THE FEEDING VALUE OF NATIVE GRASSES IN THE SHEYENNE NATIONAL GRASSLANDS

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Grasses sampled (wooly sedge, big blue stem, switchgrass, little blue stem, needle and thread, blue grama and Kentucky blue grass) were found to differ significantly in their nutritional value. All species were relatively nutritious during early growth stages but declined rapidly as the season progressed. Phosphorus was deficient most of the season in many of the grasses in meeting the requirements of gestating-lactating cows and growing and replacement beef cattle. Additional energy should be supplied for replacement and growing cattle if they are to make satisfactory growth rate after mid-July. Cool season grasses vary more in feeding value than warm season grasses. Upland grasses did not decline in nutritional value to the same extent as grasses in the lowland and midland sites. Burning, mowing or increased grazing rotation improves the utilization of lowland areas and defers grazing on the upland sites until later in the season. These practices would also improve the nutrition available to livestock grazing these areas.

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Introduction:

The nutritional composition of plants is variable and affected by factors such as species, soil types, temperature, day-length, rainfall, growth stage of the plant, level

of fertility and others. A knowledge of the feeding value of the major species in a given area would be very useful in management decisions related to range use and supplementation needed for livestock utilizing these forages. Work reported by Whitman *et al.* (1951) involving several native and tame species in western North Dakota indicated a steady decline in levels of protein, phosphorus and carotene as the season progressed. A nutritional decline in some native species during the growing season along with variations between the warm and cool season species and the tall and short grasses was reported by Erickson, Barker and Haugse (1977). Ferebee *et al.*, 1972 reported that both brome and alfalfa declined in nutritional value with advancing physiological growth stage. The following study was designed to determine the major nutritional components of the predominant species in the Sheyenne Grasslands throughout the grazing season.

Procedure:

The indivual grass species (replicates of four) were clipped at ground level from ungrazed areas every other week from early June until early October for four years. The species sampled were: wooly sedge, big blue stem, switch grass, little blue stem, needle and thread, blue grama, and Kentucky blue grass. The samples were air dried, ground through a 30 mesh screen and analyzed (in duplicate) by standard procedures for the nutritional components. Results of the analyses are presented in Tables 1 through 5. Dry matter, ash, protein and phosphorus were determined by the A.O.A.C. (1975) methods, acid detergent fiber and acid detergent lignin were analyzed by the method of Goering and Van Soest (1970) and calcium, magnesium and potassium were determined by atomic absorption spectrophotometry.

Results and Discussion:

Protein levels were the highest during the early growth stages in all the grasses and sedge except Kentucky blue grass (Table 1). The cool season species were more variable in protein as the season progressed, which would indicate their growth patterns are more temperature dependant. During July the protein of Kentucky blue grass and needle and thread (both cool season species) dropped to their lowest levels of the season. Blue grama, primarily an upland warm season grass, was fairly high in protein the entire grazing season. All three of the major upland species (needle and thread, blue grama and Kentucky blue grass) remained fairly high in protein even through September, early October and more than likely for late fall and early winter grazing.

The taller grasses that are the major species in the midland sites (switch grass, little and big blue stems) were lower in protein and even dropped below the level required for beef cows in the second trimester of pregnancy. Range management practices that encourage the use of the early growth of the more productive taller grasses and sedges, which are mainly found on lowland and midland sites, are recommended. The data would indicate that a deferred grazing system on the upland sites would result in a more desirable nutritional balance for the livestock and a more productive use of the range.

Phosphorus concentrations of the various grasses (Table 2) follow similar patterns to that of protein (correlations as high as .81 for sedge) in that during periods of rapid growth phosphorus and protein were high. The cool season species, being quite dormant in July and August, were low in phosphorus during these periods with the phosphorus concentrations increasing during September when days were cooler and fall rains started. The tall grass species were considerably lower in phosphorus compared to the short grasses. Most of the grasses would be deficient in meeting the phosphorus requirement of cows in any reproductive stage. Even early in the season, when phosphorus levels of grasses are the highest, the requirement of the lactating-pregnant cow would not be met (.28 per cent NAS-NRC for Beef 1976). None of the grasses at any growth stage would meet the phosphorus requirements of cows, replacement heifers and bulls or growing steers and heifers except for blue grama and needle and thread for a short period in September for cows in the second trimester of pregnancy. Phosphorus supplementation is recommended throughout the entire grazing season.

As the season progresses the fiber and lignin content increases in all the grasses with some variations due to climatic conditions such as rainfall and temperature which stimulate growth and reduce concentrations of these fibrous fractions (Tables 3 and 4). In most cases fiber and lignin were quite highly related to each other; for example, a correlation of .77 in switch grass. The relationship of fiber and lignin to digestibility is negative, indicating that as fibrous portions increase, digestibilities decrease. Correlations of over $-.70$ were observed for fiber and digestibility in blue grama, needle and thread, and wooly sedge.

The estimated digestibilities (Table 5) are very high during the early growth stages in all grasses and sedge. There is a marked decrease in digestibility during July and in most cases continued to decrease into October. Short grasses on the upland sites (blue grama and Kentucky blue grass) do not drop as low in digestibility as the other grasses and would provide enough energy for the cows in the second trimester of pregnancy.

The nutritional value of sedge was similar to the taller grass species early in the season but the cattle preferred not to graze the low areas after three to four weeks of

growth had accumulated. Management practices which would encourage repeated grazing of the more productive low areas would improve both the range carrying capacity and the nutrition available to the livestock. The upland areas were more nutritious than the low and mid areas in the latter part of the grazing season, therefore, deferred grazing in these areas is desired.

The requirements for calcium, magnesium and potassium for the lactating cow during the first one third of pregnancy are .28, .18 and .60 per cent (NAS-NRC for Beef 1976) respectively. These levels were amply supplied by the composite grasses during the entire season (Table 6). The requirement for calcium in the second trimester of pregnancy drops to .18 per cent. It is likely that the magnesium and potassium requirements are also reduced, but this information is not given in the NAS-NRC Requirements for Beef 1976. The range grasses would also provide enough of these minerals to meet the requirements of heifers, steers and replacement bulls gaining 1.5 pounds per day. It has been suggested by Mayland, Grunes and Lazar 1976 that a potassium to calcium plus magnesium ratio of 2.2 on the milli-equivalent bases could cause grassy tetany. The early June grasses resulted in an average ratio of 1.72 and then declined as the season progressed (Table 6). The average phosphorus content during the year was considerably higher ($P<.01$) in the composite upland sites compared to the other two sites (Table 7). The upland and midland composite samples were higher ($P<.01$) in calcium than the lowland samples.

Summary:

Grasses in Sheyenne National Grasslands differ in their nutritional value. All of the species were relatively nutritious during early growth stages or periods of rapid growth. Phosphorus was deficient most of the season in most of the grasses in meeting the requirements of gestating-lactating cows, growing and replacement beef cattle. Phosphorus declined as the season progressed, which resulted in a deficiency even for beef cows in mid gestation. Protein and dry matter digestibility follow the patterns of phosphorus. Based on digestible energy estimates from digestibility analysis, additional energy would have to be supplied to obtain growth rates of the replacement and growing cattle of one and one-half pounds or above per day, after mid-July. Cool season grasses vary more in feeding values during the season as they were more affected by changes in temperature and rainfall. Upland grasses do not decline in nutritional value to the same extent as grasses in the lowland and midland sites. The upland grasses were shorter and had more leaf to stem ratio, which might account for the higher feeding value. The sedge, which is the major lowland species, is very productive and highly nutritious during the early growth but decreases very rapidly in feeding value and palatability as the season progresses. Burning, mowing or increased grazing rotation improves the utilization of low areas and defers grazing on the upland sites until later in season. These practices would also improve the nutrition available to livestock grazing these areas.

Table 1. Protein of the major species from early June to early October

	Average Percentage on 100% Dry Basis From 1972 to 1975						
Week	Wooly Sedge	Big Blue Stem	Switch Grass	Little Blue Stem	Needle & Thread	Blue Grama	Kentucky Blue Grass
24	12.26	11.12		8.35	11.00	11.78	9.72
26	10.24	9.93	9.24	8.18	8.24	10.25	9.32
28	9.29	8.81	9.15	7.60	7.50	10.49	9.71
30	7.14	8.09	7.90	7.71	6.64	11.13	6.00
32	7.34	6.62	7.30	6.27	8.98	9.98	8.20
34	9.50	7.44	7.51	7.01	9.23	10.24	9.39
36	9.69	5.33	6.18	6.02	10.45	10.87	10.93
38	7.78	5.35	6.76	5.86	9.65	10.54	11.00
40	7.07	4.42	4.42	5.05	9.00	7.18	9.72

Protein levels within all grasses varied from week to week with some values significant at $P<.01$ level.

Protein requirements (NRC for Beef 1976).

Gestation first three months 9.2%.

Gestation remainder 5.9%.

Growing (1.5 lbs./day) steers and heifers 10-11%.

Table 2. Phosphorus of the major species from early June to early October

Week	Average Percentage on 100% Dry Basis From 1972 to 1975						
	Wooly Sedge	Big Blue Stem	Switch Grass	Little Blue Stem	Needle & Thread	Blue Grama	Kentucky Blue Grass
24	.159	.142	.137	.117	.210	.196	.185
26	.128	.140	.137	.102	.162	.155	.163
28	.136	.125	.121	.102	.141	.169	.135
30	.076	.116	.106	.096	.113	.146	.096
32	.121	.085	.082	.072	.118	.139	.101
34	.135	.104	.113	.113	.178	.187	.136
36	.117	.115	.109	.099	.184	.201	.160
38	.056	.066	.084	.074	.157	.185	.140
40	.067	.072	.076	.067	.117	.128	.128

Phosphorus levels within all grasses varied from week to week with some values significant at P<.01 level.
Phosphorus requirements (NRC for Beef 1976).
Gestation first three months .28%.
Gestation remainder .18%.
Growing (1.5 lbs./day) steers and heifer .18 to .28 lighter weights higher requirements.

Table 3. Acid detergent fiber of the major species from early June to early October

Month	Average Percentage on 100% Dry Basis From 1972 to 1975						
	Wooly Sedge	Big Blue Stem	Switch Grass	Little Blue Stem	Needle & Thread	Blue Grama	Kentucky Blue Grass
June	39.3	39.6	41.7	45.4	43.8	37.5	44.8
July	38.4	39.7	40.8	46.6	42.5	39.8	41.4
Aug.	42.8	43.2	43.5	47.0	44.2	40.5	45.9
Sept.	40.8	44.8	43.5	45.0	44.1	44.0	43.7
Oct.	42.7	48.3	48.1	50.8	44.0	45.6	42.7

Acid detergent fiber levels within all grasses varied from week to week with some values significant at P<.01 level.

Table 4. Acid detergent lignin of the major species from early June to early October

Month	Average Percentage on 100% Dry Basis From 1972 to 1975						
	Wooly Sedge	Big Blue Stem	Switch Grass	Little Blue Stem	Needle & Thread	Blue Grama	Kentucky Blue Grass
June	3.2	4.5	4.8	4.5	4.6	3.7	4.5
July	3.5	3.0	3.8	5.5	5.2	3.7	4.0
Aug.	4.2	4.8	5.5	5.9	6.2	5.0	4.2
Sept.	3.7	5.4	5.8	4.6	6.2	4.8	4.9
Oct.	5.6	6.9	6.5	6.2	6.6	5.4	5.5

Acid detergent lignin levels within all grasses varied from week to week with some values significant at P<.01 level.

Table 5. In vitro dry matter digestibilities[1] of the major species from early June to early October

	Average Percentage on 100% Dry Basis From 1972 to 1975						
Month	Wooly Sedge	Big Blue Stem	Switch Grass	Little Blue Stem	Needle & Thread	Blue Grama	Kentucky Blue Grass
June	73	64	53	56	59	74	62
July	57	65	54	54	56	61	55
Aug.	46	46	43	38	43	52	47
Sept.	40	46	40	37	44	44	43
Oct.	26	42	37	38	39	46	51

In vitro dry matter digestibilities levels within all grasses varied from week to week with some values significant at P<.01 level.

[1]*Laboratory technique (Tilley and Terry, 1963).*

Table 6. The major minerals in composite samples taken through the grazing season for four years

	Average Percentage on the 100% Dry Basis		
Week	Ca	Mg	K
Early June	.600	.197	1.292
Late June	.645	.418	1.506
Early July	.708	.259	1.417
Late July	.912	.309	1.034
Early August	.705	.199	1.093
Late August	.875	.231	.997
Early Sept.	.750	.241	1.288
Mid Sept.	.728	.218	.689
Late Sept.	.914	.276	.841
Early Oct.	.758	.189	.476
P<	.05	NS	.01

Table 7. The major minerals in composite samples taken through the grazing season for four years in each of the three sites

	Average Percentage on the 100% Dry Basis			
Site	Phosphorus	Ca	Mg	K
Upland	.192	.803	.203	1.087
Lowland	.124	.592	.306	1.156
Midland	.119	.777	.295	1.059
P<	.01	.01	NS	NS

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