

# Dairy Grazing Newsletter – July 2007

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## Heat Stress in Pasture Based Dairies

Heat stress can be a major issue on dairy farms during the summer months in Missouri. Heat stress occurs when surrounding heat load overwhelms the cow's natural ability to dissipate the heat. Relative humidity and ambient air temperature are used to calculate heat loads or temperature humidity index (THI) for dairy cows. Visually noticeable signs of heat stress are evident around a THI of 72 or above. Figure 1 demonstrates the various combinations of temperature and humidity and its effect on THI. Obvious signs of heat stress to a dairy producer are reduced milk production, increased respiration rate and sweating, increased water intake, decreased dry matter intake and reduced reproductive efficiency. Signs not as well monitored may be slower rate of passage of feedstuffs and decreased blood flow to organs. Cows can reduce their heat load via several mechanisms such as conduction, convection, radiation and evaporative cooling. Radiation and evaporative cooling are two of the more common methods of cooling cows in Missouri. Radiation of body heat occurs when the air temperature is cooler than the cow while evaporative cooling when moisture is evaporated from the cow's respiratory tract or skin. Evaporative cooling is the cow's primary defense against heat stress when air temperatures are above 70 F. Radiation cooling is most effective at cooler temperatures while evaporative cooling can be limited by high humidity levels.

In Missouri pasture based systems the obvious choice to cool cows is in the holding pens. The spray and fan system is the most popular and possibly the most effective way to cool cows in a grazing operation. Due to the high humidity levels in the lower Midwest large water droplets are required to wet the skin of the cow rather than a fine mist used in the drier climates of the southwest. Fans or natural air movement increases the rate of evaporation and cools the cows more rapidly. Research as shown a cow's body temperature may rise 3 F within 20 minutes of entering the holding pen if cooling is not provided. Conversely cow's body core temperatures may lower 3-4 F when cooling systems such as the spray and fan system are offered. This correlated to nearly a 2 pound increase in milk production per cow. Additional data from the southeast and southwest United States indicate up to a 4 pound increase in milk production if shade is offered in pasture systems. Normal recommendations are 35-45 square feet of shade per cow is needed for adequate cooling. Other systems have provided exit lane from milking parlor cooling systems where cows are soaked leaving the barn. Producers must be somewhat cautious of this system if natural ventilation (wind) is low or non-existent as the water will not evaporate as quickly and may exacerbate heat stress for the cow.

Fan sizing and placement is critical in ensuring proper cooling for cows in the holding pen. Fans should be capable of moving around 1000 cfm/cow. Most 30-36 inch fans are capable of moving 10-12,000 cfm so each fan is capable of cooling 10-12 cows. Most of our newer milking facilities have side walls higher than 10 feet. It may be best to orient the fans perpendicular to cow movement and in rows provided the holding pen is 20-24 feet or wider. This should maximize the amount of airflow over the cow's backs and efficiently cool the cows.

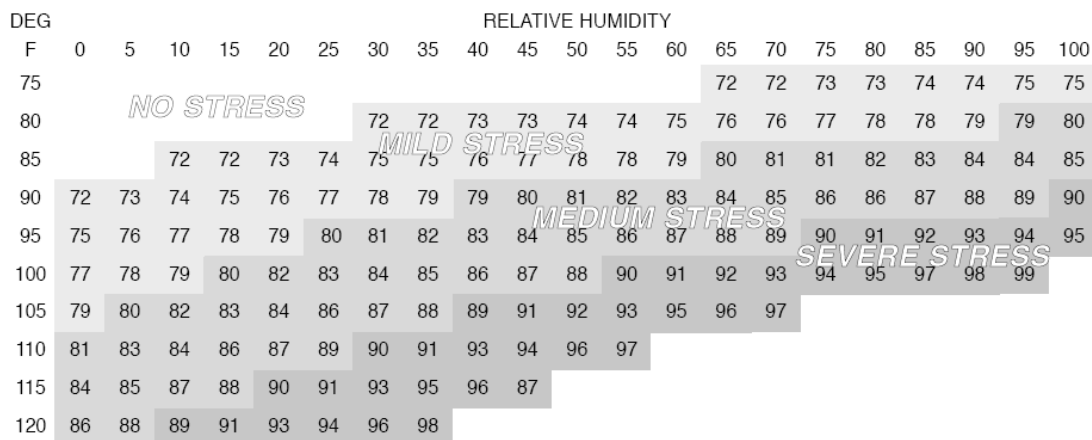
To combat the lower dry matter intake producers may wish to add fat to the diet to increase the energy density of the ration. Fat is high in energy and does effect the starch load of the diet causing acidosis and potentially may reduce heat load. Fat should not exceed 6-6% of the total diet dry matter. Some producers may also wish to increase protein levels in the diet as well. However attention must be paid that surplus protein is not fed as excess protein must be metabolized and excreted which can increase heat stress and reduce milk production due to energy required to rid the cow of the protein.

Another method to employ to reduce heat stress is to move milking times. Moving milking time from 5 or 6 in the morning to later in the morning will allow her to graze more effectively in the early morning hours and not have her “heat of digestion” peak during the warmer periods of the day.

Genetics of the cow herd may also play a role in reducing the effects of heat stress. Producers have commented the effect Jersey influence can play in the amount of time cows spend grazing during periods of heat stress. Research conducted at the MU Southwest Research Grazing dairy confirms this by demonstrating Jersey and Jersey influenced cows rectal temperatures rise more slowly and peak at lesser maximum temperature than Holstein cows. Respiration rates of the Jersey cows were higher than Holstein animals lending evidence of their potential ability to dissipate heat easier or more quickly. Although the Jersey produced less fat corrected milk than the Holstein a producer must take into account the amount of milk produced per acre rather than per cow when trying to maximize efficiency of the grazing platform. More research needs to be done on this subject. See Table 1.

In summary there are many methods that may reduce heat load on cows in a pasture based system. Producers must evaluate the costs and benefits of the return on the costs to determine which method will pay dividends to their own operation.

**Figure 1. Temperature Humidity Index (THI)<sup>1</sup> for Dairy Cows. Modified from Dr. Frank Wierama (1990), Department of Agricultural Engineering, The University of Arizona, Tucson, Arizona.**



<sup>1</sup>THI = (Dry-Bulb Temp. °C) + (0.36 dew point Temp., °C) + 41.2)

If more than two cows out of 10 have respiratory rates exceeding 100 breaths per minute, then immediate action should be taken to reduce heat stress.

**Table 1.** Least square means for production and thermal balance parameters of cows with different breed composition managed in a management intensive management system during summer

Breed	Body Weight (Kg)	4% FCM (Kg/day)	Rectal Temp. (C)	Resp. Rate (Breaths/Min)
Holstein	529 a	21.4 a,b	39.14	68.2
¼ Jersey	501 a,b	23.5 a	39.09	62.9
½ Jersey	413 b,c	18.9 b,c	38.97	69.1
¾ Jersey	466 b	19.7 b,c	38.91	66.6
Jersey	378 c	17.7 c	38.85	64.5
SE	22	1.5	0.09	2.7