

Technical Report No. 94
HERBAGE GROWTH RATE, FORAGE INTAKE,
AND FORAGE QUALITY IN 1970 ON HEAVILY AND
LIGHTLY GRAZED BLUE GRAMA PASTURES

G. W. Dyck and R. E. Bement

Department of Range Science
Colorado State University
Fort Collins, Colorado

and

Agricultural Research Service
Crops Research Laboratory
Colorado State University
Fort Collins, Colorado

GRASSLAND BIOME
U.S. International Biological Program

March 1971

TABLE OF CONTENTS

	Page
Title Page	i
Table of Contents	ii
Abstract	iii
Introduction	1
Sampling Procedure	1
Results	5
Conclusion and Discussion	10
Literature Cited	15

ABSTRACT

Herbage growth rate, forage intake, and forage quality were measured on heavily and lightly grazed pastures during the summer of 1970. When a growth opportunity occurred, herbage growth was more rapid on the lightly grazed pasture. Forage intake by individual non-fistulated heifers was greatest on the lightly grazed pasture. Heavily and lightly grazed pastures did not differ significantly in forage quality.

INTRODUCTION

The object of this study was to compare herbage growth rate, forage intake, and forage quality on lightly and heavily grazed blue grama pastures during the summer of 1970.

These adjacent pastures were grazed at their respective intensities from May 1 through October 31 for 30 consecutive years prior to 1970.

SAMPLING PROCEDURE

Standing herbage was measured biweekly by the double sampling method on the heavily (23E) and lightly (23W) grazed pastures at the Central Plains Experimental Range. Eight one-half-mile-long transects, extending the width of the pastures, were systematically spaced along the length of the pastures. Ten plots were measured on each transect. A trained observer estimated standing herbage to the nearest 22.75 kg (50 lb/acre oven-dry) on each plot. One plot on each transect was clipped after the estimate was made. The clipped samples were dried, a regression coefficient calculated, and all estimated plots were corrected. Confidence limits at the 95% level of probability were calculated for the corrected standing herbage.

The Crow Valley Livestock Cooperative furnished 35 heifers for the heavily grazed pasture and 12 heifers for the lightly grazed pasture. In addition, each pasture carried four esophageal-fistulated heifers from the University of Wyoming.

Each herd drank from its own float-controlled water tank. The esophageal-fistulated heifers drank from individual "hog-type" waterers. All cattle were corralled for watering approximately two hours a day. Water

drunk from each tank and individual waterer was measured to the nearest .4 liter and recorded daily. On days when rain left water in ponds on the pastures, measuring of water intake was stopped.

Moisture content of forage consumed by cattle was measured daily from hand-plucked samples collected by observers moving with the grazing herds.

Mean daily temperatures and moisture content of forage were used in the table, "Feed-intake Rates of European Cattle in Pounds of Herbage Dry Matter Eaten Per Gallon of Water Drunk" (Hyder et al. 1966), to estimate the kilograms of dry matter consumed per day. Daily forage intake was calculated in g/m^2 for each biweekly period.

The difference between total standing herbage at the beginning and end of a period, plus forage grazed during that period, was assumed to be herbage growth for the period (Tables 1 and 2). This method does not account for herbage losses caused by translocation, weathering, disease, insects, or animals other than cattle.

Cattle were weighed biweekly after an overnight shrink (approximately 15 hours). Mean herd liveweight with 95% confidence limits and period animal gain were calculated.

Forage quality for each period was expressed as kilogram daily forage intake by cattle per kilogram daily gain. Esophageal-fistulated heifers were not used in forage quality determination.

Collection of cattle data applicable to the heavily grazed pasture was terminated September 4 after no cattle gain was made for the period August 21 to September 3. Approximately 23 g/m^2 of standing herbage were available to the cattle during this period.

Table 1. Herbage growth (g/m^2) in 1970 in heavy-use pasture (23E).

Period		Standing	Difference	Herbage	Herbage Growth	
From	To	Herbage		Eaten	Period	Daily
	6/8	$33.41 \pm 2.25^{\text{a/}}$				
6/9	6/18	33.85 ± 1.89	.44	1.89	2.33	.23
6/19	7/6	34.07 ± 2.80	.22	3.40	3.62	.20
7/7	7/16	34.19 ± 3.59	.12	1.76	1.88	.19
7/17	8/3	27.80 ± 1.75	-6.39	3.07	-3.32	-.18
8/4	8/13	29.59 ± 2.26	1.79	1.85	3.64	.36
8/14	8/26	23.32 ± 1.47	-6.27	2.57	-3.70	-.28
8/27	9/14	21.30 ± 1.33	-2.02	1.53	-.49	-.03
Total					3.96	

^{a/} 95% confidence limits.

Table 2. Herbage growth (g/m^2) in 1970 in light-use pasture (23W).

Period		Standing	Difference	Herbage	Herbage Growth	
From	To	Herbage		Eaten	Period	Daily
	6/8	$42.15 \pm 2.87^{\text{a/}}$				
6/9	6/18	51.23 ± 2.66	9.08	.82	9.90	.99
6/19	7/6	49.21 ± 2.91	- 2.02	1.46	- .56	- .03
7/7	7/16	48.76 ± 2.13	- .45	.73	.28	.03
7/17	8/3	38.56 ± 3.40	-10.20	1.35	- 8.85	- .49
8/4	8/13	48.43 ± 2.98	9.87	.86	10.73	1.07
8/14	8/26	46.07 ± 3.15	- 2.36	1.09	- 1.27	- .10
8/27	9/14	39.35 ± 1.94	- 6.72	.56	- 6.16	- .32
Total					4.07	

^{a/} 95% confidence limits.

RESULTS

Standing herbage on the heavily grazed pasture increased each period from June 9 to July 16 and again during period August 4 to August 13. Standing herbage decreased during the periods July 17 to August 3, August 14 to August 26, and August 27 to September 14 (Table 1).

Standing herbage in the lightly grazed pasture increased only during the periods June 9 to June 18, and August 4 to August 13, and decreased during the remaining periods (Table 2).

Daily dry matter intake by non-fistulated cattle was greatest in the lightly grazed pasture (Tables 3 and 4). Mean daily dry matter intake (kg/hd/day) was 7.40 and 6.43 on the lightly and heavily grazed pastures respectively (Tables 3 and 4). These differences in daily dry matter intake are highly significant.

Mean daily dry matter intake (kg/hd/day) by fistulated heifers in the heavily and lightly grazed pastures was 4.32 and 4.19 respectively (Tables 3 and 4).

The highest rate of herbage growth for both pastures occurred from August 4 to August 13. The period of greatest herbage loss was August 14 to August 26 for the heavily grazed pasture and July 17 to August 3 for the lightly grazed pasture. Total seasonal growth was 4.07 g/m^2 and 3.96 g/m^2 for the lightly and heavily grazed pastures respectively (Tables 1 and 2). Total seasonal growth is not significantly different for the two pastures.

Non-fistulated heifer gain per head during period May 15 to September 4 was 82 kg in the light-use pasture and 62 kg in the heavy-use pasture. For the same period, gain per head for fistulated heifers was 31 kg in the light-use pasture and 8 kg in the heavy-use pasture (Tables 5 and 6).

Table 3. Amount of oven-dry forage eaten by yearling heifers on heavily grazed pasture (23E) in 1970 as estimated by the water intake method.

Period		Moisture Content of Forage	Mean Air Temp.	Mean Daily Water Drunk	Dry Matter Intake/Liter Water Drunk	Dry Matter Intake		Number Days	Number Heifers	Forage Grazed		
From	To					CPER	WYO					
		(%)	(°C)	(liter)	(kg)	(kg/hd/day)		(g/m ²)				
				CPER ^{a/}	WYO ^{b/}	CPER	WYO	CPER	WYO			
6/9	6/18	57	18.9	18.6	14.2	1.32	6.45	4.94	10	35	4	1.89
6/19	7/6	54	20.0	20.8	13.9	1.19	6.50	4.39	18	35	4	3.40
7/7	7/16	52	20.5	16.7	12.1	1.14	6.11	3.60	10	35	4	1.76
7/17	8/3	50	21.1	20.5	13.0	1.09	5.89	3.72	18	35	4	3.07
8/4	8/13	42	20.5	23.7	16.0	1.04	6.46	4.37	10	35	3	1.85
8/14	8/26	38	20.0	25.4	18.9	1.03	6.88	5.11	13	35	3	2.57
8/27	9/14	37	19.4	26.2		1.30	7.08		8	35		1.53

^{a/} Cattle furnished to Central Plains Experimental Range by Crow Valley Livestock Cooperative.

^{b/} Fistulated cattle from the University of Wyoming.

Table 4. Amount of oven-dry forage eaten by yearling heifers on lightly grazed pasture (23W) in 1970 as estimated by the water intake method.

Period		Moisture Content of Forage	Mean Air Temp.	Mean Daily Water Drunk	Dry Matter Intake/Liter Water Drunk	Dry Matter Intake		Number Days	Number Heifers	Forage Grazed
From	To					CPER	WYO			
<hr/>										
		(%)	(°C)	(liter)	(kg)	(kg/hd/day)		(g/m ²)		
				CPER ^{a/}	WYO ^{b/}	CPER	WYO	CPER	WYO	
6/9	6/18	62	18.9	18.2	11.4	1.48	4.42	10	4	0.82
6/19	7/6	55	20.0	22.5	13.0	1.25	4.22	18	4	1.46
7/7	7/16	50	20.5	23.2	11.6	1.10	3.38	10	4	0.73
7/17	8/3	50	21.1	24.1	12.9	1.08	3.68	18	4	1.35
8/4	8/13	42	20.5	30.0	16.4	1.04	4.49	10	3	0.86
8/14	8/26	37	20.0	29.0	18.9	1.02	5.09	13	3	1.09
8/27	9/14	34	16.1	25.4	1.14	7.60		19	12	0.56

^{a/} Cattle furnished to Central Plains Experimental Range by Crow Valley Livestock Cooperative.

^{b/} Fistulated cattle from the University of Wyoming.

Table 6. Cattle gains in the lightly grazed pasture (23W) in 1970.

CPR ^{a/}					WYO ^{b/}					
Date	No. Head	No. Days	Liveweight	Total Gain/Head	Daily Gain/Head	No. Head	No. Days	Liveweight	Total Gain/Head	Daily Gain/Head
			(kg)	(kg)	(kg)			(kg)	(kg)	(kg)
5/15	12		2485.5							
5/29	12	14	2644.6	159.1	13.26	4		891.4		
6/15	12	17	2829.4	184.8	15.40	4	17	937.1	45.7	11.42
6/26	12	11	2868.8	39.4	3.28	4	11	901.8	-35.3	-8.82
7/10	12	14	2984.0	115.2	9.60	4	14	886.8	-15.0	-3.75
7/24	12	14	3035.8	51.8	4.32	4	14	894.1	7.3	1.82
8/7	12	14	3236.0	200.2	16.68	4	14	942.1	48.0	12.00
8/21	12	14	3353.1	117.1	9.76	3	14	752.9	18.50	1.32
9/4	12	14	3465.6	112.5	9.38					
			Total	980.1	81.68				31.17	

^{a/} Cattle furnished to Central Plains Experimental Range by the Crow Valley Livestock Cooperative.

^{b/} Fistulated cattle from the University of Wyoming.

During period May 15 to September 4, total cattle gain by the non-fistulated heifers was 980 kg in the lightly grazed pasture and 2155 kg in the heavily grazed pasture.

Forage quality, as measured by the dry matter conversion rate, was highest in the heavily grazed pasture during period June 15 to June 25. Forage quality decreased continually through period July 10 to July 23 when 36.94 kg of dry matter were required to produce one kg of gain (Table 7). Forage quality improved with new herbage growth, and for the period August 7 to August 20 the dry matter conversion rate was 7.16. In mid-August the standing herbage dropped to 23.32 g/m², the cattle made no gain, and the dry matter conversion rate rose to infinity.

In the lightly grazed pasture, forage quality was low during the period June 15 to June 25. The quality of forage fluctuated the next two periods when the dry matter conversion rate was 10.78 during period June 26 to July 9 and 20.34 during period July 10 to July 23 (Table 8). The highest quality forage occurred during period July 24 to August 6 when it took 6.10 kg dry matter to produce one kg of gain. Forage quality decreased the next two periods and was low during period September 4 to September 17. Forage quality increased to a conversion rate of 7.64 during period September 18 to October 1 and declined during period October 2 to October 15 when cattle made no gain.

CONCLUSION AND DISCUSSION

The standing herbage biomass was greater on the lightly grazed pasture at all times during the study.

When a growth opportunity occurred, herbage growth was more rapid in the lightly grazed pasture than the heavily grazed pasture.

255BT 9 468MJF 5.00 22.207E,9N, 4,10,65 7
AGSM 400GR 3SPCR 1TRVU 1ASTR11KOSC 9MILI 1
254BT 9 468FJF 6.00 22.104E,1N,33,11,65 6
AGSM 700GR 1STCO 1ASTR 1KOSC13UNKN 3
253BT 9 468MJF 3.09 22.052E,9N, 4,10,65 4
AGSM 2SPCR 1KOSC16PSTE 2
252BT 9 468MJF 5.04 21.557E,9N, 5,10,65 1
PSTE20
251BT 9 468MJF 4.09 21.552E,9N, 5,10,65 3
AGSM10KOSC 9UNKN 2
250BT 9 468FJF 4.06 21.456E,9N, 6,10,65 3
AGSM20ARLO 1PSTE 4
249BT 9 468FJF 3.04 21.451E,1N,31,11,66 4
AGSM 40ACO 6KOSC16MESA 4
248WT 9 468MJF 7.00 21.159E,2N,36,11,66 3
AGSM 7KOSC14VEBR 3
247BT 9 468MJF 3.05 21.159E,5N,36,11,66 5
AGSM11BOGR 1ASTR 3KOSC10PSTE 9
246WT 9 468FJF 4.14 21.159E,5N,36,11,66 4
AGSM17STCO 1ATCA 4GUSA 1
245WT 9 468MJF 6.00 21.159E,5N,36,11,66 5
AGSM 0KOSC13VEBR 6MILI 1HASP 1
244WT 9 468FJF 7.05 21.109E,9N,36,11,66 5
AGSM19BOGR 2CAHE 1KOSC 5LYJU 1
243BT 9 468MJF 5.06 20.459E,9N,23,11,66 4
AGSM15ASTR 3ATCA 2PSTE 3
242WT 9 468FJF 3.05 20.306E,9N,22,11,66 4
AGSM15ARLO 1PSTE10MILI 1
241WT 9 468FJF 5.01 20.253E,9N,22,11,66 5
AGSM 1ATCA 1KOSC11MESA 1PSTE13
239WT 9 468FJF 6.00 20.056E,9N,20,11,66 4
AGSM10CAHE 1FEOC 1ASTR 3
240BT 9 468MJF 3.01 20.107E,1N,17,11,66 5
AGSM19BOGR 2BUDA 2SPCO 2UNKN 1
SSS