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Maintaining a Consistent House Temperature During Cold Weather

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One of the keys to maximizing bird performance and minimizing fuel costs during cold weather is providing a consistent house environment. Large fluctuations in house temperature can lead to excessive feed consumption, resulting in poor feed conversions. The combination of wide swings in air temperature and air quality can lead to health problems. Sudden drops in house temperature can cause furnaces and brooders to cycle on, resulting in excessively high fuel bills.

The type of ventilation system a grower has determines to a large extent his ability to maintain a consistent environment. The ventilation system must allow the producer to bring in a specific volume of cold fresh air into the house and heat it before it comes in contact with the birds. One system which has proven very effective at doing this is a negative pressure ventilation system with inlets. In a negative pressure system, exhaust fans on timers allow the producer to bring in the exact amount of fresh air he feels is required, while inlets allow him to determine how it moves once it enters the house. When a producer has control over these two factors, providing a consistent house temperature is not very difficult.

Last winter a study was conducted in a 40' X 400' broiler house located in North Georgia. The objective of this study was to demonstrate how consistent a house temperature could be obtained using exhaust fans and inlets during cold weather.

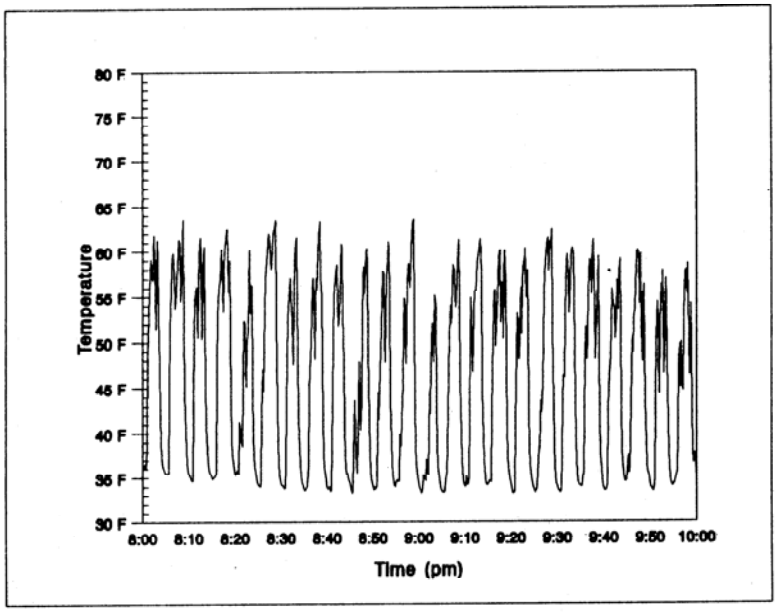

Figure 1. Air Temperature at Location A (ceiling)

PUTTING KNOWLEDGE TO WORK

At the time of the study the birds were approximately five weeks old. The producer had opened twelve 4' inlets, approximately three inches, along the south side wall. Three synchronized 36" fans were operating 2 1/2 minutes out of five. House static pressure was 0.07" of water column. Outside temperature during the recording period was in the thirties.

Figure 1 is a graph of house temperature recorded one evening at one of the locations monitored in the house. At first glance one might conclude that bird performance was probably less than ideal in this house. But, it is important to realize when examining this rather ominous looking graph that the temperature sensor recording the nearly 35°F swings in house temperature every five minutes was located 6" off the ceiling, approximately 1' from the side wall (Figure 3, Location A). On the floor during the same period, the environment was very different. Floor air temperatures, less than 7' away, only varied between 72°F and 75°F.

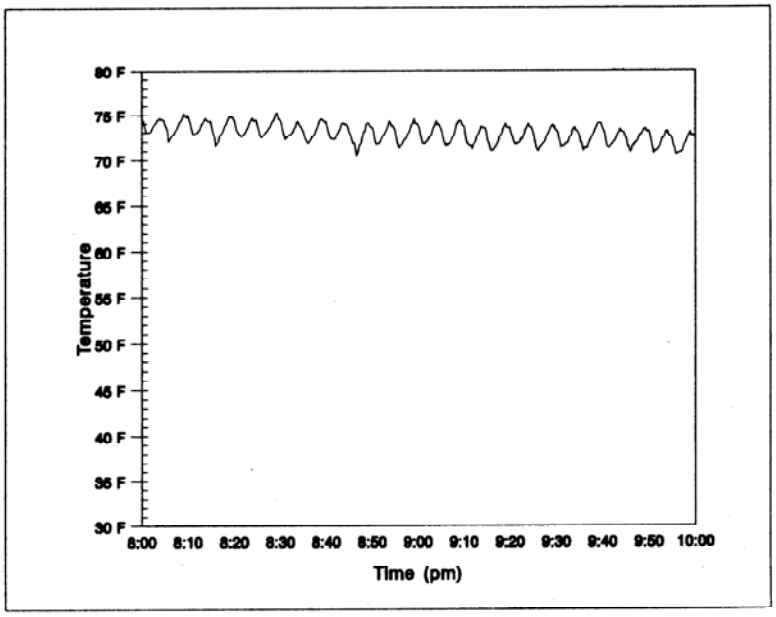

Figure 2. Air Temperature at Location D (floor)

To understand how this can happen it may be helpful to review the air patterns in a negative pressure house with inlets (Figure 3). Due to the "partial vacuum" created by the exhaust fans, air enters through the inlets with considerable speed (800 ft/min). The inlet board deflects the incoming cold air away from

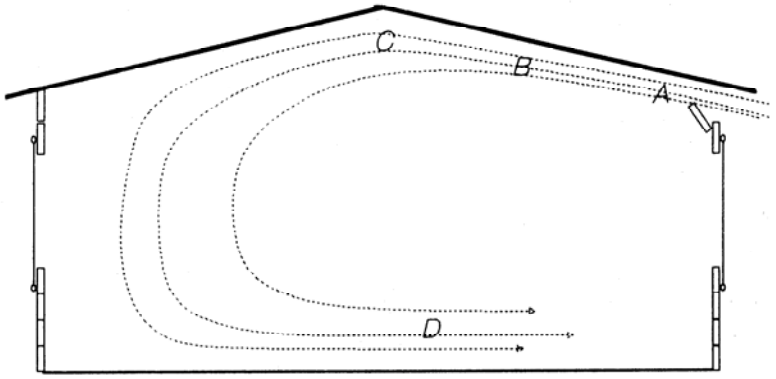

Figure 3. Air Patterns in Negative Pressure House With Inlets

the birds and towards the ceiling. As the cold air shoots across the ceiling, it mixes with the warm air produced by the birds and the brooders/furnaces which has accumulated near the ceiling. The fresh air quickly warms as it mixes with this warm air. In fact, by the time the outside air reaches the center of the house (Location C), its temperature can be increased by 30°F or more.

As the air moves across the ceiling and warms up, it is also slowing down. Air entering a house at 800 ft/min, is generally moving less than 200 ft/min at the center of the house and a barely perceivable 50 ft/min or less as it reaches the floor. The final result of using the inlets with exhaust fans is that by the time the air reaches the floor it is moving very slowly and is fully warmed.

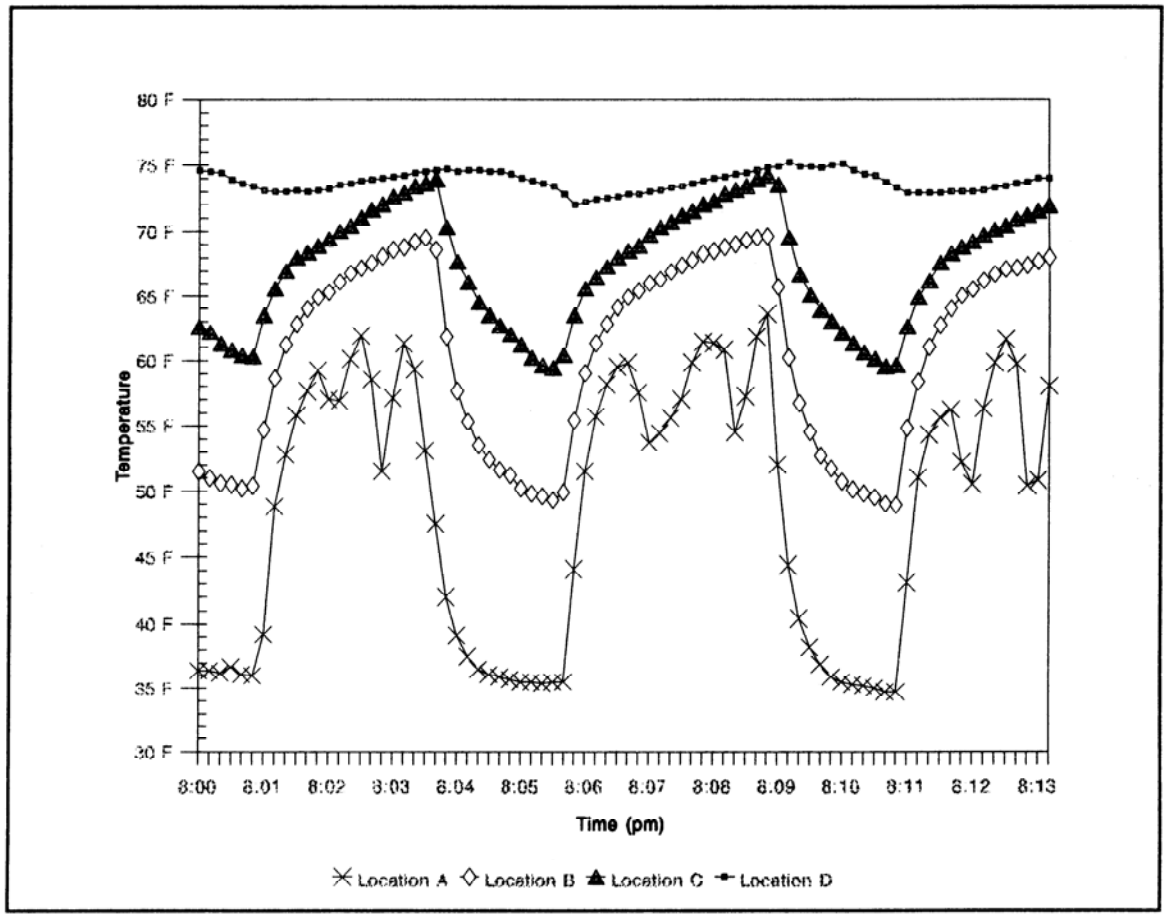

Figure 4. House Air Temperatures

Figure 4 illustrates the aforementioned warming process. The graph shows the temperature of the air at four locations in the house over a 13 minute period during which timer fans came on twice.

The sudden decrease in the temperature of the air at location A at 8:03 is an indicator that the timer fans started to run. Over the next minute, the temperature of the air at location A dropped nearly 25°F while there was no change in the temperature of the air near the floor (Location D). At 8:05 the warming process can clearly be seen. Within 10' of the inlet, the temperature of the incoming air had warmed nearly 15°F (Location B). Over the next 10', the air heated an additional 10°F (Location C). If there had been another temperature sensor located 10' further along the ceiling, another 5°F to 10°F of heating would have been seen. By the time the fresh air reached bird level, it was warmed sufficiently to have little cooling effect upon the birds (Location D).

It is important to note that the consistent house temperatures were the result of using exhaust fans and air inlets. If air had been allowed to enter through a cracked curtain instead of an inlet, the result would have been significantly different. Instead of the air shooting along the ceiling, the air would have moved straight down towards the floor (Figure 5). This is because when a curtain is opened an inch or less the opening formed directs the air down to the floor. This means that little preheating of the air would occur and the birds would have very cold air blowing over them every 5 minutes when the timer fans ran. In addition, the cold air would most likely fall on brooders or furnace thermostats, causing them to come on. The end result would be cold birds, caked litter, high fuel bills, and poor performance.

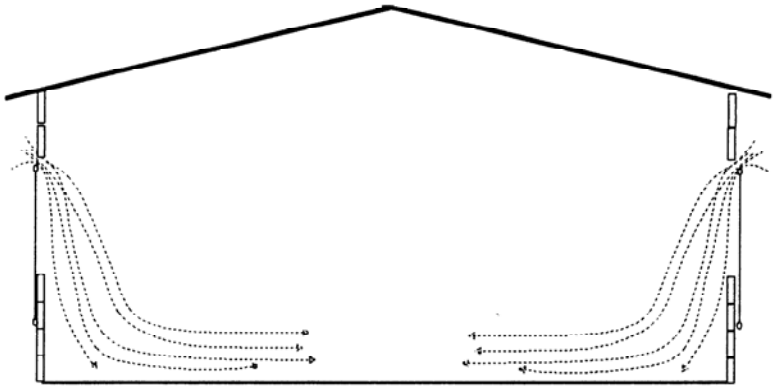

Figure 5. Negative Pressure Using a Cracked Curtain.

Even with the use of inlets, house temperatures may not be as consistent as one thinks. It is important that enough static pressure is generated to throw the air across the ceiling far enough that it has a chance to heat up before it moves towards the floor. If the static pressure had been only 0.03", the air would have had only enough speed to make it to approximately location B before falling. This would have meant that the air would have preheated only 15°F before it fell and came in contact with birds.

When using exhaust fans and air inlets, keep the following points in mind to help create the most consistent house environment.

1) Make the house as tight as possible.
2) During cold weather, try to obtain a pressure of at least 0.05", preferably 0.08".
3) If you cannot get enough static pressure, try tightening the house before turning on another fan.
4) In most cases, inlets have to be opened at least 2 to 3 inches to allow the air to be thrown to the middle of the house.
5) Not all the inlets have to be opened in order to provide a uniform environment. One inlet opened a few inches every 30' to 40' is often sufficient.

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