Determining Animal Preference for Grasses: Methods and Error Analysis[1]

Shewmaker, Glenn E., Henry F. Mayland, and Susie B. Hansen[2]

Abstract

Grazing preference of 8 tall fescues was evaluated by 1) clipping and weighing forage before and after grazing (CW), 2) a selection ratio (SR), and 3) preference scores (PS). The coefficients of variation were 96, 52, and 20% for SR, CW, and PS methods, respectively. The ranking of preference was similar for CW, SR, and PS methods. The PS method was done in 6% of the time and with less error than CW and SR, used the entire row, and was nondestructive.

[1] Presented at the Fifth International Rangeland Congress (Salt Lake City, Utah, July 23-28, 1995).

[2] Biological technicians (GES and SBH) and soil scientist, Northwest Irrigation and Soils Research Laboratory, USDA-ARS, 3793 N. 3600 E., Kimberly, Idaho 83341, U.S.A.

Introduction

Determining grazing preference is difficult, time consuming, and detrimental to other determinations if they are destructive methods. Methodology was needed that minimized plant and animal variability, provided adequate statistical degrees of freedom, was rapid and inexpensive, and detected real differences.

Grazing preference is commonly determined by clipping a subsample of each forage before and after grazing, calculating the difference in mass (CW) for each cultivar, and expressing it as a proportion of the available grass (utilization) or as a normalized selection ratio (SR). The SR is calculated:

$$SR = \frac{\dfrac{\text{dry weight of cultivar consumed}}{\text{dry weight of all forage consumed}}}{\dfrac{\text{pre-grazing forage dry weight of a cultivar}}{\text{pre-grazing forage dry weight of all cultivars}}}$$

The objectives were 1) to compare the CW method with a subjective preference score (PS) at 30 (PS30) and 48 hr. (PS48), and 2) to determine time and error associated with each method.

Measurements were made in May, June, August, and September when 6 yearling heifers consecutively grazed 3 pastures for 48 hr. Each pasture contained 3 randomized complete blocks with each of the 8 tall fescue [*Festuca arundinacea* (Schreb.)] cultivars planted in plots of 6 rows 56 cm apart X 6 m long. Before- and after-grazing biomass yields (CW) were determined from 61-cm lengths randomly selected from rows 3 and 4. Relative preference score (PS) in rows 3 and 4 for given cultivars was recorded by 4 observers at 30 (PS30) and 48 (PS48) hr. grazing. A PS from 0 to 10 represented 0 to 100% utilization of available forage, respectively. The procedure used a separate pre-study pasture to train observers and condition heifers to the forage prior to each monitored trial. The stocking rate was designed to remove an average of 50% of the forage in a 48 hr. period for optimum sensitivity of preference.

Results and Discussion

Occasionally, variability in forage mass and regrowth over a 48-hr. grazing period resulted in negative utilization values. Such values were corrected to a small positive number (0.0001) prior to further calculations. Table 1 shows parameters and statistics from ANOVA and Student-Newman-Keuls mean separation test. The coefficients of variation from ANOVA are the most revealing of the amount of error associated with each variable. The PS48 and PS30 estimates had much lower CV than the other estimates. Since the preference scores are averages of 4 observations, one would expect less variation because of the central tendency theorem. Moreover, apparently the human eye and brain provide rapid integrated estimates of forage mass. Although "subjective scoring" connotes poor science to some; if done with "blind restrictions" (not knowing the treatment), the amount of bias should be reduced to levels similar to more quantitative measurements.

The PS method had high repeatability, with a Pearson correlation coefficient of 0.92 for the independent PS30 and PS48 scorings. The preference rankings were almost identical for the CW, SR, and PS methods (Table 1). The PS method provided more statistical mean separation because of less variation. The SR method theoretically would be good because it should normalize the quantity of forage ingested based on its relative abundance. In this study, SR had a high CV and consequently resulted in less mean separation, although cultivar ranking was similar.

Two important advantages of subjective scoring over clipping and weighing are that it is rapid and nondestructive. Destructive clipping decreases available forage, but also affects animal grazing behavior. Preference scoring took about 1.3 min. per plot (all 6 rows) versus 17 min. per plot (only 2 rows) for clipping and weighing. Technicians also preferred scoring as they remained an order of magnitude cleaner than when clipping the "after-grazing" plots.

Conclusions

The preference score at 30 and 48 hours provided similar ranking, lower CV, and more sensitive mean separation than utilization determined by clipping and weighing. The preference scoring method took 6% of the time and used less resources than clipping and weighing.

Table 1. Means across 4 grazing trials, ranking by the Student-Newman-Keuls test, root MSE, and %CV for yield and preference of tall fescue. Within a column, means with a common postscript are not different (alpha=0.05).

Cultivar	Forage dry matter		Utilization[1]	Selection	Preference Score	
	Before	After		Ratio	PS30	PS48
	(kg/ha)		(%)			
Kenhy	2470 d	1040 f	62 a	2.40 a	7.2 a	8.1 a
KY-31	2890 c	1810 e	42 b	1.40 b	4.5 b	5.9 b
Himeg	2810 b	2000 de	34 bc	.98 bcd	4.2 bc	5.7 bc
Barcel	2960 bc	2070 d	34 bc	1.20 bc	4.2 bc	5.5 c
C1	2970 bc	2120 cd	34 bc	1.20 bcd	4.0 c	5.6 c
Stargrazer	3270 a	2320 bc	36 bc	1.20 bcd	3.6 d	5.0 d
MO-96	3200 a	2470 b	33 c	.81 cd	3.5 d	4.8 d
Mozark	3280 a	2880 a	21 d	.66 d	2.7 e	4.1 e
√MSE	640	704	19	1.20	0.85	0.82
CV (%)	22	34	52	96	20	15

[1] Utilization is calculated as 100*((before grazing DM)-(after grazing DM))/(before grazing DM).