Comparison of fan type and effect on dairy cow temperatures on a California dairy during summer conditions

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Introduction

Heat stress in dairy cattle is an economically important factor on dairy farms. Annual economic losses due to heat stress on US dairies have been estimated at $1.2 billion (Key, 2014). Reproductive performance, especially pregnancies per AI, has been shown to be negatively impacted at body temperatures above 39.1°C (Periera 2013). Multiple factors affect cow cooling effectiveness, including shade/housing type, soakers and use of fans to aid in evaporative cooling. Fan type in a commercial setting has not been extensively evaluated as to effects on dairy cow heat abatement and was the objective of this study.

Materials and Methods

A cow-cooling evaluation was done on a commercial Holstein dairy in central California August 19-26, 2020. Cows (n = 9-10 per group) from 4 different freestall pens (615-679 head per pen) were selected for temperature monitoring. Group 1 consisted of primiparous cows and groups 2-4 were multiparous cows. Cows were selected to be similar for days in milk (DIM) (170-186), gestation (67-86 days carried calf [DCC]), and milk production within parity. Cow temperatures were monitored by attaching an iButton (Embedded Data Systems DS1921H-F5 for Lactation = 1 and DS1922L for Lactation>1) to a Controlled Internal Drug Release (CIDR) device inserted intravaginally with temperatures taken every 5 minutes. Cow-level temperatures were aggregated to 15-minute intervals for analyses. Temperature/humidity monitors (HOBO proV2) were placed in 3 of the 4 pens (no T/H monitor in Lactation = 1 pen) and in the milking parlor holding area to capture temperature and humidity at the same time and frequency of cow temperatures. During the evaluation, 92% of all pen-level THI readings were above the heat stress threshold THI of 68. Each freestall pen differed in fan type. Group 1 had no fans in the pen, group 2 had 84-inch diameter high-capacity fans spaced at 100-foot intervals, group 3 had 72-inch louvered fans spaced at 60-foot intervals, and group 4 had 52-inch panel fans spaced at 27-foot intervals. Each of the 4 pens was equipped with soaker lines mounted above the feed bunk, with identical settings for shower time and shower interval. Game camera footage indicated there was a difference in actual soaker on time among pens. Pens 1-3 had a 3-inch water supply line for soakers, while pen 4 had a 2-inch supply line. Nozzle spacing was identical in all pens at 6 feet apart.

Results

Mean cow temperatures averaged across days, in 15-minute increments (n = 96 per pen), were compared across pens using the Tukey-Kramer HSD test with a = 0.05. The mean for group 1 was statistically higher than the other groups (39.4 ± 0.03°C). The means of groups 2 and 4 were similar (39.1 ± 0.02°C and 39.0 ± 0.03°C). The mean of group 3 was statistically lower than the other groups (38.8 ± 0.02°C). Over the entire evaluation period (n = 667 15-minute increments), the frequency of temperatures over 39.17°C varied by group, with group 3 having only 10.3% readings above 39.17°C compared to group 1 (78.0%), group 2 (33.7%), and group 4 (35.1%). Based on a logistic model, differences in the frequency above threshold were significantly different between groups ($P < 0.01$) except for groups 2 and 4 ($P = 0.60$).

Significance

There was a clear difference between the body temperatures of cows in the pen with no fans and cow temperatures in pens with fans present. Additionally, fan type in group 3 (72-inch louvered fan) appears to have had a more significant impact in reducing cow body temperature versus the other fan types. More investigation is needed to determine if this is a repeatable effect.

