PUBLICATIONS
1985

Forage Research In Texas, 1985

Mineral Composition of Forages in a Short Duration Grazing System

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Summary

Forage samples were collected eight times from May 1981 through November 1984 on a rotational grazing system. Samples were subdivided into live and dead components within the following forage classes: annual grasses, sideoats grama, Texas wintergrass, forbs, and other warm-season grasses. Samples were pooled into two seasonal groupings (March — June and July — December) and analyzed for phosphorus, calcium, magnesium, sodium and potassium concentrations. Annual grasses appeared to have a greater phosphorus concentration in live material and a lower phosphorus concentration in dead material during July — November than March — June. Summarized across species and season of year, phosphorus concentration was 0.108 percent in live material and 0.046 percent in dead material. Forage calcium concentrations ranged from 0.3 to 2.0 percent with concentrations in live material being slightly less in annual grasses, sideoats grama, Texas wintergrass, and other warm-season grasses while greater for other forbs during July — November as compared to March — June. Magnesium concentration of forages was greatest in forbs for both live and dead material. Sodium concentrations in forages were less in live material during July — November than during March - June. Potassium concentration of the live material in all plant species was greater during March — June which corresponds to the more active growing season. Dead material contained relatively low concentrations of potassium in both seasons.

KEYWORDS: Phosphorus/calcium/magnesium/sodium/potassium/short duration grazing.

Introduction

Minerals are required in livestock diets to meet nutritional and metabolic requirements. As changes occur in stages and levels of production, mineral requirements also change. To maximize animal productivity, adequate quantities of minerals need to be provided to grazing livestock. If forage consumed does not meet the animals' requirement for specific minerals, mineral supplementation should be practiced.

As forage growth and development change with the season of the year, mineral composition also changes. This experiment was conducted to determine the mineral composition of five forage-groups, live and dead tissue, during March — June and July — November.

Procedure

Forage samples were collected at the Texas Agricultural Experimental Station Ranch located in the eastern portion of the Rolling Plains near Throckmorton, Texas. Vegetation sample areas were located in four adjacent paddocks of a 16-paddock, cell-designed rotational grazing treatment. Vegetation samples were collected over a 40-month period immediately prior to and after 1-4 day grazing events. All samples were clipped by major species at ground level from within 10 randomly

located, 0.25 square meter quadrants. All samples were ovendried and separated into live and dead components. Species and species groups were annual grasses, Texas wintergrass, sideoats grama, other warm-season grasses, and forbs. All estimates were based on 10 subsamples per grazing event; five prior to and five after grazing. Samples were grouped into two seasons (March-June and July-November) and analyzed for phosphorus, calcium, magnesium, sodium, and potassium.

Results and Discussion

Annual grasses (Table 1) appeared to have a higher phosphorus concentration in live material and a lower phosphorus concentration in dead material during July-November than March-June. Phosphorus content for all forages averaged 0.108 percent for liver material and 0.046 percent for dead material. These concentrations are approximately 23 and 54 percent below the requirements of a mature dry cow. Phosphorus supplementation appears essential to maintain maximum animal production and reproductive efficiency. This is true even if it were assumed that the animals only consumed those species with the highest concentration of phosphorus, since the phosphorus concentration in those species was well below the requirements of a mature, dry cow.

Forage calcium concentrations (Table 2) ranged from 0.3 to 2.0 percent. Calcium concentrations in live material were generally greater than for dead material. The highest calcium concentration was in live forbs (1.75 percent). The lowest concentration was in warm season grasses (0.36 percent). Calcium concentrations in all forage classes were of sufficient magnitude to meet nutritional requirments of lactating cows.

Magnesium concentration of forages (Table 3) was highest in forbs. Generally, dead material was lower in magnesium than live material (0.097 versus 0.130 percent). Magnesium concentration in the forage appeared adequate to meet the nutritional requirement for gestating cows. During early- and mid-lactation, magnesium supplementation should be increased to supply approximately 0.2 percent magnesium in the animal's diet.

Sodium concentrations in forages are presented in Table 4. Sodium concentrations were 66, 16, 46, 5, and 30 percent lower in live material of annual grasses, sideoats grama, forbs, Texas wintergrass, and other warm-season grasses, respectively, during July - November than during March - June. Dead material averaged 0.12 percent sodium during the experimental period.

Potassium concentration (Table 5) in live material averaged 2.09 percent and ranged from 1.76 percent in the warm-season grasses to 2.59 percent in forbs. Concentrations in senesced forage material averaged 0.69 percent and ranged from 0.45 percent in warm-season grasses to 1.57 percent in forbs. This suggests that cows which have access only to senesced forage should be supplied with supplemental potassium.

The relative changes of mineral composition discussed in this paper are largely associated with differences between plant species and stage of plant development.

TABLE 1. PHOSPHORUS COMPOSITION OF LIVE AND DEAD FORAGE FOR FIVE PLANT SPECIES DURING TWO SAMPLING SEASONS

Phosphorus, %	March-June	July-November
Live,		
Annual grasses	0.104	0.159
Sideoats grama	0.099	0.089
Forbs	0.102	0.107
Texas wintergrass	0.103	0.104
Warm-season grasses	0.102	0.106
Dead,		
Annual grasses	0.061	0.037
Sideoats grama	0.042	0.039
Forbs	0.044	0.044
Texas wintergrass	0.048	0.044
Warm-season grasses	0.053	0.044

TABLE 2. CALCIUM COMPOSITION OF LIVE AND DEAD FORAGE FOR FIVE PLANT SPECIES DURING TWO SAMPLING SEASONS

Calcium, %	March-June	July-November
Live,		
Annual grasses	0.544	0.460
Sideoats grama	0.459	0.407
Forbs	1.591	2.027
Texas wintergrass	0.435	0.356
Warm-season grasses	0.368	0.333
Dead,		
Annual grasses	0.373	0.389
Sideoats grama	0.431	0.440
Forbs	1.147	0.994
Texas wintergrass	0.443	0.369
Warm-season grasses	0.375	0.374

TABLE 3. MAGNESIUM COMPOSITION OF LIVE AND DEAD FORAGE FOR FIVE PLANT SPECIES DURING TWO SAMPLING SEASONS

Magnesium, %	March-June	July-November
Live,		
Annual grasses	0.141	0.139
Sideoats grama	0.108	0.102
Forbs	0.181	0.219
Texas wintergrass	0.112	0.115
Warm-season grasses	0.107	0.103
Dead,		
Annual grasses	0.102	0.073
Sideoats grama	0.074	0.079
Forbs	0.194	0.131
Texas wintergrass	0.082	0.082
Warm-season grasses	0.080	0.076

TABLE 4. SODIUM COMPOSITION OF LIVE AND DEAD FORAGE FOR FIVE PLANT SPECIES DURING TWO SAMPLING SEASONS

Sodium, %	March-June	July-November
Live,		
Annual grasses	0.097	0.033
Sideoats grama	0.134	0.113
Forbs	0.118	0.064
Texas wintergrass	0.118	0.112
Warm-season grasses	0.152	0.107
Dead,		
Annual grasses	0.103	0.104
Sideoats grama	0.081	0.134
Forbs	0.163	0.170
Texas wintergrass	0.084	0.110
Warm-season grasses	0.120	0.086

TABLE 5. POTASSIUM COMPOSITION OF LIVE AND DEAD FORAGE FOR FIVE PLANT SPECIES DURING TWO SAMPLING SEASONS

Potassium, %	March-June	July-November
Live,		
Annual grasses	2.360	1.647
Sideoats grama	1.860	1.659
Forbs	3.502	1.670
Texas wintergrass	2.557	2.099
Warm-season grasses	1.998	1.516
Dead,		
Annual grasses	0.670	0.248
Sideoats grama	0.428	0.507
Forbs	2.324	0.809
Texas wintergrass	0.588	0.417
Warm-season grasses	0.484	0.426