Fat Feeding Facts 9. Heat Stress with Lactating Cows

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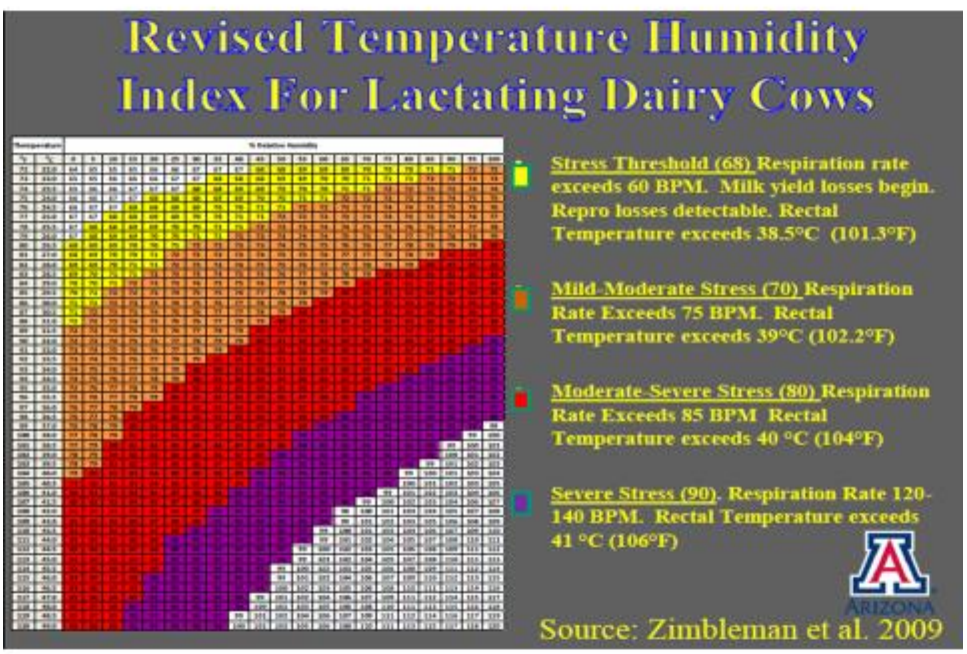
While heat stress has been known for years to be a problem, especially for lactating dairy cows, more has been recently learned about the mechanisms involved, that heat stress occurs at a lower temperature humidity index (THI) than previously thought, and how to alleviate it (Allen et al., 2013; Rhoads et al., 2015).

Heat stress affects several aspects of the dairy industry, and has been estimated to cost the US dairy industry $2 billion annually. Heat stress has been found to directly and/or indirectly affect feed intake, cow body temperature, maintenance requirements and metabolic processes, feed efficiency, milk yield, reproductive efficiency, cow behavior, and disease incidence. Reduced dry matter intake (DMI) and lower milk production are the most commonly noted effects of heat stress in lactating dairy cows. More recently (Allen et al., 2013) have noted that
heat stress will increase a cow's standing time as it tries to dissipate heat over its entire
body surface, increase standing time or decreasing resting time which reduces milk production, and increases risk of lameness. Prolonged heats tress also increases core body temperature, increases estrous cycle length but decreases estrus length, and can increase embryo mortality. Lameness also contribute to lower reproduction due to decreased DMI and less activity.

Typically, a THI over 72 [75 °F (23.9 °C) with 65% RH to 90 °F (32.2 °C) with 0% RH] was established as the lower threshold of heat stress. But with increased milk production per cow since development of the THI, a 22 lb/day increase will decrease the threshold for heat stress by 9 °F (5 °C). A recent re-evaluation of the THI has modified that due improved milk production. That is shown in the graph in which THI heat stress threshold was lowered to 68 [72 °F (22.2 °C) with 45% RH to 80 °F (26.7 °C) with 0% RH).



Allen et al., 2013. Proc. Western Dairy Management Conf.

When cows experience heat stress, DMI decreases. At the same time, maintenance requirements are increased due to activation of the thermoregulatory system. This can increase maintenance requirements by 7 to 25% (NRC, 2001). This decreased DMI can account for about 36% of decreased milk production due to shifts in post-absorptive metabolism and nutrient partitioning. Under heat stress cows also have lower NEFA concentrations and a higher rate of peripheral glucose utilization. This reduced DMI precedes by several days reduced milk production.

Heat abatement involves a number of actions: providing shade, air movement, misters and fans, feeding more earlier and later in day, use high quality forages to minimize heat of rumen fermentation, and avoiding feeding fat sources that can reduce DMI or contribute high levels of fatty acids such as linoleic or palmitic. When DMI is reduced as in heat stress, using a mostly saturated free fatty acid supplement can increase energy intake by increasing energy as long as DMI is not reduced. A study near Shanghai, China during the summer illustrates this. There were 16 Holstein cows per treatment used with 2.2 parity average, the study began at 184 days in milk for 10 weeks, and fed TMRs with 41% forage and 0, 1.5, and 3.0% saturated free fatty acids (FFA).

	No FFA	**1.5% FFA**	**3.0% FFA**
DMI, lb/d	44.5	44.3	44.5
NEL balance, Mcal/d	1.60	0.25	1.22
Solids-Corrected Milk, lb/d	55.9[a]	62.5[b]	64.1[b]
SCM/NEL lb/Mcal	1.77[a]	1.96[b]	1.94[b]
NEFA, µEq/L	376[a]	359[b]	330[b]

[ab] $P<0.05$

Increased NEL (net energy of lactation) intake went more into milk production and components. Rectal temperatures were also reduced during the hottest part of the day for treatments containing FFA in rations.

What is too commonly overlooked is how prevalent heat stress occurs over the US. Granted length of heat stress is much more extended in southern US, but even northern states have a number of days during summer, and some fall and spring days too, where THI is over 72 [75 °F (23.9 °C) with 65% Relative Humidity.

Allen, J.D., S.D. Anderson, R.J. Collier, and J.F. Smith. 2013. Managing Heat Stress and its Impact on Cow Behavior. Proc. Southwest Nutrition and Management Conference, p. 69-81.

Rhoads, R. P., L. H. Baumgard, and G. Xie. 2015. The physiology of heat stress: A shift in metabolism priorities at the systemic and cellular levels. Proc. 4th International Symposium on Dairy Cow Nutrition and Milk Quality, p. 86-96, May 8-10, Beijing, China.

Wang, J. P., D.P. Bu, J.Q. Wang, X.K. Huo, T.J. Guo, H.Y. Wei, L.Y. Zhou, R.R. Rastani, L.H. Baumgard, and F.D. Li. 2010. Effect of saturated fatty acid supplementation on production and metabolism indices in heat-stressed mid-lactation dairy cows. J. Dairy Sci. 93:4121-4127.