FORAGE QUALITY OF COMMON BUFFELGRASS AS INFUENCED BY PRESCRIBED FIRE

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ABSTRACT

Response of common buffelgrass (Cenchrus ciliaris) nutritional components to prescribed fire was monitoried during two consecutive years. Prescribed burning during late winter generally increased crude protein (CP), total digestible nutrients (TDN), phosphorus (P), Calcium (Ca), and potasium (K) levels for 3-4 months post-burn. CP and TDN levels increased after burning in excess of lactating cow requirements. Ca and K levels were adequate at all times. Amounts of P increased slightly with burning but generally were below minimum livestock needs. These results indicate that winter-burned common buffelgrass pastures can provide high quality forage to grazing animals during spring months. Animals with high nutritional needs can use burned buffelgrass regrowth to their advantage during this critical period of the year.

Key Words: forage quality, common buffelgrass, prescribed fire, crude protein, total digestible nutrients, phosphorus.

INTRODUCTION

There is a long history of man's use of fire on rangelands (Nelson and England 1978; Hanselka 1980; Pyne 1982). Burning objectives have varied from pasture renovation and brush and weed suppression to parasite control (White and Hanselka, 1989). One of the earliest objectives, and a major management goal today, is to enhance the palatability and nutritional quality of range and pasture forage plants by the application of prescribed fire (Chapin and Van Cleve 1978).

Burning removes mature, unpalatable herbaceous foliage and litter and often increases herbage yields (Wright 1974, Mayeux and Hamilton 1988). Many browse plants sprout profusely following burning producing regrowth containing generally elevated, albeit, short-lived nutritional levels (Dewitt and Derby 1955; Springer 1977; Rasmussen et al. 1983; Wood 1988). There is also a general increase in livestock and wildlife utilization of regrowth forages following fire (Klett et al.1971; Oefinger and Scifres 1977; Drawe 1980; Mutz et al. 1985). Increased utilization and a higher quality diet translates into increased productivity from range cattle (Anderson et al. 1970; Kirk et al. 1974; McGinty et al. 1983).

Erratic forage quantity and quality are major limiting factors that affect beef production in South Texas. Low calf crops and weaning weights, breeding failures, and late calves in the region are related to low nutritional planes. Several "improved" grasses have been planted in an effort to provide a more stable nutritional regime for livestock. The most successful of these has been common buffelgrass (Cenchrus ciliaris. Buffelgrass was introduced into South Texas in the 1940's and presently occupies over 1,700,000 acres in the region (Hanselka, 1988). Over 3 million acres have been seeded to buffelgrass in Mexico (Ibarra 1988).

Buffelgrass nutritional values, such as dry matter digestibility, crude protein, and phosphorus, are generally greater than in the major native grass species (Holloway and Varner 1985; White and Wolfe 1985; Gonzalez and Everitt 1982). Quality is slightly better than or similar to other introduced grass species such as Bell Rhodesgrass (Chloris gayana) and Kleberg bluestem (Dicanthium annulatum (Mutz and Drawe 1983).

Prescribed burning affects the nutritional characteristics of buffelgrass much as it does other bunchgrasses. Elevations in concentrations of crude protein and phosphorus were reported by Everitt and Mayeux (1983). Burned buffelgrass has been used by livestock more than 2.5 times heavier than non-burned pastures due to improved palatability and increased quality of regrowth following fire (Hamilton and Scifres 1982; Hamilton 1985). White and Wolfe (1985) quoting Chamred, 1984, reported greater average daily gains on heifers that were grazed on burned buffelgrass pastured as compared to those grazed on non-burned pastures.

The objective of this study was to determine the influence of prescibed fire on the level of certain nutritional levels in common buffelgrass. The longevity of any changes was also monitored.

METHODS AND MATERIALS

Descriptions of Sites

This study was conducted at three locations within the Rio Grande Plains of Texas. Pastures on the Cerrito Prieto and the Howell Ranches were monitored in 1986. The Cerrito Prieto Ranch is located 10 mi south of Encinal in Webb county. Sampling was initiated on a gray sandy loam range site composed of Copita series soils. Topography is gently rolling with less than a 3% slope. The Howell Ranch is located ca.7 miles west of Premont in Jim Wells County. The study pasture was composed of loamy sand and tight sandy loam sites with soils in the Delfina series.

The Montemayor Ranch, 15 miles east of Benavides in Duval county, was the study site in 1987. Samples were taken from a fine sandy loam site. Soils on this site are in the Delmita series.

Each pasture originally supported dense communities of mesquite-dominated (Prosopis-Acacia) mixed brush. Each had been root plowed and raked with the brush stacked and burned. Common buffelgrass was then broadcast seeded in the pasture. The ages of the buffelgrass stands ranged form 2 to 19 years.

Prescribed Burning and Sampling Procedures

Late winter burns were selected to increase forage quality during the spring calving period when a higher nutritional plane was necessary. This is also the season of the year when most range burning occurs in South Texas for the purpose of brush suppression (Hamilton and Scifres 1982). The Premont and Encinal sites were burned in February, 1986 and the Benavides site was burned in Febuary, 1987. Twelve foot wide fire lanes were disced completly around each pasture. Burns were installed as headfires following backfiring on the downwind side of the pastures Weather and fuel conditions for each burn are shown in Table 1. Over 90% of the fine fuel (standing crop and litter) on each pasture was removed by the fires. Precipitation data was collected at each site.

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Table 1. Weather and fuel conditions during prescribed burning of common buffelgrass.

Location	Area (Ac)	Burn Date	Air Temp. (F)	Relative Humidity (%)	Wind Speed-Direction (MPH)	Fuel load (lb/Ac)
Premont	75	Feb. 1986	60	40%	0-7 (North)	4000
Encinal	25	Feb. 1986	58	42%	8-10 (North)	2550
Benavides	80	Feb. 1987	55	48%	6-10 (SE)	3543

Five buffelgrass sub-samples of leaves and stems were hand-plucked, at random, simulating grazing, from several plants in the pasture immediately prior to burning. Similar samples were then collected monthly thereafter from the burned pasture and from an adjacent non-burned (control) area for the next 12 months. The samples were oven-dried at 100° F for 48 hours and sent to the Forage Testing Laboratory at Texas A&M University for analysis.

Each sample was analyzed for crude protein (CP), total digestible nutrients (TDN), phosphorus (P), potassium (K), and calcium (Ca). Crude protein was determined by the Kjeldahl method. TDN contents were estimated from acid detergent fiber methods; P was determined by digestion and analyzed with an Intercoupled Plazma Unit (ICP); and K and Ca were determined through block digestion methods and analyzed by atomic absorption spectrometry.

Subsample data were pooled from each location by month. Burned and control values were compared by a Students' t-test and all statistical comparisions were made at the .05 probability level.

RESULTS AND DISCUSSION

Chemical composition of plants is influenced by a variety of morphological, physiological, environmental, and management factors. These include parts of the plant (e.g. stem and leaf); age of plant material; amount and timing of precipitation; air and soil temperatures. Animal nutrition from ranges and pastures will thus fluctuate with varying conditions, season of the year, and plant species composition.

The Texas Rio Grande Plain has a bimodal rainfall pattern with peak monthly total in May and September. July-August and December-January are usually dry periods. Rainfall amounts and distribution in 1986 and 1987 generally followed these trends (Figure 1). However, the summer and early fall of 1986 were relatively dry. Likewise, the fall and winter of 1987 were extremely dry. These dry periods were reflected by changes in crude protein, total digestible nutrients. and mineral levels of common buffelgrass, whether burned or not burned.

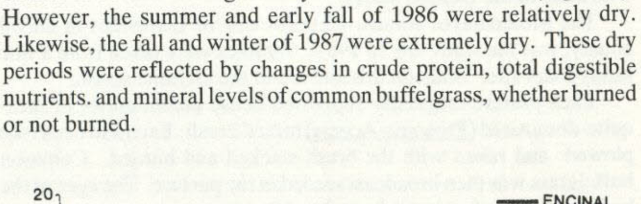

Figure 1. Bimonthly cumulative precipitation totals from Encinal and Benavides, 1986 and 1987.

Crude Protein

Protein, interacting with forage digestibility, in the diet of range cattle is important because it affects forage intake. Cows without adequate protein will have lowered rumen activity, which will reduce forage consumption and, in turn, reduces the availability of all nutrients to the animal. Burning common buffelgrass resulted in a short-term increase in CP content during both years of the study (Figure 2).

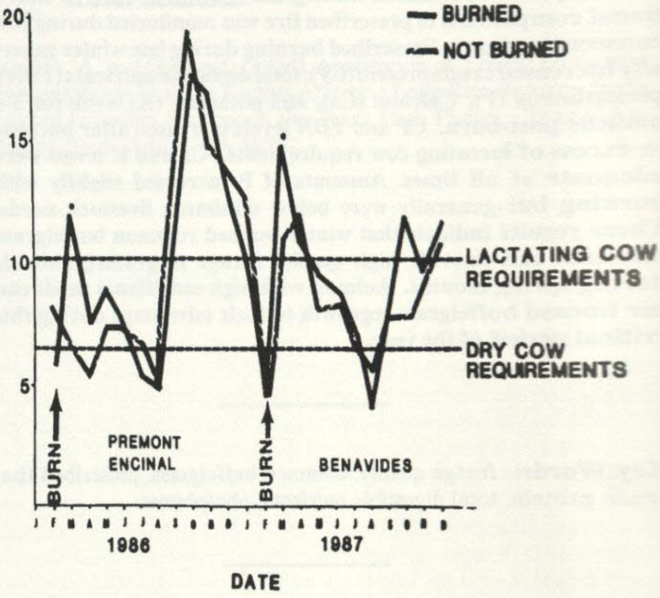

Figure 2. Crude Protein levels (%) in common buffelgrass, 1986 and 1987. (*Significant difference from control at P < 0.05 level)

Crude protein levels significantly increased during March, 1986, to 12% in the burned pasture as compared to 7% in the control pasture. CP levels from the burned pasture remained elevated over non-burned forages through June when plant maturity and summer drought resulted in similar CP levels in both pastures. Similar trends occurred following burning in 1987. CP content of the burned pasture was significantly higher in March compared to the nonburned pasture. Pastures were again similar by May. Another peak in CP content was recorded in the burned pasture following late summer rains in 1987, but was not statistically significant.

CP values were generally sufficient to meet the requirements of a dry cow. Noticeable exceptions occurred in burned and non- burned pastures during the summer and winter stress periods. Levels exceeded requirements for lactation cattle only following burning and/or rainfall peaks.

TOTAL DIGESTIBLE NUTRIENTS

Lack of total feed (mainly energy) is one of the most common deficiencies of breeding cattle during the winter and during the frequent droughts in South Texas. This can cause excessive loss of body weight, delayed breeding, improper fetus development, lowered tolerance to cold weather, and lowered parasite and disease resistance. This may be the result of heavy stocking rates but, more often, is the result of low energy levels in the forage. A high percentage of TDN allows quick passage of forage through the rumen. Burning apparently had little or no effect on TDN content of common buffelgrass (Figure 3). A non-significant increase was recorded following the burn in 1988 but this quickly leveled out in response to rainfall by May. No differences were noted for the remainder of the study. TDN levels from both burned and control pastures ranged between 40% and 60%, except in February, 1987.

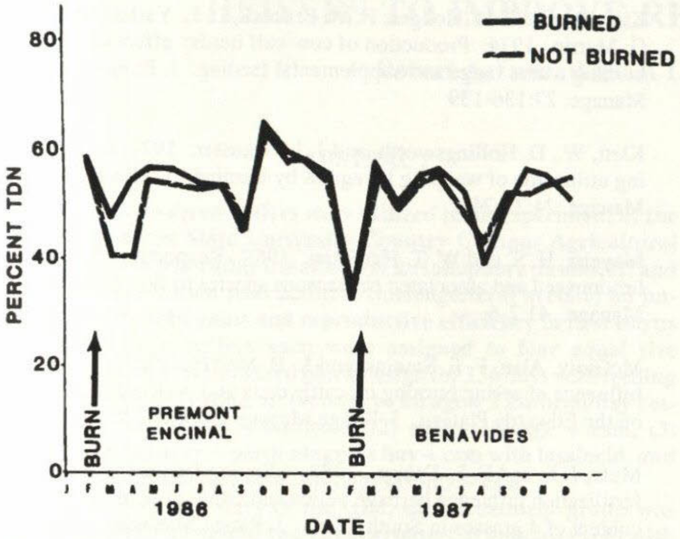

Figure 3. Total digestible nutrient content (%) of common buffelgrass from burned and non-burned pastures, 1986-1987.

Phosphorus

Lack of phosphorus is the major mineral deficiency in Texas. Grass forage plants do not provide a stable supply to meet beef cattle requirements (Everitt et al. 1980; Huston et al. 1981); however brush intake may offset this deficiency. Phosphorus levels were enhanced in the growing season following prescribed fire for 3-4 months with significant increases immediately following the burn (Figure.4). During this same period, phosphorus in non-burned buffelgrass remained below requirements for a dry cow. Phosphorus levels responded to rainfall events whether the grass had been burned or not. However, increases were not as great in non-burned pastures.

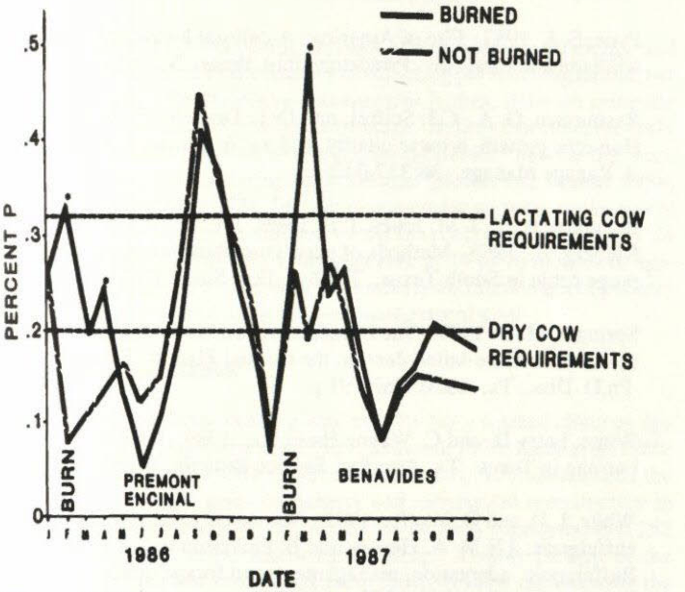

Figure 4. Phosphorus content (%) in burned and non-burned common buffelgrass. (*Significant difference from control at P<0.05 level).

Other Minerals

Potassium is generally not lacking in South Texas forages. However, during a wet winter in highly weathered forage, potassium may be limiting (Hinnant and Kothman 1982) and livestock reproduction impaired. Potassium was present in adequate amounts in both pastures at all times during the study. A low value of .63% occurred in Jan, 1987, but increased to a high of 3.58% in October of 1987 in the non-burned pastures. The burned pasture generally contained slightly higher levels of potassium.

Calcium in buffelgrass forages likewise varied from month to month in response to growth events. However, it is usually not a problem since most of the area soils are calcareous. Burning did not appear to affect calcium content of buffelgrass foliage. Levels, in general, were adequate to meet animal needs on both pastures.

Conclusions and Management Implications

Prescribed burning of common buffelgrass did not result in any long-term nutritional advantages. Short-term increases in crude protein and phosphorus were noted but other minerals and total digestible nutrients remained similar between burned and non-burned pastures. These data follow trends from many areas and species in the published literature. In most situations, any nutritional advantage disappears within 3-4 months post-burn.

However, when higher forage quality is combined with greater availability of green forage on burned pastures, the influence is magnified. For example, spring standing crops of buffelgrass on non-burned pastures consisted of 4076 lb/ac. Of this, 2500 lb/ac (61%) were dry, mature stems and leaves with only 1576 lb/ac (39%)of new green foliage (Hanselka, unpubl. data). The burned pasture produced 2948 lb/ac of green foliage during this same time frame and 90% of the old, dry foliage was removed by fire. The burned pastures "greened up" approximately one month earlier than the non-burned pasture. Ibarra (1988) reports similar responses in Sonora, Mexico.

This access by grazing animals to fresh, quality forage translates into potentially improved animal performance. McGinty et al. (1983) recorded a higher percentage of grass in steer diets on a burned range than in diets on an non-burned range in Central Texas. Livestock weight gains were significantly higher on the burned pastures. White and Wolfe (1985) reported similar results from South Texas and Kirk et al. (1974) drew similar conclusions from long-term studies in Florida.

The burning of buffelgrass pastures can thus provide an increase in the quantity of quality forage to animals with high nutritional requirements during a critical period of theyear. First calf heifers or cows needing a higher nutritional plane as a prerequisite to rebreeding, can use regrowth on burned pastures to their advantage.

Although burning tended to increase phosphorus content of common buffelgrass, levels were too erratic to provide a dependable supply of phosphorus to meet minimum beef cattle requirements. Stress periods and resulting non-growth of grasses caused P levels to drop to very low levels. Since these periods are common in South Texas, it is advisable to provide phosphorus supplement free choice, yearlong to range cattle (Reynolds et al. 1953).

Burning did have positive short-term effect on common buffelgrass quality. Generally, dry weather and poor growing conditions negated this advantage by the summer months. During winter, dry seasons, and/or extended drought, beef cattle should be supplemented based upon requirements, management needs, and forage quality.

In general, the result from this study follow the conclusions of a review by Huston (1980). Regrowth of burned buffelgrass is usually higher in some nutrients and the diets of animals grazing burned pasture should reflect an increased nutrient content. Also, the burning of buffelgrass stands which have excessive amounts of old growth and litter will give the greatest net benefit on diet quality. Benefits of improved diet quality and increased animal productivity are relatively short-lived so the greatest livestock response to burning will be in animals in a high productive state (growing, lactating, rebreeding, etc.)

If these constraints are considered in a buffelgrass forage management program, then prescibed burning has the potential to improve cattle production on South Texas ranches.

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