Environmental Modification Update

by

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The work reported in this paper has been funded mostly by the Dairy Check-Off Fund and is a summary of work done by many individuals.

Effect of Water Application Rates

Dairy cattle under hot, humid conditions common in Florida experience heat stress which inhibits their ability to produce and reproduce to their genetic potential. Many approaches have been taken to alter the environment of dairy cattle to improve performance under heat-stressing conditions. The sprinkler and fan method reduces heat stress in Florida, but little research has been done to determine an optimum water application rate for such a system.

An experiment was conducted to compare three water application rates for a sprinkler and fan cooling system for dairy cattle in Florida. Thirty-six mid-lactation Holstein dairy cows were used, and data were recorded with respect to milk production, respiration rates, rectal temperatures, vaginal temperatures, dry matter intake, milk yield, milk composition, and weather conditions. Cows were divided into three treatment groups of 12, and each treatment group received three 28 day treatments. Water application rates for treatments 1, 2, and 3 were 51, 77, and 108 gallons per day respectively, at 10 psi.

Overall, the cows did not respond differently to changes in water application rate. There was no difference observed between water application rate with respect to daily milk yield, daily 3.5% fat-corrected milk yield, and dry matter intake.

Fat yield, protein yield, and percent protein did not differ among water application rates.

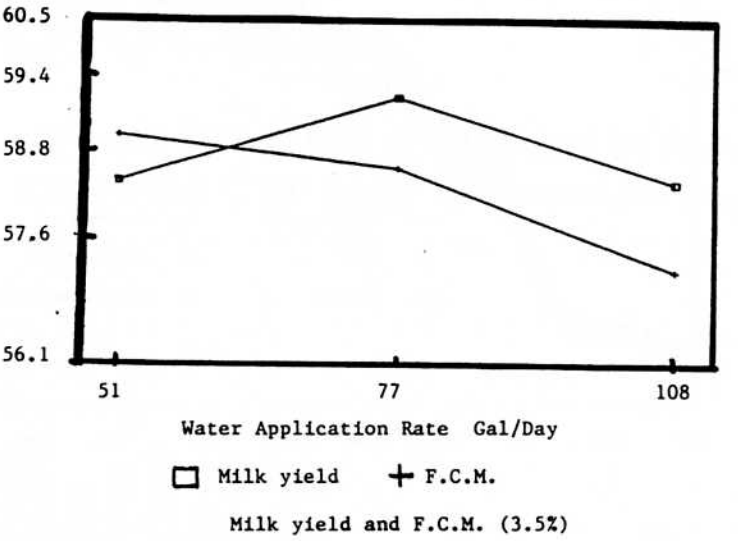
The percentage fat of milk was affected by treatments. Mean fat percentages for treatments 1, 2, and 3 were 3.60, 3.44, and 3.43%, respectively.

Presented at the 28th Florida Dairy Production Conference, Gainesville, April 9-10, 1991

No significant differences were observed among treatments with respect to respiration rates, rectal temperatures or vaginal temperatures. The cooling system ran each day of the experiment because dry-bulb temperatures within the feed barn were above 76°F every day. Peak dry-bulb temperatures ranged from 80 to 97°F over the course of the experiment.

The radiotelemetry system successfully monitored differences in cow vaginal temperatures over time. Statistical analysis on vaginal temperature reflected the same trends as respiration rate and rectal temperature.

Figure 1



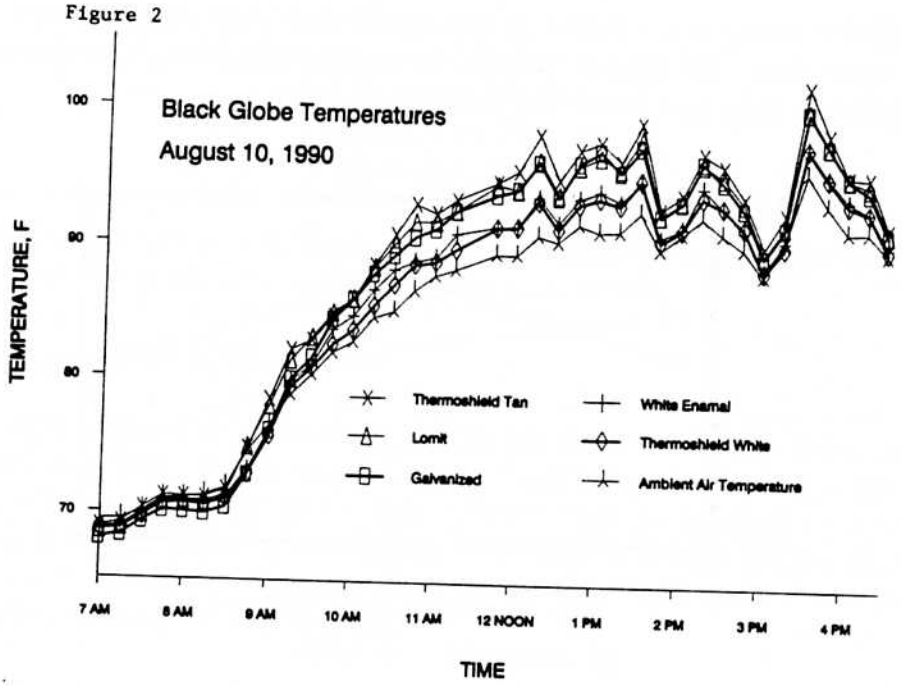
Milk yield and F.C.M. (3.5%)

Roof Color of Calf Hutches

Temperatures were compared under the roofs of open sided calf hutches painted with several reflective coatings or paints. The materials compared were Lo/mit (silver paint), Thermoshield White (white paint with ceramic particles), Thermoshield Tan (tan paint with ceramic particles), white enamel and galvanized. The following measurements taken were dry bulb temperature one foot under the roof, black globe temperature one foot under the roof, roof metal temperature, ambient dry bulb temperature and wind velocity were measured. The roofs of the hutches were 36 inches above the ground surface. The data shown for August 1, 1990 were collected under still, clear conditions. The maximum average wind speed (averaged over 15 minutes) was 3.7 mph and the largest solar radiation load was 320 btu/hr/ft_2 (1 btu is the amount of energy required to raise one pound of water 1°F, probably would also raise 320 lb of cow 1°F). Black globe temperatures were lowest under roofs coated with Thermoshield White, however, they were only slightly lower than those measured under the roof painted with white enamel. The black globe temperatures measured under hutches painted with Lo/mit were no lower than those measured under the galvanized roof. Black globe temperatures measured under the roof coated with Thermoshield Tan were intermediate between Thermoshield White

and galvanized. Metal temperatures and air temperatures followed the same trends as black globe temperatures. The Thermoshield White material produced the best thermal environment under the hutches, however, conditions under the Thermoshield White were only slightly better than those measured under white enamel.

Figure 2



Chilled Water Experiment II

The chilled water experiment was continued this year. Last year there was no difference in milk production between the cows receiving chilled or well water, however, the experiment was conducted under dry lot conditions and the cows did not have access to feed and water under the shades.

This year the experiment was conducted at Gen Farm IV in Bell, Florida in a feed barn where cows had access to feed and water under the shade structures. Again this year, the Paul Mueller Company provided and installed the refrigeration equipment. There were approximately 170 cows per treatment.

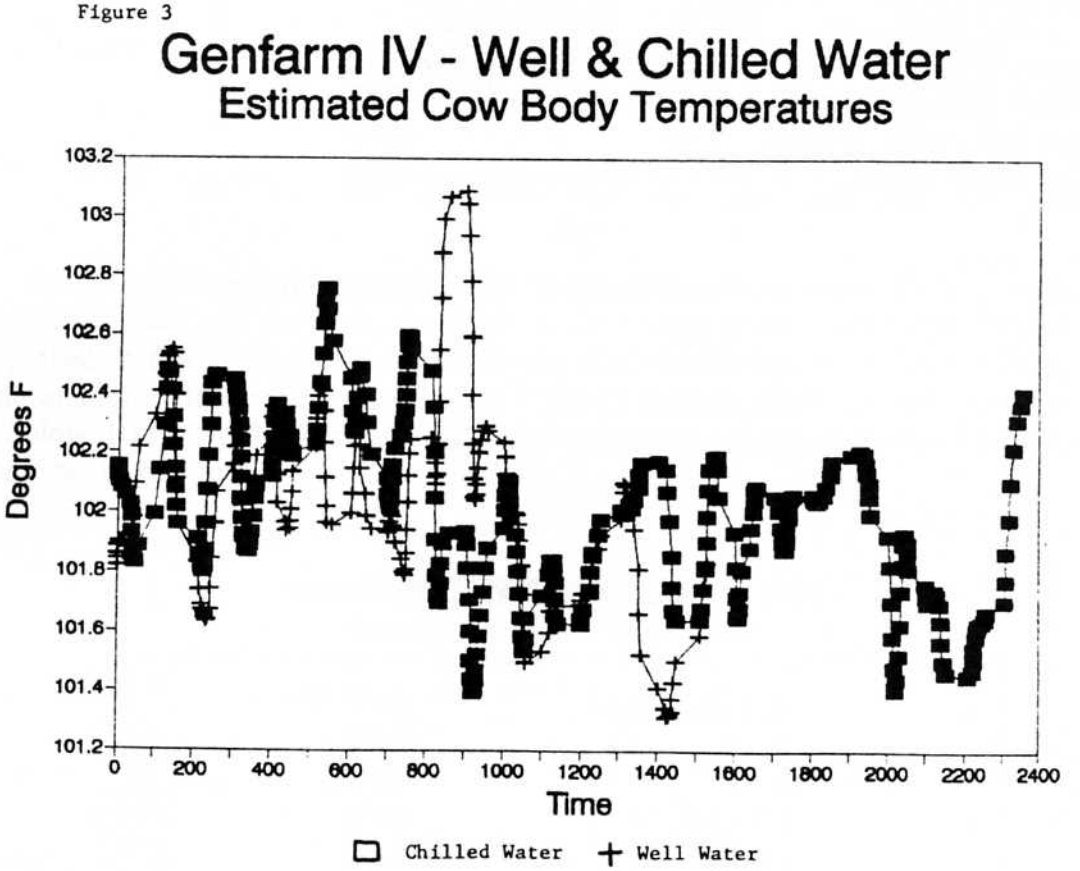
The water consumption per cow for the two months of the study were similar; well water consumption was 21.7 gal/cow/day, while for the chilled water the average was 23.2 gal/cow/day.

Table 1. Cooled Drinking Water

Response	Well Water 75-80°	Chilled Water 52-57°
Milk yield - lbs/day	63.1	64.2 N.S.

These cows were monitored with the vaginally mounted transmitters. There was no difference in body temperature between the two groups.

Figure 3



Drinking Water Tank Temperature Survey

Russ Giesy, IFAS Dairy Specialist in West Central Florida, conducted this study in Hillsborough, Hardee, Polk and Pasco counties. It contains data from 31 dairies which had a total of 201 water tanks.

This study was conducted to determine the characteristics of water available to cows in this area.

Ambient temperature while samples were taken	91°F
Temperature in the sun	104°F
Average temperature of water in tanks	86°F
Range	77-97°F
Temperature of fresh water entering tank - avg.	82°F
If tank was 0-100 feet from well	80°F
If tank was 100-300 feet from well	82°F
If tank was 300+ feet from well	83°F

Temperature of fresh water tank if inlet pipe is above ground:

0 - 100 feet above ground	79°F
100 - 200 feet above ground	80°F
200+ feet above ground	82°F

Effect of Shade on Tank Water Temperatures

No shade	87°F
AM shade	85°F
PM shade	81°F
complete shade	81°F

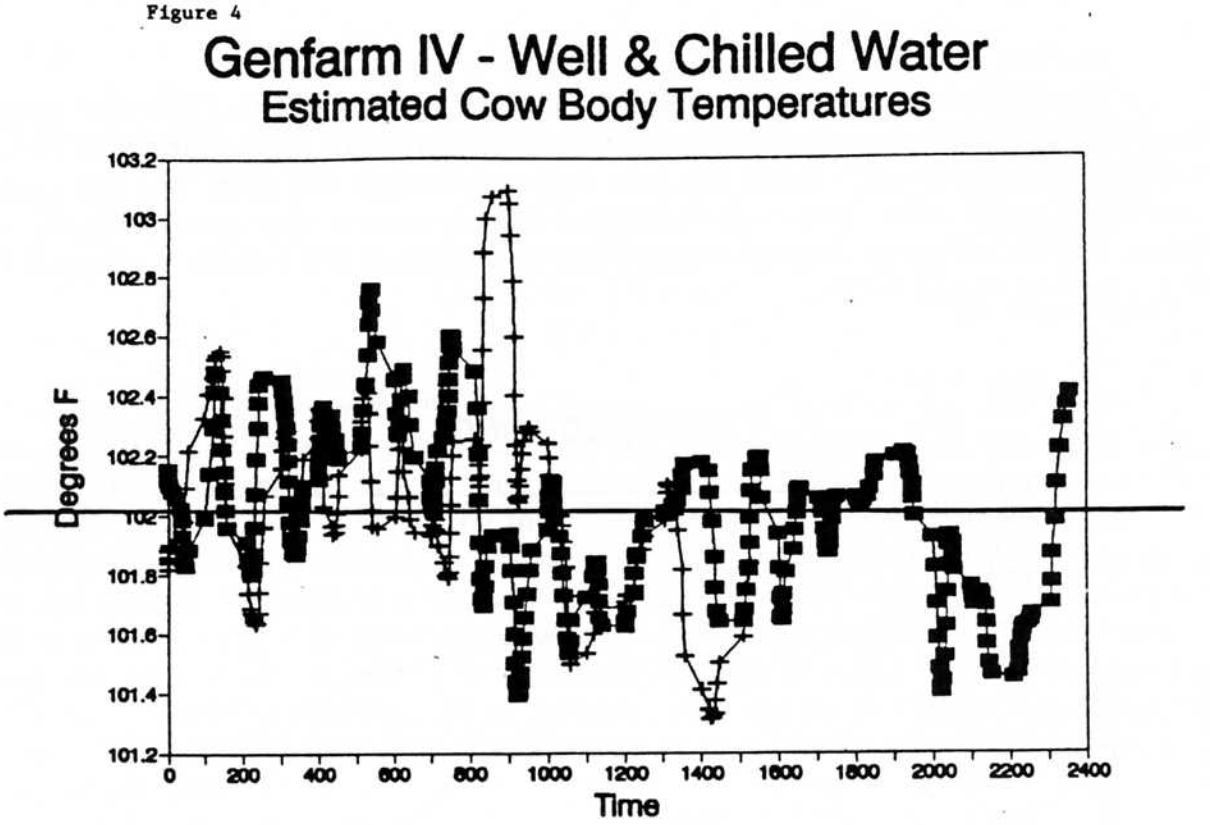
Size of Tank and Water Temperature
(Volume of Tank in gal/cow)

< 1 gal/cow	82°F
1 - 3	85°F
4 - 9	86°F
10 - 19	87°F
20 - 39	88°F
40+	91°F

Night Cooling

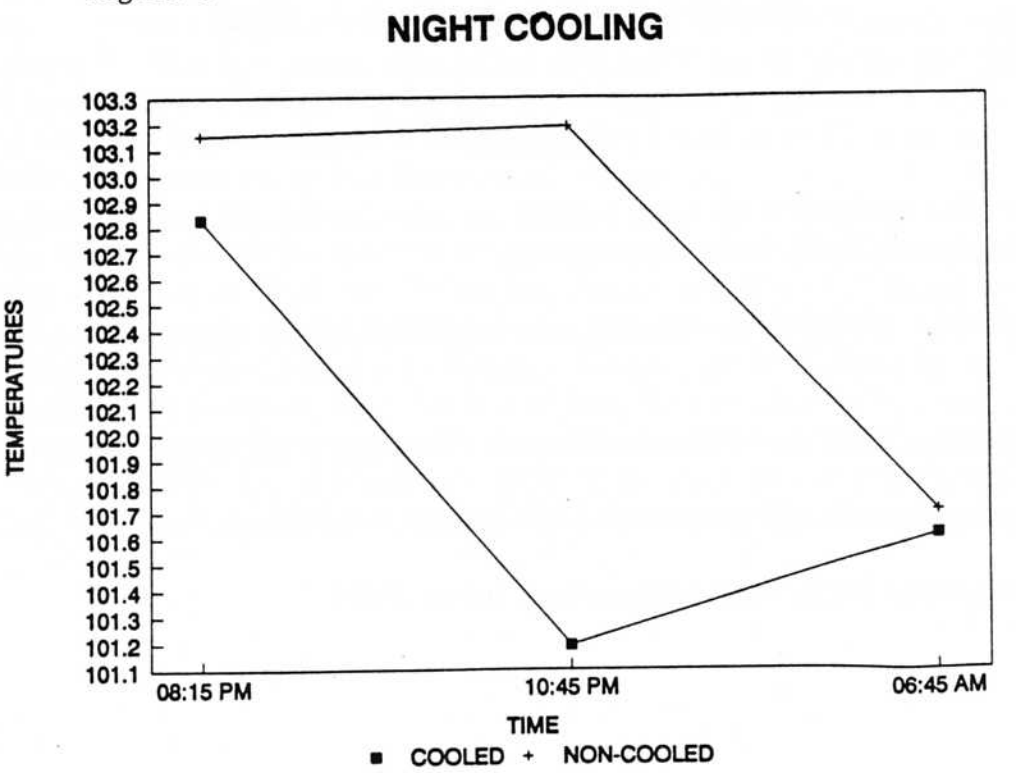
As demonstrated in previous years, the cows body temperatures can be kept below 102°F during the day by fans and sprinklers, but when they leave the cooling area at night their body temperature increases. If we take the chilled water data and observe the times that the cows vaginal temperature was above 102°F, we see the majority of the time is at night when the cows are out on pasture.

Figure 4



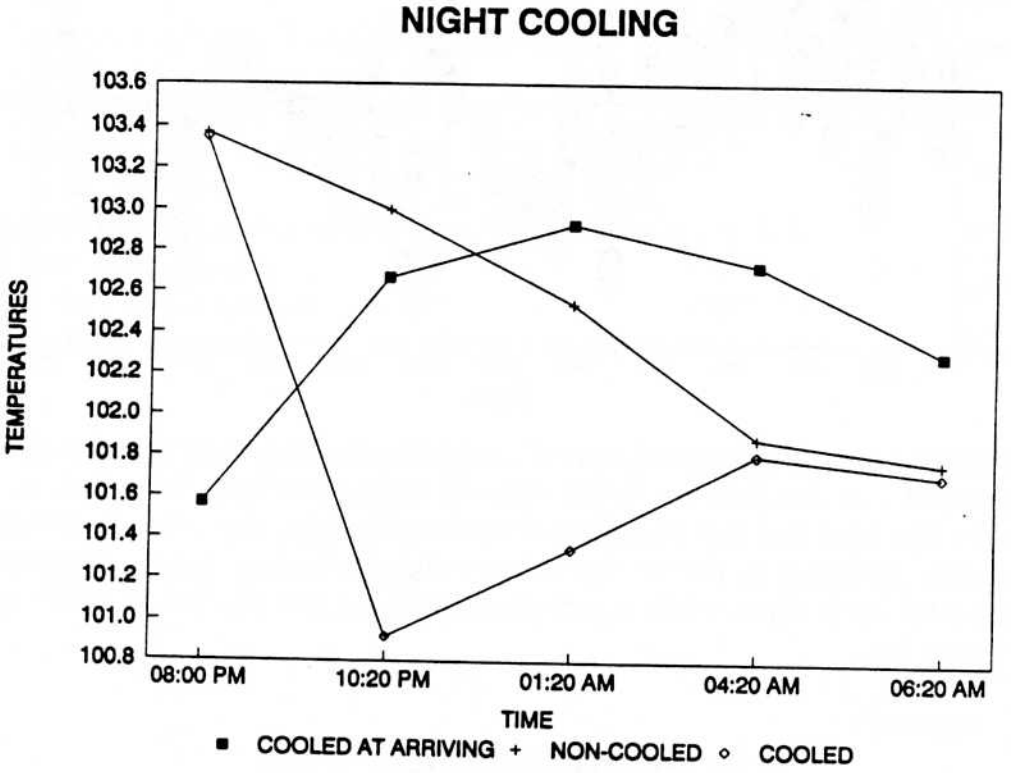
Two experiments were carried out to determine the effects of night cooling on rectal temperature. In the first, the cows were divided at 8:15pm. One half of them were placed in the barn and fan and shower cooled all night; the other half were left outside at night. In figure 5, the results indicate that the cooled cows temperatures went below 102°F by 9:15pm while the cows outside did not dip below 102° until 6:00am the next day.

Figure 5



The other experiment (Figure 6) contained 3 groups of cows. The first group was cooled in the barn and then returned outside; they were much warmer at the start. One group was left inside the barn and cooled while the other was left outside. The initial group which was cooled increased in temperature upon going outside. Again, the cooled group dropped below 102° quickly while the outside cows took 7 hours to drop below 102°F.

Figure 6



Summary

1. Increasing application of water beyond 50 gal/cow/day did not increase milk production or lower body temperatures.

2. Painting of calf hutch roofs white decreased black globe temperature under the roof.

3. Chilled water had no effect on milk production and body temperatures.

4. Temperature of drinking water are affected by many things.

5. Night cooling keeps body temperatures below 102°F.