Evaluating Methods of Estimating Forage Intake by Grazing Cattle

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Summary with Implications

Two methods of estimating forage intake of grazing cattle were compared to clipped estimates in 4-pasture rotational grazing systems on Sandhills subirrigated meadow from mid-May through early August over a 4-year period. Clipping standing vegetation samples within a pasture before and after cattle grazing provides for an accurate estimate of forage removal during a grazing period. A less laborious method of intake estimation commonly used is based on a percentage of an animal's liveweight. University Extension and some federal agencies use a 2.3% factor and others such as the Natural Resources Conservation Service use a 2.7% factor. In this study on a Sandhills subirrigated meadow, the 2.3% of body weight intake factor appropriately matched the clipping estimates in 63% of the evaluations. In contrast, the 2.7% of body weight factor provided similar estimates to the clipping estimate in only 38% of the evaluations. This implies that the 2.3% estimate more accurately represents forage intake of beef cattle and has less chance of overestimating cattle intake. Allocation of surplus forage to grazing cattle reduces harvest efficiency, reduces beef production per acre, and negatively effects profitability of beef operations

Introduction

Daily forage intake of beef cattle on grazing lands is difficult to estimate and can be variable depending on management, forage quality, plant growth stage, animal charachteristics, and ecological factors. The animal unit (AU) concept is based on forage intake and is used to balance forage supply and demand on grazing lands.

Forage demand is commonly reported as stocking rate (AU days of forage per acre; AUD/acre) and is calculated based on a ruminant consuming daily a certain percentage of its liveweight. There is disagreement among advisors and practitioners alike on the daily intake (AUD) of a grazing ruminant. The standard intake amount used by University Extension and the Natural Resources Conservation Service (NRCS) has been based on 2.3% of liveweight (23 lbs. DM for a 1,000 lb. animal); more recently, the NRCS has changed to 2.7% of liveweight (27 lbs. DM for a 1,000 lb. animal). A stocking rate based on the 2.7% intake is lower than that of a 2.3% intake and likely results in reduced harvest efficiency and beef production; therefore, identifying and using accurate estimates of intake are important. An approach to assess which predicted intake level is most similar to actual is to estimate forage removal of grazing cattle on a pasture by clipping vegetation before and after a grazing period. The question then becomes, is the estimate of forage intake by grazing cattle better represented at 2.3 or 2.7% of liveweight? This difference of 0.4% can make a considerable difference in how much forage is consumed and left behind, and significantly affects efficiency of beef production.

Procedure

Research was conducted from 2013 through 2016 on a subirrigated meadow at the University of Nebraska-Lincoln Barta Brothers Ranch in the eastern Sandhills of Nebraska. Vegetation was dominated by exotic, cool-season grasses, sedges, and exotic legumes; warm-season grasses were less common. Forage quality analysis was conducted in 2013 and the overall average NDF and crude protein content of the standing live vegetation was 63% and 8.0% respectively. The study site included two replications of two different 4-pasture rotational grazing treatments: a 4 pasture with a single cycle of grazing (4PR1) and a 4 pasture with two grazing cycles (4PR2). The 4PR1 replications were grazed for a 60-day grazing season where each 1-acre pasture had a single occupation for 15 days. Nine head of yearling steers were placed in the first pasture of each replication around June 10 of each year. The 4PR2 replications were grazed for an 80-day grazing season from mid-May to early August where each 1.5-acre pasture was occupied twice for 10 days each. Ten head of yearling steers were placed in the first pasture of each replication around May 20 of each year. The average weight of the yearling steers was 844 (± 21) lbs. during the growing season. All pastures were grazed at a stocking rate of 3 AUM/acre, which is a moderate stocking rate for Sandhills meadow.

Prior to moving the steers to a new pasture, each of the 4 years of the study (2013–2016), ten 10.8-ft^2 exclosure cages were randomly placed throughout each pasture. At the end of an occupation in a pasture the cages were removed and a quadrat (2.7 ft^2) was placed in the middle of each cage area and vegetation was clipped to ground level and sorted into standing live and standing dead components. One quadrat was also placed 3.3 ft directly north of each cage and the vegetation was clipped to ground level, sorted into standing live, standing dead, and trampled. Litter was also collected from all quadrats inside and outside the cages. Trampled vegetation was defined as any tiller that was bent at a 45° angle or greater from the ground. All samples were dried in a forced-air oven at 140°F and then the final weight was recorded. The data used to determine intake was only the current year's growth or standing live.

Method 1 was an intake estimate based on clipping. Intake was calculated on a per pasture basis by comparing the samples clipped on the inside of the exclosure cages to the samples clipped outside of the exclosure cages. The standing live and trampled forage from the outside samples were subtracted from the standing live forage from the inside samples and then averaged. The

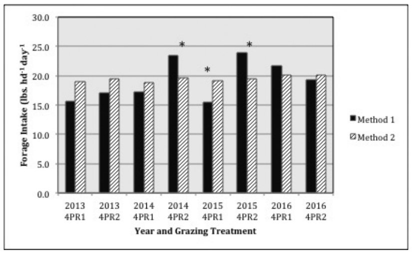

Figure 1.

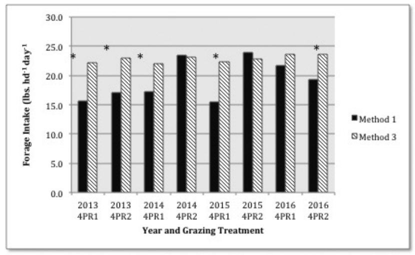

Figure 2.

results from each individual pasture were averaged over the entire grazing period.

Method 2 and Method 3 estimated intake by percentage of liveweight. To estimate intake based on steer body weight, the average weight of all animals in each replication was calculated as the animal's liveweight. The average liveweight of the group of steers in each replication was used to calculate their intake. Method 2 assumed intake as 2.3% of liveweight (690 lbs oven dry per AUM, 780 lbs air dry per AUM) and method 3 assumed intake as 2.7% of liveweight (810 lbs oven dry per AUM, 912 lbs air dry per AUM).

Results

Estimates of forage intake for method 1 (biomass clipping) and method 2 (based on 2.3% of liveweight) differed only three of the possible eight combinations of grazing treatment (4PR1 and 4PR2) and year (2013–2016; Figure 1). Intake based on method 2 was 16 and 19% less than method 1 for 4PR2 in 2014 and 2015 and 23% greater than method 1 in 4PR1 in 2015. Estimates of forage intake for method 3 (based on 2.7%) were greater than for method 1 for five of the eight possible combinations of grazing treatment and year (Figure 2). Method 3 estimates were 22 to 44% greater than for method 1 estimates in these 5 years by treatment combinations. Intake estimates did not differ between the two methods for the 4PR2 treatment in 2014 and 2015, and for the 4PR1 treatment in 2016. The overall average intake as a percentage of body weight when using method 1 was 2.27%.

The general trend over the course of the study was that cattle forage intake in both grazing treatments was less than 2.7%. Clipped estimates of intake compared better to the estimate of 2.3% of liveweight than they did to the 2.7% estimate. Method 1 was significantly different from method 2. 38% of the time (Figure 1); whereas, method 1 was significantly different from method 3. 63% of the time (Figure 2). Other research conducted by the University of Nebraska–Lincoln found that dry matter intake of cows and heifers was 2.23% of body weight when the cattle were fed subirrigated meadow hay in confinement and at free choice. Our conclusion is that method 2 was likely a more accurate depiction of what was happening in the pasture and provided a better estimate of forage intake.

Figure 1. Forage intake estimates based on method 1 (clipping) v. method 2 (2.3% of body weight) by grazing treatment and year. [1]* Indicates significant differences within in clustered column at $P < 0.05$; [2] 4PR1 is a 4 pasture set with 1 rotation cycle; [3] 4PR2 is a 4 pasture set with 2 rotation cycles.

Figure 2. Forage intake estimates based on method 1 (clipping) v. method 3 (2.7% of bodyweight) by grazing treatment and year. [1]* Indicates significant differences within clustered column at $P < 0.05$; [2] 4PR1 is a 4 pasture set with 1 rotation cycle; [3] 4PR2 is a 4 pasture set with 2 rotation cycles.

Implications and Conclusions

The dry matter forage intake of yearling steers on Sandhills subirrigated meadow was more closely estimated by the 2.3% intake factor than the 2.7% intake factor. The current use of 2.7% by NRCS as an estimate of forage intake appears to be an overestimate. Overestimation of forage intake results in calculation of recommended stocking rates that are below the carrying capacity. Based on an intake of 2.3% of liveweight, the conventional AUD (23 lbs. DM and 26 lbs. air dry) and AUM (690 lbs. DM and 780 lbs. air dry) equivalents used by University Extension and formerly by NRCS are reasonably accurate. Using the most representative intake estimates is important in optimizing harvest efficiency and livestock production. Assuming that the forage intake of an AU (1,000 lb liveweight) is 27 lbs. per day (2.7% of liveweight) can result in a surplus of forage being allocated to intake and an underestimation of carrying capacity. It is important to note that the class of livestock used in this experiment were yearling steers. Class, size, and pregnancy status can influence intake thereby affecting estimate of stocking rate.

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