Reducing Winter Cold Stress Increases Feedlot Production Efficiency

The Canadian winter environment can have a dramatic negative effect on the performance and efficiency of feedlot cattle. Performance records from Canada and the United States indicate that in the winter feedlot average daily gain is 10%-26% lower than during the summer months. Since winter intake was the same or slightly greater than in the summer, reduced gains were associated with decreased efficiency. Steers housed indoors gained weight 32 to 61% faster and had gain:feed ratios 38-53% better than steers housed outdoors at the same level of feed intake. The reduction in winter feed efficiency was likely due to an increase in maintenance requirements. Acclimatization occurs as a result of prolonged winter exposure and requires that animals elevate their basal or resting heat production (RHP). The cost of RHP acclimatization in Canada and the Northwestern USA winter conditions is thought to be substantial.

The biological signal which regulates adaptation is unknown but it is possible that acclimatization is in response to a subtle but prolonged reduction in body temperature during the winter. The temperature of the body core (brain and internal organs) is approximately 38°C in cattle and varies about 0.5°C throughout the day, being lowest during the early morning hours when the animal has been exposed to the cooler overnight environment and has been relatively inactive in terms of physical and eating activity. The daily variation in body temperature increases if the animal is exposed to extremes in environmental temperature. Reports indicate that the daily mean body temperature of cattle is reduced by exposure to cold temperatures but little is known about the physiological consequence of this change in body temperature.

Feed energy (heat increment) not available for animal growth is used to keep the animal body warm. Because the heat increment is at its maximum 4 to 6 hours after eating, daytime feeding results in the majority of heat increment being produced in the daytime and early evening.

Researchers at the Lethbridge Research Centre conducted a research study that proposed that during winter months the peak in heat increment would be most beneficial to the cattle producer if present during late evening and early morning hours when cattle are naturally experiencing a decline in core body temperature. The presence of heat increment in the evening should act to minimize the core temperature variation. The feeding behaviour of lightweight feedlot steers fed an 80% barley silage diet in the morning or evening for a 209 day feeding period during Dec 1999 to July 2000 was compared. Weight gains and feeding behaviour were compared for the two groups during a backgrounding period and finishing period. The relationship between eating behaviour and body core temperature during this period were also examined.

When morning and evening feeding groups were compared over the entire trial there was no interaction effects between feed fluctuation and time of feed delivery were observed (P= 0.17) for dry matter intake, average daily gain (ADG) or gain:feed or for the backgrounding and finishing periods alone. Intakes were higher (P< 0.05) for evening than for morning fed cattle (7.48 ± 0.016 vs. 7.26 ± 0.16 kg/d), when compared by feeding phase intakes. Intakes were lower (P<0.001) during the backgrounding than finishing period (6.29 ± 0.07 vs. 8.23 ± 0.07).

Cattle fed late in the day gained marginally (P = 0.07) more weight than cattle fed in the morning (1.24 ± 0.02 vs. 1.18 ± 0.02), which supports the results observed for feed intake. An interaction (P<0.05) for average daily gain (ADG) and feed efficiency were observed between time of feed delivery and whether the cattle were in the backgrounding or finishing phase. The lowest ADG was observed for morning fed steers during the backgrounding phase, where as the highest ADG was recorded for evening fed steers during the backgrounding phase (1.00 ± 0.04 vs. 1.28 ± 0.04 kg/d). These differences were not evident during the finishing phase. Cattle fed in the evening also had higher (P<0.05) daily dry matter intake than morning fed cattle (7.48 ± 0.06 vs. 7.26 ± 0.06 kg/d). These results indicate that it may be beneficial to feed in the evening from a cold climate thermodynamics perspective because the heat produced during fermentation and metabolism is shifted to the evening when cold stress is more likely to occur. Also in
regions where heat stress is a concern, evening feeding would help decrease any additional heat load that could occur if the animals were fed during the warmest part of the day.

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