Update: Barn cooling, Tunnel and Otherwise

David R. Bray* and Ray A. Bucklin†
Departments of *Animal Sciences and †Agricultural and Biological Engineering
University of Florida, Gainesville
bray@animal.ufl.edu

We all know the effects of heat stress on dairy cattle in the Southeast United States. Various barn types and cooling methods have been experimented with in the last fifteen years to reduce this high stress. Last year we compared two types of fan and sprinkler barns. A tunnel barn with 50" fans, curtains and feed face sprinklers was compared with an open freestall barn with 36" fans down the length of the barn and feed face sprinklers. The results were about the same as far as cow body temperature was concerned.

New Cooling Methods for Tunnel Barns

Our first study was to compare cow body temperatures in two identical 4 row tunnel barns 700 feet in length and 100 feet wide with fans on the south end of the barns and fully open on the north end. Sidewall height was 11 feet 8 inches and peak height was 13 feet 4 inches with a 1:12 roof pitch. Sidewall curtains were closed during the experiment. One barn was equipped with a high-pressure fogging system that operated when barn temperature exceeded 80 degrees F from 9:30 AM to 9:00 PM. Feed face sprinklers were available in both barns and operated when barn temperature exceeded 72 degrees F. Cycle time was 1.6 minutes on and 4.8 minutes off.

In the first experiment (May 27 to June 1, 2004) 6 cows in each barn were fitted with vaginal temperature devices. In figure 1, the cows in the cooled barn varied in their body temperature and it looks like one cow escaped the barn for a trip outside. Cows in this cooled barn had the high pressure foggers in the daytime and feed face sprinklers at night.

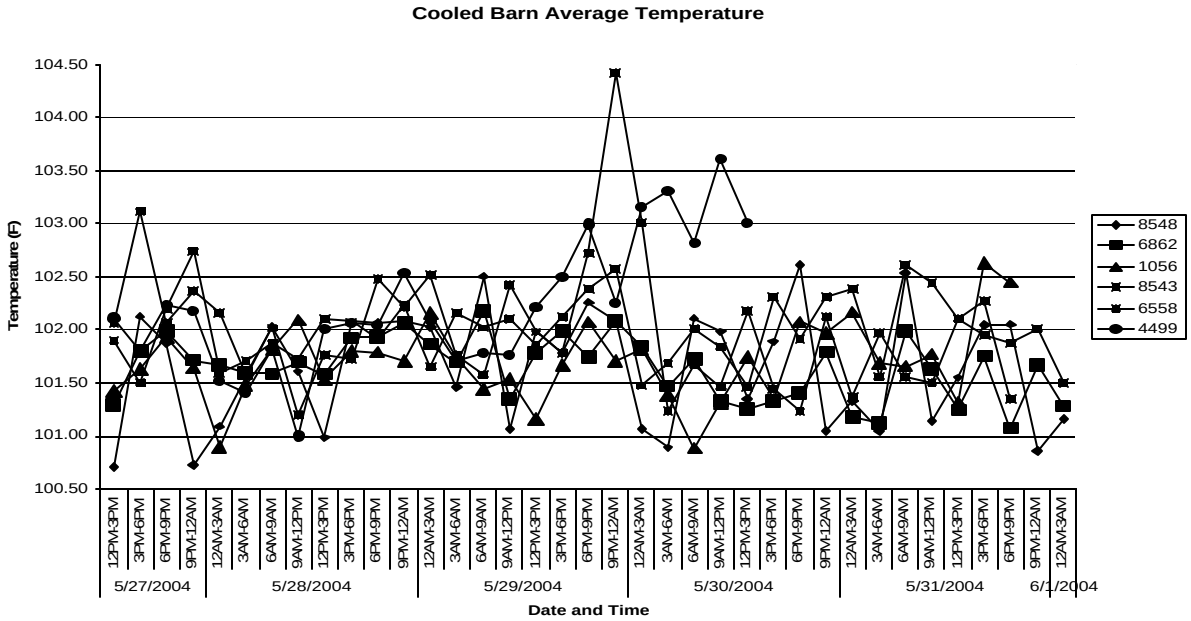

Figure 1. Average vaginal temperatures for cows in cooled barns.

In figure 2 the cows in the un-cooled barn had higher body temperatures but they also varied greatly. These cows had feed face sprinklers 24 hours a day.

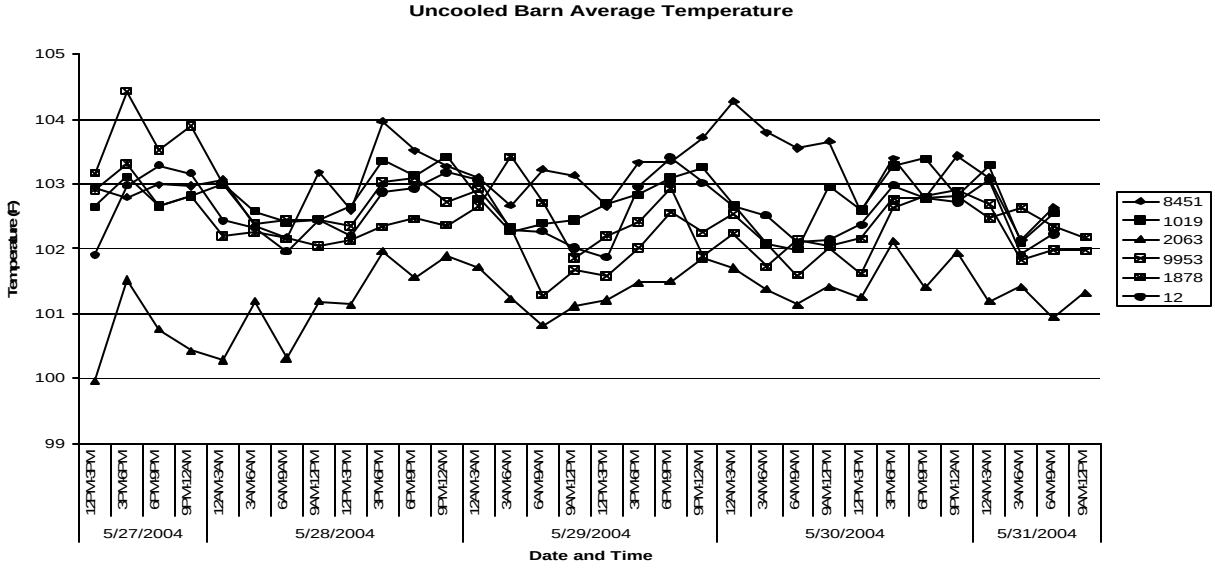

Figure 2. Average vaginal temperatures for cows in un-cooled barns.

In figure 3 we have the combined body temperatures of the cows in the two barns and one cow who was in an outside lot to show the variation. The high spikes of all the cows

usually occur at milking time. There were no overhead sprinklers in the holding area of this dairy at this time.

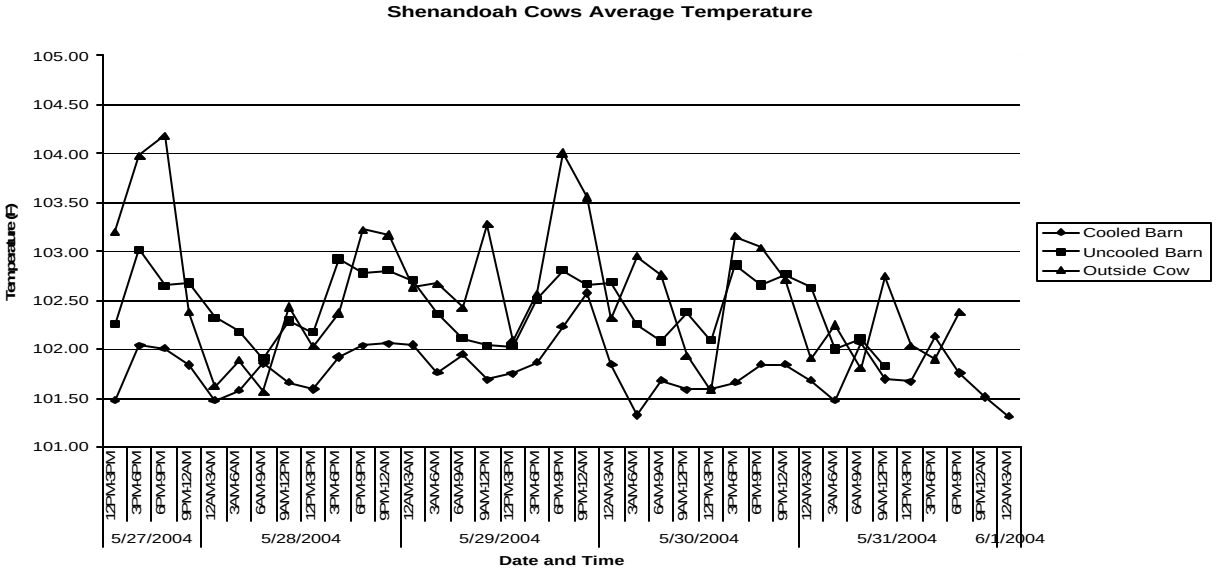

Figure 3. Average temperatures for cows in a cooled barn, un-cooled barn and outside.

In figure 4 is the combined temperatures, RH%, and outside temperature and humidity (pole). In the un-cooled barn you can see the temperature is the same in the barn as the outside temperature (pole). This is not the same week as the body temperatures were taken but the results are about the same.

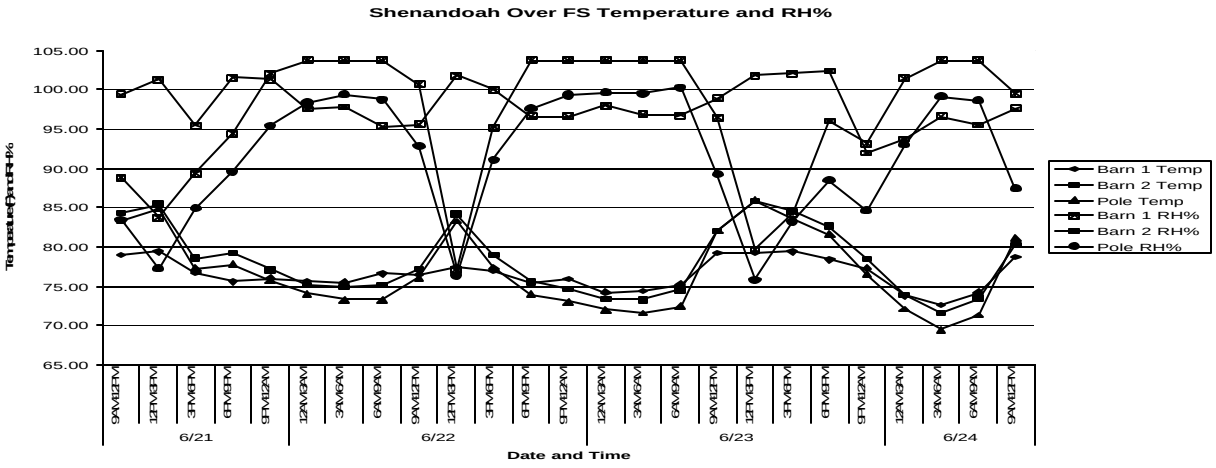

Figure 4. Temperature and RH% for cooled (barn 1) and un-cooled barns (barn 2) compared to ambient temperature and RH%.

Study #2 Tunnel Barn Fall 2004

This study was designed to determine if the use of sprinkler are necessary in a high pressure fogged tunnel barn. The design was to shut off all feed face sprinklers for the first forty-eight hours on one side of the barn and have them on the other side of the barn during the same portion of time, then switch sides for the next forty-eight hours. The final part was to only run sprinklers at night on one side then the other for a night. A hurricane made its approach at the beginning of the experiment and it never got very hot, but the results are given. In figure 5 we see that the cows in pen 4 were cooler on average in the first forty-eight hours than the cows in pen 3 who had no sprinklers during that period. The foggers were working in both pens during the day; the higher temperatures were at night in the pen with no sprinklers. The second forty-eight hours there was not much difference because it was not hot due to the clouds that came in before the storm.

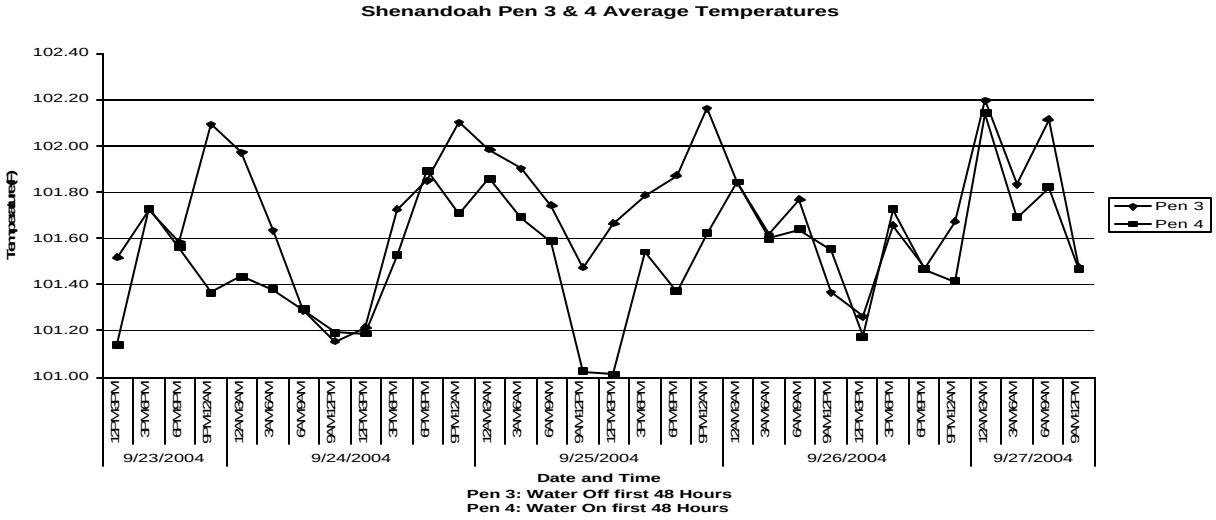

Figure 5. Differences in average cow temperatures in pens with and without feed face sprinklers.

In figure 6 we can see that they ambient temperature (pole) never got above 80 degrees F after the first 48 hours except for September 28th.

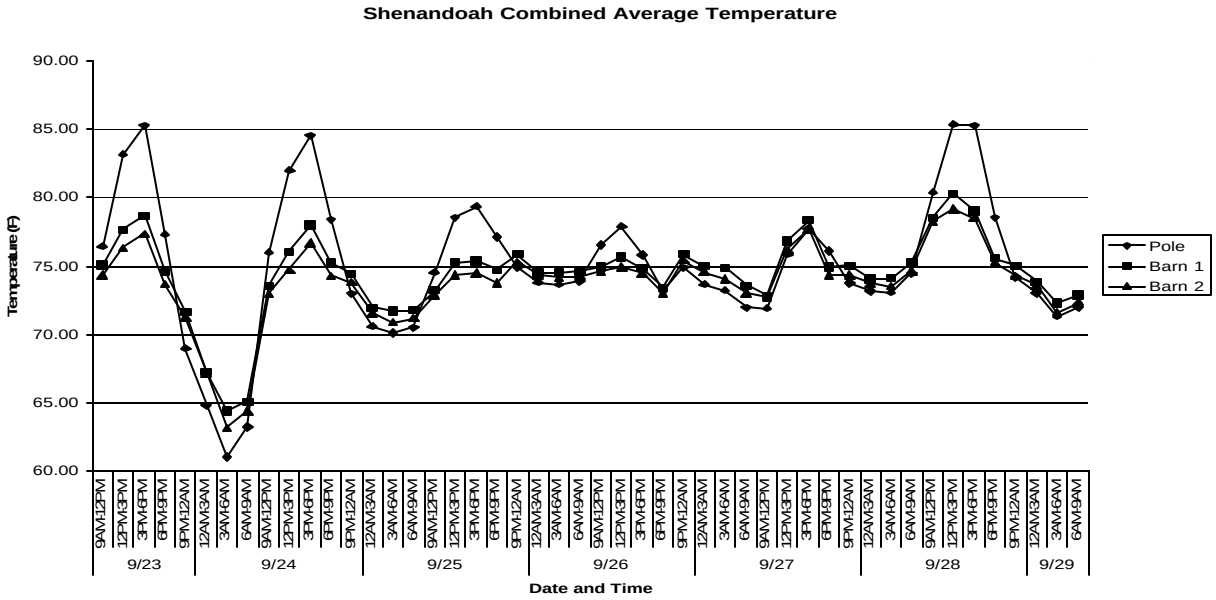

Figure 6. Ambient temperature compared to cooled (barn one) and un-cooled (barn 2) barns.

In figure 7 we have included the RH% for this week, you can see that the humidity stayed very high during the bad weather.

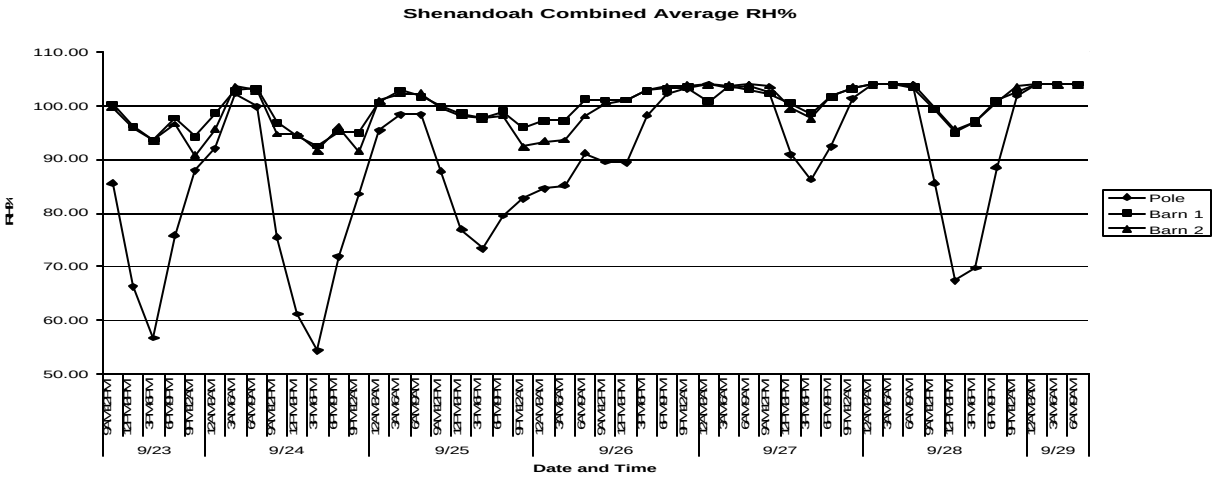

Figure 7. Ambient RH% compared to cooled (barn 1) and un-cooled (barn 2) barns.

2004 DRU Studies

The study was done at the UF Dairy Research Unit. The barn is 200 feet long and 100 feet wide. Eave height is 16' to 20' with a 3' ridge opening and the roof slope was 4:12 pitch.

The first study was designed to compare feed face sprinklers with fans during the day with high pressure foggers (250 PSI) over the feed face and over the freestalls and sprinklers at night versus not at night. This experiment was doomed by a few cows that were very hot and the weather which was not very hot at the end of the experiment.

In figure 8 the north barn cows had higher body temperatures than the south barn cows. The cooling was the same for the first forty-eight hours and both dropped at the end of the experiment.

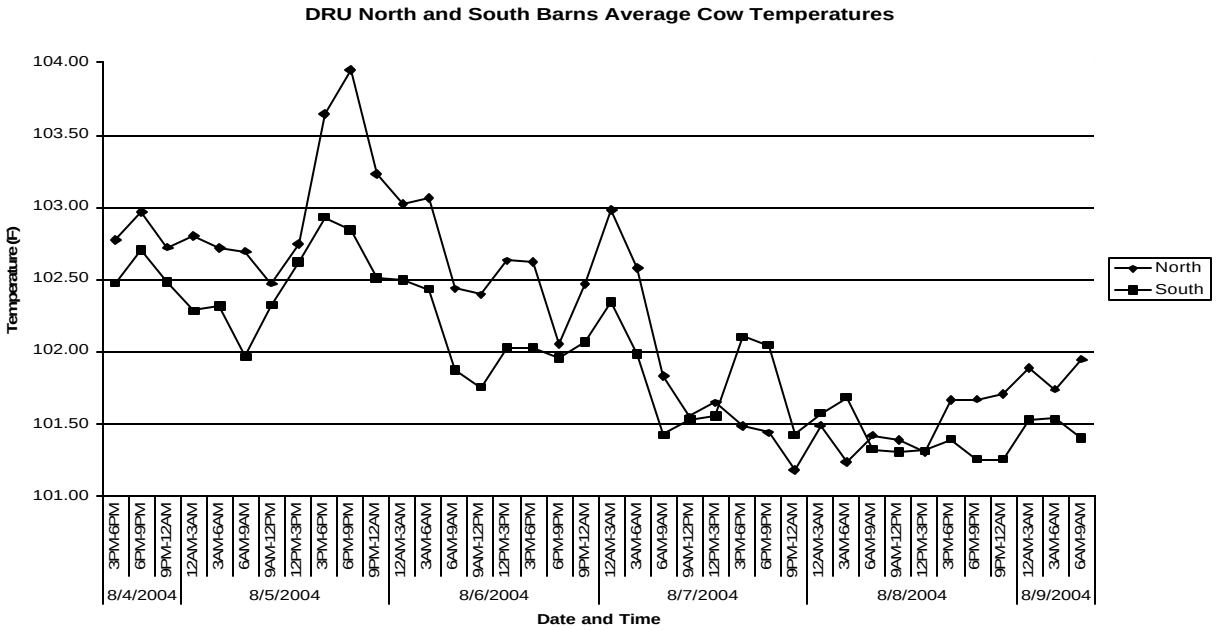

Figure 8. Average cow temperatures in two barns.

DRU Barn Monitoring

There are always many varied experiments being carried out at the DRU, so we monitor barn temperature in about every barn and the ambient temperature (pole), where these have little scientific merit, they may be of interest.

Figure #9 compares the ambient temperature (pole) with Lindsey Blvd. Lindsey Blvd is a long shed with a flat tin roof 12' high. As you can see, under this shed it is hotter that ambient temperature in the afternoon.

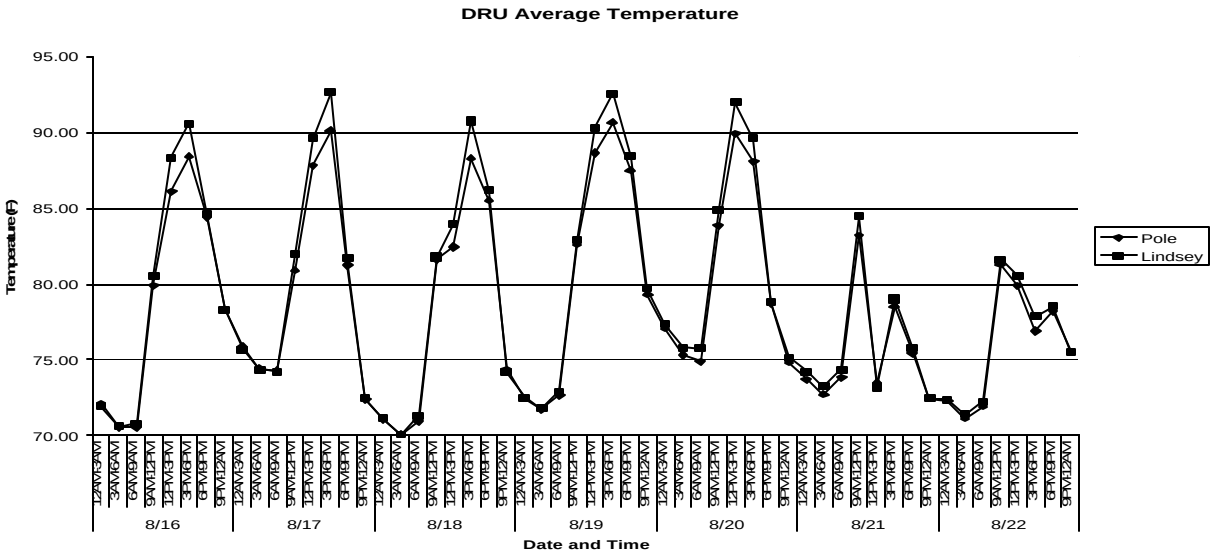

Figure 9. Ambient temperature compared to the temperature under an outside shed.

In figure 10 we compared the ambient temperature (pole) with the Monsanto barn which is a 150' long by 85' wide freestall barn used for nutritional trials. This barn has fans with high pressure foggers but only over the feed face. This demonstrates that one row of high pressure foggers and fans is not sufficient to cool this barn.

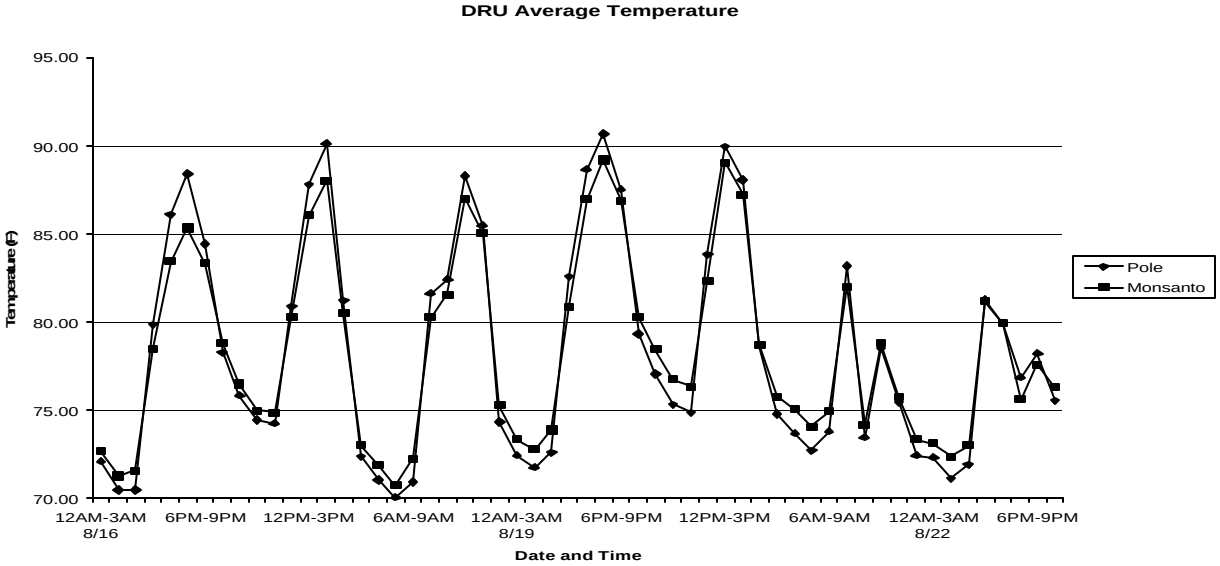

Figure 10. Ambient temperature compared to a barn cooled by high pressure foggers over the feed face.

In figure 11 we compare ambient temperature (pole) with the north and south barn which use high pressure foggers (250 PSI from J&D Manufacturing, Eau Claire, WI) to the transition cow barn. The transition cow barn is a 40' by 90' machinery shed with 12' eaves and an insulated roof and walls. It also has 7 48" belt driven poultry fans at one end and a variable sized opening for feeding at the opposite end. This barn has 3 double fans with 100 PSI foggers (F.I.T. ventilation Clearwater, Fl). This is a work in progress, how to cool this barn. The 7 big fans remove too much air for the three F.I.T. fans to cool the barn; they also suck rain into the barn. We hope to find the right combination to cool this barn to 10 degrees F below ambient temperature. Cows in this barn are not above normal temperatures because the foggers blow on them without wetting the sand below.

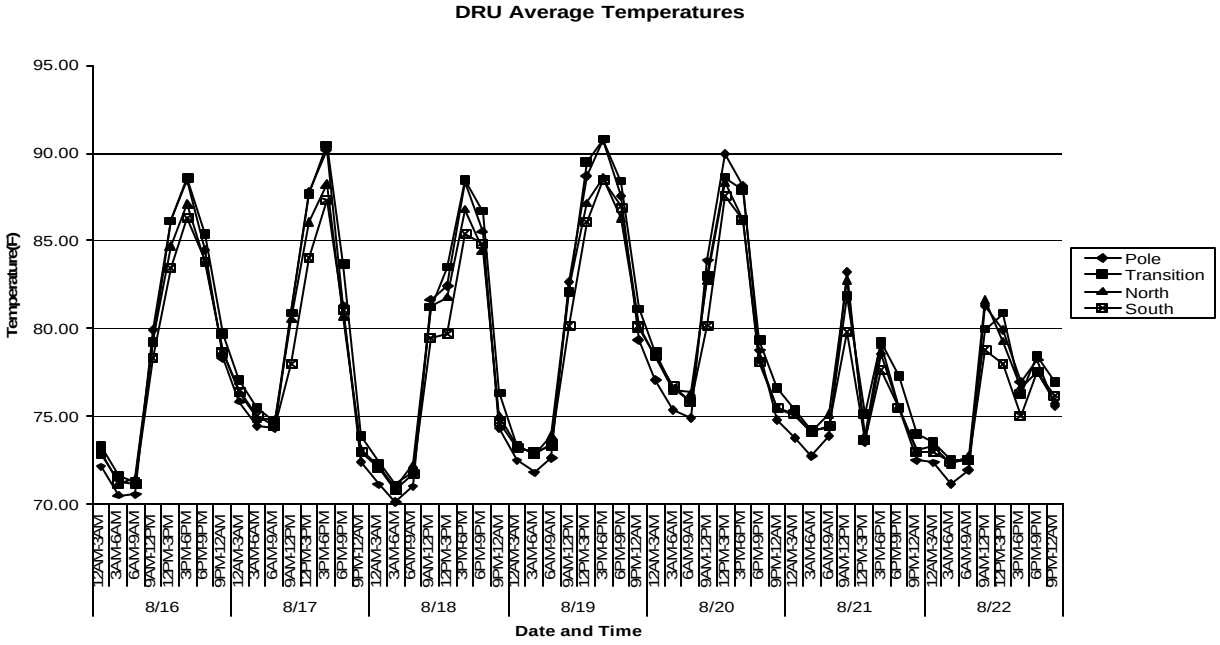

Figure 11. Ambient temperature compared to the transition barn and two barns that are cooled with high pressure foggers.

Planned 2005 Studies

1) Resolve night time sprinkling at large fog barn
2) Add three 1000 PSI foggers and fans to north/south barn to drop barn temperature 10 degrees below ambient temperature.
3) Resolve the transition barn cooling.