

The Impact of Heat Stress on Dry Cows

The increase in environmental temperature seriously impacts animal productivity. Recent data has revealed that heat stress not only affects current lactation of dairy cows but also suppresses future milk production when dairy cows experience it during the dry period or *in utero*. It is estimated that a US dairy cow can lose approximately 640 lb of milk in the subsequent lactation if not cooled when dry.¹

Heat stress occurs when THI, an index calculated based on ambient temperature and relative humidity, is above 68. Cows experiencing heat stress can be easily detected on the farm, and characteristic signs of heat stress are:

- Increased respiration rate (> 60 breaths per min)
- Increase body temperature (> 102.2°F)

This bulletin summarizes scientific findings of the effects of heat stress during the dry period on both the subsequent lactation of dams and on health and productivity of the calves born to those dams. The following information is presented from summer studies in which dry cows were divided into two treatment groups:

1. **Cooling (CL)** – substantial heat abatement with shade, fans and soakers
2. **Heat stress (HS)** – slight heat abatement with shade only

In each trial, cows from both treatment groups were moved to the same pen with substantial heat abatement after calving. Therefore, treatment differences are due to environmental differences during the dry period.

Dam's Milk Production

A summary of 10 trials conducted during summer months in multiple U.S. states between the years of 1988 and 2017 revealed that HS cows averaged 7.7 lb/d less milk than their CL herd mates.² The suppressed milk production experienced by HS cows lasted for the entire length of the subsequent lactation (Figure 1).³ Also, a 2013 report captured a strong negative correlation between afternoon core body temperature of dry cows and their subsequent lactation performance (Figure 2);⁴ each 0.5 °F increase in rectal temperature above the cow's normal temperature, about 101.3 °F, equated to 7 lb/d drop in milk yield.

Dam's Reproductive Performance

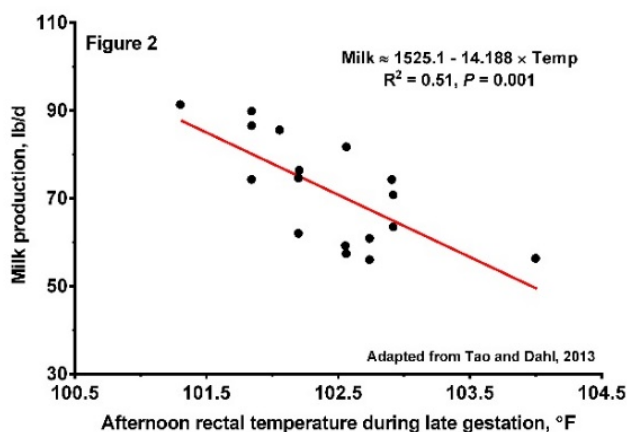
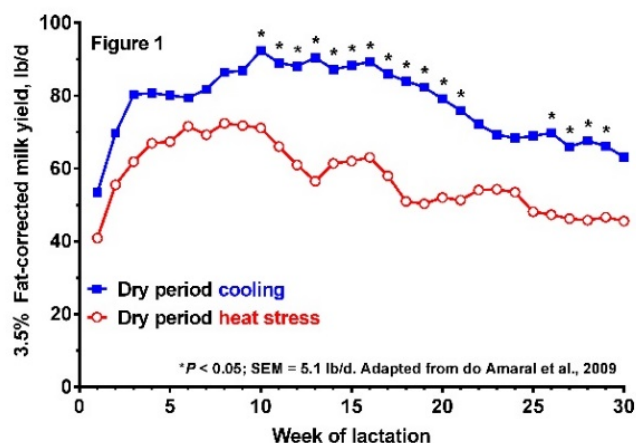
In three different experiments, researchers at the University of Arizona reported that CL dry cows had improved subsequent reproductive performance compared to their HS counterparts:⁵

- Substantial heat abatement reduced services per conception from 3.68 to 3.09
- Substantial heat abatement reduced cows culled due to reproductive issues from 19.0 to 7.7%

Calf Development and Health

In utero heat stress can alter the immune status of calves and have lasting consequences on their growth and productivity. A review paper in 2019 found that:²

- Length of gestation averaged 277.4 d for CL cows vs 274.1 d for HS cows (8 trials)
- Calf birth weights averaged 9.7 lb more for calves born to CL vs HS dams (12 trials)
- Calf weaning weights averaged 16.9 lb more for calves from CL vs HS dams (5 trials)



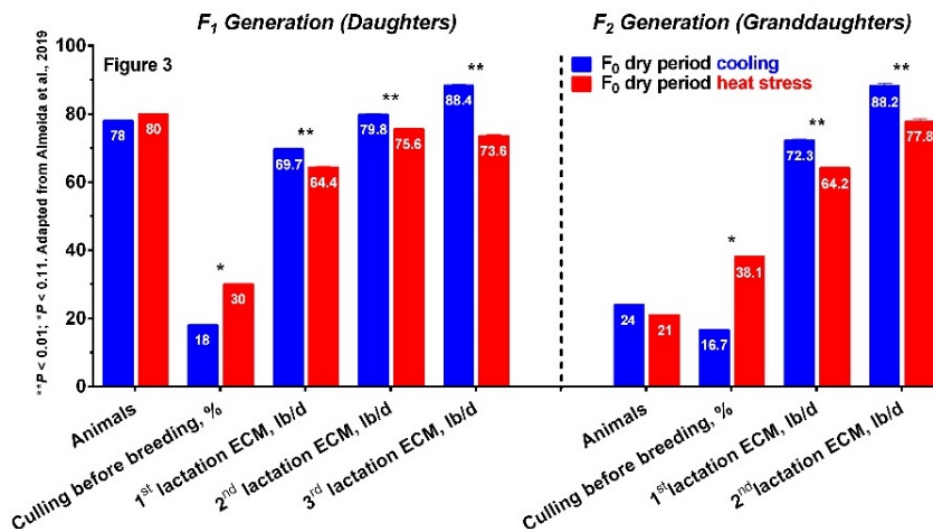
The apparent efficiency of IgG absorption for calves born to CL cows was approximately 4 percentage units higher than that of calves born to HS cows, even when provided the same pooled colostrum source.⁶

Transgenerational Milk Production and Culling

A 2016 report⁷ documented that heifers born to HS dry cows produced an average of 11 lb/d less milk in their first lactation than their cohorts calved from CL dry cows. Heifers born to CL cows that completed their first lactation was 85.4% compared to only 65.9% of the heifers born to HS dams. The cost of rearing a heifer from birth to first calving would be \$157.49 greater if the heifer is born from a HS dam. In the U.S., the economic losses for additional heifer rearing cost, reduced productive life, and reduced milk yield of daughters born to HS dams, were estimated to add up to \$595 million per year.⁸ Moreover, *in utero* heat stress impacts productivity beyond the first generation of offspring. After analyzing lactation records from dry period heat abatement experiments during 10 summers, from 2008 to

2018, researchers at the University of Florida found that late-gestation heat stress not only impairs performance of daughters but also of granddaughters of dams heat-stressed during the dry period (Figure 3).^{8,9} For example, granddaughters of those HS dams produced 8.1 and 10.4 lb/d less energy-corrected milk during their first and second lactations, respectively, compared to the CL counterparts.

Investments made in heat abatement equipment for dry cow housing can support huge long-term returns. Incorporating a proven feed additive in the summer dry cow ration to maintain hydration can further ensure success if it does not contribute to increasing electrolyte balance of the diet (i.e. additional sodium or potassium). Promote® I.C.E.® PLUS is a synergistic blend, including an osmolyte, which works at the cellular level to help cattle better regulate body temperature during heat stress. Additionally, the I.C.E. PLUS formula has been updated to include plant-based compounds that help maintain antioxidant status, supporting animal health and well-being.



References:

- Ferreira, F.C., R. S. Gennari, G. E. Dahl, and A. De Vries. 2016. Economic feasibility on cooling dry cows across the United States. *J. Dairy Sci.* 99:9931.
- Tao, S., G. E. Dahl, J. Laporta, J. K. Bernard, R. M. Orellana Rivas, and T. N. Marins. 2019. Physiology Symposium: Effects of heat stress during late gestation on the dam and its calf. *J. Anim. Sci.* 2019. 97:2245.
- do Amaral, B. C., E. E. Connor, S. Tao, J. Hayden, J. Bubolz, and G. E. Dahl. 2009. Heat stress abatement during the dry period: Does cooling improve transition into lactation? *J. Dairy Sci.* 92:5988.
- Tao, S. and G. E. Dahl. 2013. Invited review: Heat stress effects during late gestation on dry cows and their calves. *J. Dairy Sci.* 96:4079.
- Wiersma, F., and D. V. Armstrong. 1988. Evaporative cooling dry cows for improved performance. Paper No. 88-4053, *Am. Soc. Agric. Eng., St. Joseph, MI.*
- Monteiro, A. P. A., S. Tao, I. M. Thompson and G. E. Dahl. 2014. Effect of heat stress during late gestation on immune function and growth performance of calves: Isolation of altered colostrum and calf factors. *J. Dairy Sci.* 97:6426.
- Monteiro, A. P. A., S. Tao, I. M. T. Thompson and G. E. Dahl. 2016. In utero heat stress decreases calf survival and performance through the first lactation. *J. Dairy Sci.* 99:8443.
- Laporta, J., F. C. Ferreira, V. Ouellet, B. Dado-Senn, A. K. Almedia, A. De Vries, and G. E. Dahl. 2020. Late-gestation heat stress impairs daughter and granddaughter lifetime performance. *J. Dairy Sci.* 103. In press.
- Almeida, A. K., J. Laporta, B. Dado-Senn, F. C. Ferreira, A. De Vries, and G. E. Dahl. 2019. Late-gestation heat stress impairs performance of daughters and granddaughters. *J. Dairy Sci.* 102(Suppl. 1):403.

For additional support and to learn more about Promote® I.C.E.® PLUS, and other strategies to mitigate the effects of heat stress in dairy cows, contact the Provimi Dairy Tech Team at 937-770-2400 or dairy@provimi-na.com.