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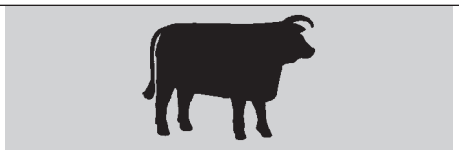

Case Study: The Effects of Severe Winter Weather on Net Energy for Maintenance Required by Yearling Steers

J. J. Wagner,[1] PAS, P. T. Grubb, and T. E. Engle, PAS
Department of Animal Sciences, Colorado State University, Fort Collins 80523

ABSTRACT

Severe winter storms in southeast Colorado in December of 2006 and January 2007 resulted in severe economic losses for the cattle feeding industry. Two hundred fourteen steers were weighed on December 26, 2006, and average BW (minus 4% pencil shrink) was 558 kg ± 21.7. Over the following 58-d period there was a 7.0% death loss and ADG was −0.13 kg ± 0.21. Average steer BW (minus 4% pencil shrink) was 550 kg ± 18.7 on February 22, 2007. Total DM delivered was 53,436.7 kg and average NE_m concentration in the diet was 2.263 Mcal/kg DM. Daily DMI averaged 9.67 kg/d per head. Average shrunk BW (SBW) was 554.1 kg and average empty body weight (497.7 kg), empty body gain (−0.00686 kg/d), and retained energy (−0.0283 Mcal/d) were calculated from NRC (2000) equations. The required NE_m was 21.9176 Mcal/d per head or 0.1919 Mcal/kg of $SBW^{0.75}$. These data indicate that NE_m required during and in the aftermath of a major winter weather event may be 2.5 fold higher than NE_m required (0.077 × $SBW^{0.75}$) under thermal neutral conditions. Calculations of lower critical temperature and external insulation indicate that the insulation value of the hair coat may have been destroyed by the moisture, mud, and snow following the storm.

Key words: steers, net energy for maintenance, cold stress, retained energy, lower critical temperature

INTRODUCTION

Maintenance requirement for energy has been defined as the amount of feed energy intake that will result in no net loss or gain of energy from the tissues of the animal body (NRC, 2000). Body temperature regulation, essential metabolic processes, and physical activity all contribute to maintenance energy requirements. Lofgreen and Garrett (1968) and Garrett (1980) described the NE_m requirement using the expression NE_m = 0.077 Mcal/$EBW^{0.75}$, where **EBW** is average empty body weight in kilograms. NRC (2000) calculates NE_m using 0.077 Mcal/$SBW^{0.75}$, where **SBW** is average shrunk body weight in kilograms.

Maintenance energy requirements vary with many factors including BW, breed, sex, age, season, temperature, physiological state, and previous plane of nutrition (NRC, 2000). Adjustments to NE_m for metabolic acclimatization of 0.0007 Mcal/°C that average monthly temperature is above or below 20°C are recommended by NRC (1981). Additional adjustments to NE_m for cold stress are recommended by NRC (1981) if cattle are exposed to temperatures below their lower critical temperature (**LCT**). Increases in maintenance energy are a function of surface area, LCT, and total insulation. Total insulation is a function of tissue insulation (hide thickness and subcutaneous fat) and external insulation (hair coat plus layer of air surrounding the body). Mud, wind, and precipitation influence the effectiveness of external insulation.

Severe winter storms in southeast Colorado in December of 2006 and January 2007 resulted in severe economic losses for the cattle feeding industry. Several research trials were lost at the Southeast Colorado Research Center (**SECRC**). Data from one of the studies were utilized to provide an assessment of the effect of severe winter weather on NE_m requirements. Therefore, the retrospective objective of this study was to examine NE_m required for mainte-

[1] Corresponding author: john.wagner@colostate.edu

nance during and in the aftermath of severe winter weather.

MATERIALS AND METHODS

Prior to the initiation of the original experiment, care, handling, and sampling of the animals defined in this research project were approved by the Colorado State University Animal Care and Use Committee.

Because of severe winter weather in December 2006, several research studies at SECRC were terminated before their conclusion. Data from 214 yearling steers (557.8 kg ± 21.7) that were originally part of one of these terminated studies were utilized for this evaluation of NE_m. Steers were of various Continental × British breed crosses, had been on feed for 95 d at the start of this evaluation, and based on visual appraisal, needed approximately 6 additional weeks on feed to achieve an acceptable slaughter endpoint. Steers were individually weighed on December 26, 2006, and on February 22, 2007. A 4% pencil shrink was applied to all weights before data analysis. Pen feed delivery records were not maintained for all days during the study period. However, for accounting purposes, total feed delivery records for this set of steers were maintained. Total DM delivered to the steers and total head days for the entire group was calculated. Dry matter intake was estimated by dividing DM delivered by total head days.

Empty body weight, empty body gain (**EBG**), retained energy (**RE**), and NE_m and NE_g required were calculated using equations described by NRC (2000). Diets fed to the steers during the trial period were typical winter finishing diets with steam flaked corn, corn silage, ground alfalfa hay, yellow grease, condensed corn distillers solubles, soybean meal, and supplement. Crude protein concentration was approximately 13.5%, and NDF supplied by the roughage in the diet was 6%. Average DM concentration was 70%. The ME, NE_m, and NE_g concentrations in the diet (3.279, 2.263, and 1.573 Mcal/kg DM, respectively) were calculated from tabular values (NRC, 2000). The efficiency of ME use for maintenance (k_m) was assumed to equal 0.69.

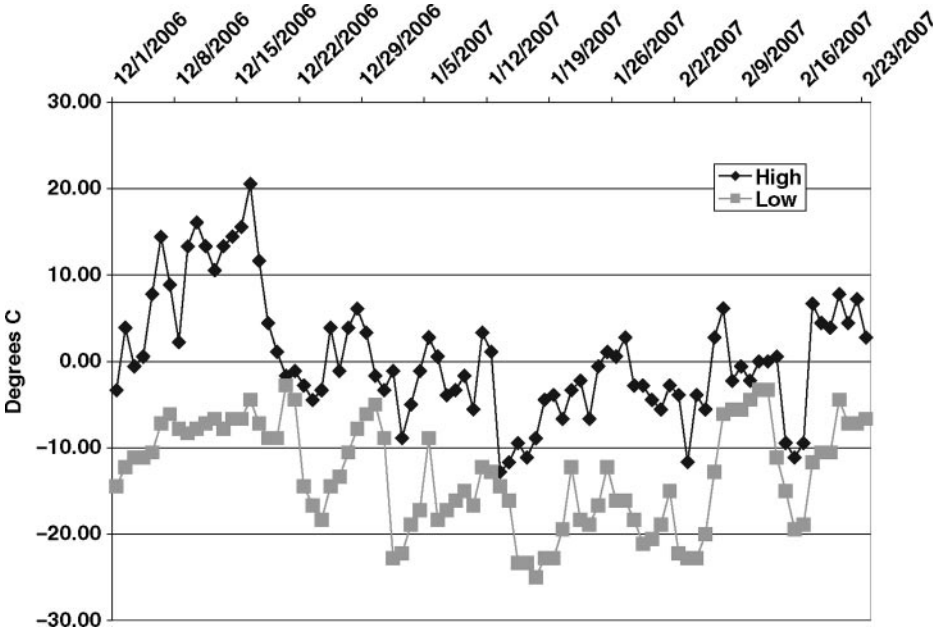

Figure 1. Daily low and high temperature.

Daily high and low temperature and daily precipitation records for December 2006 through February 2007 for the Lamar Colorado recording station were obtained from the National Weather Service (NOAA, 2008).

RESULTS AND DISCUSSION

Figure 1 displays the daily high and low temperature obtained from the Lamar Colorado Reporting Station of the National Weather Service for December 2006 through February 2007. The Lamar weather station is located approximately 1.6 km southeast of SECRC. Average high and low temperature observed from December 26, 2006, through February 22, 2007 was −2.16°C ± 0.20 and −14.69°C ± 0.24, respectively. Average temperature that the steers were exposed to during the feeding period was calculated as the average of the daily high and low temperatures and averaged −8.43°C.

Figure 2 shows the snowfall and snowpack records for December 2006 through February 2007. Snowfalls of 25.4 and 5.1 cm were recorded on December 20 and 21, respectively. An additional 25.4, 30.5, and 30.5 cm of snow fell on December 29, 30, and 31, respectively. Additional snow events occurred on January 13 and 14, January 21, and February 14 and 15, 2007. The average snow depth peaked at 91.4 cm on December 31 and averaged 32.3 cm ± 0.26 from December 26, 2006, through February 22, 2007. This snowpack contributed to extremely muddy pen conditions through the feeding period. By the end of the study, mud depth in the pens ranged from dew claw deep in some areas to nearly belly deep through much of the pen. There were no dry areas for the steers to lie down.

Death loss was 7% (15 of 214 steers) from December 26, 2006, through February 22, 2007. Steers weighed 557.8 kg ± 21.7 on December 26, 2006, and 550.3 kg ± 18.7 on February 22, 2007. Average shrunk weight was 554.1 kg. Average daily gain was −0.13 kg ± 0.21 over the 58-d feeding period. Steers were slaughtered at a commercial facility in Dumas, Texas on February 23, 2007. Average hot carcass weight, dressing percentage, 12th rib fat