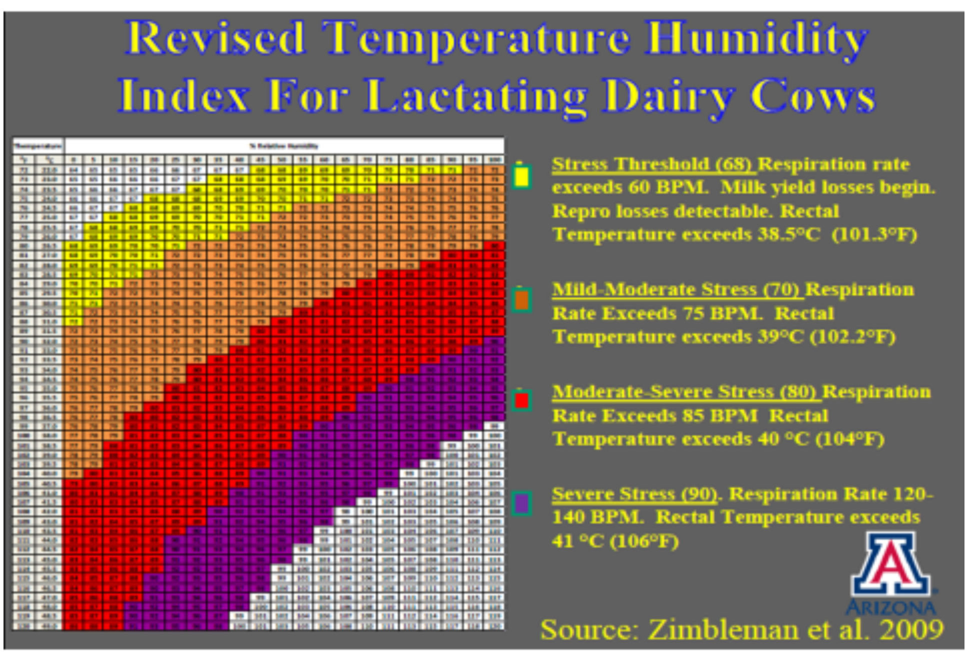
Fat Feeding Facts 2
Heat Stress with Lactating Cows

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

Heat stress affects several aspects of dairy production, 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; and this increased standing time or decreased resting time reduces milk production and increases the risk of lameness. Prolonged heat stress also increases core body temperature, increases estrous cycle length but decreases estrus length, and can increase embryo mortality. Lameness also contributes to lower reproduction due to decreased DMI and less physical activity.

Typically, a THI over 72 (75 °F with 65% relative humidity to 90 °F with 0% RH) was established as the lower threshold of heat stress. But with increased milk production per cow since original development of the THI, a 22 lb milk increase daily will decrease the threshold for heat stress by 9° F. A recent re-evaluation of the THI has modified that index due to improved milk production. That revision is shown in the graph in which THI heat stress threshold was lowered to 68 (72 °F with 45% RH to 80 °F 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 (non-esterified fatty acids from hydrolysis of body fat) concentrations and a higher rate of peripheral glucose utilization. This reduced DMI precedes by one or more days a reduction in milk production.

Heat abatement involves a number of actions: providing shade, more air movement, using misters and fans, feeding more earlier and later in day, use of high quality forages to minimize heat of rumen fermentation, and avoiding the feeding fat sources that can reduce DMI or contribute to high levels of dietary fatty acids such as linoleic or palmitic. The latter two can reduce DMI. When DMI is reduced, as in heat stress, using a mostly saturated free fatty acid supplement can increase energy intake by increasing dietary energy concentration as long as DMI is not reduced. A study near Shanghai, China during a summer illustrated this. There were 16 Holstein cows per treatment used with 2.2 parity average, the study began at 184 days in milk and ran for 10 weeks, and TMRs were fed with 41% forage and 0, 1.5, or 3.0% saturated free fatty acid supplement (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 mostly into milk production and components. But note there was no decreased DMI from this fat supplementation. Rectal temperatures were also reduced during the hottest part of the day for treatments containing FFA in rations.

What is too commonly overlooked about heat stress in lactating dairy cows is how prevalent it is over the entire US. Granted, length of heat stress is more extended throughout the year in southern states, but even northern states have a number of days, weeks, and maybe months during spring, summer, and fall where THI is over 72 (75 °F 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.

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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.

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