Plant Chemical Composition and Digestibility of Rangeland Forage

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Story in Brief

Forage samples were collected on a monthly basis from various points on a native rangeland watershed located near Stillwater. The forage samples were collected according to grazed (G) and caged (C). Both live and standing dead plants were collected. The samples were analyzed for fiber (ADF), lignin (ADL) and cellulose (CELL) for both grazed (live and dead) and caged (live and dead). The grazed dead acid detergent fiber (GDADF) and caged dead acid detergent fiber (CDADF) values were similar in August, being 51.0 percent (GDADF) *vs* 51.1 percent (CDADF). The grazed standing vegetation (GSTDV) showed an overall increase in ADF fiber composition from 45.7 percent in October to 52.5 percent in January.

In vivo digestion data showed a decrease in digestion when there was an increase in fiber. The ADF rose from 51.5 percent in May to 54.3 percent in July. *In vivo* digestibility at these same times decreased from 23.9 percent in May to 21.8 percent in July.

Introduction

Beef cattle are major consumers of forages, and rangelands will likely be relied upon to supply more of the forages needed. Due to higher grain prices and greater demand of grain for human consumption and export, more livestock will need to be maintained and grown with greater forage utilization. A broader understanding of the chemical make up of forages throughout the growing and grazing seasons is beneficiary to proper nutritional management and improved range forage utilization. The purpose of this study was to determine the chemical composition (acid detergent fiber, lignin, and cellulose) of rangeland forage, grazed and ungrazed, throughout the year and to relate changes in plant chemical composition to digestibility of the forage.

Materials and Methods

The study area consists of a 70 hectare watershed located at the Northwest end of Lake Carl Blackwell in Noble County, Oklahoma. Both live and dead standing vegetation were collected, except for winter months when a clear distinction could not be obtained between dead and live plants. During these months the forage was described as standing vegetation. Both caged and grazed samples were collected, from twenty-nine various locations on the watershed. Three enclosures (0.5 acres each) at various points on the watershed were constructed to serve as controls, unaccessible to the cattle.

Three Holstein steers (408 kg) were fitted with rumen cannulaes for the purpose of running nylon bag *in vivo* digestion trials. The nylon bag *in vivo* digestion trials were run on a monthly basis as were the forage collections. Preweighed samples of forage are placed in nylon bags and placed in the rumen for an incubation period of 48 hr. After 48 hr the bags are removed, dried at 55 C for 48 hr and weighed back. The dry matter digestibility is calculated as the percent disappearance during incubation.

Acid detergent fiber, lignin, and cellulose were determined on the forage samples collected. The forage was analyzed for acid detergent fiber and then for lignin by the permanganate method. The cellulose was determined by difference, ashing the remaining sample after lignin determination.

Results and Discussion

Chemical composition data for the period from August, 1976 to July, 1977 are shown in Tables 1, 2 and 3. The fiber contents of grazed (G) and caged (C) dead forage samples were almost identical (51.0 *vs* 51.1 percent) during August indicating grazing selectively by cattle to avoid the dead plants. The ADF for the standing vegetation showed an increase from October (45.7 percent) to January (52.5 percent). A decrease in fiber content was then noted from January (52.5 percent) to March (51.3 percent) and April (48.0 percent), reflecting the beginning of some growth in April. The same increase was noted for lignin and cellulose from October to January. The increased fiber content is

Table 1. Chemical composition of live and dead forage-acid detergent fiber (ADF) content

Month	Grazed dead ADF %	Grazed live ADF %	Caged dead ADF %	Caged live ADF %	Grazed standing vegetation ADF %	Caged standing vegetation ADF %
August	51.0	39.0	51.1	37.6		
September	49.3	36.3				
October					45.7	
November					48.3	
December					51.5	
January					52.5	
March					51.3	
April					48.0	47.1
May	51.5	36.6				
June	52.6	40.0				
July	54.3	43.0	54.5			

Table 2. Chemical composition of live and dead forage-acid detergent lignin (ADF) content

Month	Grazed dead ADL %	Grazed live ADL %	Caged dead ADL %	Caged live ADL %	Grazed standing ADL %	Caged standing ADL %
August	13.0	10.2	18.4	10.7		
September	14.1	10.3				
October					11.3	
November					11.7	
December					12.6	
January					13.3	
March					11.0	
April					9.3	9.2
May	10.8	7.0				
June	10.6	8.4				
July	14.2	9.6	15.6			

Table 3. Chemical composition of live and dead forage-cellulose content

Month	Grazed dead cellulose %	Grazed live cellulose %	Caged dead cellulose %	Caged live cellulose %	Grazed standing vegetation cellulose %	Caged standing vegetation cellulose %
August	37.9	29.9	37.7	29.5		
September	37.0	27.9				
October					34.3	
November					33.5	
December					35.1	
January					36.6	
March					35.8	
April					34.5	35.0
May	35.8	28.8				
June	37.0	29.7				
July	36.8	31.5	36.4			

Table 4. *In vivo* dry matter digestibility (48 hr disappearance)

Months	Grazed dead %	Grazed live %	Caged dead %	Caged live %	Grazed standing vegetation %
August	22.0	50.4	19.9	47.6	
September	18.1	44.8			
October					30.0
November					21.9
December					23.9
January					23.0
March					18.8
April					28.6
May	23.9	49.1			
June	17.4	42.8			
July	21.8	48.1	24.3	43.5	

due to the plants going into winter dormancy and the movement or storing of more nutrient reserves into the root system. Having a lower soluble carbohydrate content, the forages would have more fiber.

Digestibility data (Table 4) show a substantial reduction in digestibility for dead *vs* live plant material during all warm months. This was true for both caged (ungrazed) and grazed (access to grazing permitted) samples. As expected, digestibility of the standing vegetation was much lower during the period from November to March. In general, digestibility differences were often on the order of two-fold; between the live *vs* dead forages, and between growing *vs* non-growing months of the year. As fiber increases over any particular time, digestibility decreases.

Effect of Forage Density on Grazing Behavior, Forage Intake and Animal Performance

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Story in Brief

Sorghum sudan hybrid (Sx-17) was planted at three seeding rates (A, 16.8; B, 33.6 and C, 50.4 kg/ha) to determine the effect of different forage densities on grazing behavior, forage intake and animal performance of beef heifers. Two 1.2 ha pastures were used for each seeding rate. All pastures received 57 kg/ha of actual nitrogen at planting time. Four animals grazed each pasture from July 1 to September 29, 1977. An intake trial was conducted from July 26 to August 8, 1977, using chromic oxide as an external marker. During this time, one animal in each pasture was fitted with an 8-day recorder to continuously monitor grazing behavior.

There was a high correlation between grazing time measured by visual observation and that estimated when the vibration recorder was used (r=.92). Further, the activity of one animal in each pasture represented the activity of about 75 percent of the other animals in the pasture within a given five minute interval. This indicates the animals behave primarily as a group rather than as individuals.

In cooperation with USDA, Science and Education Administration, Southern Region.