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Chemical Composition of the Diet of Cows Grazing an Arid Range[1]

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Chemical composition of range plants offers an indication of their nutritive value. The protein content of forages usually decreases as plants mature. The levels of fiber and lignin are generally reflections of the availability of energy from the plant, because as plants grow and mature the level of fiber and degree of lignification increase and the digestibility of these fibrous portions decreases. Several New Mexico studies (Watkins, 1943; Watkins and Repp, 1964; and others)have reported the chemical composition of range plants collected throughout the state. These reports concern forage species found in a pasture without emphasis on proportions or quantities of each species grazed by livestock. Also, sampling has not included many forbs, which may constitute a major portion of the diet of grazing cows.

The objective of this study was to determine the chemical composition of the plant species grazed by cattle on an arid range in southern New Mexico.

Procedure

Samples of forages were collected on the Jornada Experimental Range, 25 miles north of Las Cruces, New Mexico. The climate is typical of the arid phase of the semidesert grassland. The average annual precipitation is 22.9 cm. and the average growing season (July-September) precipitation is 12.7 cm. The precipitation during the test (1962-63) was nearly 140% of the average with double the average for the summer of 1962 (25.5 cm.), near average in the fall of 1962, but below average for the winter of 1962-63.

The major plant species are: burrograss (Scleropogon brevifolius Phil.); mesa dropseed (Sporobolus flexuosus (Thurb.) Rydb.); black grama (Bouteloua eriopoda (Torr.) Torr.); leatherweed croton (Croton corymbulosus Engelm.); and soaptree yucca (Yucca elata Engelm.). Data by soil type and average basal cover of the plant species by soil type were reported by Herbel and Nelson (1966a).

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Samples for chemical analyses were collected from March, 1962, through February, 1963. Two men observed test cows grazing, and selected plants or plant parts similar to those consumed by the cattle (Herbel and Nelson, 1966b). Test cows of both Hereford and Santa Gertrudis breeds were selected at random from a herd of 15 cows of each breed grazing the range. They were marked with white paint and observed continuously for a 24-hour period once every four weeks. Another cow of each breed was observed once every four weeks during daylight hours only. The samples collected were based on daylight grazing selection by the test cattle; but observations of night-time grazing indicated no notable change in species selected between daylight and night-time grazing.

The forage samples were identified according to species, stage of maturity (Harris et al., 1967), and date of collection. Samples of a single species which were of the same stage of maturity and collected in the same month were combined. Also, in many instances samples of certain species which were collected at the same stage of maturity in successive months were combined. In a few instances samples were not of adequate size for analyses and were discarded. During each observation period additional samples of each plant species were collected in the proportions estimated being consumed by the cow, and were combined to form a composite sample representing the diet consumed on that day. All samples were dried before analyses.

The dry matter, ash, protein, and ether extract contents of the samples were determined by A.O.A.C. (1965) methods. Acid detergent fiber and lignin were determined by the method of Van Soest (1963). Only the protein and acid detergent fiber contents of nine species are presented here.

Results and Discussion

A total of 117 samples representing 35 plant species were collected. The seasonal protein contents of nine species are shown in figure 1. The species shown include the five previously listed plus red threeawn (Aristida longiseta Steud.), alkali sacaton (Sporobolus airoides (Torr.) Torr.), woolly paperflower (Psilostrophe tagetinae (Nutt.) Greene), and russianthistle (Salsola kali L.).

Red threeawn was consumed during much of the year. Its highest protein content was 10.4% in the August-September sample. Samples collected later showed the expected decrease in protein with advancing stage of maturity and weathering. The protein content of black grama varied only slightly throughout the year (4.6 to 6.7%). Three other perennial grasses were eaten in several of the months. Burrograss contained 11.8% protein in the July-August sample, and about 7.5% protein during the winter months. High values for alkali sacaton were near 8% in several of the months and the low values were 4.2% protein in December and January. Mesa dropseed was eaten regularly and contained from 4.4 to 9.2% protein.

The protein content of three forbs exceeded 12% in many instances and furnished considerable quantities of protein during the winter

months. Leatherweed croton was eaten in May and from August through December. Its protein content exceeded 13.5% in four months, but declined to a low of 8.4% in December. Woolly paperflower was eaten in June and July when it contained near 15% protein and from October to February when its average protein content was 13%. Immature russianthistle was readily eaten. The finer parts of this species were eaten during the winter months when they contained high levels of protein (near 10%). Soaptree yucca leaves contained near 10% protein and were consumed from November through February.

The seasonal acid-detergent fiber (ADF) content of six species is shown in figure 2. The ADF content of the three perennial grasses (red threeawn, black grama, mesa dropseed) varied from a low of 42 to a high of 54%. Woolly paperflower contained less ADF (near 32%) in early summer but slightly more ADF (near 57%) during the winter than the perennial grasses. Russianthistle contained unusually low levels of ADF in all seasons. The low of 21.6% in August-September was considerably lower than the 42 to 47% in the perennial grasses in these same months. Likewise the high values of 41% for russian-thistle in January and February were lower than the 46 to 53% for the perennial grasses. Soaptree yucca leaves contained 36.0 to 46.2% fiber.

The protein and ADF contents of the several individual species grazed by cattle were generally quite variable. The lack of response of cattle to supplemental protein in this area might be explained by the high protein content of the composite samples representing the cow's diet as compared to the protein content of some of the major grass species. The average protein content of composite samples for each of the months is shown in Figure 3. The values equalled or exceeded NRC requirements in all months except February when the protein deficiency was slight. The protein content was highest (12.0%) in July. Values were 9.9% or higher in eight of the months, and had declined only to 6.6% in February.

Summary

The protein content of composite samples of range plants representing diets grazed by cows was adequate in all months except February, when the deficiency was slight. Protein content of the grasses was variable and exhibited the expected pattern of highest values for the samples collected at early stages of maturity and lowest values for dormant and overripe samples. If the diets had consisted only of grasses, protein would have been deficient for at least 9 months of the year. Many samples of forbs contained between 14 and 16% protein and contributed considerably to the protein intake of the cows.

The acid detergent fiber (ADF) content varied considerably among plant species and among months (stages of maturity). Many forbs contained less ADF than grasses and were eaten readily during many months.

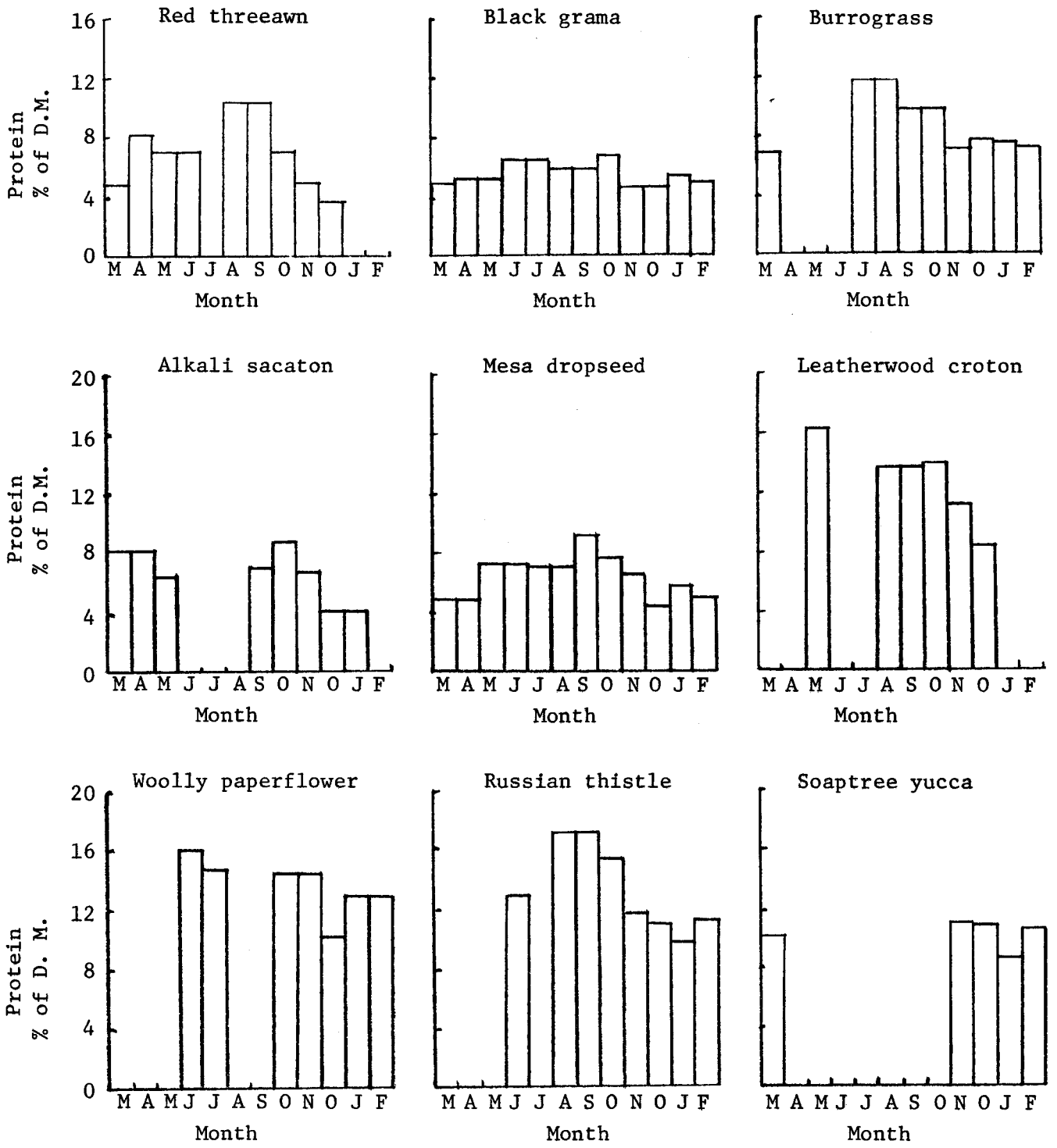

Fig. 1. Seasonal protein content of nine species of plants grazed by beef cows.

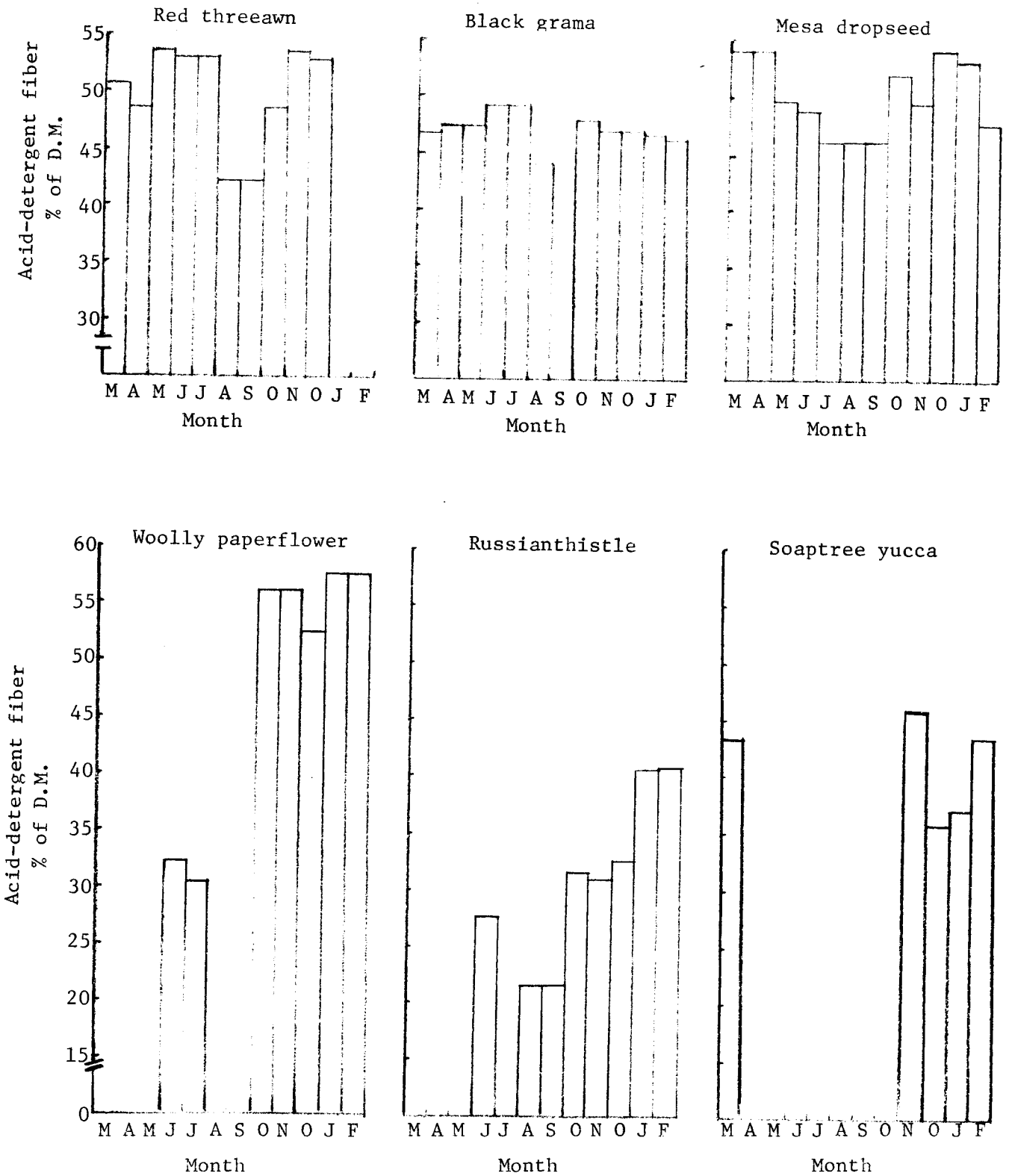

Fig. 2. Seasonal acid detergent fiber content of six species of plants grazed by beef cows.

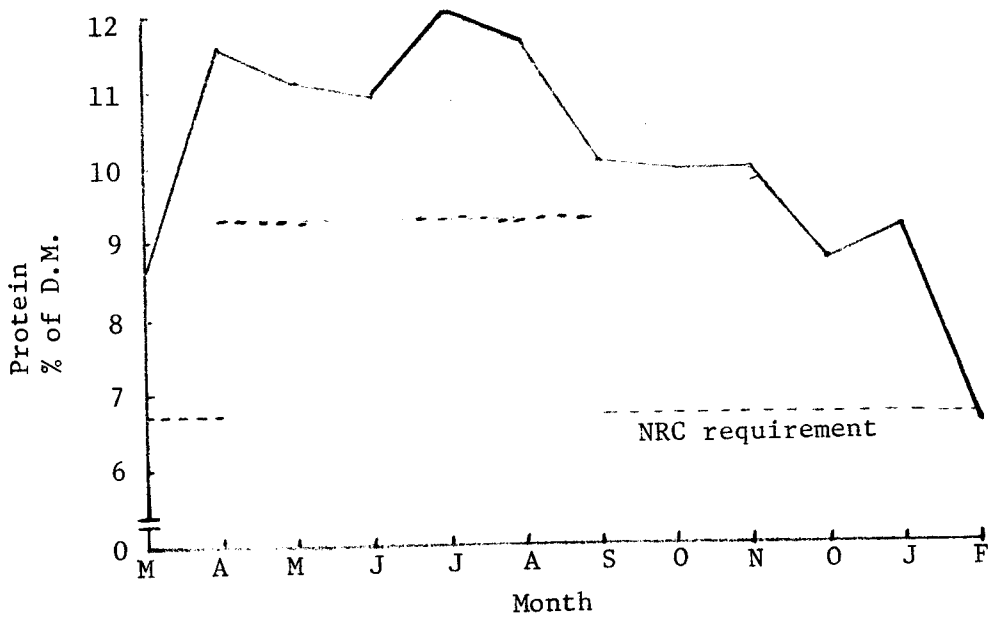

Fig. 3. Protein content of composite samples of cow diets.

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