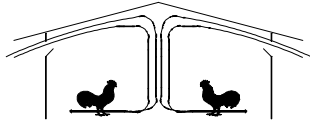




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Poultry Housing Tips

Circulation Fans in Houses with Radiant Brooders

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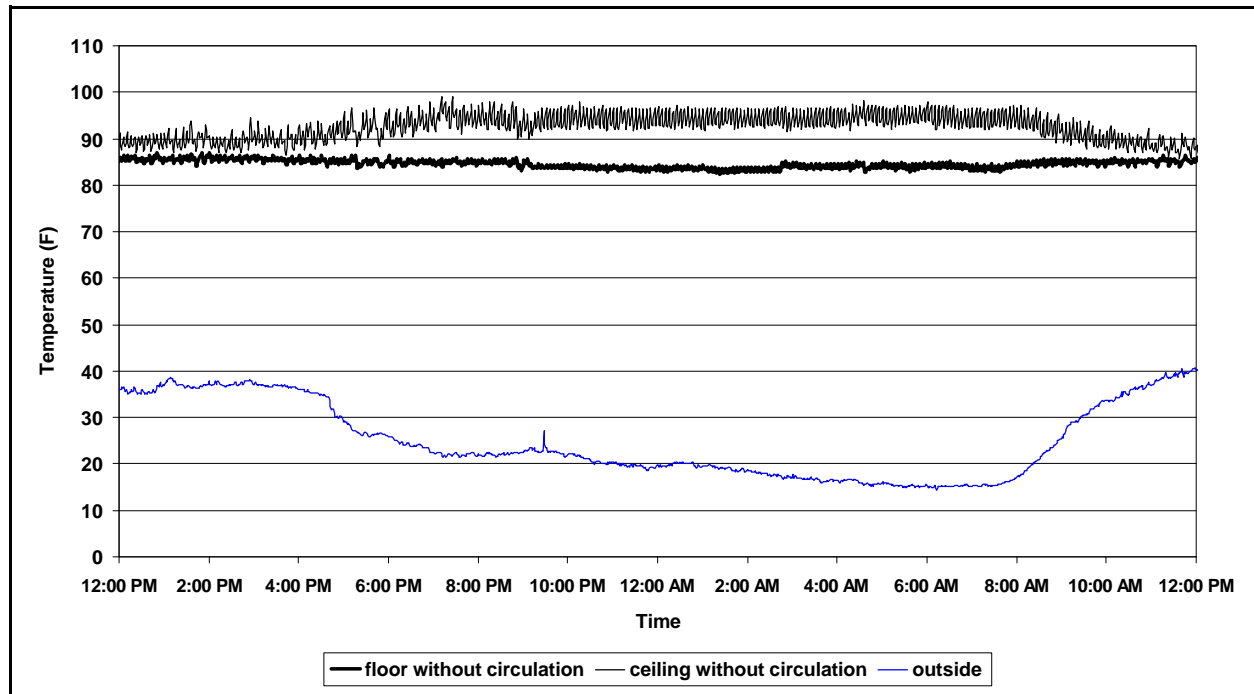


Figure 1. Air temperatures in house with radiant brooders and no circulation fans

Last winter a study was conducted to determine the possible benefits of installing small mixing fans in houses which used forced air furnaces for brooding. By moving the hot air produced by the furnaces off the ceiling, the 18" circulation fans were found not only to reduce fuel usage on the test farm by approximately 30%, but also raised floor air temperatures by as much as five degrees. Reports from other farms with forced air furnaces which have installed circulation fans this winter have shown similar results, though there have been differences. As a result, some lessons have been learned.

First, if furnace thermostats are placed three feet or more off the floor, it is possible to actually increase fuel usage through the use of circulation fans. As you well know, hot air produced by a furnace quickly rises toward the ceiling. The furnace often has to run a fairly long time for the hot air accumulating near the ceiling to make it down to floor level. The closer a furnace thermostat is placed near the ceiling, the faster the hot air will reach it and the sooner it will shut off. Therefore, if you placed your heating thermostats at the peak of the ceiling the furnaces could shut off after just a few seconds of operation and you would save a fortune on fuel. The only problem with this is that we do not raise chickens on the ceiling. And though the ceiling may be hot, the floor where the chicks are is likely to be very cold, and performance will suffer. In order to insure that we get our chicks off to a good start, we must make sure that the hot air is making it all the way down to chick level and the only way to insure that this is happening is to place the furnace thermostats at chick level. Though it may take a long time for the furnace to produce enough hot air to make it to the floor, at least you are insured of proper brooding conditions.

But, what happens when circulation fans are used when furnace thermostats are relatively high above the chicks? The hot air produced by the furnaces is moved off the top of the house down to chick level. This of course means that the furnace thermostat located three feet or more above the floor will be cooled and will come on more often. Of course, the up side is that we are now keeping the floor at the proper temperature. In the study conducted last winter, the furnace thermostats were located just a foot or so above the floor, and as result the furnaces had to run a lot to get the hot air all the way to floor level. By using the mixing fans, the hot air collecting near the peak of the ceiling was moved down to floor level which kept the heating system from operating as much, which resulted in a significant fuel savings. So keep in mind that though we are trying to keep fuel costs to a minimum, we have to make sure that our fuel savings are not being more than offset by a decrease in bird performance.

Another potential problem to watch out for mentioned in the first newsletter on circulation fans is bird chilling caused by excessive circulation fan operation. Generally, circulation fans controlled by an interval timer should operate no more than one minute at time. This is because in most instances stratification can be effectively eliminated after just one minute of operation and that running fans longer than a minute in most instances does not make the floor any warmer, just draftier. Therefore, the key to maximizing the effectiveness of circulation fans is not their on time but rather making sure they do not stay off for too long a period of time. The longer the fans stay off, the more of a chance the hot air will rise back to the ceiling, and potential fuel savings will be reduced. For this reason, it is best to use a five-minute timer and not a ten-minute timer.

What about using small circulation fans in houses with brooders? To answer this question a study was recently conducted on a four house broiler farm which used radiant brooders for heating. Two 18" fans were placed in the brooding end of one house, two 20" fans were placed in the brooding area of a second house, and no circulation fans were placed in the remaining two houses. All the dropped ceiling houses had a solid north wall and curtain flaps as well as wooden strips were installed on the curtains on the southern side of the houses, and as a result were very tight. With one 48" fan operating, a static pressure of 0.23" could be obtained with all the inlets closed. The houses had 14 radiant brooders on the brooding end of the house divided into three heating zones. The circulation fans were controlled both off of ceiling air temperature (a temperature sensor for the electronic controller was placed 6" from the ceiling in front of one of the mixing fans) as well as an interval timer. The circulation fans were set to operate if the ceiling air temperature reached eight degrees above the desired air temperature as well as one minute out of four. The houses had modern electronic controllers tied to a personal computer and as a result hourly heating system run time could be monitored and fuel usage determined.

During the first two weeks of the growout the two houses with circulation fans consistently used 10% less fuel than the two houses without circulation fans. The fuel savings were confirmed when the circulation fans were shut off and fuel usage increased approximately 10% in the houses with circulation fans.

Why was the fuel savings reduced from the approximately 30% seen in the furnace houses to approximately 10%? First, the houses were extremely tight which made the air inlets very effective in breaking up stratification. During

brooding, one 36" fan was used on the brooding end and one 36" in the nonbrooding end. All the inlets (located in the ceiling) were closed on the nonbrooding end as well as half the inlets on the brooding end. The controller was set to maintain a static pressure of 0.12" which resulted in the inlets opening approximately 1" when the 36" timer fans came on.

Figures 1 and 2 show floor and ceiling air temperatures in one of the houses without circulation fans for a 24-hour period when the chicks were approximately five days old. The variation in ceiling air temperature is caused by the air inlets opening and cold air pushing the hot air off the ceiling. The variation can be seen more clearly in Figure 3. Every five minutes the ceiling temperature dropped approximately six degrees when the timer fans came on. Floor air temperature only dropped one degree which is not much considering it was less than twenty degrees outside and fans were operating one minute out of five. If the air inlets were not functioning properly there would have been little variation in ceiling air temperature and a large variation in floor air temperature as the cold outside dropped quickly to the floor. This would have led to cold floor temperatures and brooders coming on more frequently and increased fuel usage.

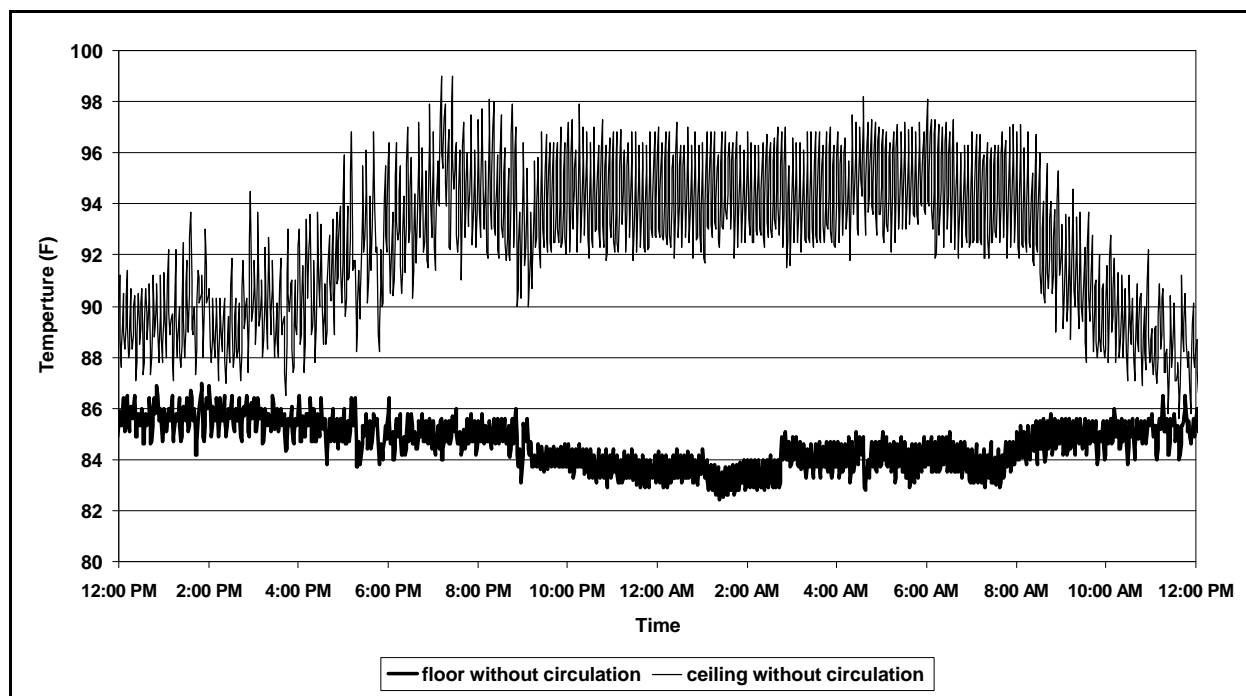


Figure 2. Ceiling and floor air temperatures in broiler house with circulation fans

The other cause for the reduced fuel savings is the fact that in houses with radiant brooders a significant portion of the heat produced by the brooders goes directly to the floor. This is one of the reasons why radiant brooders typically use 10 to 20% less fuel than those with forced air furnaces. Since there is less hot air near the ceiling and more heat on the floor, there is less stratification and therefore less fuel savings would be expected with the use of circulation fans.

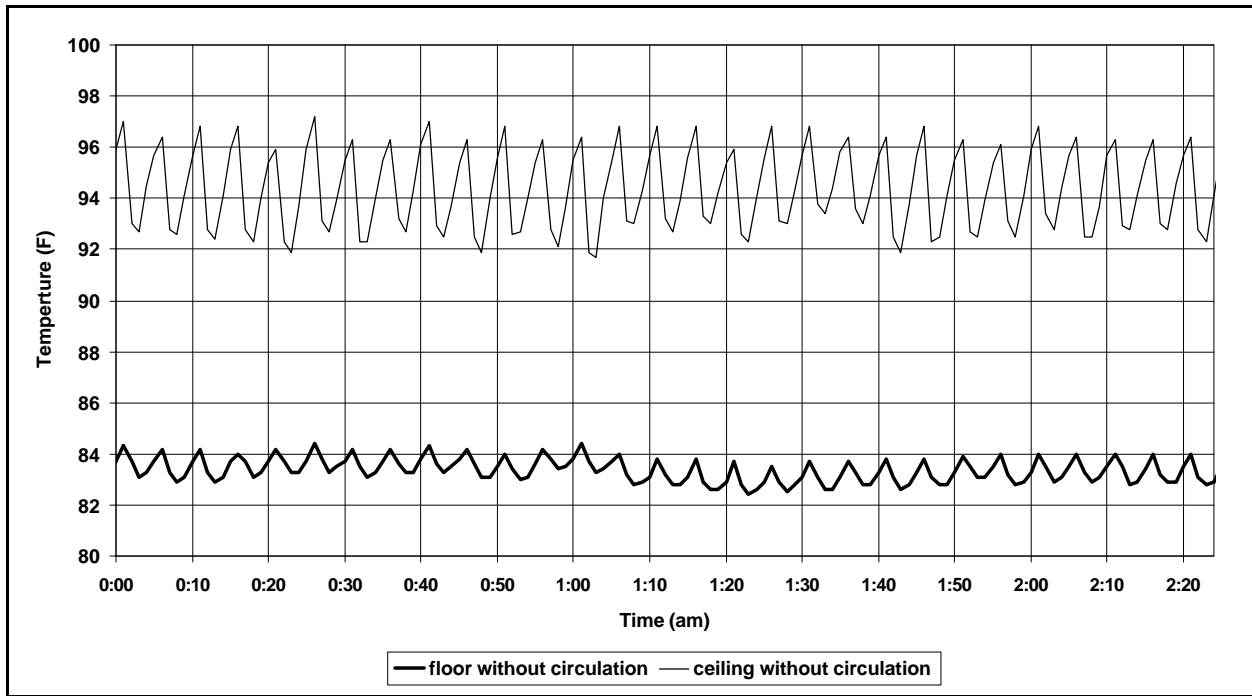


Figure 3. Variations in floor and ceiling air temperatures caused by timer fans.

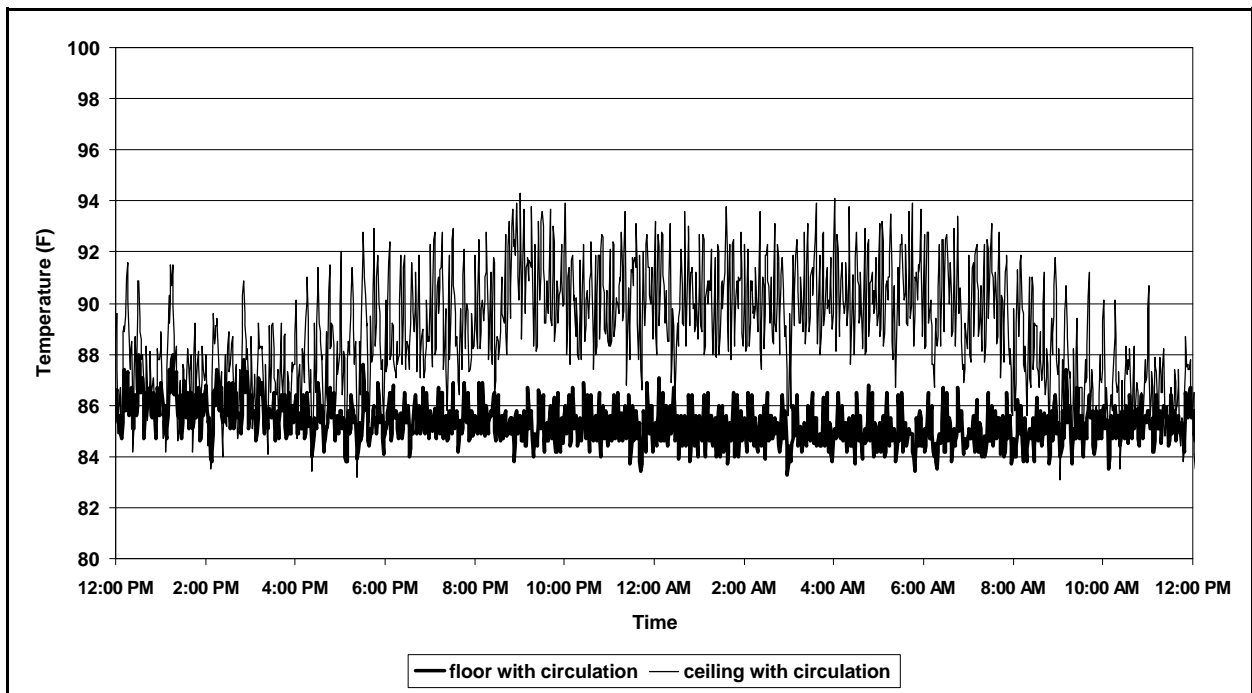


Figure 4. Floor and ceiling air temperatures in houses with circulation fans

Though the fuel savings were not as great as in the houses with forced air furnaces the circulation fans did have a significant effect on temperature stratification and the environment at floor level. Ceiling and floor air temperatures

in one of the houses with circulation fans can be seen in Figure 4. The circulation fans increased floor air temperatures by between one to two degrees. The slightly greater variation in floor air temperatures was caused by the circulation fans pushing hot air off the ceiling and raising the floor temperature slightly above the desired (85°F). This kind of variation is not likely to cause a problem considering the variation is above the desired room air temperature. The variation in ceiling air temperature was caused by both the circulation fans and the air inlets. The combination of air mixing produced by the air inlets and the mixing fans kept the temperature of the ceiling below 94°F (the temperature at which the circulation fans were set to run constantly) and most of the time below 90°F, whereas the ceiling temperature reached between 96 and 98°F in the house without circulation fans.

Another apparent benefit of the use of circulation fans during brooding is the reduction of caked litter. Though litter caking was not a major problem in any of the houses, there was noticeably less cake under the water lines on the brooding end of the houses with circulation fans. The slight increase in air temperature as well as air movement at floor level helped to remove moisture from the litter, thereby reducing litter caking which is always a problem when temperatures are low and fuel costs are high. It is interesting to note that though the amount of caked litter was reduced in the houses with circulation fans there were no noticeable differences in ammonia levels in any of the four houses.

The question for producers with radiant or conventional brooders is whether they should install circulation fans. It of course depends. The tighter the house, the better the inlets work in breaking up stratification, the slower the payback for installing circulation fans. But if you have a loose house with a high ceiling and no side wall inlets; the circulation fans are likely to have a quick payback. Of course with high fuel costs (i.e, over \$1.50 a gallon), circulation fans look better no matter what. On the farm where the study was conducted, even though the circulation fans reduced heating costs by only about 10%, this resulted in reduced heating cost by approximately \$100 during the time the birds were in ½ house.



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