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for sustainable resource management”

Responses of Crossbred Lactating Cows to Heat Stress and its Alleviation under a Tropical Environment

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Abstract

Rising temperatures in the world are an increasing concern for the welfare and production of livestock. Dairy cows are particularly sensitive to heat stress (HS) due to their metabolic heat production from milk synthesis. Heat stress decreases milk yield (MY) beyond decreases in dry matter intake (DMI), by impairing the carbohydrate and protein metabolism. In high yielding cows, multiparous are more susceptible to HS than primiparous, due to their greater MY (~10 kg) and body weight (BW) (~100 kg) compared with primiparous. However, in the tropics, smaller size, lower production, and long-term exposure to HS may influence the cows' response to HS and its alleviation. To prove this hypothesis, 12 cows, six primiparous and six multiparous ($\frac{3}{4}$ Holstein, $\frac{1}{4}$ Brahman, 520 ± 35 kg BW, 16.6 ± 1.2 kg d⁻¹ MY) were exposed to four 15-days-long periods, two controls (no cooling), alternated with two cooling periods (fans and sprinklers in 1-hour cycles at 10:00, 12:00, 14:00 and 16:00 h). Cows were monitored for rectal temperature (RT) and respiration rate (RR) at 09:00, 11:00, 13:00, 15:00 and 17:00 h, and for MY.

Contrary to high yielding cows, primiparous were more susceptible to HS than multiparous, with higher RT (39.46 vs. 39.16°C) and RR (76 vs. 66 breath min⁻¹), likely due to smaller differences in MY ($\delta=1.5$ kg d⁻¹) and body weight ($\delta=35$ kg) between primiparous and multiparous compared with those in high yielding animals. Cooling effectively reduced RT and RR and increased MY in both primiparous (+9.7%) and multiparous (+6.5%). However, cooling did not improve feed efficiency (0.87 and 0.88 kg milk kg⁻¹ DMI, with or without cooling, respectively). This additional discrepancy with high yielding cows may be related to the lower level of production, smaller size, and better adaptation to HS by tropical cows. But it could also indicate that HS was not alleviated to the point of improving nutrients metabolism, as evidenced by an overall low feed efficiency, and RT and RR not differing with or without cooling before the first cooling cycle of the day. These results highlight different responses of cows in tropical environments to HS and its alleviation, a phenomenon worth of further research.

Keywords: Dairy cattle, heat stress, multiparous, primiparous