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Estimating Livestock Forage Demand: Defining the Animal Unit

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Summary

Animals were housed in individual pens and fed high quality (11% CP) meadow hay ad libitum *daily to evaluate the effect of a beef animal's physiological state (cow-calf pair vs. dry cow vs. yearling steer) on forage intake. Daily diet samples were composited by week and analyzed. Refusals were collected, composited by week per pen and analyzed. Dry matter intake (DMI) was different among treatments. The results indicate different physiological states or classes of cattle should be considered when calculating forage demand for stocking rate or feeding purposes.*

Introduction

The term animal unit (AU) is utilized widely in grazing management strategies. Various definitions for the terms AU, animal unit day (AUD), animal unit month (AUM) and animal unit year (AUY) exist, but they all have one common theme — to define forage intake on the basis of a standard animal. The general consensus is a standard animal consumes about 2.6% of its BW on a DM basis. The factor accounted for in many animal unit definitions is body size, with physiological status being the most erratic factor in defining an animal unit. Therefore, the objective of the current experiment was to evaluate the effect of a beef animal's physiological state on forage intake.

Procedure

This project was replicated over two years, with year 1 located at the Gudmundsen Sandhills Laboratory (GSL) near Whitman, Neb., and year 2 at the West Central Research and Extension Center, North Platte, Neb. All animal procedures were approved by the University of Nebraska Institutional Animal Care and Use Committee.

Each year six replications of three treatments were evaluated: cow-calf pair (CC; BW = 1,307 lb); dry cow (DC; BW = 1,119 lb); and yearling steer (S; BW = 602 lb). The cow and calf were treated as one unit, with calves averaging 42 days and 161 lb at the start of the experiment each year. In year 1, the trial was 13 weeks and in year 2, the trial was nine weeks. Yearling and calf BW change during each trial is shown in Table 1.

Cattle were offered hay harvested from sub-irrigated meadows at GSL. Tables 2 and 3 provide the analysis of the hay supplied. Hay was weighed and offered daily in amounts to allow *ad libitum* intake. DM was determined from samples collected daily and composited within the week. Refusals from each pen were collected weekly in year 1 and collected daily in year 2.

At the beginning, middle and end of each trial, all animals were weighed for three consecutive days and their weights averaged. Average BW during the trial was used to determine intake relative to BW. Diet and refusal samples were dried in a forced air oven for 48 hours at 60°C. Daily diet and refusal samples were composited by week. All samples were ground to pass through a 2-mm screen, with a subsample ground to pass through a 1-mm screen.

Diet and refusal samples were analyzed for dry matter (DM), organic matter (OM), *in vitro* dry-matter digestibility (IVDMD), neutral detergent fiber (NDF) and

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Table 1. Average BW change of yearling steers and calves for year 1 and year 2.

	Year 1			Year 2		
	Start BW	End BW	ADG	Start BW	End BW	ADG
Yearling steers, lb	582	746	1.74	631	733	1.46
Calves, lb	151	368	2.31	171	330	2.27

Table 2. Characteristics of hay fed to treatment animals during year 1.

	Hay offered	Hay refused	Actual diet
DM, %	84.1	76.4	—
OM, %	90.5	85.5	91.3
NDF, % DM	64.3	70.0	63.8
CP, % DM	11.6	10.5	—
IVDMD, % DM	52.6	48.4	53.2
UIP, % of CP	40.8	46.4	—

Table 3. Characteristics of hay fed to treatment animals during year 2.

	Hay offered	Hay refused	Actual diet
DM, %	79.7	85.8	—
OM, %	89.9	89.8	89.9
NDF, % DM	67.2	76.5	66.2
CP, % DM	10.7	10.2	—
IVDMD, % DM	51.8	46.5	52.9
UIP, % of CP	44.9	53.2	—

undegradable intake protein (UIP). Ruminally fistulated cows fed a basal diet of meadow hay provided inoculant for IVDMD, as well as *in situ* incubation.

Average daily intake during each week of the experiment was analyzed as a repeated measure using the MIXED procedure of SAS with a first order autoregressive (AR1) covariance structure. The model included the effects of treatment as a fixed effect and year, week, and treatment by week interaction as random effects. Individual animal or cow/calf pair was used as the experimental unit.

Table 4. Average intake in lbs, % BW and % MBW.[1]

	Cow-calf pair	Dry cow	Steer	SE	*P*-value
BW, lb	1431.4	1118.5	683.6	43.11	< 0.0001
MBW, lb	232.4	193.0	133.6	5.52	< 0.0001
DMI, lb	36.2	25.8	14.5	0.84	< 0.0001
DMI, % of BW	2.5	2.3	2.1	0.0006	< 0.0001
DMI, % of MBW	15.6	13.5	10.8	0.003	< 0.0001
OMI, lb	32.8	23.4	13.2	0.77	< 0.0001
OMI, % of BW	2.3	2.1	1.9	0.0005	< 0.0001
OMI, % of MBW	14.1	12.2	9.8	0.003	< 0.0001
IVDMD, lb	19.1	13.6	7.7	0.54	< 0.0001
IVDMD, % of BW	1.3	1.2	1.1	0.0004	0.0013
IVDMD, % of MBW	8.3	7.1	5.8	0.001	< 0.0001
NDF, lb	23.4	16.7	9.4	0.52	< 0.0001
NDF, % of BW	1.7	1.5	1.4	0.0004	< 0.0001
NDF, % of MBW	10.1	8.7	7.0	0.002	< 0.0001

[1]MBW (Metabolic body weight) = $BW^{0.75}$.

Results

Differences occurred among treatments for the variables analyzed as shown in Table 4. Actual daily DMI was over 28% higher for CC when compared to DC and almost 60% higher when compared to S. When DMI is compared as %BW, CC still had an 8% greater intake than DC and 16% greater intake than S. Maintenance requirements of lactating cows are approximately 20% higher than those of nonlactating cows (*Nutrient Requirements of Beef Cattle*, 2000 update.). While calves were observed to eat the hay, no attempt was made to partition hay intake between the cow and calf. Some of the increased intake by CC compared to DC can be attributed to calf intake.

Voluntary intake in beef cows is similar to intake in growing cattle when adjusted for effect of milk production (NRC, 1987, *Predicting Feed Intake of Food-Producing Animals*). However, in this experiment, dry cows consumed 2.3% and yearling steers consumed 2.1% of their BW, compared to cow-calf pairs consuming 2.5% of their BW.

Actual daily organic matter intake (OMI) was over 28% higher for CC when compared to DC and almost 60% higher when compared to S. Previous research measured intake of calves approximately the same age as those in the present study, and found they consumed 1.1% to 1.5% of their BW on an OM basis (*1995 Nebraska Beef Report*, pp. 3-4). Lactating cows in the same study consumed 2.0% to 2.6% of their BW on an OM basis. In the present experiment, the cow and calf were treated as one unit, with the intakes for the lactating cows in the previous study being similar to intakes for the cow-calf pair (2.3% BW, OM basis).

Conclusion

In addition to BW, these results indicate DMI differences among cattle of different physiological state or class should be considered when calculating forage demand. This would further increase accuracy of forage demand estimates for stocking rate or feeding purposes.

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