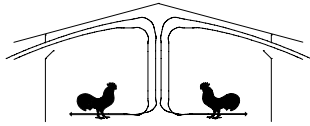




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# Poultry Housing Tips

## Circulation Fans For Open Ceiling Houses

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Circulation fans have proven to be very effective in reducing fuel usage, promoting drier litter, and minimizing hot and cold spots in broiler houses during cold weather. The key to obtaining maximum benefit from circulation fans is making sure that you install a circulation fan system. That is, you should install circulation fans in such a way so they work together as a unit to thoroughly, yet gently, mix the air in the house not only from ceiling to floor but from end to end, on a continuous basis, without producing excessive air movement at floor level.

As with many things, what works well in one type of house may not be the best option for another. For instance, though six 18" 1/15 hp circulation fans may do a good job of mixing the air in a 40' X 500' dropped-ceiling house, the same fans in a 40' X 500' open-ceiling house with exposed trusses will not tend to produce the same results. There are a number of reasons for this. First, an open-ceiling house has a greater volume of air than a dropped-ceiling house, requiring more fan power to produce the same level of circulation. Secondly, stratification tends to be greater in a house with a higher ceiling which increases the difficulty in moving all the hot air down to floor level. Last but not least, the exposed trusses in an open ceiling house reduces the distance a circulation fan will throw the air, which means a stronger fan is required to push the air the same distance as that achieved in a smooth, dropped-ceiling house.

Figure 1 illustrates a fairly typical 18" (1/15 hp) circulation fan layout for a 40' X 500' dropped-ceiling house. The simplest way to offset the challenges with air circulation in an open-ceiling house is to install 1/3 hp, 18" circulation fans instead of 1/15 hp, 18" fans. 18" 1/3 hp fans tend to move around 30% more air than 1/15 hp fans which is often just enough power to properly mix the air in an open-ceiling house. The circulation fans should be installed just below

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the ceiling as in dropped-ceiling houses, blowing parallel to the ceiling, and operating continuously during cold weather.

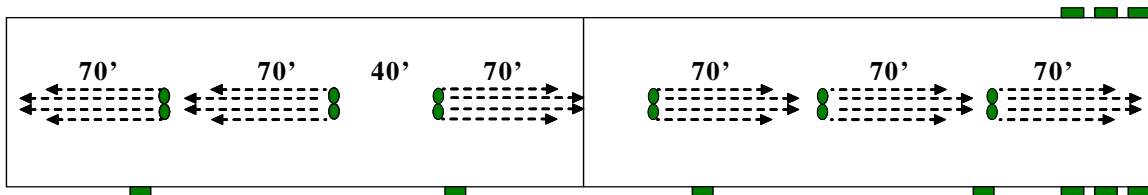


Figure 1. Circulation fan positioning in 40' X 500' broiler house.

In March of last year the use of 18", 1/3 hp circulation fans in two 40' X 500' open ceiling houses was studied on a broiler farm in North Georgia. In the first house, temperature data loggers were placed near the ceiling and the floor 15' from the half house brood curtain and end wall as well in the center of the brooding area. In the second house, temperature dataloggers were placed at the floor 15' from half house curtain and end wall as well as in the center of the brooding area. One temperature data logger was placed near the ceiling 15' from the end wall. In the first house the circulation fans were for the most part run continuously while in the second house circulation fans were operated off an interval timer running one minute out of five.

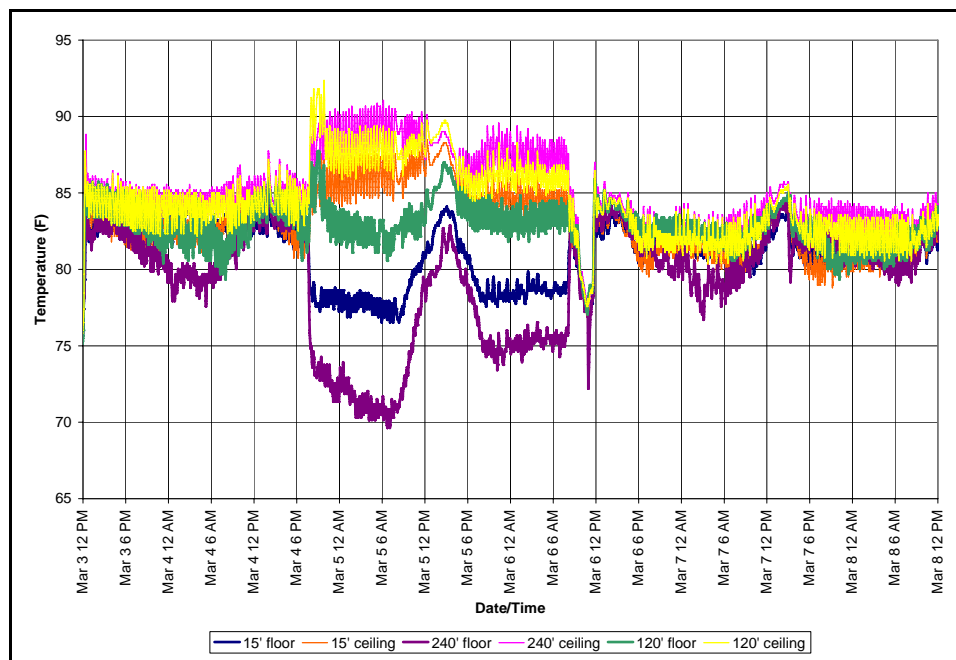


Figure 2. Floor and ceiling air temperatures in 40' X 500' open ceiling house with and without circulation fans operating.

Figure 2 shows floor and air temperatures during a five-day period when the chicks were in half house. When the circulation fans were operating the entire brooding area (floor to ceiling, end to end) was within a two to three degrees. When the circulation fans were turned off the variation in house temperatures increased dramatically with the largest differences occurring near the end wall and brooding curtain. For instance, while the circulation fans were operating there was less than a three degree difference between floor and ceiling air temperatures near the brooding curtain. When the circulation fans were shut off floor temperature rapidly dropped to near 70°F while ceiling air temperature increased to nearly 90°F. The sudden drop in floor temperature near the brooding curtain was as a result of leakage of cold air from the nonbrooding end into the brooding end due to a loose fitting brooding curtain. When the circulation fans were operating this cold air was being heated by the hot ceiling air rolling down the brooding curtain. Though not quite as dramatic, a similar trend was seen near the brooding end wall. This is an important characteristic of a circulation fan system. Not only are we moving air from the ceiling to the floor but from end to end creating more uniform house air temperatures.

Figure 3 shows the floor and air temperatures in the house where the circulation fans were operating off of an interval timer one minute out of five. It is clear to see from this graph that the circulation fans were not operating long enough to fully mix the air in the brooding area. The brief period during which the circulation fans operated did cause a momentary drop in ceiling air temperature and corresponding increase in floor air temperatures but the stratification was never fully broken up. Because of the lack of air mixing floor temperatures were approximately five degrees lower than in the house where the circulation fans were operated continuously for the five days shown in Figures 2 and 3.

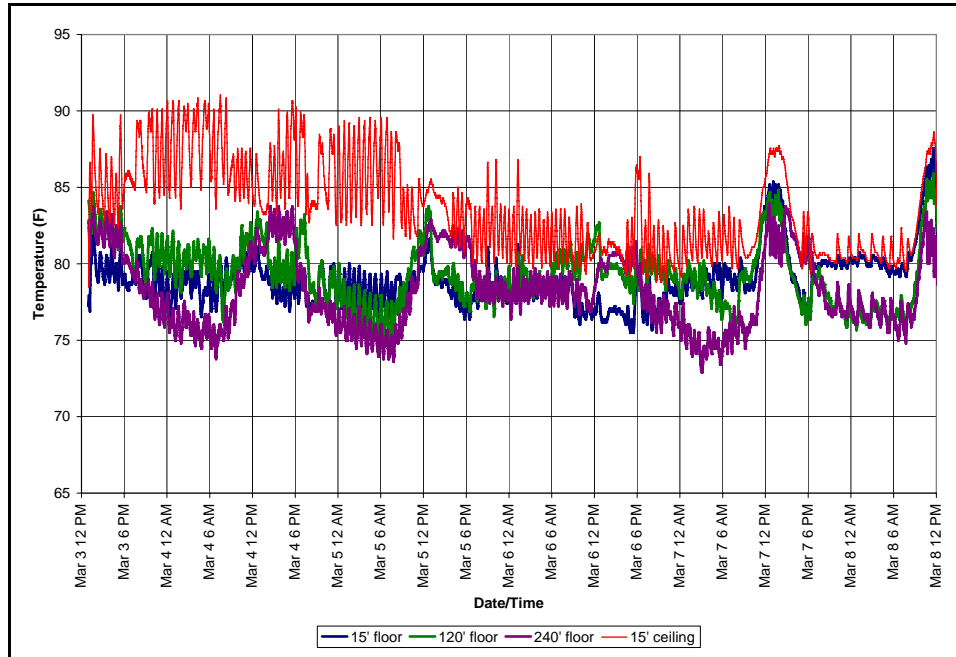


Figure 3. Floor and ceiling air temperatures in 40' X 500' open ceiling house with and without circulation fans operating.

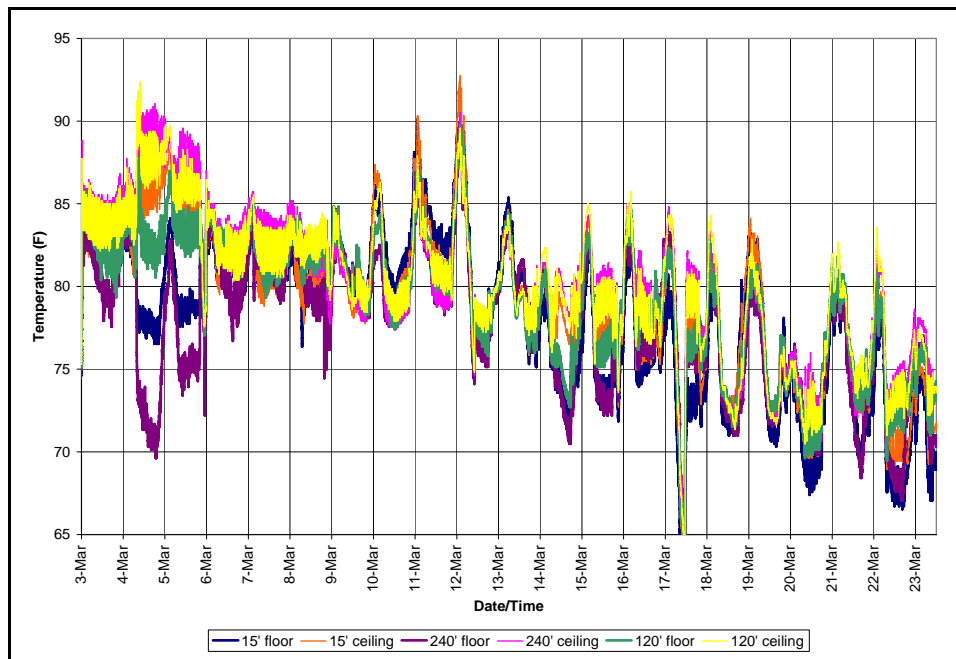


Figure 4. Floor and ceiling air temperatures in 40' X 500' open ceiling house with and without circulation fans operating.

Figures 4 and 5 show floor and ceiling air temperatures from March 3 to March 23. For the most part, a similar trend of more uniform house temperatures can be seen in the house where the circulation fans were run continuously as compared to the house where the circulation fans were operated off an interval timer. The biggest difference between the houses tended to occur at night when ventilation rates were at their lowest and heating system run time tended to be at its highest. There was an increased variation in house temperatures in the house where the circulation fans were operated continuously from March 14 to the March 18. This was due to the circulation fan being switched from running continuously to operating off an interval timer.

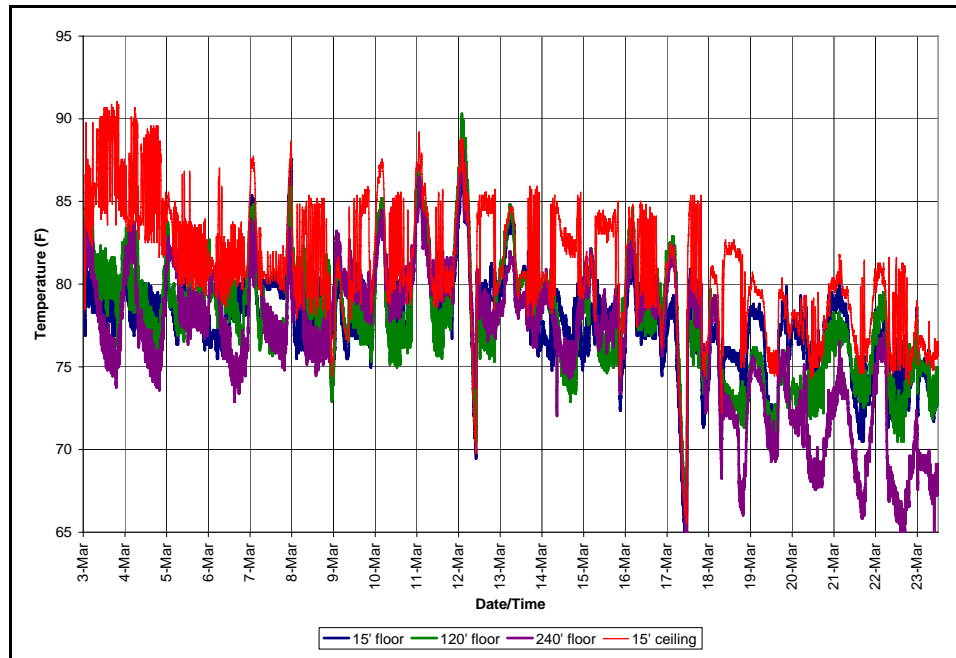
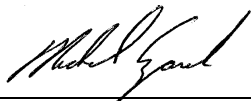


Figure 5. Floor and ceiling air temperatures in 40' X 500' open ceiling house with circulation fans operating off an interval timer.

Though the circulation fans operating constantly did a superior job of breaking up temperature stratification and producing much more uniform house temperatures, the fuel usage was approximately 10% higher than in house where the circulation fans operated one minute out of five. Though this is certainly not a common occurrence, it is a fact that in some circumstances circulation fans can increase fuel usage. Fuel usage can be increased by the use of circulation fans if the thermostats/sensors controlling the heating system are installed too high above the floor. It is important to realize that the hot air we heat a house with starts at the ceiling and works its way to the floor as we continue to heat a house. When a thermostat/sensor is placed let's say three feet above the floor the heating system will turn off before the hot air ever reaches the floor leading to cool floors and a reduction in fuel usage. When circulation fans are operating the entire house is now being properly heated which can lead to an increased fuel usage. Another similar situation can occur when temperature sensors controlling furnaces/brooders near are located too far end walls and/or brooding curtains. The ends of the house run cool in part because there are no thermostats/sensors to turn on the heat when needed. Again, this results in fuel savings because the heating system is not really heating the entire house. When circulation fans are used, hot air from the center of the house is moved into the ends, resulting in an overall warmer house but the possibility of an increase in fuel usage. The fact is that when circulation fans do increase fuel usage it tends to indicate that floor level temperatures before the circulation fans were installed were cooler than thought and fuel usage was lower than it really should have been. On this particular farm the thermostats controlling the heating system were too high and located towards the center of the brooding area which tended to "save" propane usage at the birds expense. The fact is that even though the producer feels that his fuel usage may be slightly higher in his houses with circulation fans, he continues to use them and is happy with his results. In fact, he has installed circulation fans in other houses on his farm since this study.

Here are some tips to help you get the most out of installing circulation fans in open-ceiling houses:

- 1) Though 18", 1/3 hp circulation fans will do a good job of circulating the air in most open-ceiling houses it is important to note that in wider houses or those with very high ceilings, either more fans or more powerful circulation fans may be required.
- 2) If you feel the 1/3 hp fans are creating too much air movement at floor level they can be tilted up towards the ceiling slightly (a few degrees) which will tend to reduce their "throw", reducing overall air movement in the house.
- 3) If you feel the need to operate the circulation fans off a timer, use a five-minute timer and try to operate the fans at least two and a half minutes out of five. During preheating or times when the heating system is operated a significant portion of the time the circulation fans should be operated continuously.
- 4) It is possible to control the amount of air movement created by circulation fans through a variable speed controller. Though this can be a good option for some, keep in mind that variable speed controllers can increase the cost of a circulation fan system significantly and if not operated properly can result in reduced fan motor life.
- 5) Place a large dial thermometer or temperature sensor near the ceiling to monitor the level of stratification that is occurring in your houses.
- 6) Circulation fans are most useful during cold weather when the heating systems are operating a fair amount and fans are operating off of interval timers. Once the exhaust fans start operating on a continuous basis you may want to turn off the circulation fans.
- 7) Take care not to place circulation fans closer than 60' from a brooding curtain. The force of the air coming out of the circulation fan can move the brooding curtain, causing hot air from the brooding end of the house into the nonbrooding end of the house, resulting in increased fuel usage.
- 8) Make sure you clean your circulation fans at least once a flock. Dust tends to accumulate on the wire basket surrounding the fan which can dramatically reduce the fan's air circulation capacity.



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