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Effect of morning vs evening feeding of limit-fed Holsteins during summer months

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Abstract

Thirty-eight Holstein steers (avg 339 lb) were grouped into four weight blocks, with two pens per block. Within each block, cattle in one pen were fed at 8:00 a.m. and those in the other at 8:00 p.m. All cattle were limit-fed to achieve a programmed rat e of gain of 2.2 lbs/d using NRC net energy equations. The trial lasted from July 13 through September 6, 1993. With the same quantity of feed, cattle fed in the evening gained 18% faster than cattle fed in the morning (P<.02) resulting in better feed efficiency for the evening-fed cattle (P<.06). Average high temperature for the 56-day period was 88F, average low temperature was 69 ÌŠF, average relative humidity was 73%, and average wind speed was 1.8 mph. Feed tended to be consumed within a 3-hour period, regardless of time of feeding. Because the effective ambient temperature frequently rose above the upper critical temperature for cattle (77 ÌŠF), animals needed to expend energy to dissipate excess heat. These results indicate that cattle limit-fed during the summer may utilize metabolizable energy more efficiently if allowed to ferment the bulk of their feed during the cooler hours of the evening.

Keywords

Cattlemen's Day, 1994; Kansas Agricultural Experiment Station contribution; no. 94-373-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 704; Beef; Limit-feeding; Heat stress; Night feeding

EFFECT OF MORNING VS EVENING FEEDING OF LIMIT-FED HOLSTEINS DURING SUMMER MONTHS

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Summary

Thirty-eight Holstein steers (avg 339 lb) were grouped into four weight blocks, with two pens per block. Within each block, cattle in one pen were fed at 8:00 a.m. and those in the other at 8:00 p.m. All cattle were limit-fed to achieve a programmed rate of gain of 2.2 lbs/d using NRC net energy equations. The trial lasted from July 13 through September 6, 1993. With the same quantity of feed, cattle fed in the evening gained 18% faster than cattle fed in the morning (P<.02) resulting in better feed efficiency for the evening-fed cattle (P<.06). Average high temperature for the 56-day period was 88°F, average low temperature was 69°F, average relative humidity was 73%, and average wind speed was 1.8 mph. Feed tended to be consumed within a 3-hour period, regardless of time of feeding. Because the effective ambient temperature frequently rose above the upper critical temperature for cattle (77°F), animals needed to expend energy to dissipate excess heat. These results indicate that cattle limit-fed during the summer may utilize metabolizable energy more efficiently if allowed to ferment the bulk of their feed during the cooler hours of the evening.

(Key Words: Limit-Feeding, Heat Stress, Night Feeding.)

Introduction

A large amount of heat is generated during fermentation of feedstuffs in the rumen. When ambient temperatures exceed the upper critical temperature of the thermoneutral zone, cattle must expend energy to dissipate excess heat to maintain their body temperature. If limit-fed cattle are programmed for a particular gain using NRC net energy values, and heat dissipation reduces efficiency of metabolizable energy use for gain, cattle will not achieve the desired rate of gain and will be less efficient. Therefore, we compared efficiencies of cattle limit-fed in the morning vs the evening.

Experimental Procedures

Thirty-eight Holstein steers were stepped up to a medium-energy ration containing 54% rolled corn, 25% sorghum silage, 11% soybean meal, 7% supplement, and 3% molasses (dry matter basis) and weighed on July 13, 1993 (avg 339 lb). Cattle were grouped into four weight blocks and equally stratified within blocks into two outdoor, unshaded, concrete-floored pens. One pen per weight block was assigned to morning feeding and one pen to evening feeding. Morning-fed cattle were fed at 8:00 a.m., and evening-fed cattle were fed at 8:00 p.m. In calculating daily feed requirements, we assumed that the maintenance requirement of Holstein steers was 13% greater than that of beef breeds (87 vs. 77 kcal/BW$^{.75}$). Energy required for gain was assumed to be the same as for large frame beef calves. Diet net energy values were taken from NRC tabular values. Intakes were adjusted every 14 days based on the assumed rate of gain. At the end of the experiment, all cattle were fed in the morning for two consecutive days and weighed on the third consecutive day (September 6, 1993, avg 438 lb). Weather data were provided by the Kansas State University Weather Data Library in Manhattan.

Results and Discussion

By design, daily dry matter intakes were equal across all pens when expressed as a percent of body weight (Table 1). However, neither treatment group realized the desired rate of gain of 2.2 lbs/day. Cattle fed in the evening gained faster (P<.02) and, subsequently, more efficiently than those fed in the morning (P<.06). Average high temperature for the 56-day period was 88°F, average low temperature was 69°F, average humidity was 73%, and average wind speed was 1.8 mph.

Table 1. Performance of Limit-Fed Cattle during the Summer when Fed in the Morning or Evening

Item	Morning	Evening	SEM
Number of pens	4	4	
Number of head	19	19	
DM intake, lbs/d	9.3	9.4	.286
DM intake, % of BW	2.3	2.3	.081
Daily gain[a], lb	1.66	1.96	.043
Feed:Gain[b,c]	7.46	6.37	.303

[a]Means differ (P<.02).
[b]Means differ (P<.06).
[c]Analyzed as Gain:Feed.

The thermoneutral zone (the range in effective ambient temperature for which no physiological adaptation must be made to maintain homeostasis) for beef cattle is from 59 to 77°F. Effective ambient temperature increases with rising relative humidity, because cattle are less able to cool themselves through sweating and respiratory evaporation. Sunny conditions elevate the effective ambient temperature 5 to 9°F by direct and indirect radiant heat.

Ruminal fermentation of high-grain diets peaks during the first 12 hours after consumption. Hence, cattle fed in the evening digest the bulk of their daily allotment of feed between sundown and sunrise, whereas cattle fed in the morning experience a fermentation peak during the hottest part of the day. If cattle are already experiencing heat stress, the heat of fermentation adds to the animals' total heat load and increases the energy expenditure needed for heat dissipation. Slightly increased respiration from heat stress can increase the maintenance energy expenditure by 7%, and heavy, labored panting can increase the maintenance energy cost by 11 to 25%. Our data suggest that, during the summer, cattle limit-fed in the evening convert feed to gain more efficiently than those fed in the morning.