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Poultry Housing Tips

Insulated Tunnel Doors...A First Look

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Figure 1. Standard Tunnel Curtain

Figure 2. Insulated Tunnel Doors

One of the challenges facing many growers during cold weather is keeping the tunnel curtain ends of their broiler houses warm and dry. There are a number of reasons for this problem, other than the obvious loose end wall door. First, in more and more houses the tunnel curtain is significantly larger than the remainder of the side wall curtains in the house. For instance, most tunnel curtains are approximately five feet in height whereas many side wall curtains are less than three feet in height. Since curtains have a very low insulation value, this two-foot difference in height can result in brooders/furnaces in the vicinity of the tunnel curtain having to run 30% more than those in the remainder of the house in order to maintain the proper house temperature. Making matters worse is since the tunnel curtain has to be free to open and close it is often looser than the remainder of the side wall curtains in the house. Air leaking in from around the tunnel curtain can further increase the amount of time brooder/furnaces have to operate in this area of the house as well as lead to litter caking.

Though most growers have noticed that the brooders/furnaces in the tunnel curtain area of a house will run more than those in the remainder of the brooding area, nowhere is this more evident than in a totally enclosed broiler house. In the typical totally enclosed house, heat loss in the tunnel curtain area of the house is as much as three times greater than that from the center of the brooding area. In other words, in a totally enclosed house, a producer can spend just as much to keep the tunnel curtain area of the house warm on a cold winter day as the remaining 185' foot of the 250' brooding area.

To eliminate problems associated with poorly insulated and leaky tunnel curtains a new system has been developed and has been field tested for the last year on a broiler farm in North Georgia. The tunnel curtain (Figure 1) in the test house was replaced by a series of insulated doors manufactured by Canarm Ltd. (www.canarm.com). The doors measure eight feet by two feet and are constructed of two sheets of hard PVC plastic injected with one inch of polyurethane insulation (Figures 2 & 3). Each door has a continuous rubber hinge along the bottom and rubber gasket along the top that virtually eliminate any leakage. The doors have slot connectors on the sides that allow the doors to be slid together forming a continuous two-foot-high door down the length of the tunnel opening. To facilitate a four- or five-foot-tall pad, the doors are stacked one on top of the other.

The tunnel doors open and close much like most side wall inlets. A string is attached to a handle located every four to five feet along the top of the door and then connected to a cable through a small pulley. The cable is then connected to a standard inlet/curtain machine which opens the doors to about a 45 degree angle. Each eight-foot door is equipped with two latches which allow the doors to be closed extra tightly during cold weather, eliminating any possibility of leakage. During cold weather or when tunnel ventilating small birds, the bottom doors can be latched closed allowing only the top doors to open.

Figure 3. Partially Opened Tunnel Doors

Figure 4. Northern Sidewall

Figure 5. Southern Sidewall With 2' Curtain

The insulated tunnel doors were installed in a dropped ceiling 40' X 500' broiler house in February of 2002. The northern sidewall of the house is constructed of a sheet metal outside surface insulated with 3 ½" of fiberglass with a plywood interior (Figure 4). The southern sidewall is of similar construction but had a two-foot curtain (Figure 5). The house has 70 feet of four-foot-tall evaporative cooling pads on each side of the house, installed two feet from the side wall. The house is heated using radiant brooders in the brooding end, divided into three groups (zones), each of which is controlled independently by a modern electronic controller. An identical house, with the exception of the insulated tunnel doors, next to the test house was used for comparison purposes.

The electronic controllers in both houses were connected to a PC so that temperatures and brooder run times could be recorded on a continuous basis. Since a 40,000 Btu/hr radiant brooder burns 0.43 gallons of propane per hour, daily fuel usage was estimated by simply multiplying the number of brooders in a zone, by the number of hours the zone operated, by 0.43 gals/hr (Gallons per zone = Number of brooders X hours operated X 0.43 gals/hr). Fuel usage was also verified through propane tank fill level observations. In addition to the data collected from the environmental controllers, temperature data loggers were placed six inches from the center of the tunnel opening as well as on the water line approximately three feet from the tunnel opening in both houses for one of the cold weather flocks.

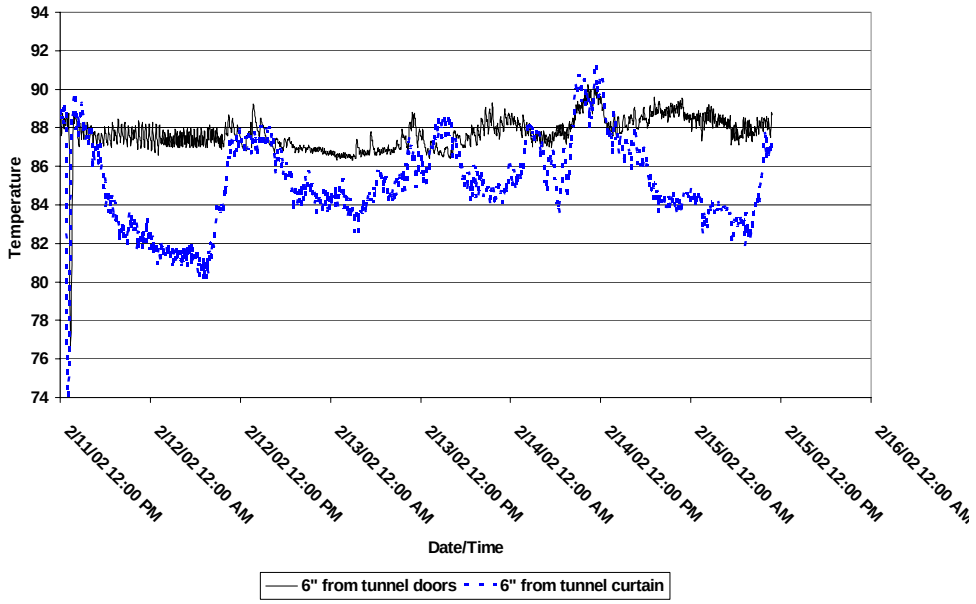

Figure 6. Air Temperatures Near Tunnel Opening

Though for the most part the tunnel opening area of both houses remained relatively warm during cold weather, it was noticeably cooler when standing near the side wall in the house with the tunnel curtains. Data loggers indicated that the air immediately next to the tunnel curtain was up to eight degrees cooler than that next to the insulated tunnel doors (Figure 6). The cooler air next to tunnel curtain, along with a little leakage from along the bottom of the curtains, resulted in slightly lower air temperatures at floor level at the outside water lines (Figure 7). The controller sensors located above the inside water line indicated no or little temperature differences between the two tunnel curtain areas. This was likely due to the fact that the radiant brooders, installed along the center line of the house, did a very good job of heating the floor toward the center of the house, thereby reducing the effect of the cooler air emanating from the tunnel curtains.

In the house with tunnel curtains, as expected, the lower insulation value of the tunnel curtains resulted in the brooders in the vicinity of the tunnel curtain burning significantly more propane than those in either the center of the brooding area or those near the brooding curtain (Figure 8). Over the 14 days the birds were in the brooding half of the house the brooders near the tunnel curtain used approximately 30% more gas than the brooders in the center and 50% more gas than those near the brooding curtain.

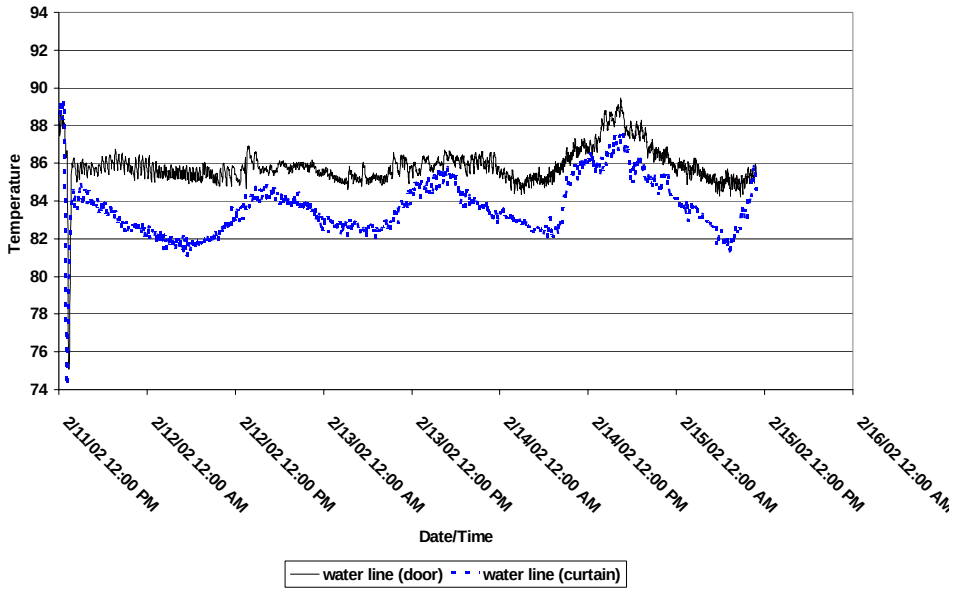

Figure 7. Air Temperature Near Outside Water Line

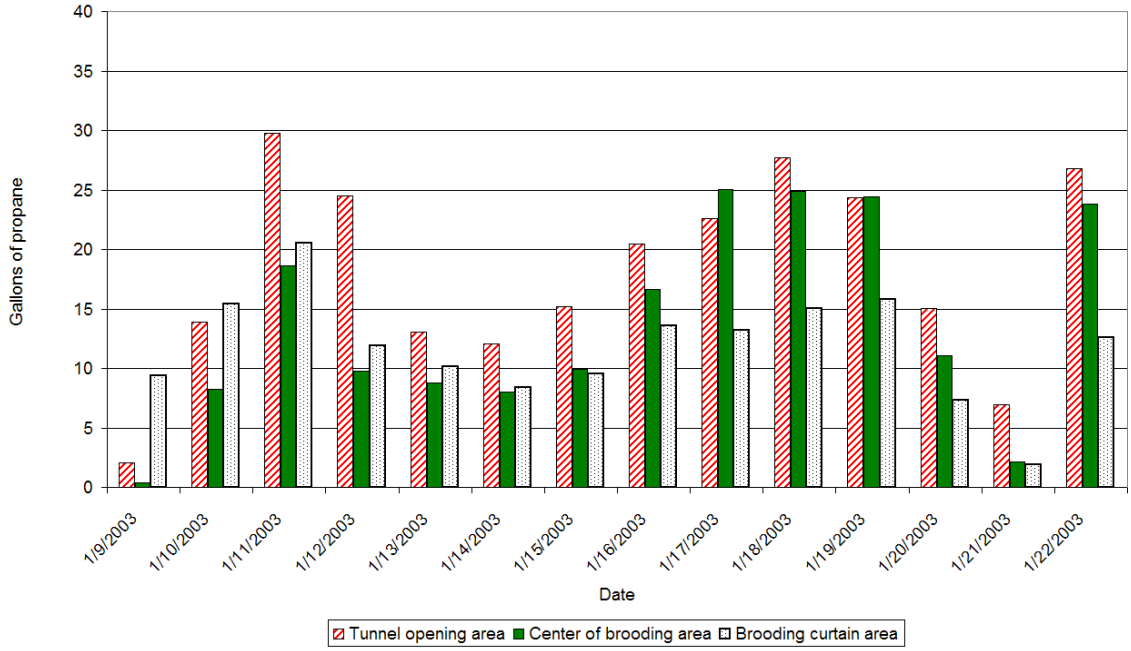

Figure 8. Daily Fuel Usage by Brooder Zone in House with Tunnel Curtains

Figure 9 illustrates the fuel usage of each of the three brooder zones in the house with insulated tunnel doors. Since the insulated doors had a similar insulation value and tightness as the side wall throughout the remainder of the brooding area, the brooders in the vicinity of the tunnel curtain used about the same amount of fuel as those in the remainder of the house. In fact, over the 14 days the chicks were in the brooding end of the house there was less than a 5% difference in the amount of fuel the brooders in the three zones burned.

When the two houses were compared it was found that though the brooders in the center and brooding curtain zones of both houses used about the same amount of gas, the brooders near the tunnel curtain used well over 30% more fuel than those near the tunnel doors. When the fuel usage of three zones of brooders in each of the houses were combined, overall daily fuel usage was found to be between 10% and 15% lower in the house with the insulated tunnel doors than in the house with the conventional tunnel curtains (Figure 10). This same level of savings was noted during all three cold weather brooding periods studied.

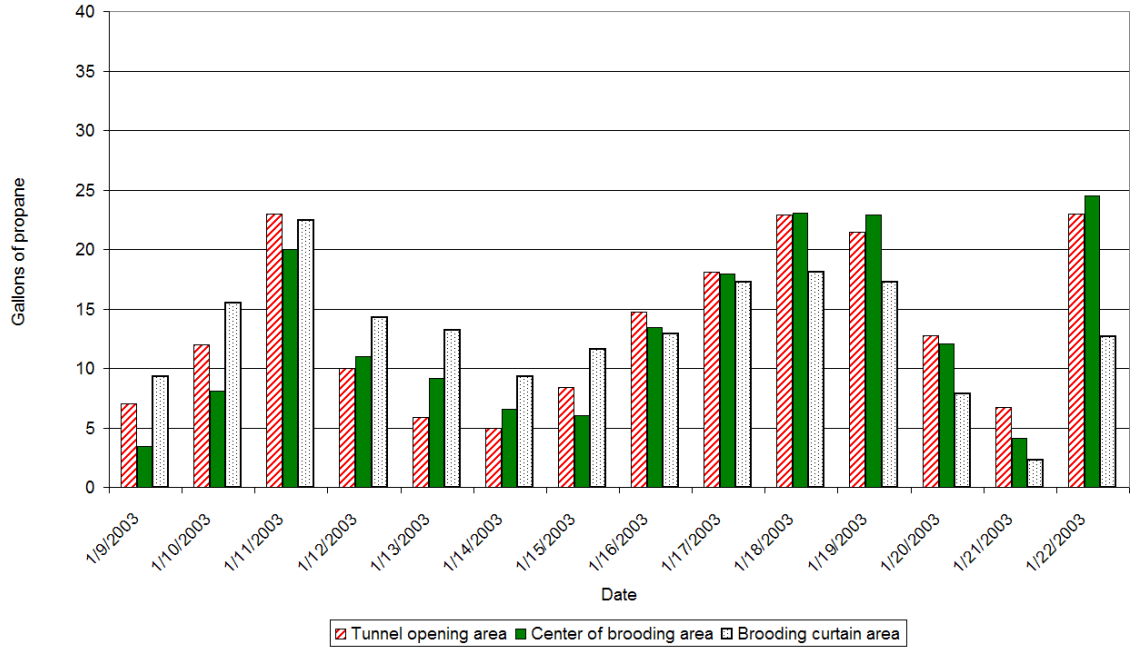

Figure 9. Daily Fuel Usage by Heating Zone in House with Tunnel Doors

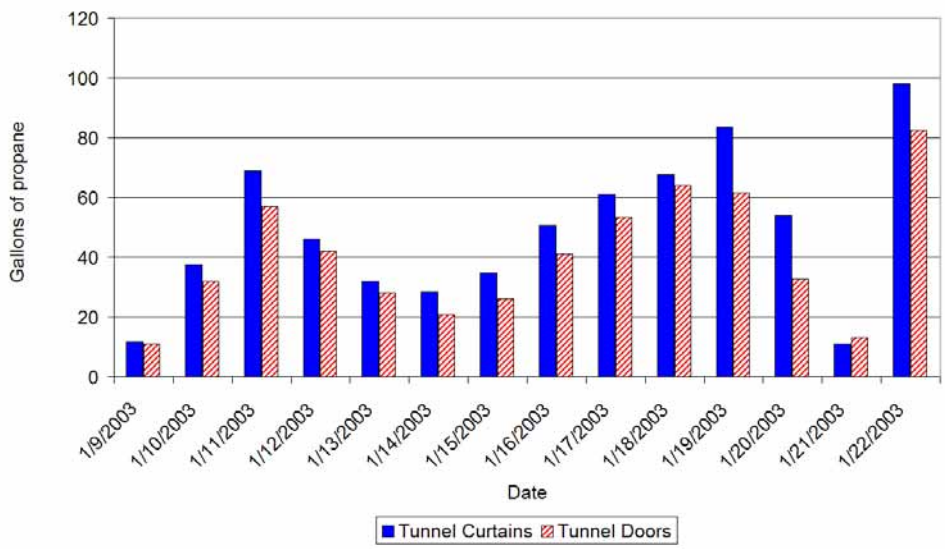

Figure 10. Total Daily Fuel Usage in Both Houses.

It is important to note that the tunnel curtains in the control house were unusually tight. Unlike most tunnel curtains which are just held against the exterior wall by strings or straps, the tunnel in the control house curtains dropped into a pocket made of curtain material, allowing the bottom curtain rod to seal on three sides instead of one. Had the study been conducted on a farm with tunnel curtains of average tightness, the fuel savings would have likely been even greater.

Another significant difference noted between the houses was that the producer reported significantly less litter caking in the tunnel opening area in the house with the insulated tunnel door than in the house with the traditional tunnel curtain. What was interesting was that reduced litter caking was noted during the summer flocks as well. The reduced litter caking during cold weather was likely due to the fact that the insulated tunnel doors not only maintained slightly warmer air temperatures but reduced the amount of cold air leaking into the house. During the summertime when tunnel ventilating, the cool, damp air produced by the six-inch evaporative cooling pads was directed toward

the ceiling allowing a little heating of the air and therefore drying before the air moved back down to floor level. There was some initial concern that when tunnel ventilating, since the tunnel doors tend to direct the air toward the ceiling, there would be a dead air spot immediately under the doors next to the side wall. As of this date and three flocks where tunnel ventilation was used extensively, the producer has reported no heat-stress related mortality in the vicinity of the tunnel doors.

One of the challenges with the use of tunnel doors has been installation. Winching closed two sets of relatively heavy (compared to a curtain) stacked inlet doors can be a little tricky. Instead of running one cable along the top of the side wall, the insulated tunnel doors require two cables, one for the top doors and a second for the bottom doors on each side of the house. With two cables care must be taken to make sure that the cable is split properly and that the four sets of doors close at the same time. Furthermore, the cables closing the lower doors have to be run in a fairly tight space and if not installed properly can get caught up in door handles or latches. Testing on the farm will continue to come up with the best way of opening and closing the doors.

What about cost? The insulated doors and related hardware (latches, handles, etc.) for two 70' X 4' tunnel openings would cost roughly $1,600. Because they are significantly more expensive than standard tunnel curtains, tunnel doors are not for everyone. The tunnel doors are best suited for producers with totally enclosed houses with a history of problems with keeping the tunnel curtain area of their houses warm and their litter dry.

One method of reducing the cost of installing insulated tunnel doors is to install an evaporative cooling pad system using an extension kit rather than the traditional "dog house." When evaporative cooling pads are attached directly to the side wall of a poultry house a number of serious problems are typically encountered. The most common problem is due to the fact that there is no easy access to the tunnel curtain. As a result when the curtain hangs up, which they tend to do when installed in a confined space, the producer has to take his/her pads out to fix the curtain. Furthermore, even with the best extension kit the tunnel curtain obstructs air flow through the pad reducing both air speed and cooling when tunnel ventilating. Last but not least, with extension kits there is typically very little room at the bottom of the extension kit for the tunnel curtain to seal against the side wall, resulting in excessive air leakage during cold weather.

As you can see, most of the problems with mounting pads directly to the side of the house were tunnel curtain related. But, if tunnel doors were used with an extension kit most of the disadvantages of mounting the pads directly to the side of the house would be eliminated. With the cost of a dog house eliminated, the savings would likely more than pay for the additional cost of the insulated tunnel doors. The producer would be left with a system that not only is less expensive but reduces heating costs and litter caking as well.

It is important to note that insulated tunnel doors are on just a few farms so all the details have not been worked out. Winching can be a problem and if not installed properly they can leak just as much as a tunnel curtain. But, the fact remains that in the future there will be more and more houses that will find that insulated tunnel doors are the answer to many of their tunnel curtain related problems.

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