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Poultry Housing Tips

Reducing Temperature Stratification in Houses with Forced Air Furnaces

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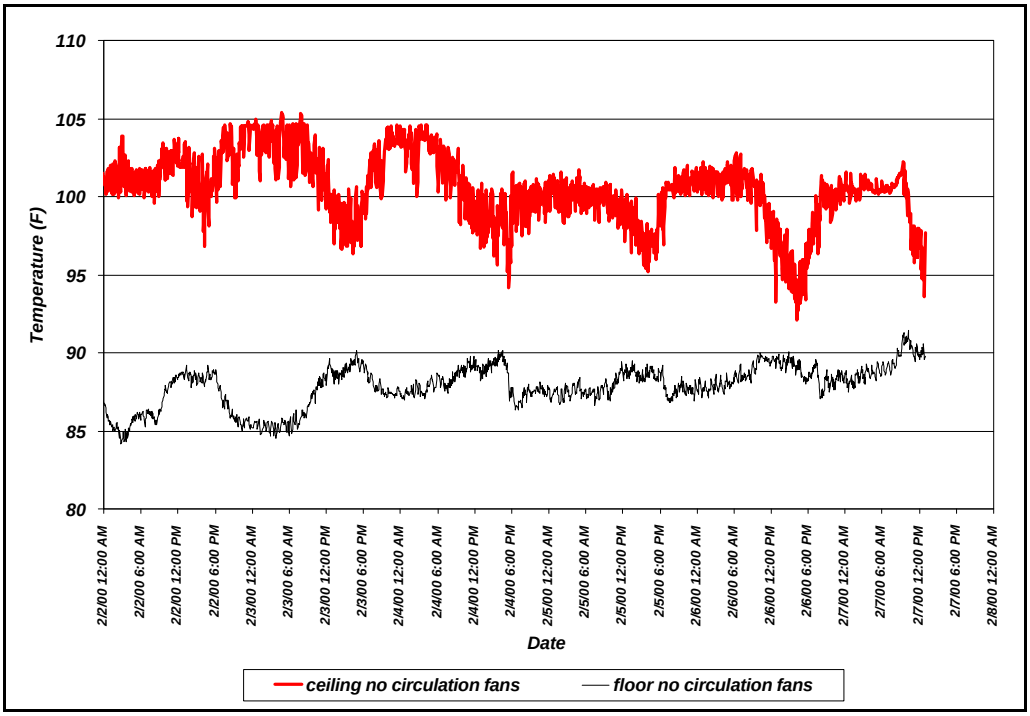

Figure 1. Temperature stratification during brooding

Ten years ago forced air furnaces were a very popular method of providing heat during brooding. Over the years there has been a trend away from forced air furnaces towards the use of conventional/radiant brooders. This trend has been so strong that today very few poultry companies would even consider using forced air furnaces on baby chicks.

The primary reason for the move to radiant/conventional brooders has to do with the very nature of forced air furnaces. First, furnaces are, in a sense, a top-down heating system. The hot air coming from a furnace does not move along the floor keeping the chicks warm, but rather, rises quickly to the ceiling of the house keeping the ceiling warm. Therefore, in order to get the hot air down to chick level you have to keep on filling up the ceiling of the house with hot air until you have added enough heat to make it down to floor level. The problem is that in most instances the hot air never makes it to floor level because the thermostats, located a few feet off the floor, shut the furnaces off before the hot air makes it all the way down to the floor. Therefore, producers may think they are brooding at 85 - 90°F, when really they are brooding at 80 to 85°F. A secondary problem with furnaces is that in order to get the air next to the floor at 90°F,

the air in the rest of the house has to be close to a 100°F. As a result fuel usage can be excessive when a producer operates his/her furnaces correctly.

Temperature stratification can be eliminated through the use of side wall inlets. When exhaust fans pull air through side wall or ceiling inlets at the proper static pressure, a jet of air travels along the ceiling pushing the hot air located there back down to the floor. However the problem is that early in the flock when the exhaust fans often are operating less than one minute out of five, the fans are not running long enough to totally eliminate stratification. Furthermore, in many cases houses do not have side wall inlets or are so loose that when timer fans come on the side wall inlets do not even open.

One way to minimize stratification is to install circulation fans. The objective of a circulation fan system is to move the hot air from the ceiling down to the floor without causing a draft. Often 36" fans have been used to fill this job, but of course these are the same fans that are used during hot weather to cool the birds. As a result, even if the fans are directed away from the birds the high air movement created by these fans can cause drafting. Paddle fans have been used by some companies to break up stratification, but in most instances if they are operated at a high enough speed to break up stratification, they too can cause bird chilling. What is needed is a smaller fan that can break up stratification but not cause bird chilling.

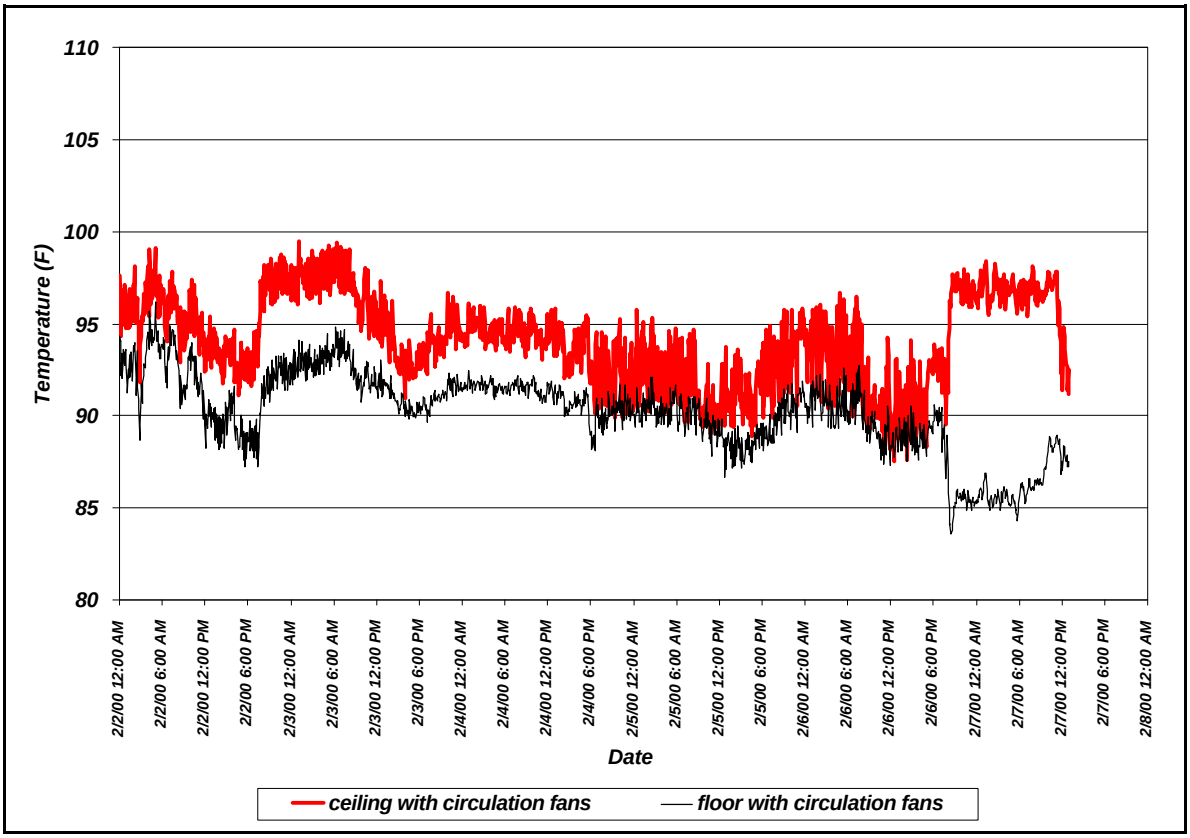

Figure 2. Floor and ceiling air temperatures in the house with circulation fans

Recently a study was conducted in two side-by-side broiler houses to evaluate the use of small circulation fans to improve floor temperatures and reduce fuel usage in houses with forced air furnaces. In one house, two 18" direct drive circulation fans were placed in the brood area next to the peak of the ceiling. The fans were placed 70' and 170' from the brooding end wall and directed air toward the brooding end wall. The fans were wired directly into the forced air furnace circuit so that whenever any furnace ran the fans would also operate. Temperature recorders were placed at

the peak of the ceiling in the center of the brooding area in both the house with circulation fans and in the adjacent house that had no circulation fans. Temperature recorders were also placed within three inches of the floor (directly under the ceiling temperature recorders) in each of the houses. Each house had its own separate propane tank. Both tanks were filled to capacity prior to bird placement.

Figure 1 shows floor and ceiling air temperatures in the house without circulation fans for the first week the birds were in the house. The amount of temperature stratification was highest at night when the furnaces were operating the most and lowest during the day when furnaces ran the least. Temperature stratification ranged between 15 and 20 degrees.

Figure 2 shows floor and ceiling air temperatures in the house with circulation fans during the same time period. Notice that not only was the ceiling air temperature much lower, but the floor air temperatures were at least five degrees higher. The grower had the furnace thermostats in both houses set at approximately 89°F. In the house without mixing fans the air next to the floor was never quite warm enough because the thermostats shut off the furnaces before the hot air could make it all the way down to the floor.

Toward the end of the week in Figure 2 the circulation fans were accidentally shut off. As you can see the temperature of the air next to the ceiling went up approximately eight degrees and the temperature of the air next to the floor dropped five degrees.

In the past the two houses had consistently used about the same amount of propane. During the first three weeks of this study the houses with the circulation fan were not only warmer but consumed $200 less propane, a 30 percent reduction. Though this magnitude of fuel savings cannot be assured on all farms, a number of studies have found fuel savings of 20% or more when circulation fans have been used.

The producer and field representatives have also reported that the litter conditions were better in the house with circulation fans. Moving the warm, dry air off the ceiling and down to the floor with the circulation fans reduced the amount of litter caking in the house.

Would the same benefits be seen in houses with brooders? What is the best size of circulation fan to use? How should the circulation fans be controlled? How should the circulation fans be positioned? These are all questions we are presently studying. But, it does appear that small circulation fans would be beneficial in houses which use forced air furnaces to brood chicks.

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