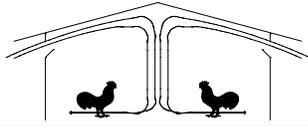




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# Poultry Housing Tips

## *A New Method of Totally-Enclosing Curtain-sided Houses*

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Figure 1. Side wall - before



Figure 2. Side wall - after

Though many producers may want to totally enclose their curtain-sided houses to minimize heating costs as well as increase their ability to precisely control the environment within their houses, there is a common obstacle - cost. For instance, taking a traditional stud-wall house and placing metal sheeting on the outside, filling the wall with fiberglass batt insulation, installing an interior vapor barrier, then covering the interior with plywood can cost nearly \$10,000 for a 500' house. Closing up curtain openings using lumber or polystyrene board insulation and sheet metal siding are other viable options, but again the cost can run between \$5,000 and \$10,000. Spray polyurethane insulation is yet another option, but at a dollar a square foot is still more than many producers would like to spend.

There is another option. Heavy duty polypropylene-faced fiberglass batt insulation in 50-foot long rolls, that though new to the poultry industry, has shown on a number of farms over the past few years to be a relatively inexpensive and easy way of totally enclosing many types of curtain-sided houses. Therm-All\*, the most commonly used form of this insulation product, is basically a specialized form of insulation that has been used to insulate steel buildings for years. Therm-All consists of a 1.5 mill black polypropylene facing reinforced with tri-directional fiberglass/polyester scrim with a 0.5 metalized polyester film backing for added strength as well as to act in part as a radiant barrier. Attached to the metalized polyester film is a 3 ½" fiberglass batt that is specifically designed to recover its original 3 ½" thickness after it is unrolled. The insulation comes in two to six foot tall rolls and has proven to be very durable in poultry houses.

Installation is fairly straightforward. In a traditional stud-wall house the side wall curtains are sealed at the top and bottom using 1" X 2" wood strips (Figure 4). The insulation is then rolled over the inside surface of the stud wall so

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that it overlaps the curtain opening a couple of inches at the top and bottom. 1" X 2" wood strips are then used to attach the insulation to the side wall above and below the curtain opening (Figures 2 and 3). Additional vertical wood strips are then typically installed every 10' to 15' for added support. In most instances, installation takes less than a day.



Figure 3. 1" X 2" wood strips securing Therm-All to side wall.



Figure 4. Side wall curtain sealed using 1" X 2" wood strips.

There are a number advantages to this method of totally enclosing curtain-sided houses. First, and most importantly, is cost. Most forms of the polypropylene-faced batt insulation costs approximately \$0.40 per square foot. If a producer were to install it himself, the cost of the insulation and wooden stripping would likely run around \$2,000 for a 500' house with a four-foot curtain opening. Secondly, the fact that the insulation comes in 50-foot rolls and that the wooden strips crush the top and bottom an inch or so of the 3 ½" insulation against the side wall makes for a very tight seal. Another important advantage to this method of totally enclosing curtain-sided houses is that it allows producers to significantly reduce their heating costs before the house is actually finished being totally enclosed. That is, it is important to realize that eventually the side wall curtains are going to need to be removed and replaced with sheet metal siding. With many other methods of totally enclosing curtain-sided houses this cannot be put off until later. But, if the side wall curtains are in good shape producers should be able to wait a few years before installing sheet metal siding, thereby making it possible to spread the cost of totally enclosing a house over time.

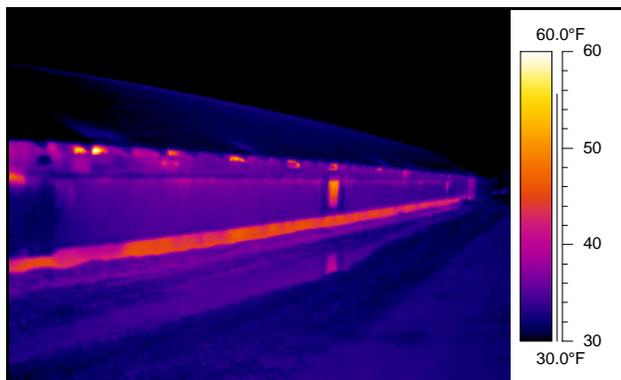


Figure 5. Thermal image of exterior of the house insulated with Therm-All insulation.

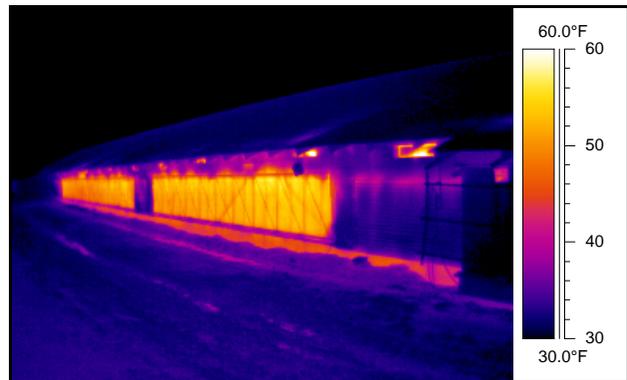


Figure 6. Thermal image of exterior of the house with traditional side wall curtain.

Recently, this new method of totally enclosing curtain-sided houses was evaluated on a farm in North Georgia. One house on the farm was insulated using Therm-All insulation in the manner described above. A second identical house on the farm was left unchanged to serve as a comparison. The 40' X 500' dropped ceiling houses were equipped with four-foot-tall curtains (42" actual curtain opening). The sidewall above the curtain opening in both houses was of typical stud wall construction; exterior metal, 3 ½" fiberglass batt, and 3/8" plywood interior. The side wall below the curtain opening consisted of an 18" tall concrete stem wall.

The thermal images shown in Figures 5 and 6 were taken on a December morning just after the chicks were placed and illustrate just how effective the Therm-All insulation was in reducing heat loss from a poultry house. Temperature inside the houses was approximately 90°F while outside it was in the low thirties. The exterior surface temperature of the curtain in the house where the Therm-All insulation was installed was in the mid thirties indicating very little heat loss from the curtain portion of the side wall. In fact, the surface temperature of the curtain portion of the side wall was essentially identical to the side wall above the curtain opening that is constructed of plywood, fiberglass, and metal, indicating that the insulation value of the curtain area was essentially the same as the wall above it.

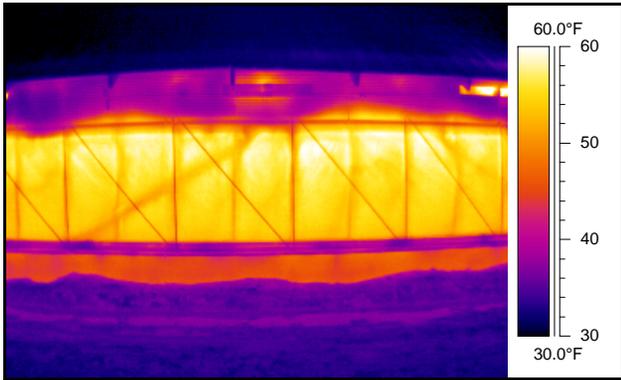


Figure 7. Hot air leaking from top of the side wall curtain.

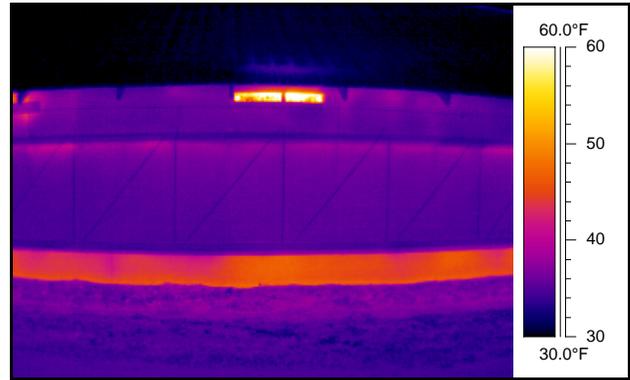


Figure 8. House insulated with Therm-All insulation.

The thermal image of the side wall of the house that wasn't enclosed is dramatically different than the enclosed house. The exterior surface temperature of the curtain was in the mid-fifties indicating significant heat loss through the curtain. Making matters worse was the fact that there was a significant amount of hot air leaving the house from the top of the side wall curtain which can be clearly seen in Figure 7.

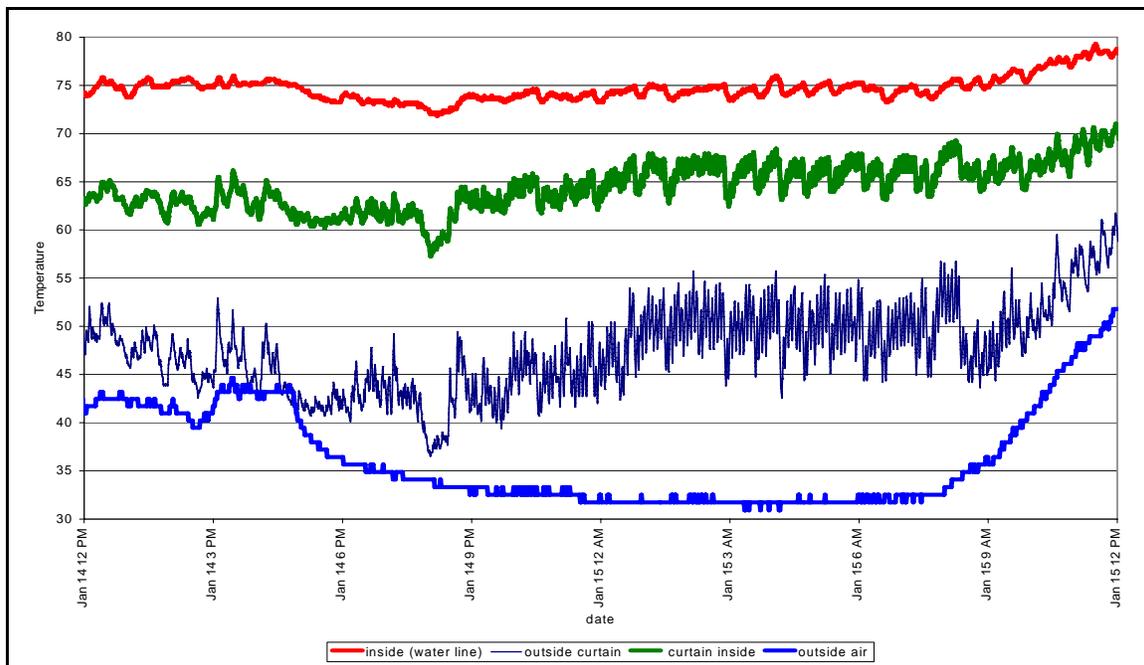


Figure 9. Temperature graphs for the control house.

When the birds were approximately four weeks old, temperature data loggers were placed inside and outside the houses to better document heat loss from the side walls of both houses. Dataloggers were placed just above the side wall curtain outside each house, inside both houses near the bottom of the curtain opening, on one of the outside water lines in each house as well as under the roof overhang on one of the houses to obtain outside air temperature. The graphs

in Figures 9 and 10 are for one 24-hour period which is fairly representative of the temperatures seen during the two weeks the dataloggers were used.

For the totally enclosed house the temperature of the air above the outside curtain is essentially the same as the air temperature measured under the eave, indicating little or no hot air was escaping from the sealed curtain (Figure 10). The higher outside air temperatures measured just above the closed side wall curtains of the control house show that a significant amount of hot air was lost from the house especially at night (Figure 9). The jagged nature of the line is an indicator of the timer fans operating. When the fans were off, the air temperature rose above the loose-fitting curtain as warm air leaked from the house. When the timer fans turned on, warm air would no longer exit the house and the air temperature just above the curtain opening would decrease. The inside air temperature at the bottom of the curtain opening of the control house was noticeably cooler than at the same location in the house where the Therm-All insulation was installed, indicating cool air leaking into the house (Figures 9 and 10). Air temperature measured at the water line was just slightly warmer in the house where the Therm-All insulation was installed (Figures 9 and 10).

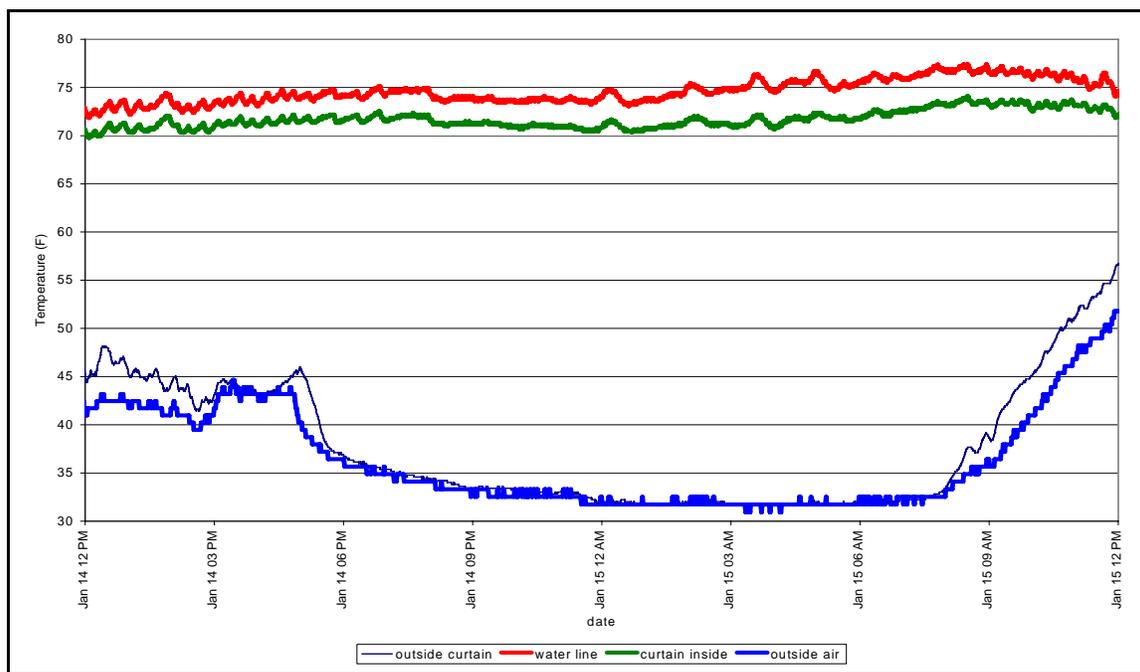


Figure 10. Temperature graph for the treatment house.

Fuel usage was determined by observing the tank level gauges on each house's propane tank as well as fuel delivery records. When the tanks were refilled when the birds were seven days old, it was found that the treatment house used approximately 45% less propane than the control house (290 Vs. 520 gallons). Propane usage for the entire flock was 1,036 gallons for the enclosed house and 1,387 gallons for the control house, approximately a 25% difference. By enclosing the curtain opening with the Therm-All insulation the producer saved approximately \$500 (351 gallons @ \$1.40 per gallon), roughly one quarter of the cost of totally enclosing the house. It is of interest to note that the enclosed house used 696 gallons (40%) less fuel than a third 500' house on the farm where only the brooding end of the house was enclosed and 255 (20%) less gallons of fuel than a 400' curtain-sided house on the farm both of which were not part of the study.

One of the reasons for the decreased fuel savings towards the end of the flock was the fact the producer inadvertently under-ventilated the totally enclosed house during the first couple of weeks, which even though reduced his propane usage, also led to damp litter. This meant he had to "over-ventilate" the house a week or so to help correct the problem which increased fuel usage. This is a common occurrence when houses are first totally enclosed because producers typically underestimate the amount of fresh air that is entering their curtain-sided houses when the fans are off. So when producers try to use the same timer settings they used in the past, they often discover they are often under-ventilating their totally enclosed house. The fact is even if a producer increases his minimum ventilation rates 30% or

more after a house is totally enclosed, they are still ventilating the house less than when the house was curtain-sided. Another contributing factor to the loss in fuel savings over the growout period was how the forced air furnaces were wired into the house's environmental controller. The four furnaces on the brooding end of the house were wired in pairs. The operation of the first two furnaces were based off a sensor 40' from the tunnel inlet end wall while the operation of the second two were based off a sensor 30' from the brooding curtain. Though this is problematic in any house, it is especially so in a totally enclosed house. The heating requirement for the tunnel curtain area of a totally enclosed house is nearly twice that of the center of the house. This meant that the furnace toward the center of the house often ran when it was actually warm enough in its location, leading to excess fuel usage. This problem becomes especially critical as ventilation rates are increased due to the leaky nature of tunnel curtains compared to the rest of the house that was totally enclosed. A similar problem was also observed with the second two furnaces in the brooding area. The drafts from the loose brooding curtain caused both furnaces to come on when only the one near the brooding curtain needed to operate.

Though an overall fuel savings of 25% is significant, it is not quite as high as noted on other farms after they were totally enclosed. In addition to the problems noted previously, the fact that the house was built with a concrete stem wall could have reduced potential fuel savings. Figures 7 and 8 show that the exterior surface temperature of the concrete was not that much different than the uninsulated side wall curtains, indicating that the insulation value of the concrete stem wall is not that different than a curtain. So though heat loss from the curtain was significantly decreased, the stem wall which was almost half the size of the side wall curtain was left uninsulated. Furthermore, the joint between the concrete stem wall and stud wall was a significant source of air leakage. Though it was a potential problem area in both houses, in the totally enclosed house leakage was increased due to the fact that timer fans generated significantly higher static pressure in the house that was totally enclosed, which increased leakage from this crack, which further decreased floor temperatures in the vicinity of the concrete stem walls (Figures 11, 12 and 13). The issue of air leaking from the joint was often noted by the observation of birds acting chilled near the side wall in the house that was totally enclosed.

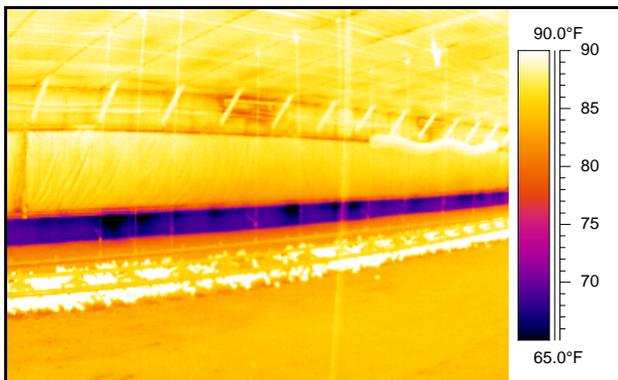


Figure 11. Leakage from crack between stem and stud walls indicated by dark blue streaks.

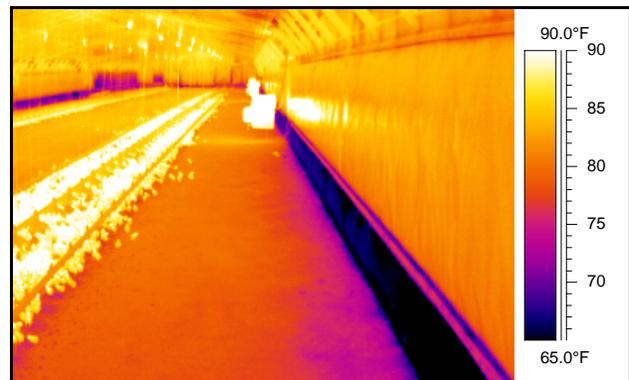


Figure 12. Low floor temperatures near concrete stem wall.

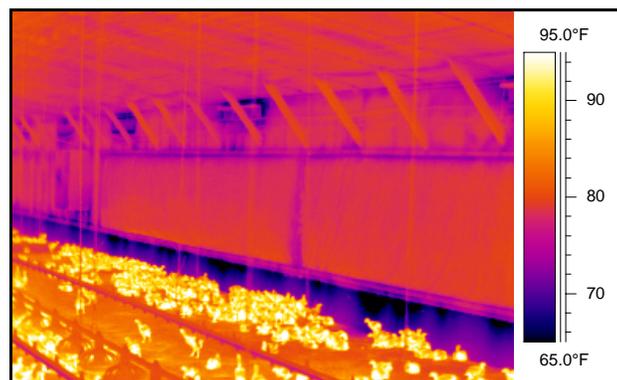


Figure 13. Leakage from crack between stem and stud walls (three-week-old birds).

The problem of the air leakage from the crack between the stem and stud walls was made worse by the fact that the house was heated using forced air furnaces without circulation fans. Had the house been equipped with circulation fans the hot air from the ceiling could have been moved down to floor level helping to offset the cold air leaking in through the crack in the lower side wall. Though the circulation fans would have not helped the two situations of increased heat loss due to the low insulation value of the concrete stem wall and the crack between the stem and stud walls, at least the birds would have likely been more comfortable near the side wall, and fuel usage would have been reduced as the hot air produced by the forced air furnaces would have been better utilized.

One last problem with the houses that may have affected the potential fuel savings was that the houses had small 4' X 4" wooden inlets. Inlets are important in any broiler house, but having good inlets is more critical in tight houses. The inlets in these houses did not do a good job of throwing air to the center of the house when compared to more conventional metal inlets in other houses on the farm. The thermal image in Figure 14 was taken in another house on the farm that was totally enclosed using reflective insulation (a subject to be covered in a future newsletter) that was equipped with galvanized ceiling inlets. The dark blue streaks starting at the inlets and fading toward the center of the house are an indicator that the air entering through the inlets is making it more or less to the center of the house (the blue areas in the center of the houses are indications that there is missing ceiling insulation). In contrast the air entering through the wooden inlets in the house is not being thrown nearly as well to the center of the house (Figure 15). Since the cold incoming air was not being mixed as well with the hot air near the ceiling this could result in draftier conditions and increased fuel usage.

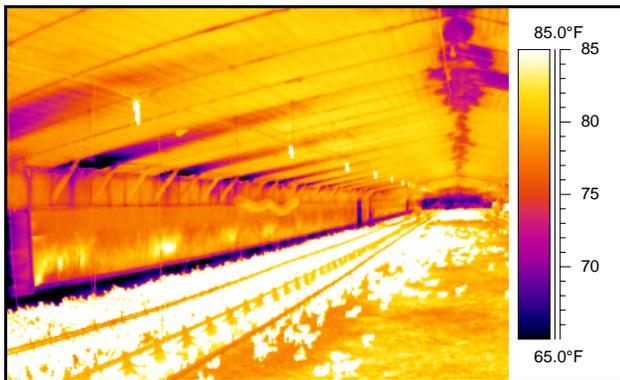


Figure 14. Thermal image of a totally enclosed house with galvanized ceiling inlets on the test farm.

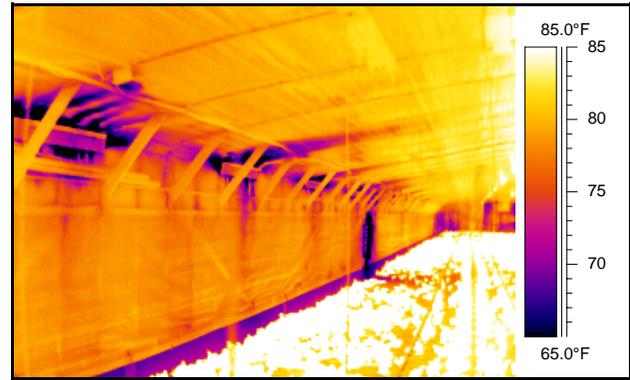
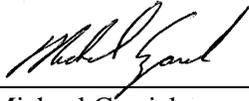


Figure 15. Thermal image of totally enclosed house with small wooden inlets.

No formal analysis of bird performance was done other than noting mortality, which showed no significant differences. It is of interest to note that on the farm where one house was totally enclosed using spray polyurethane foam insulation there has been significantly lower mortality as well as increased weight gains when compared to the other houses on the farm for two flocks since the house was totally enclosed. A possible explanation for the difference not only in bird performance but the lower fuel savings (25% vs nearly 50%) for two flocks since the test house was totally enclosed, could be the fact that not only was the house insulated from floor to ceiling, but the house was also equipped with circulation fans and proper air inlets, the combination of which amplified the benefits associated with totally enclosing a house.

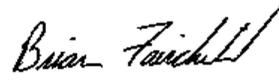
Getting rid of side wall curtains does not automatically mean that fuel usage will be cut in half and bird performance will be dramatically improved. If the tunnel curtain is very loose or there are cracks in the side wall, the inlets don't work properly, the house doesn't have circulation fans, furnaces are not individually wired/controlled, or a house's environmental controller is not programmed properly, the benefits associated with totally enclosing a house will be reduced. Removing side wall curtains is a part of the answer, not the entire answer, to reducing fuel usage and improving bird performance.

Overall, the owner of the farm is very happy with this method of totally enclosing curtain-sided houses and is planning to totally enclose the other houses on the farm. In the future, we are planning to study different methods of insulating the concrete stem wall, sealing the crack between the stem and stud walls, installing new inlets and circulation fans to see if the benefits associated with totally enclosing the houses on this farm can be increased.



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