Forage Availability and Cattle Diets on the Texas Coastal Prairie

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Highlight: Forage availability was determined at six intervals from December through April on the Texas Coastal Prairie. Warm-season perennial grasses were the dominant class of available forage. Forbs were not present in significant amounts. Cattle diets were also determined at six intervals using esophageally cannulated cows. Some Macartney rose, the only browse species available, was consumed by the cows from December through February. Warm-season grasses constituted the major portion of the diet throughout the study period. Cows showed the highest preference for brownseed paspalum and rattail smutgrass during the winter when other forage was dormant and these species contained green material. As each grass species initiated new growth in the spring, diet content of that species increased accordingly. Leaf:stem ratio of the diets was lowest from December to February and increased significantly in mid-March. The increase of leaf: stem ratio in the spring paralleled the availability of new forage growth.

The Coastal Prairie, primarily an open, tall-grass prairie, comprises approximately 3.85 million hectares of Texas. Over 400 thousand beef cows were reported in this region in 1972 (Caudill et al. 1973). The climate is humid and mild with the frost-free period averaging 300 days. Average annual precipitation is 934 mm. The low elevation and flat topography result in large areas of shallow, standing water for extended periods following heavy rains.

Frequent rains, heavy dews, and flooding on the Coastal Prairie contribute to rapid deterioration of forage quality during the fall and winter. Cows wintering on these ranges have exhibited rapid weight losses, low reproduction rates, and overall reduced productivity, which traditional supplemental feeding programs have failed to correct.¹ The first step towards solution of these problems lies in a better understanding of forage availability and utilization. Objectives of this research were to study forage availability, degree of use, and dietary

Personal communications with ranchers.

preferences of cattle grazing rangeland on the Coastal Prairie of Texas during the winter.

Materials and Methods

This study was conducted on the Green Lake Ranch, located approximately 29 km southeast of Victoria, Tex. Four esophageally cannulated cows were grazed from December through April in a 7.2-ha enclosure situated on a typical Coastal Prairie site (Fig. 1). The enclosure was established on a representative area in late November within a 809-ha pasture. The stocking rate of the enclosure and the large pasture were comparable. Soils of the study area were dark, heavy clays of the Lake Charles-Benard association with less than 1% slope.

Vegetation was dominated by little bluestem (*Schizachyrium scoparium* (Michx.) Nash var. *littoralis*) and Macartney rose (*Rosa bracteata* Wendl.). Available forage was determined by the method of Edlefsen et al. (1960), using a 50- by 50-cm plot divided into 25 units of 10 by 10 cm each. Forage availability was calculated on six dates from December 22, 1973, to April 10, 1974, for each species. Species composition was based on weight.

Forage samples were collected from each of four esophageally fistulated cows on five consecutive days during six collection periods from December 22, 1973, to April 12, 1974. The cows were allowed to graze for approximately 1 hour during the daily collection periods. The forage samples were frozen and stored at -20° C until they were lyophilized at 24°C.

Utilization was determined within the enclosure during each collection period using the ocular-estimate by plot technique (Heady 1949). Utilization estimates were based on forage disappearance, including consumption and other losses.

Botanical composition of the grazed forage samples was determined using the microscopic analysis described by Kothmann (1968). A white poster board was cut to fit a shallow pan and marked with a 17by 36-cm grid. Each individual unit in the grid was 1 cm². From the total number of units in the grid, 100 were randomly selected and permanently delineated with India ink. An area of 1 cm² was a convenient site for working under the binocular microscope at a magnification of 10 to 15 times. Dry forage samples were worked by hand until plant fragments were disassociated. After the sample was thoroughly mixed, it was spread evenly across the poster board. Twenty units were selected at random from 100 permanently marked units. Each individual plant fragment occurring in each of the 20 units was identified by species and recorded as leaf or stem. Unidentifiable fragments, a very small percentage of the total, were disregarded in further treatment of the data. Sample composition was calculated

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Fig. 1. Study area on the Texas Coastal Prairie supporting a vigorous stand of native grasses following deferment from July to November (A) and after being grazed from November to April (B). Cattle were fed along the road visible in the background of picture B.

directly from the percentage of plant fragments recorded in each classification. Analysis of variance was used to analyze data by species; Duncan's multiple range test was used for mean separation.

Preference ratings were calculated for each species by collection period using the method described by Taylor (1973):

Preference rating =
$$\frac{\% \text{ in diet} - \% \text{ available}}{\% \text{ in diet} + \% \text{ available}} \times 10$$

A preference rating of +10 would indicate a high preference, while a -10 indicates a low preference. Preference rating of 0 represents selection in proportion to availability.

Results and Discussion

Forage Availability

Forage available to grazing animals consisted primarily of mature plants plus some new growth in the spring. Warmseason, perennial grasses constituted the major portion of the available forage during the study. Forbs were almost non-existent due to a past history of annual spraying with 2,4-D [(2,4-dichlorophenoxy)acetic acid], and a high population of white-tailed deer (*Odocoileus virginianus* L.). The grasses were partially dormant from mid-December until late February. Total available forage decreased from 3,781 kg/ha to 2,708 kg/ha during this period (Fig. 2). Following initiation of spring growth, available forage increased to a peak of 4,250 kg/ha in late March. Forage availability declined in April, probably as a result of reduced growth coupled with continued grazing and deterioration of old growth.

Marked differences were noted among species in the rates of forage disappearance and accumulation. Little bluestem had the greatest availability until mid-March, when longtom paspalum (*Paspalum lividum* Trin.) was most abundant (Fig. 2). Little bluestem nearly doubled in availability from March 10 to March 27, partly in response to 4.45 cm of rainfall and favorable temperatures. Common Bermudagrass (*Cynondon dactylon* (L.) Pers.) also increased markedly during this period. Brownseed paspalum (*Paspalum picatulum* (Michx.), Indiangrass (*Sorghastrum nutans* (L.) Nash), and longtom paspalum initiated growth earlier than little bluestem; little bluestem greened up earlier than knotroot bristlegrass (*Setaria geniculata* (Lam.) Beauv.).

Rattail smutgrass (*Sporobolus indicus* (L.) R. Br.) was most abundant on the more heavily grazed areas, such as along roads. Although generally considered of low grazing value, rattail smutgrass retained some green foliage throughout the study. Due primarily to grazing, rattail smutgrass decreased in availability from 454 kg/ha on December 23 to 108 kg/ha on March 27. When grazing pressure shifted to other species, it increased in availability to 144 kg/ha by April 10.

Switchgrass (*Panicum virgatum* L.), Macartney rose, brownseed paspalum, longtom paspalum, and common Bermudagrass thrived in the low, wet areas. Little bluestem and Indiangrass were more abundant on better drained areas. Switchgrass generally grew in association with Macartney rose, which protected it from grazing. Minor grass species which appeared



Fig. 2. Species composition of available forage (kg/ha), determined on six dates for a grazed pasture in the Coastal Prairie of Texas.

Table 1. Estimated utilization (%) by cattle of forage species in the Coastal Prairie of Texas on six dates during the winter of 1973-74.

	Date							
Species	Dec. 22	Jan. 14	Feb. 11	Mar. 8	Mar. 25	Apr. 8		
Brownseed paspalum	28	26	38	25	17	14		
Common Bermudagrass	35	31	40	27	20	31		
Indiangrass	7	4	25	18	14	33		
Knotroot bristlegrass	12	3	30	24	27	40		
Little bluestem	10	16	29	22	22	24		
Longtom paspalum	15	33	32	25	22	11		
Macartney rose	6	9	6	5	2	0		
Rattail smutgrass	37	44	55	46	36	14		
Misc. grasses	5	14	15	14	24	20		

during the latter part of this study included Scribner's panicum (*Dichanthelium oligosanthes* (Schlt) Gould), Dallisgrass (*Paspalum dilatatum* Poir.), and Texas grama (*Bouteloua rigidiseta* (Steud.) Hitch.).

Utilization and Distribution of Grazing

Utilization was not uniform, as cattle were observed to graze a few plants of the same species very closely while little use was made of the majority of plants. This behavior was attributed to the maturity and coarseness of the forage and the preference of the animals for regrowth on the heavily grazed plants.

From December through February, utilization increased followed by a general decline in March and April as warm season species initiated growth in the spring (Table 1). Rattail smutgrass was utilized most intensively during the winter, primarily due to the preference of the animals for green forage. Although longtom paspalum available from December to February was mostly stems, it was grazed intensively on mornings following a heavy dew. This behavior resulted in distinct, heavily utilized areas in which longtom paspalum flourished during spring, apparently due to removal of the dense mat of dead plant material. This growth accounted for the increase in availability and decrease in percent utilization of longtom paspalum from February 11 through April 8.

Spring growth of common Bermudagrass, longtom paspalum rattail smutgrass, and brownseed paspalum exceeded plant removal by grazing animals, resulting in decreased estimates of percent utilization of these major grass species. Utilization exceeded plant growth again in April for several species.

Botanical Composition of the Diets

Little bluestem was the dominant grass found in cattle diets, except in February and early March, when brownseed paspalum, longtom paspalum, and rattail smutgrass made up about 66% of the diet (Table 2). After initiation of spring growth, little bluestem increased significantly in the cattle diets during late March and April to 29 and 34%, respectively. Even though the cattle tended to prefer little bluestem more in winter than in spring, it was generally selected in proportion to its availability (Table 3). Rattail smutgrass and brownseed paspalum had the highest preference values of the species encountered during this study. Brownseed paspalum increased significantly from 14% of the diets in January to 26% of the diets in February and 32% in March. This increase was associated with initiation of spring growth. Rattail smutgrass and brownseed paspalum decreased significantly in the diets in late March when new growth of other warm-season grasses increased in availability.

Diet content of longtom paspalum increased steadily from 5% in December to 21% in late March. Diets from December through February contained primariy mature stems of this species. During March and April succulent leaf growth of longtom paspalum constituted 27% of the available forage and about 20% of the diets. Preference values for longtom paspalum indicated that it was selected in proportion to availability (Table 3).

Preference values for common Bermudagrass, with the exception of January, were negative. Preference values for Indiangrass were consistently negative during the study, ranging from minus one to minus five. Maximum diet content of Indiangrass was 7% in December. Hence, Indiangrass appears to be of minor forage value from late December to early April. Knotroot bristlegrass was not found in any diet samples.

Macartney rose, the only browse species available, was consumed in limited amounts contributing an average of only 4% to the diet (Table 2). The Macartney rose in the diets was primarily leaves, indicating the animal's ability to strip the leaves from the thorny stems. Cattle generally selected leaves of all species in preference to stems, when conditions allowed. However, this was increasingly difficult as plants weathered. The study area was not grazed until the end of the growing season, when the grasses were mature. As a result, the leaf:stem

Table 2. Average botanical composition (%) of diets selected by cattle during six, 5-day collection periods between December 22, 1973, and April 12, 1974, on the Coastal Prairie of Texas.¹

	Date							
Species	Dec. 22–26	Jan. 14–18	Feb. 11–15	Mar. 8–12	Mar. 25–29	Apr. 8–12	Mean	Standard deviation
Brownseed paspalum	16°	14 ^c	260	374	270	276	22	7.0
Common Bermudagrass	9¢	16 ^a	Qc	1200	140	110	12	1.5
Indiangrass	7a	5ab	30	6ab	Sab	3ab	5	4.4
Little bluestem	30%	24 ^c	130	0 Qe	200	310	23	4.J 5 1
Longtom paspalum	50	110	140	170	$\frac{2}{21^{a}}$	160	14	5.1
Macartney rose	9a	6 ^b	6 ⁰	17 70	21	10	14	2.8
Rattail smutgrass	170	180	254	170	2 5d	110		5.0
Misc. grasses	7	6	4	5	2	1	5	2.3

Means in the same row not followed by the same letter differ significantly ($P \le .05$).

Species	Date						
	Dec. 22-26	Jan. 14-18	Feb. 11–15	Mar. 8-12	Mar. 25-29	Apr. 8–12	
Brownseed paspalum	7	0	4	4	3	3	
Common Bermudagrass	-1	4	-2	-2	-2	-3	
Indiangrass	-1	-4	-5	-2	-2	-4	
Little bluestem	0	1	-4	-4	-1	1	
Longtom paspalum	-1	-1	-2	-2	2	-1	
Rattail smutgrass	2	1	5	5	4	4	
Misc. grasses	-2	-2	2	-1	-4	-6	

Table 3. Relative preference values for major grass species in the diets of cattle selected in six collection periods from December 22, 1973, to April 12, 1974, in the Coastal Prairie of Texas.

ratio in diets during winter was low (Table 4). The significant decrease of leaf:stem ratio in January was associated with a significant dietary increase of longtom paspalum, consisting of mostly stems. Diet leaf:stem ratios increased during the spring to a peak of 5.4 in late March, paralleling the greatest availability of forage, and declined slightly in April with the slight decline in available forage.

Table 4. Leaf:stem ratios of cattle diets for six collection periods from December 22, 1973, to April 12, 1974, on the Coastal Prairie of Texas.¹

Dates	Leaf:stem		
December 22–26, 1973	2.26 ^b		
January 14-18, 1974	1.29 ^c		
February 11–15, 1974	2.00%		
March 8–12, 1974	2.85		
March 25–29, 1974	5.39 ^a		
April 8–12, 1974	4.33 ^a		
Mean	3.11		
Standard deviation	1.10		
Coefficient of variation (%)	35.60		

Means not followed by the same letter differ significantly ($P \le .05$).

Conclusions

From an examination of the patterns of changing forage availability and diets, it is possible to draw some inferences concerning the nutritional importance of the respective species. Indiangrass, generally considered a highly desirable forage species, was of little importance during the winter and early spring. Likewise, no consumption of knotroot bristlegrass was detected, although 848 kg/ha were available in December. Utilization estimates, as a measure of the dietary importance of a species, can be misleading, since utilization estimates for knotroot bristlegrass ranged from 2% in January to 40% in April. Weathering, trampling, and consumption by other animal species may contribute to utilization estimates (Laycock and Harniss 1974; Pearson 1975), making the ocular estimates of use a poor measure of forage consumption.

Even though a relatively large quantity of forage was available, 2,829 and 2,708 kg/ha in January and February, respectively, the quality was low (Durham 1975) and the amount of green material available was limited. Increased production of warm-season grasses such as knotroot bristlegrass, Indiangrass, little bluestem, or common Bermudagrass would not alleviate the nutritional stress during January and February. The low utilization of several species and the poor grazing patterns within species are evidence of inefficient utilization of the forage produced. This indicates a need to further evaluate grazing plans for this type of vegetation.

Literature Cited

- Caudill, Charles E., Robert S. McCauley, Loyd P. Garrett, and Charles W. Wallis. 1973. Texas livestock statistics. Tex. Dep. Agr. Bull. 100. 65 p.
- Durham, Albert J., Jr. 1975. The botanical and nutritive composition of winter diets of cattle grazing prairie on the Texas Gulf Coast. MS Thesis, Texas A&M Univ. 64 p.
- Edlefsen, James L., C. Wayne Cook, and Joseph T. Blake. 1960. Nutrient content of the diet as determined by hand plucked and esophageal fistula samples. J. Anim. Sci. 19:560-567.
- Heady, H. F. 1949. Methods of determining utilization of range forage. J. Range Manage. 2:53-56.
- Kothmann, M. M. 1968. The botanical and nutrient content of the diet of sheep grazing on poor condition pasture as compared to good condition pasture. PhD Thesis, Texas A&M Univ. 60 p.
- Laycock, William A., and Royal O. Harniss. 1974. Trampling damage on native forb-grass ranges grazed by sheep and cattle. In Sectional Papers: "Grassland Utilization." XII Int. Grassl. Congr. [Russ., 1974] Proc. p. 349-354.
- Pearson, H. A. 1975. Herbage disappearance and grazing capacity determinations of Southern pine bluestem range. J. Range Manage. 28:71-73.
- **Taylor, C. A. 1973.** The botanical composition of cattle diets on a 7-pasture high-intensity low-frequency grazing system. MS Thesis, Texas A&MUniv. 60 p.