Effects of cold temperatures on feed intake in beef cows

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The objective of this study was to measure the response in intake by cows fed a forage-based diet to cold temperatures. Results indicate cows ate more as the temperature declined during months when they were acclimating to the cold temperature. When cows were acclimated to the cold temperature, intake changed little across temperatures. Cows ate more during warmer temperatures in February, which was the opposite of earlier months. This may not be completely due to temperature because cows were in late pregnancy at this time as well.

Summary

Forty-seven pregnant beef cows (1,453 pounds of body weight) were fed initially a diet (6.7 percent crude protein) of 45 percent grass hay, 45 percent wheat straw and 10 percent partially de-sugared molasses. One group was supplemented with dry-rolled corn at 0.3 percent of body weight, and the other was just fed the hay-based diet. All cows wore radio-frequency identification tags to monitor individual intake. Feed intake of cows was measured in November, December, January and February (115 to 224 days of gestation). Cows fed the control diet gained 1.0 pound/day and lost 0.2 body condition score units (9-point scale). Cows fed supplement gained 1.5 pounds/day and 0.2 score units. In November and December, intake increased due to temperatures getting colder ($P < 0.01$). In January, feed intake did not respond to temperature change ($P = 0.07$). In February, feed intake increased when the temperature warmed ($P < 0.01$). During January and February, the cows' response to colder temperatures was different than in November and December. We hypothesize these differences were because cows had longer to become acclimatized to colder temperatures, having thicker hair coats and higher metabolism rates.

Introduction

Temperatures have been shown to affect feed intake of beef cattle when they move toward extremes of heat or cold. Outside the range of 59 to 77 F, cattle try to maintain their critical temperatures by heating or cooling. Effects are more likely to be shown if the environmental changes are through time because daily intake is more variable as the result of many factors.

In temperatures below 59 F, intake will increase gradually to provide more heat to the animal's core. Above 77 F, the animal will reduce feed intake to reduce internal heat.

Acclimation to colder temperatures happens in a few ways. As days grow shorter, the coats of cattle will grow thicker, adding insulation, to keep the internal temperature steady. But while the coat is growing, feed intake will need to produce the extra heat. Once the coat is grown in and body temp stabilizes, intake will level off. We hypothesized that beef cows will increase their feed intake as temperatures become colder.

Experimental Procedures

Forty-seven pregnant beef cows (Angus cross) were housed at the NDSU Beef Cattle Research Complex and were part of an experiment measuring the effect of corn supplementation on blood flow to the uterus and development of the calf, including lifetime effects on growth, carcass and meat traits. The cow's starting average body weight was 1,453 pounds and average body condition score was 5.2 on a 9-point scale.

Cows were weighed monthly throughout the duration of the study. The starting diet (dry basis) consisted of 45 percent grass hay, 45 percent wheat straw and 10 percent partially de-sugared beet molasses. The diet contained 6.7 percent crude protein (CP), 67 percent neutral detergent fiber (NDF), 42 percent acid detergent fiber (ADF), 0.37 percent calcium (Ca) and 0.12 percent phosphorus (P).

After Dec. 2, the diet changed to 60 percent grass hay, 30 percent wheat straw and 10 percent partially de-sugared beet molasses. The new analysis was 7.0 percent CP, 65 percent NDF, 38 percent ADF, 0.33 percent Ca and 0.14 percent P. One group was supplemented with dry-rolled corn at 0.3 percent of body weight and the other was just fed the hay-based diet.

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All cows wore radio-frequency identification tags to monitor individual intake and feeding behavior. We are just reporting total intake for this study.

For the purpose of this study, feed intake was measured during November, December, January and February. During this period, cows were 115 to 224 days in gestation. This covers midgestation to about a month into late gestation, during which nutrient requirement changes would be minimal, allowing us to focus more on environmental effects on intake.

The data was statistically analyzed within months because cows acclimate to temperatures. Our initial analysis indicated different responses during the months (a time interaction).

Results and Discussion

Cows fed the control diet gained 1.0 pound/day and cows fed supplement gained 1.5 pounds/day. Also, cows fed the control diet lost 0.2 body condition score and supplemented cows gained 0.2 score units (9-point scale).

The daily average ambient temperature ranged from 16 to 52 F in November, 1 to 39 F in December, minus 13 to 32 F in January and 1 to 34 F in February. The daily average dew point ranged from 9 to 48 F in November, minus 6 to 34 F in December, minus 22 to 28 F in January and minus 8 to 30 F in February.

Intake changed quadratically with temperature ($P < 0.001$) and dew point ($P = 0.002$). With this dataset, temperature and dew point did not interactively affect intake ($P = 0.20$). Dew point is highly dependent on temperature, and cold air has very little moisture. Therefore, only temperature will be presented and discussed here; intake responded to dew point very similarly to the way it responded to temperature.

In November and December, the cows' intake increased due to temperatures getting colder ($P < 0.01$; Figure 1). These months showed results as expected; as temperatures fell, intake increased. In November, intake rose steadily as temperatures declined. In December, with the temperatures cooler than in November, the cows increased their intake more rapidly as temperature dropped. In January, their feed intake did not respond as much due to change in temperature ($P = 0.07$). A hypothesis for this is that they had become acclimated to the colder temperatures and maintained nutrition.

February once again showed changes in feed intake due to temperature ($P < 0.01$), but this time, intake increased with warmer temperatures. This change was less than the increase with colder temperatures in earlier months.

The best-fit line for February is inverted when compared with November and December lines. This inversion may be due to the cows' gestational period, which would be the third trimester. The cows' energy and nutrient requirements are rapidly increasing during this period. The inverse response also could be attributed to longer acclimatization and warming temperatures.

During January and February, the cows' response to colder temperatures was different than earlier months, with February being markedly different. One likely cause was cows had longer to become acclimatized to colder temperatures, having thicker hair coats and higher metabolism rates. February's change also may have been caused by physiological changes associated with pregnancy, as well because the cows are closer to parturition.

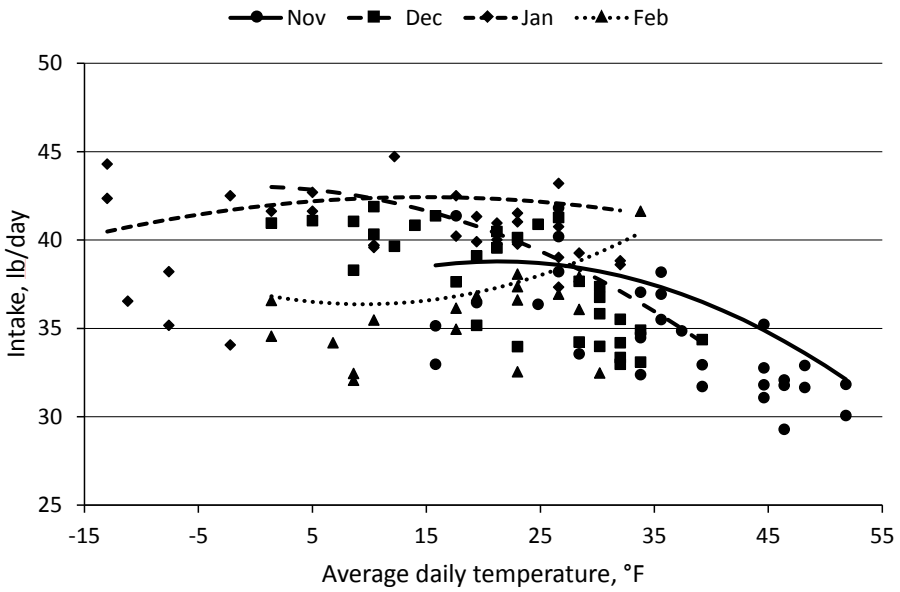

Figure 1: Daily intake based on average daily temperature