Mineral and Protein Contents of Blue Grama and Western Wheatgrass[1]

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Highlight

Mineral and crude protein contents of blue grama and western wheatgrass were influenced by stage of maturity and precipitation at the Archer Substation near Cheyenne, Wyoming during the growing season in 1965. Mineral and crude protein levels of the two grasses generally declined with maturity.

Contenido de Minerales y Proteinas en el Navajita Azul (*Bouteloua gracilis*) y Western Wheatgrass (*Agropyron smithii*)

Resumen[2]

Este estudio se llevó a cabo en la Subestación de ARCHER cerca de Cheyenne, Wyoming, EUA. El contenido de proteína de cada especie declinó generalmente con el desarrollo. Sin embargo, el navajita azul mostró variaciones en el contenido de proteína por el crecimiento nuevo después de las lluvias aún durante el otoño y después de algunos días con heladas. Se observó un aumento rápido en el contenido de proteína con el crecimiento nuevo pero éste no ocurrió para el Western Wheatgrass.

A mediados de agosto el contenido de fósforo en ambas especies declinó por abajo de los requisitos alimenticios dados por el National Research Council (NRC). Esto sugiere la necesidad de empezar la suplementación de fósforo en agosto. El contenido de cobre en el mes de julio para ambas especies estuvo abajo de los requisitos alimenticios del NRC, pero los borregos no mostraron síntomas de deficiencias. Cada especie tuvo bastante calcio, manganeso, magnesio y hierro para toda la estación de pastoreo.

The chemical composition of native grass species can vary with soil fertility, stage of growth, climate, and the inherent characteristics of the species. Phillips et al. (1954) reported that the quantity of protein, acid-soluble ash, and ether extract declined during maturation of eight different grasses. The amounts of lignin and crude fiber which are assumed to be undigestible, increased with maturity.

Evidence indicates that the food value of range forage species declines during the growing season. Reid et al. (1959) emphasized that the stage of maturity is directly related to consumption as well as nutritive value of forages. During 1965, a study to evaluate the mineral and crude protein

Table 1. Daily precipitation (inches) and average monthly day and night temperatures (F) for June, July, August, September, and October. Archer Substation, Wyoming 1965.

Date	June	July	Aug.	Sept.	Oct.
Precip.					
1	.03				
2		.01			
3	.27		.57		.10
4					
5	.08	.11		.08	
6					
7	.02			.03	
8	.01	.02			
9	.19				
10	.90			.19	
11	.42				
12	.58				
13					.06
14	.03		.06		.05
15	.05		.07		
16	1.29			.46	
17	.36	.01	.03		
18	.14	.01	.03	.19	.02
19					
20	.26			.10	
21				.08	
22		.20		.23	
23	.12	.26		.42	
24	.24	.20			
25		.34			
26		.05			
27		.46			
28					
29					
30			.02	.20	.15
31					.15
Total	5.09	1.67	.78	1.98	.38
Av. Day Temp.	65.4	76.1	73.1	57.1	54.5
Av. Night Temp.	52.3	60.4	56.7	43.1	38.7

[1] Contribution from Northern Plains Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and the Wyoming Agricultural Experiment Station, Journal Article No. 355.

[2] Por Ing. Edmundo L. Aguirre, Dep. de Zootecnia, ITESM, Monterrey, N. L., Mexico.

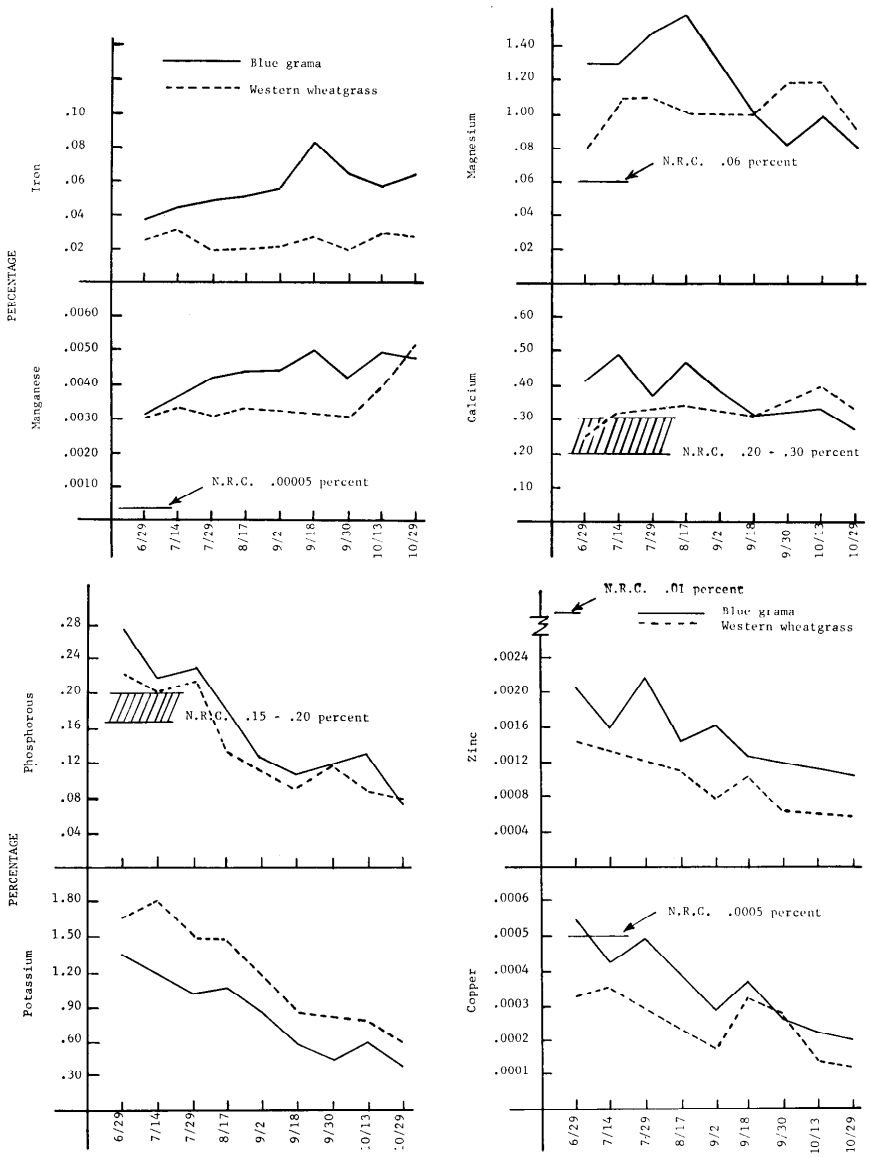

FIG. 1. Percentage chemical composition of blue grama and western wheatgrass from the Archer Substation, Wyoming. 1965.

content of blue grama grass and western wheatgrass was conducted at the Archer Substation near Cheyenne, Wyoming.

Study Area and Procedures

Vegetation on the area was chiefly blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), and western wheatgrass (*Agropyron smithii*). The area was open to grazing by sheep. Because of preferential grazing, only blue grama was grazed. The western wheatgrass on the collection area produced no seed heads during the 1965 season, and remained green and in a vegetative stage throughout the collecting period.

Blue grama and western wheatgrass were clipped to ground level approximately every two weeks from June 29 through October 29 on a native pasture moderately grazed by sheep. Blue grama produced numerous seed heads that were included in the samples. Plant materials were air-dried and ground with a stainless steel Wiley mill with 60-mesh opening. Minor elements were determined by the atomic absorption method.[3] Phosphorous and crude protein were determined by techniques described by A. O. A. C. (1955).

The 45-year average annual and seasonal (April 1 to September 30) precipitation at the Archer Substation is 14.71 and 11.52 inches, respectively. Annual and seasonal precipitation during 1965 were 16.39 and 13.04 inches, respectively. Table 1 shows the amount and date of precipitation for June, July, August, September and October 1965. Average day and night temperatures for June, July, August, September, and October are also shown on Table 1. During the period September 15 to September 30, eleven daytime temperatures between 20 F to 30 F were recorded. The average daytime and nighttime temperatures were determined from the following equations:

$$\text{Average day temperature} = \text{Tmax} - 0.25\,(\text{Tmax} - \text{Tmin})$$

$$\text{Average night temperature} = \text{Tmin} + 0.25\,(\text{Tmax} - \text{Tmin})$$

Results and Discussion

The stage of maturity and climate influenced mineral uptake. Phosphorous, potassium, copper, and zinc decreased with maturity as expected (Fig. 1). Calcium and magnesium decreased with maturity in blue grama but not in western wheatgrass. Iron content of western wheatgrass remained fairly constant during the growing season, and manganese content increased after September 30. The decline in iron and manganese contents in the blue grama after September 18 was halted later in the season by periods of precipitation.

The calcium, manganese and magnesium contents of both grasses were adequate for livestock nutrition throughout the grazing season, according to the standards set by the National Research Council (1964). According to Morrison (1956), the iron content necessary for adequate nutrition is one-tenth or less of that of copper. Thus, the iron content was more than adequate in both species.

Phosphorous became deficient before the August 17 clipping date in western wheatgrass and shortly after that date in blue grama. The N.R.C. has suggested that .01% zinc in forage is adequate for livestock nutrition. Thus, the zinc content of the blue grama and western wheatgrass did not meet the N.R.C. nutritional requirements of animals throughout the growing season.

[3] Plants were digested with nitric, perchloric, and sulfuric acid and analyzed in accordance with "Analytical Methods for Atomic Absorption Spectrophotometry." Perkin Elmer Corporation. Norwalk, Conn. Jan. 1962.

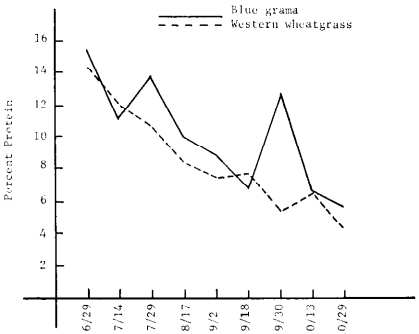

FIG. 2. Percentage crude protein of blue grama and western wheatgrass collected at nine dates. Archer Substation. 1965.

According to N.R.C. requirement of .005%, the copper content was deficient after the first clipping date in blue grama and throughout the season in western wheatgrass.

No minimum requirement for potassium has been established by the N.R.C.

Crude protein content of blue grama during June was 15.4% but decreased to 5.3% by the end of October (Fig. 2). These results are similar to those described by Whitman et al. (1951), in North Dakota.

The crude protein content of blue grama varied considerably during the nine collection dates throughout the growing season. This upland warm season grass responded to small amounts of precipitation by additional growth, which coincided with sharp increases in protein content of blue grama forage.

Blue grama also may respond to early fall precipitation by production of new growth, thus increasing crude protein content. The abrupt crude protein increase at the end of September was preceded by nine days of minimum temperatures below 32 F, during which 1.68 inches of precipitation were received as rain and snow. The large increase in crude protein content was not accompanied by significant changes in mineral content.

Western wheatgrass declined steadily in crude protein content from 14.5% on June 29 to 4.7% on October 29, with no major fluctuations (Fig. 2). Apparently, western wheatgrass does not respond to fall precipitation. The percentage protein in June was identical to that reported for western wheatgrass by Whitman et al. (1951), who also reported a steady decline in protein throughout the growing season.

By September, blue grama and western wheatgrass had lost over 46% of their original protein value. This loss amounted to 66% by the last of October. According to the N.R.C., crude protein requirements are 7.5 to 8.0% for mature animals and 10.5 to 11.0% for growing animals. After mid-August the crude protein content was insufficient to meet the N.R.C. requirements.

The mineral and crude protein levels of the clipped samples of western wheatgrass and blue grama generally declined with maturity. In some instances the levels were below the recommended N.R.C. levels for adequate nutrition. However, by selectively grazing plant parts or other grasses and forbs present on the area, the sheep may have consumed sufficient minerals and protein to meet their productive needs.

Since the phosphorous levels of the two grasses dropped off sharply in August, it is possible that phosphorous declined in other grazed plants. Thus, it is suggested that supplemental feeding of phosphorous may be necessary in late summer for this area.

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