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## *Calf Note #140 – Shades and sprinklers for Holstein heifers*

### **Introduction**

Selecting the appropriate housing to maximize calf health and performance is an important consideration on any farming operation. It's especially important when rearing valuable animals such as replacement dairy heifers. A number of research studies have shown that the type of housing can affect performance. Important aspects of housing include bedding type, amount of space available for each animal to lie down and eat, availability of water, ventilation, etc. Several studies have also shown that, in warm climates, animals perform better when they are able to move out of the sun to control their body temperature. However, it's not as clear whether shading or other methods of cooling animals (i.e., sprinkling heifers with water) would be equally effective in helping animals control body temperature.

### **The Research**

Research conducted by Marcillac-Embertson and co-workers (2009) evaluated the value of shades and sprinklers on growth and efficiency in Holstein heifers. In this study, Holstein heifers (n = 40) were housed in one of four dry lot pens in the Central Valley of California during July to October, 2003. The average BW of the heifers at the start of the study was 300 kg (660 lbs).

Each pen (10 heifers per pen) was provided with either shade (no sprinklers) or sprinklers (no shade). The amount of bunk space was 0.6 meters per heifer. Calves were fed a standard heifer TMR designed to meet NRC requirements for body weight and water was available at all times.

Shades were tin sheets installed at 4.6 m height in the front half of the pen. The total amount of shaded area (65 m<sup>2</sup>) provided 6.5 m<sup>2</sup> per heifer. Sheets were placed to maximize the amount of shade available throughout the day.

Sprinklers were designed to provide cooling by evaporation. Sprinklers were installed at the water trough and had a 180° spray pattern over a diameter of 9.7 m. The sprinklers were automatically turned on at 11:00 a.m., 1:00 p.m., 3:00 p.m., 5 p.m., and 7:00 p.m. for 7 minutes. The amount of water kept the pen surface moist without making the pen muddy.

The researchers conducted the study for 21 days, then switched the treatments (unshaded pens became shaded and unsprinkled pens had sprinklers added).

The researchers followed many different performance, physiological and behavior parameters. Of greatest practical interest were (1) how hot it was during the experiment and (2) how did the animals perform in the two types of housing.

## Results

It is hot in the Central Valley of California in summer. The average maximum temperature exceeded 30°C (86°F) and black globe temperature exceeded 37°C (99°F) in each of the 21-day periods. Black globe temperature is the temperature reading of a thermometer that has a reservoir painted black to have a better indication of the heat “in the sun”. Black globe temperatures are better indicators of heat stress when solar radiation is important (as in the case of unshaded heifers).

The THI (temperature-humidity index) averaged 82.3, which is another good indicator of the heat stress conditions.

According to a University of Minnesota Extension publication, a THI of 82 indicates moderate heat stress

(<http://www.extension.umn.edu/Dairy/Publications/keepingcowscool.htm>).

Performance of heifers housed in pens with shades or sprinklers.

Trait	Shade	Sprinklers	SE	P
ADG, kg/d	1.35	1.16	0.02	<0.001
DMI, kg/d	9.82	9.49	0.09	0.02
Feed:Gain	7.42	8.52	0.16	0.02

The performance of calves is shown in the table. Clearly, the availability of shade improved the intake, growth and efficiency of heifers in this study. The improvement in intake was 3.4% and growth was improved by over 16%. This is a very significant increase. The improvement in feed efficiency was about 13% - meaning that calves grew 13% faster on the same amount of feed when shade was available.

The physiological and behavioral measurements reported in the article all confirm the improvements in animal performance. For example, heifers in shaded pens had about 13% decrease in respiration rates, though rectal temperatures were unaffected. Respiration is a good indicator of heat stress.

According to an Extension publication

([http://www.extension.org/pages/Heat\\_Stress\\_in\\_Dairy\\_Cattle](http://www.extension.org/pages/Heat_Stress_in_Dairy_Cattle)), respiration rates >80 breaths per minute indicate heat stress. In this study, respiration rates were 76 and 87 breaths for shaded and unshaded heifers, respectively. Basically, when calves are in a hot, sunny environment, providing shade as a way of avoiding solar radiation and heat stress improved performance.

When cattle are exposed to significant heat stress, intake declines to help the animal cope with heat of fermentation, which increases the animal’s body temperature. Heat of fermentation is the heat produced by fermentation of feed by bacteria in the rumen. Every functional ruminant produces some heat caused by ruminal fermentation and this heat contributes to the overall heat the animal must accommodate. In the winter, heat of fermentation can be valuable as it tends to keep cattle warm. However, in summer, heat of fermentation must be dissipated. The amount of heat produced by fermentation depends on the diet – high fiber feeds produce more heat than readily digestible feeds. By reducing intake, the animal reduces its own heat production, thereby allowing it to at least partially cope with the hot environment. However, productive, healthy heifers need to eat to grow, so providing shade seems an easy decision.

The dramatic improvement in feed efficiency observed in this study suggests that a rapid payback period for installation of shades on farms that don’t already provide them. Reducing the amount of feed needed per unit of gain by 13% should make this decision quite easy, though each producer should calculate the payback period for their own operation.

## **Summary**

Providing shade to growing heifers in a hot, sunny environment of the Central Valley of California dramatically improved growth and feed efficiency compared to cooling heifers with sprinklers. This report suggests that heifers would benefit from allowing them to control their environment and maintain their body temperatures closer to the optimal.

## **References**

Marcillac-Embertson, N. M., P. H. Robinson, J. G. Fadel, and F. M. Mitloehner. 2009. Effects of shade and sprinklers on performance, behavior, physiology, and the environment of heifers. *J. Dairy Sci.* 92:506–517.

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