Top *Eleven* Considerations for Dry Cow Cooling

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While producers are quite familiar with the positive effects of cooling cows during lactation, fewer understand the impact of cooling dry cows. Yet there is increasing evidence that failure to cool cows when they are dry leads to negative effects on productivity and health in the next lactation. Perhaps more critical is the emerging data that indicates a significant impact of in utero heat stress on the developing heifer, which results in long term effects on that calf's productivity and health. This paper considers those topics, along with the economic and implementation considerations.

1) How does dry period cooling affect milk yield?

Cows that experience heat stress during the dry period make 8 to 10 pounds less milk each day in the next lactation compared with herdmates that are cooled. There is no impact on milk composition, though component yields are increased with cooling. The effect is present on the first day of lactation and persists for at least 40 weeks, though all evidence suggests it persists through the entire lactation.

Mammary epithelial cell growth is depressed in heat stressed dry cows relative to cooled animals, and that is consistent with greater capacity to produce milk in the next lactation. These production responses have been confirmed in a number of studies in different locations around the world, supporting the concept that effective cooling is critical to achieve top performance in the next lactation.

2) How long do I need to cool cows in the dry period?

Some reports indicate that cooling in the transition or close-u period alone yield better performance in the next lactation. In a recent study we tested the impact of cooling cows for the first half of the dry period, the second half, or the entire dry period compared with heat stress throughout the dry period. As expected, cooling for the entire dry period improved yields relative to heat stress, but even heat stress of the first or second half of the dry period had negative effects on subsequent yield. Thus, our recommendation is that cows be cooled for the entire dry period to realize the benefits on performance.

3) What are the metabolic effects?

Similar to lactating cows, heat stressed dry cows consume less feed compared with cooled cows. Under heat stress, dry cows have lower bodyweight relative to cooled herdmates as well. Despite the lower nutrient intake and lack of gain, there is no evidence that heat stressed dry cows experience any impact metabolically during heat stress. Indeed, there is no difference in basal or stimulated insulin, glucose or free fatty acids between cooled and heat stressed dry cows. After calving there are some transient affects of dry period cooling, but they are all consistent with the observed increases in milk yield in those cows, and it is important to note that all cows are cooled during lactation so those metabolic effects could not be due to continued heat stress.

4) Is cow health affected?

During the dry period, heat stress reduces antibody response to vaccination, and lymphocyte (i.e. white blood cell) proliferation is also lower. Thus, heat stress has direct negative impacts on the cows ability to respond to pathogens during the dry period. Interestingly, there are carry-over effects of dry period heat stress on immune function, with those cows having lower innate immune responses in early lactation relative to their cooled herdmates, even though they are at a lower level of milk production. The improved immune status in cooled dry cows resulted in better responses to *S. uberis* challenge in early

lactation. Consistent with the improved immune status, cows that are dry during cooler months have fewer cases of mastitis, respiratory illness, and retained fetal membranes relative to cows dry during the hottest months of the year. It is important to remember that the cows are more productive when they are dry when it is cool, yet they are also healthier.

5) What about reproductive performance?

The strongest indication that dry cow cooling does not negatively impact subsequent reproduction comes from a study that compared cows that were dry in the coolest months of the year (i.e. December to February) to those dry in the hottest months of the year (i.e. June to August). Cows dry in the coolest months produced more milk and were less likely to contract disease compared with those dry in the Summer. Cows dry in the cool months had fewer services to pregnancy, fewer days to pregnancy and thus fewer days open versus those dry in the hot months; all indications that despite higher milk yield, and being bred during the hottest months of the year, a dry period during the coolest months improves reproductive performance.

6) Is calf health and growth altered?

Calves born to heat stressed dams are lighter at birth, remain lighter at weaning and even through 12 months of age, relative to calves from cooled dams. Calves that are heat stressed in utero are also shorter through a year of age. Passive transfer is also compromised in calves from heat stressed dams, with lower apparent efficiency of immunoglobulin (IgG) absorption translating to lower circulating concentrations of IgG through the first month of life. This is not due to a reduction in colostrum quality from the dam, but rather a limitation of IgG uptake. We have tracked calf health through the first lactation and found that more in utero heat stressed calves leave the herd due to sickness or illness before puberty, and thus fewer complete the first lactation.

7) Is heifer reproductive and first lactation performance affected?

Heifers born to heat stressed dams achieve puberty at the same age as those from cooled dams, but they require more services to achieve pregnancy. Most importantly, heifers born to heat stressed dams produce about 10 lbs/d less milk in their first lactation compared to the heifers from cooled dams; this effect is apparent from the beginning of lactation and extends to at least 250 DIM, and likely through the

entire lactation. This response is not associated with differences in growth during the first lactation, as both groups of animals calved at the same bodyweight (BW) and had identical BW through the first lactation. More recently, we have determined that those calves that were heat stressed in utero remain less productive in the second and third lactations, and pass on that poorer performance to their offspring. Thus, in utero heat stress generates a phenotype that never achieves its genetic potential.

8) What are the economic impacts of heat stress for dry cows?

In a recent analysis we considered the economic losses associated with a lack of dry cow cooling across the US. Potential days during the year that a cow would experience heat stress were estimated for each state and the total number of cows in each state was used to estimate the total potential milk loss. The total potential loss from a lack of dry cow cooling is at least $810 million annually. However, that estimate only considers milk losses, and does not include any impact on cow health or on the calf. Thus, the total negative impact is likely much greater. But prevention of the milk loss alone is enough to yield significant positive return on any cooling system improvements.

9) How do I assess heat stress?

Because temperature and humidity both influence the ability of a cow to lose heat to the environment, it is best to use the temperature-humidity index (THI) to assess the relative heat load on an animal. Rectal temperature (RT) is the gold standard to determine heat stress, and RT increases at a THI of 68, so abatement should begin before that THI is reached. In addition to RT, respiration rate (RR) will indicate the relative heat stress a cow is experiencing, and can be used effectively in a barn to determine if animals are heat stressed. For example, measuring RR by observation of flank movements of a group of sentinel cows within a pen should provide an indication of heat load; an average RR of 60 or greater suggests that heat stress is occurring and abatement strategies need to be employed to actively reduce the heat load on cows.

10) How are dry cows best cooled?

Methods of cooling are no different from those used on lactating cows. In a hot, humid environment such as we have in Florida, soakers, fans and shade are effective abatement strategies for heat stress, whereas misters may be effective in more arid locations. However, shade alone will not provide complete cooling for cows during high heat and humidity, although it is better than no heat abatement. Sand bedded stalls may also provide additional relief via conductive heat transfer to the sand. Overcrowding will exacerbate heat stress so be sure that dry cows pens are not above 100% stocking rate. In general, the choice should be the most effective system available in the location, and the effectiveness of the system should be tested through RT or RR monitoring.

11) Where can I get more information?

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