



DAIRY CATTLE REPRODUCTION COUNCIL

Improving Reproduction in the Midst of Heat Stress

In the next few weeks the challenges associated with heat stress will be in full swing. While the common signs of heat stress are well-recognized and understood, improving herd reproductive performance in the midst of summertime heat continues to plague dairy operations. These challenges are estimated to cost the dairy industry \$900 million annually, and will continue to negatively influence herd performance, health and reproductive function if measures to mitigate its effects are not implemented.

What we're up against

"There are multiple effects heat stress has on the reproductive performance of the dairy cow," says Dr. Todd Bilby, associate professor and extension specialist with Texas A&M AgriLife Research and Extension.

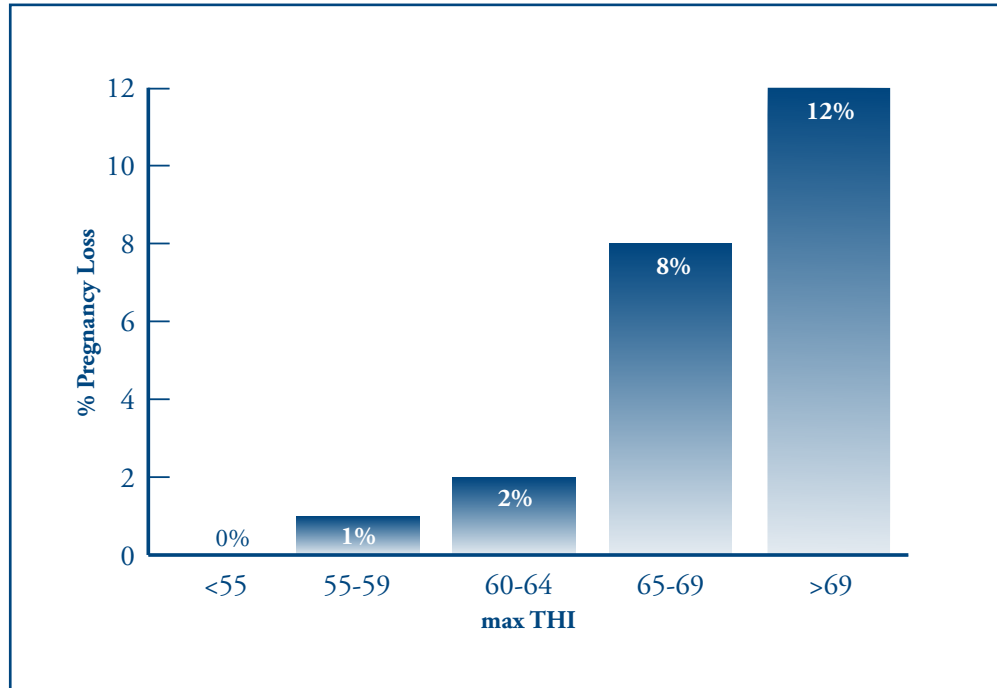
"As we've bred cows to increase milk production, they have become more susceptible to heat stress due to elevated metabolic heat production."

By understanding how heat influences the reproductive cycle, we can match our practices to meet the cow's needs. Here are a few ways reproductive function is impacted by summer heat:

- **Reduced dry matter intake.** One of the first reactions cows have to heat stress is eating less feed, supplying less energy for use by the cow. "Since cows have been bred to produce high volumes of milk, cows naturally use available energy for daily maintenance and milk production first, with fewer nutrients available for reproductive health," explains Dr. Bilby.
- **Reduced estrous expression.** Cows in heat stress conditions show fewer, less intense heats than in cooler temperatures, notes Dr. Bilby. Studies¹ have suggested that undetected estrous events were between 76 and 82 percent from June to September compared to 44 to 65 percent from October to May.
- **Follicular selection and development.** Heat stress impairs follicle selection and increases the length of follicular waves, which can reduce the quality of the oocytes. It also allows for more than one dominant follicle to develop, explaining the increased twinning seen from cows conceiving in summertime heat.
- **Embryo development.** Embryo quality and growth is often reduced during heat stress. Embryo loss is more common in these conditions as well, with cows conceiving in heat stress being 3.4 times more likely to lose their embryo when compared to those conceiving in cool seasons².
- **Carryover effects.** Even after the heat of summer is over, the carryover effects of heat stress can cause fertility to be delayed. This can reduce conception rates for a longer period of time and result in poor heat detection, more services per pregnancy and longer days open.

For all of these reasons, pregnancy losses increase dramatically as the temperature-humidity index (THI) rises. Table 1 shows pregnancy loss rate climbs as high as 12 percent when THI is 69 or greater.

Table 1. Pregnancy loss rates based on THI, 21 – 30 days of gestation



Combating the heat

Dr. Bilby notes that the greatest opportunity to reduce the negative effects of heat stress both pre- and post-partum is through cooling. “Feedline sprinklers, shades and fans are all beneficial to help keep cows cool, reducing services per conception, reproductive culls and days open,” explains Dr. Bilby. “Milk yield also increases, leading to a significant return on investment compared to cows with just shades or feedline sprinklers alone.”³

To effectively use the technologies available to mitigate heat stress, producers must be aware of hot spots in their operation, says Dr. Bilby. These places are the ones most often responsible for increasing ambient temperature rapidly and can often be places cows spend a significant portion of their day.

To best manage hot spots for optimal cow performance and reproductive health:

- **Provide cooling devices.** Shades, soakers and fans should be located in places that are extremely hot and where cows spend most of their time. This includes at the feedbunk and the holding pen as well as the freestall barn or shades on a dry lot facility.
- **Make ration changes.** Cows in heat stress conditions are prone to rumen acidosis, which makes fiber quality especially important to maximize rumen buffering and saliva production. Feeding a high-quality bypass fat remains an effective way to provide an energy-dense diet at a time when cows are eating fewer pounds of feed, recommends Dr. Bilby. Also, increase levels of potassium in the diet as cattle utilize it as the primary sweat gland regulator.



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- **Think water.** Water consumption increases 1.2 to two times during heat stress conditions. Dr. Bilby notes that since milk is 90 percent water, how much cows drink is vital to milk production and maintained thermo homeostasis.
- **Don't forget about the holding pen.** Cows should spend no more than 60 to 90 minutes in the holding area to minimize the negative effects of this hot spot. In addition, provide shade, fans and sprinklers to keep cows cool.⁴
- **Work when it's coolest.** Vet checks, pen moves and lock-up should be completed early in the morning when cows and temperatures are the coolest. Cow's body temperature is warmest between 6 p.m. and midnight, so reducing activity during this time can also reduce heat stress.

Reproductive tools to beat the heat

By making changes to the environment and rations, producers have seen vast improvements in how cows are responding to heat stress. While these changes will help alleviate the negative effects heat stress has on reproduction, other changes to reproductive protocols can help keep your program in check:

- **Increase estrous detection.** If you visually watch for heats, increase the time and frequency of observation, and watch more often during cooler periods of the day. Tail chalking is another popular estrous detection aid that can identify cows in heat during summertime temperatures. Using available technologies such as pedometers can help increase estrous detection as the use of multiple technologies in concert can have more positive benefits than using one technology alone.
- **Use A.I. for more breedings.** "After a certain number of breedings some producers move cows into a pen with a bull for natural service breeding. During summertime heat, bull fertility is often impaired, which can negatively impact your reproductive program," shares Dr. Bilby. Heat stress also decreases sperm concentration and motility and increases the percentages of abnormal sperm in an ejaculate.
- **Utilize timed-A.I. when possible.** A timed-A.I. (TAI) protocol can help improve fertility during summer months. Research⁵ has shown that a TAI protocol increased pregnancy from 16.5 percent in the control group to 27 percent in the TAI protocol, while decreasing days open, interval from calving to first breeding and services per conception.

Dr. Bilby notes that while many ways can help mitigate the heat, the most profitable and effective way to improve both milk production and reproduction during the summer months is by improving cooling systems. Enhanced cooling, coupled with appropriate ration adjustments and customized reproductive protocol changes, can help to improve reproductive performance, even in the midst of hot weather.

1 Thatcher WW, Collier RJ. Effects of climate on bovine reproduction. In: D.A. Morrow, ed. *Current Therapy in Theriogenology 2.*, Philadelphia: W.B. Sanders, Co., 1986;301– 309.

2 López-Gatius F, Santolaria P, Yáñez JL, Garbayo JM, Hunter RHF. Timing of early foetal loss for single and twin pregnancies in dairy cattle. *Reprod Domest Anim* 2004;39:429-433.

3 Garcia-Ispuerto F, Lopez-Gatius G, Bech-Sabat P, Santolaria J, Yaniz L, Nogareda C, De Rensis F, Lopez-Bejar M. Climate factors affecting conception rates of high producing dairy cows in northeastern Spain. *Theriogenology* 2007;67:1379-1385.

4 Wiersma F, Armstrong DV. Cooling dairy cattle in the holding pen. ASAE paper no. 83-4507. ASAE, St. Joseph, MI, 1983.

5 De la Sota RL, Burke JM, Risco CA, Moreira F, DeLorenzo MA, Thatcher WW. Evaluation of timed insemination during summer heat stress in lactating dairy cattle. *Theriogenology* 1998;49:761-770.