Cooling Dry Cows: Impacts on the Cow and the Calf

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Whereas the beneficial effects of cooling cows during lactation are clear, less work has been done to examine the impact of dry cow cooling on subsequent performance and health, and on the developing fetus. This summary explores the recent work related to late gestation cooling on milk yield, metabolism, and immune status in the cow, and also reviews the effects of in utero heat stress on the heifer calf. Finally, economic implications of heat stress in the dry period are explored.

Compared with cows that are cooled, dry period heat stress causes a reduction in milk yield in the next lactation, along the order of ~9 lbs/cow per day (Dahl et al., 2017). This reduced yield is apparent from calving and extends for the entire lactation. Late gestation heat stress reduces mammary cell proliferation in the dry period, possibly as a result of placental dysfunction and hormone output. Mammary cell death, as measured by apoptosis, appears to be less affected later in the dry period, although autophagy is slowed early in the dry period with heat stress (Tao et al., 2011; Wohlgemuth et al., 2016). These observations suggest that overall mammary functional capacity is increased with cooling in the dry period relative to heat stress, consistent with the impact on milk yield.

It is important to understand that heat stress at any point in the dry period will reduce subsequent yield. In a recent study, we compared heat stress effects for the initial half of the dry period with that of the final half, and with heat stress exposure for the entire dry period (Fabris et al., 2019). In contrast to cows cooled for the entire dry period, heat stress for the first 3 weeks, or the final 3 weeks of the dry period both caused similar negative effects on subsequent yield to those of full dry period heat stress. Using gestation length as a proxy for placental function, it was clear that heat stress at any point in the dry period had negative consequences for placental function, and likely the developing fetus as well. Thus, cows should be cooled for the entire dry period.

As with lactating cows, heat stress decreases DMI compared with cooling, even at the relatively low level of DMI normally observed (Tao et al., 2012). Of interest, this lower DMI does not alter circulating concentrations of insulin, glucose or NEFAs, nor do heat stressed dry cows express any indication of altered responsiveness to insulin or glucose challenge. A lack of a direct metabolic response to heat stress (other than DMI) in comparison with the lactating cow is likely due to the dry cow maintaining positive energy balance in the absence of milk production.

Heat stress abatement will also improve immune status of cows in late gestation relative to heat stress, and there appear to be residual effects in the next lactation as well (do Amaral et al., 2011). Specifically, cooled dry cows have greater lymphocyte proliferation versus heat stressed cows, and immunoglobulin responses to antigens are improved with cooling. The innate immune system appears to be unaffected by direct heat stress, but there is evidence for a carryover effect of late gestation heat stress on neutrophil activity in the next lactation. Indeed,

neutrophil oxidative burst and phagocytosis are enhanced by dry period cooling, even though those cows are at a higher level of production and lower energy balance. Immune system impacts, therefore, are improved with dry period cooling.

In addition to the impacts on the dam, late gestation heat stress also negatively affects the developing fetus such that early life growth and immune function are compromised (Monteiro et al, 2016). Calves born to heat stressed dams have lower birth and weaning weights, lower immunoglobulin transfer from colostrum, and leave the herd before calving at a higher rate relative to calves from cooled dams. In addition, calves that experience heat stress in utero produce ~ 10 lbs/d less milk in the first lactation compared with those from cooled dams. Recent studies support the concept that these effects are epigenetic in nature as they persist in the calf for life and are also transmitted to their offspring (Dahl et al., 2019). Thus, in utero heat stress programs a lower yield phenotype.

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