assisting them to locate feed and water. Once they learn where feed and water are located (somewhere around 7 to 10 days of age), the light intensity and duration can and should be reduced. Light systems should be designed to produce a minimum of 25 lux (2.5 foot candles) or more at bird level. Many broiler houses being built today are capable of provide up to 40 lux (4 foot candles) at chick level in the brood area.

Figure 6. With an insulated attic, the air is warmer than outside air. Using the air allows higher ventilation rates to be used without increasing fuel usage. These increased ventilation rates will help maintain relative humidity between 50 and 70 percent.

The light system design should allow light intensity and duration to be modified as the birds age and provide a uniform light intensity at bird level. Typically, the lights are operated 23 hours a day during brooding and the light intensity is at maximum. Between 7 and 10 days of age the number of hours the lights are operated should be reduced (depending on the operation's guidelines) and by 10 to 14 days of age the light intensity should be reduced to 5 lux (0.5 foot candles). The main purpose of the lighting during the brooding is to ensure that chicks are active and that they seek out food and water sources.

Energy Conservation

- *Make sure that controller sensors/thermostats are placed properly*
  Positioning sensors/thermostats too close to a brooder or too close to the chicks or too high off the ground may result in bird chilling. Positioning them in too close to the side wall, brood curtain or where air is entering the house may result in excessive fuel usage.
- *Use circulation or paddle fans*
  The use of these fans will move warm air off the ceiling eliminating temperature stratification and get heat down to chick level where it is needed and reduce heating costs. Studies show that circulation fans are effective no matter which type of heating system is being used.
- *Use attic inlets*
  Pulling air from the attic on cool days when the sun is out can result in higher ventilation rates without increased fuel costs. This allows producers to take advantage of the warmer air found in the attics that will help to maintain relative humidity between 50 and 70 percent. To operate attic inlets properly, the house must be tight enough to pull at least 0.13 inches of water column in a static pressure test. If the houses cannot pull this static pressure, efforts should be made to tighten the houses to reduce leakage before installing attic inlets.
- *Eliminate leakage*
  Sealing up leaks provides control of where and how much air will enter the house. This will ensure that the air comes in through planned inlets and will minimize bird chilling, litter caking and temperature stratification during cold weather.
- *Use 5 minute timers instead of 10 minute timers*
  This will reduce house temperature drops resulting in less heater run time and will help regulate ammonia and moisture levels.
- *Clean and repair brooders on a regular basis*
  Proper brooder maintenance will reduce carbon monoxide and will burn fuel more efficiently. Brooders should have the dust blown off in between each flock. Keep the burner orifices clean. Use the proper size reaming needle to avoid altering the orifice size and wasting fuel.

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