Summer Diets of Steers on a Deep Hardland Range Site of the Texas High Plains

JACK E. McCLUNG, ROBERT C. ALBIN, AND JOSEPH L. SCHUSTER

Highlight: *Botanical and chemical compositions of the summer diets of esophageal-fistulated steers were determined on a deep hardland shortgrass range site of the Texas High Plains. Consumption of belvedere summercypress was highest in June, but decreased to September; whereas, consumption of blue grama, buffalograss, and sand dropseed increased during this period. Belvedere summercypress was eaten in considerable quantities until it approached dormancy. Dietary crude protein and calcium percentages were highest in June, but declined to September. Daily forage consumption averaged 10.9 kg during June and July. A forage utilization of 17.4% was obtained during the summer grazing period and the steers gained an average of .45 kg/day.*

Little information is available concerning chemical composition of plants growing on range sites of the Texas High Plains. Estimates of nutrient and energy intake from available forage would aid in determining supplemental nutrient and energy needs to maximize cattle gains during summer grazing periods. In addition, the most economical gain could be estimated if estimates of animal performance on the Texas High Plains were available. The objectives of this study were: (1) to determine the botanical composition of the summer diets of steers grazing on a typical native shortgrass deep hardland range site of the Texas High Plains; (2) to determine the chemical composition of the diets; (3) to determine the daily forage consumption rates; and (4) to measure animal performance.

Study Area and Procedures

The study area was a 40-acre pasture on a deep hardland range site on the Texas Tech University Center at Amarillo, 14 miles east of Amarillo, Tex., in Randall County. The soil is a Pullman silty clay loam, a highly productive soil, most of which is now under cultivation on the High Plains. Average annual precipitation is 50.8 cm, ranging from 25.4 to 106.7 cm (Jacquot, 1962). Peaks of rainfall occur in May and August with most of the precipitation occurring in August.

Blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) are the most common grasses. Sand dropseed (*Sporobolus cryptandrus*), silver bluestem (*Bothriochloa saccharoides*), and belvedere summercypress (*Kochia scoparia*) are common increaser species.

Four Angus × Holstein cross steers, each weighing about 473 kg were fitted with esophageal fistulas and cannulae. The esophageal fistulation method and sample collection technique were similar to those described by Van Dyne and Torell (1964) and Hoehne (1966) and discussed by Lesperance et al. (1974). Collections of forage from esophageal fistulas were made during the third weeks of June, July, August, and September, 1969. The steers were kept off feed each night prior to the day diet samples were taken. The samples were taken by attaching collection bags around the steers' necks after removal of cannulae. After 1 hour of grazing, the collection bags were removed and the samples prepared for analysis. Each diet sample was separated into two sub-samples, one for botanical analysis and one for chemical analyses. The sample for botanical analysis was stored at 0°C until it was examined.

The sub-samples for chemical analyses were dried in a force draft oven for 5 minutes at 100°C and then 24 hours at 70°C. The dried samples were ground through a Wiley mill using a 0.8-mm sieve. Crude protein and dry matter were determined by procedures outlined by the Association of Official Agricultural Chemists (A.O.A.C., 1960). Gross energy was determined by the procedure outlined by Hunt (1963) and phosphorus by the procedure of Sumner (1944).

Botanical analysis of the diet was conducted with a point frame microscopic technique developed by Shamrad and Box (1964). One hundred points were recorded for each fistula sample, using a key prepared from a reference collection of plants which was made on each collection date. The relative frequency of each species was recorded and converted to percent composition.

An estimate of daily forage disappearance was obtained by the paired plot method (Subcommittee on Range Research, 1962). Twenty-seven paired, .89-m^2 plots were used. Wire cages were used to exclude grazing on one of each paired plot. The plots were hand clipped monthly and the herbage oven-dried. The cages were moved bimonthly to determine percent utilization by the steers.

The steers were weighed in June, August, and October. Analysis of variance and Duncan's new multiple range test were used to analyze the data (Steel and Torrie, 1960).

Results and Discussion

Botanical Composition of Diets

Belvedere summercypress, blue grama, buffalograss, sand dropseed, and silver bluestem were major components of the steer diets during the study (Table 1). The percentage of belvedere summercypress in steer diets decreased from a high of 61.3% in June to a low of 18.1% in September; whereas, blue grama and buffalograss percentages were lowest in June but

At the time of this study, authors were graduate assistant and professor, Department of Animal Science, and professor, Department of Range and Wildlife Management, Texas Tech University, Lubbock. At present Jack E. McClung is sales supervisor, Diamond V Mills, Inc., Cedar Rapids, Iowa, and J. L. Schuster is head, Department of Range Science, College Station, Tex.

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Table 1. Species composition (% of total intake) of the diets of steers on a deep hardland range site near Amarillo, Tex., (summer, 1969).[1]

Species	June diet	July diet	Aug. diet	Sept. diet
Buffalograss	6.8 a[2]	6.5 a	12.8 a	23.6 b
Blue grama	12.1 a	26.4 a,b	33.5 b	51.3 c
Belvedere summercypress	61.3 a	36.1 b	31.9 b	18.1 b
Sand dropseed	9.6 a	24.9 b	7.7 a	3.0 a
Silver bluestem	3.9	1.0	13.2	1.6
Other species	6.3	5.1	0.9	2.4

[1] For the 132-day period.
[2] Within each row, means followed by the same letter are not significantly different at the .01 level.

highest in September. Sand dropseed and silver bluestem were consumed in highest proportions during July and August, respectively. Mean composition of the sward for the 132-day period was: buffalograss, 34.0%; blue grama, 28.0%; belvedere summercypress, 10.5%; sand dropseed, 8.0% ; silver bluestem, 3.0%; and other species, 16.5%. Belvedere summercypress began its growth in early April and became somewhat dormat during August; whereas, blue grama and buffalograss did not start active growth until the latter part of June. Silver bluestem remained green throughout the study period. Blue grama consumption was highest during September and higher in August than in June. No significant differences were found among the months of June, July, and August for buffalograss intake, but intake in September was significantly greater than in earlier months. Most species were eaten readily during periods when they were growing rapidly. However, the intake of most species declined from the peak growth stage to dormancy. The exception was blue grama, which received increased utilization toward the end of the season.

Chemical Composition of Diets

The crude protein content of the diet samples was highest (14.6%) in June, but decreased progressively to a low of 7.8% in September (Fig. 1). An inverse trend was noted for percent

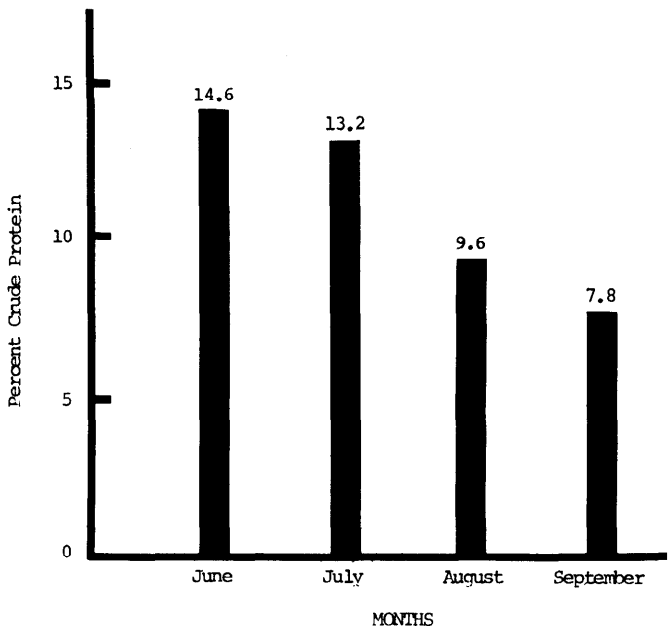

Fig. 1. *Mean percent crude protein content of forage consumed by steers during the summer months on a deep hardland site on the southern High Plains, 1969.*

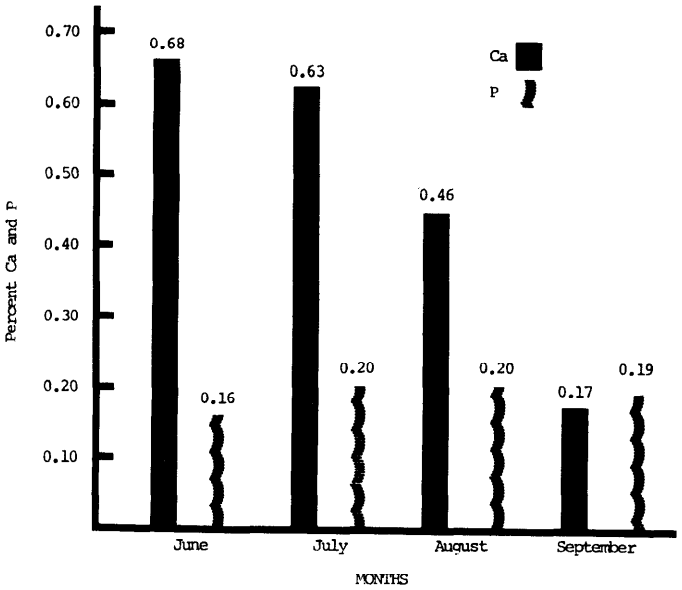

Fig. 2. *Mean percent calcium and phosphorus in diets of steers.*

dry matter of forage consumed. These data indicate a decline in quality of the diet as the vegetation reached maturity. Rodgers and Box (1967) and Hoehne (1966) have also reported a general decline in crude protein percentage in steer diets from June to September.

Calcium content of the forage ingested declined from June to September (Fig. 2). At an approximate forage intake of 11.3 kg/head daily, calcium would not have become deficient in the diet even in September.

Dietary phosphorus percentage did not vary significantly during the 4 months (Fig. 2). Phosphorus content of the diet was lowest in June, which coincided with highest percentages of calcium and crude protein. The general trend showed a slight increase in percentage of phosphorus as the percentage of belvedere summercypress decreased and as the percentage of dry matter increased. These trends are similar to the findings of Hoehne (1966).

Forage Utilization and Animal Gains

An average of 2,372 kg/ha of forage were available during the 132-day study. An average of 413 kg/ha were utilized by the steers (17.4% utilization) during the 4-month study.

Average daily forage disappearance per steer was 10.9 kg of oven-dry biomass from June 12 to August 18, and 11.8 kg from August 19 to October 21. The four steers gained an average of 0.4 kg/head/day during the first one-half of the study and 0.5 kg/head/day during the second one-half.

Daily nutrient and energy requirements recommended by the National Research Council (N.R.C.) (1970) were surpassed in all 4 months (Table 2) for all nutrients tested. Crude protein and calcium intakes declined from June to September. Daily requirements for phosphorus were met for the 132-day study period but were closer to minimum daily N.R.C. requirements than crude protein or calcium.

Gross energy was similar for each sampling period (Table 2), as expected. With an average daily disappearance of 10.9 kg/head/day and an estimated forage digestibility of 57.5%, digestible energy intake would have been sufficient to meet the N.R.C. (1970) recommendations for steers gaining .45 kg/head/day. Based on available forage, and forage consumption,

Table 2. Average daily estimated nutrient and energy intake of yearling steers on a deep hardland range site near Amarillo, Tex., (summer, 1969).

Month	Crude protein (kg)	Calcium (g)	Phosphorus (g)	Gross energy (kcal)	Digestible energy[1] (kcal)
June	1.59	74.5	17.5	38,914	25,294
July	1.42	69.0	21.9	41,859	25,115
Aug.	1.14	53.6	20.9	41,187	22,653
Sept.	.91	43.6	18.6	43,879	21,940

[1] Using estimated apparent digestion coefficient of 65% for June, 60% for July, 55% for August, and 50% for September (mean of 57.5%).

daily gains appear to have been limited by the ability of the steers to consume enough forage. Had the available forage been of higher quality, increased rates of gain would undoubtedly have occurred since the forage was available. It appears that intake capacity of this size steer limits live weight gains on a deep hardland range site. For increased live weight gain, additional protein and energy would need to be provided as a supplement to the forage. When supplementation is economically infeasible, these data indicate that only about .45 kg/head daily gain can be expected from yearling steers grazing similar Texas High Plains range.

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