

EFFECT OF LATE SPRING BURNING AND NITROGEN
FERTILIZATION ON PERFORMANCE AND DIET OF
YEARLING STEERS GRAZING FLINT HILLS RANGE

by

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A MASTER'S THESIS

submitted in partial fulfillment of the
requirements of the degree

MASTER OF SCIENCE


Department of Animal Science and Industry

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1975

Approved by:


Major Professor

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ACKNOWLEDGEMENTS

I wish to take this opportunity to express my sincere gratitude to Dr. Ed Smith for his guidance and direction during my Master's program. I also wish to express my appreciation to Dr. Keith Bolsen and Dr. Jack Riley for their advice and services on my graduate committee. A special thank you is extended to Dr. Robert Schalles for his valuable assistance in the statistical analysis of my data. My appreciation is extended to Mr. Jim Whitney for his hours of work in helping me collect my data. I wish to thank my fellow graduate students for their friendship and inspiration during my graduate studies.

I am grateful to my parents, Mr. and Mrs. Leonard Berger, for their continuous support and encouragement throughout my education.

I lovingly dedicate this thesis to my wife, Peggy, as an expression of appreciation for her love, understanding, and encouragement throughout my graduate program.

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INTRODUCTION

The importance of grassland was described in an address delivered in 1872 by John J. Ingalls, later a senator from Kansas, in this way: "Grass is the forgiveness of nature, her constant benediction. Its tenacious fibers hold the earth in place and prevents its' soluble components from washing into the sea. It yields no fruit in earth or air, and yet, should its' harvest fail for a single year, famine would depopulate the world." In this statement over one-hundred years ago, is expressed the respect with which grassland must be held in a successful agriculture.

Today, about 640 million acres of pasture and range area in the United States are used solely as grazing land. If the present high feed grain prices continue, it will force the beef industry to improve the production and utilization of our native grassland. Weed control and fertilization practices have been widely used in cultivated cropland to increase productivity, but there has been relatively little improvement in rangeland productivity.

Changing the species composition to maximize production is one way of increasing productivity. Management practices such as late spring burning, on Flint hills range, has reduced the weedy species and cool season grasses, and provided more optimum conditions for the most productive species.

Fertilization of native range could also increase productivity in many areas. The amount, combination and long term effects of different fertilizers are being studied in many areas of the U. S. We compared the effect of adding 40 or 80 pounds of nitrogen/acre on beef production of both yearling steers and spring calving cows.

We also compared intake and the quality of the forage consumed for yearling steers on burned and nonburned pastures.

REVIEW OF LITERATURE

Burning Native Range

The burning of native range is as old as the range land itself. Fire was an important part of range land development and was commonly started by lightning. The Indian recognized the value of burning to attract grazing animals. Today, burning is being used in many parts of the United States to increase production of native grasses and reduce the competition from undesirable species.

Research was conducted as early as 1918 on the effect burning had on Flint Hills range (Hensel, 1923). Aldous (1934) reported that late spring burning increased big bluestem, which agrees with work reported by McMurphy and Anderson (1965). The effects burning has on little bluestem have been quite variable. Hensel (1923) reported spring burning increased little bluestem 48%. According to Aldous (1934), little bluestem increased under fall burning, but McMurphy and Anderson (1965) reported little bluestem decreased under fall burning, and that the unburned pastures had a higher percentage of little bluestem than burned pastures.

Anderson, et al., (1970) concluded that late spring burning favored the decreasers, but discouraged the increasers. They found that unburned and early spring burned pastures had 40 to 50% decreasers, while mid and late spring burned pastures had 60 to 70% decreasers. Owensby, et al., (1970) reported that late spring burned, ungrazed, plots produced more herbage throughout the summer than unburned plots. Part of this increase in herbage may be due to the reduction in mulch.

Smith and Young (1959) reported that the crude protein content of the forage on the burned pastures were slightly higher. Smith et al., (1960) found an improvement in the digestibility of the forage on burned pastures, but no difference in consumption of forage dry matter. Grelen and Epps

(1967) showed that on Pine-Bluestem range in central Louisiana crude protein increased to 8.4% on spring burned pasture compared to 6.4% on winter burned pastures. Klett, et al., (1971) reported that on weeping Lovegrass near Amarillo, Texas, burning increased the crude protein content from 3.6% to 7.6%, while increasing forage production 332 lb/acre. Burning also increases the palatability of the resulting forage. Duvall and Whitake (1964) reported that on Longleaf Pine-Bluestem range, under a 3 year rotational burning program, cattle utilized 78% of the available forage the year it was burned, 31% of the available forage the following year, and 18% of the forage the third year after burning. On Pine-Bluestem range in central Louisiana, Grelen and Epps (1967) reported that production was increased more by spring burning than winter burning. According to Wright (1969) in west Texas, tobosa grass burning increased production 1685 lb during a wet year and reduced production 503 lb during a dry year. Burning increased the production and cattle preference for weeping Lovegrass in Texas according to Klett et al., (1971). In central Texas on an Ashe Juniper community, Wink and Wright (1973) found burning improved plant growth in a wet year due to higher soil fertility.

Burning of native range has two main effects on the soil; first, it reduces soil moisture and secondly, raises soil temperature. Anderson et al., (1970) reported that burning did reduce soil moisture, especially early spring burning, due to the greater run-off. Wink and Wright (1973) reported that burning increased drought stress, and also more soil erosion if heavy rain occurs soon after burning on central Texas range.

In the Flint Hills, Owensby and Anderson (1967) found that in the year following a drought, the mid and late spring burned pasture yielded more forage than unburned pastures due to less weeds in the stand. Hensel (1923) and Aldous (1934) found that spring burning increased the soil

temperature. Wink and Wright (1973) reported a soil temperature increase of 2-18⁰F following burning. Owensby and Wyrill (1973) reported a slight reduction in soil phosphorus, organic matter and nitrogen level, but all of these effects were so small, it should have no adverse effects on native vegetation.

One of the big advantages of burning is that it can be used to reduce undesirable species. Owensby and Anderson (1967) reported that late spring burning (May 1) reduced weedy species significantly more than earlier spring burning. Kentucky Bluegrass (*Poa pratensis* L.) and other cool season species are reduced by late spring burning, according to Owensby et al., (1967). This agrees with work reported by Ehrenreich (1959) on Iowa native prairie.

A major problem in the North East Kansas Flint Hills is the infestation of Eastern Red Cedar. Owensby et al., (1973) reported burning reduced the mulch which retarded seedling establishment, as well as controlling 89% of the seedlings, 83% of those trees between 2 and 6 ft, and 39% of those trees over 6 feet tall. Fire killed 100% of the trees less than 2 feet, 77% of the trees between 2 and 6 ft and 27% of the trees over 6 ft fall on Ashe Juniper community in central Texas (Wink and Wright, 1973). Box and White (1969) reported that fall burning of south Texas Chapparal was more effective than winter burning.

The real value of burning can be measured by the effects it has on weight gains. On Flint Hills range, Smith et al., (1965) reported the results of a fifteen year study show that steers on mid and late spring burned pastures gained 20 to 23 lb/steer more than steers on nonburned pastures. Kirk et al., (1974) reported that on two trials, yearly calf production per cow was highest on burned range and lowest on unburned range.

Fertilization of Native Range

Fertilization has been very successful in increasing the productivity of crop land, but has been used very little on native range. Research on range fertilization was started in the 1940's and has shown quite variable results. The criteria used to measure the results was the effect fertilization had on the productivity of the native grasses.

Goetz (1969) reported that in south western North Dakota, Western Wheatgrass showed a continued increase in basal cover and density, while Blue Grama decreased in basal cover, under increasing nitrogen fertilization. A definite increase in unpalatable sage species was apparent as nitrogen fertilization rates increased.

The Blue Grama increased in height 40-50% at the highest rate of fertilization of 100 lb N/acre. Three methods of applying 540 kg of N/Ha, (all applied in one year, equal amounts for three years, or equal amounts for six years) had essentially the same dry matter accumulations according to Powers (1972). Baldwin et al., (1974) fertilized at rates of 0, 1,100, 2,200 and 4,400 lb of 27-12-0 per acre and compared the total herbage production for the next four years. He found that 5,932 lb, 15,789 lb, 18,383 lb and 16,477 lb of forage per acre was produced for each of the four rates, respectively. The increasing rates of fertilization extended the green-forage season and temporarily increased the nitrate nitrogen in the forage. Houston et al., (1973) reported an increase in nitrate-nitrogen level in the forage on shortgrass plains near Cheyene, Wyoming. Application rate of 0, 200, 400 and 600 lb of nitrogen per acre produced the following levels of nitrogen in the forage; 160 PPM, 1220 PPM, 1990 PPM, and 2210 PPM, respectively.

Sneva (1973) used 20 lb of N/acre applied in the forms of ammonium nitrate and urea on Oregon's high desert range, and reported a substantial

increase in production, with the urea fertilized range having a slight advantage. Mason and Milmore (1972) applied nitrogen at various rates from 0 to 450 lb N/acre on Beardless Wheatgrass in southern British Columbia. This was a one time application and the yield responses were measured for the next 10 years. Total yields were increased by all rates of nitrogen with the 450 lb application producing the most forage (7,750 lb) and the no nitrogen treatment producing the least forages (3,000 lb). The most efficient nitrogen rate was at the 25 lb N/acre rate. It produced 25 lb of forage per lb of nitrogen. Foliar application of 40 lb of ammonium nitrate gave the most consistent yield increases when compared to urea on shortgrass range in north central Colorado, (Houston and Van Der Gluijs, 1973).

Different combinations of nitrogen and phosphorus were compared by Bown (1972), and he found that on ranges in south western Utah, a combination of 60 lb N and 60 lb P gave the most increase in forage production. Lorenz and Rogler (1973) compared different combinations of nitrogen and phosphorus fertilizer on shortgrass near Mandan, North Dakota. They found as the nitrogen was increased to a rate of 80 lb/acre, the grass growth increased proportionally, and a combination of 80 lb N and 18 lb of P produced significantly more forage than any other treatment. They also showed that without nitrogen, phosphorus had no significant effect. Larvin (1967) fertilized intermediate wheatgrass near Flagstaff, Arizona with different combinations of nitrogen and phosphorus. He found that nitrogen increased the rate of plant growth and proportionally increased the weed production, but phosphorus had no effect on either rate of growth or weed production. Pettit and Deering (1974) on West Texas range fertilized at the rate of 30 and 60 kg/Ha with ammonium nitrate, ammonium phosphosulfate and ammonium sulfate, and found all fertilizer treatments increased forage

yields, but the ammonium phosphosulfate out yielding the others. They reported that the range had to be in good condition to justify fertilizing it, and that sulfate had to be present to achieve maximum production, but phosphate had little effect on yields. Graves and McMurphy (1969) applied all twelve possible combinations of 0, 40 and 80 pounds of nitrogen, phosphorus and potassium on burned, poor condition prairie range near Stillwater, Oklahoma. They found that nitrogen gave the greatest response, while phosphorus gave only a slight response and potassium had no effect. Billy et al., (1973) found that on Lehmann Lovegrass near Tucson, Arizona, herbage yields were tripled during a year with above average rainfall, but he cautioned against applying nitrogen until they had sufficient rain fall to assure grass growth. Kay and Evans (1968) found that on mixed stands of Intermediate Wheatgrass and Cheatgrass, the application of 30, 60 and 120 lb of N/acre caused the Wheatgrass to be choked out by the Cheatgrass in California. Rehm et al., 1972 reported that on a seeded mixture of warm season prairie grasses in North East Nebraska, nitrogen fertilization increased forage yields three of four years, the fourth year, below normal rainfall may have been the limiting factor. Weeds and cool season species did not increase when the nitrogen was applied on May 15, nor did it have any effect on crude protein or percent digestible dry matter.

Owensby (1970) reported that applying 50 lb of N/acre for four consecutive years, produced an average increase of 1,780 lb of forage compared to nonfertilized plots. Owensby (1969) found that when 50 lb of N/acre was applied, water use efficiency increased over 50 lb of dry matter per inch of available water, probably due to greater root exploration. Nitrogen applied in a dry year was not totally mobilized and it carried over to the next year. The nitrogen content of the forage also increased. Nitrogen application also increased Kentucky Bluegrass and some weedy species in the stand.

Intake and Digestibility

To determine the nutritional value of a forage, we must know the intake and digestibility of the forage. To determine forage intake and get a representative sample of the forage consumed, esophageally fistulated animals as described by Torell (1954) are commonly used. This method requires the experimental animals to be fasted long enough prior to collection to avoid contamination due to regurgitation. This fasting period prior to collection may effect the amount of selectivity normally practiced and thus change the sample from what would normally be consumed. Also, only a portion of the forage consumed actually is collected and there is some question as to whether that portion is representative of the total consumed. Campbell (1968) reported only 26% of the organic matter was recovered when clipped native grass hay was fed. Even with its recognized short comings, the esophageal fistula is still the best method devised to collect a representative sample of a grazing animal's diet.

Collection by esophageal fistula also has some effects on the forage which must be taken into consideration. The biggest change in the forage is the percent ash. Campbell (1968) reported that on native and Bermuda grass, the saliva increased the ash in the forage 2-9 percent. Barth et al., (1970) and Scales (1974) showed similar increases in ash content. Generally there is no significant change in crude protein according to work reported by Barth et al., (1970) and Bath et al., (1956).

A small but significant increase in acid detergent fiber (ADF) and lignin was reported by Barth and Kazzal (1971) apparently due to the drying process. But they reported that there was no difference when samples were dried between 45° and 65°F.

Rao (1973) reported that grazing animals apparently selected plant species that were higher in crude protein and ADF when compared to hand

clipped samples. He also reported that even when they selected for higher crude protein forage, crude protein began to limit gains by mid July. Barth and Kazzal (1971) reported low nitrogen-free extract values when samples of hay were fed to esophageally fistulated animals and compared with samples of hay prior to feeding. The saliva apparently leached out some of soluble carbohydrate in the collection process resulting in a lower nitrogen-free extract. Obioha et al., (1970) reported variation in the type and nutritive value of the forage consumed at different times during the day, however most differences were nonsignificant. He also reported that in only 3 of 10 trials were there any significant differences in the forage selected among various animals.

There are many factors that influence intake in grazing animals. In a situation where forage is plentiful and palatable, physical capacity of the individual is probably most limiting. In mature forage the lignin or crude protein may be the most limiting factor. Forbes and Garrigus (1950) reported that for each percent increase in forage lignin content there was a decrease of 5.8% of maximum intake of total organic matter, and an 8.2% decrease in digestible organic matter intake. The higher the lignin content, the lower the dry matter digestibility, and Streeter (1968) reported a high correlation between dry matter digestibility and forage intake. As cell wall constituents increase voluntary intake declines according to Van Soest (1965). The point at which fiber mass appears to become limiting, occurs when the cell wall content lies between 50 to 60% of the forage dry matter. Rao et al., (1974) reported that as a plant matures it has a depressing effect on intake. Streeter, (1974) reported that forage very low in crude protein, limited digestion and hence intake. He suggested that this critical level is about 4 to 6% crude protein. Rittenhouse et al., (1970) found that supplemental protein did not increase consumption when

the crude protein level of the forage was 5.6%.

To determine total dry matter intake in grazing animals, it is necessary to measure an indigestible indicator in both the forages consumed and the resulting feces. Then a total fecal collection is made and the following equation can be used to determine dry matter consumed, Crampton and Harris, (1969).

$$\text{Dry matter consumed} = \frac{\text{wt of indicator in fecal output on DM basis}}{\% \text{ indicator in forage DM basis}}$$

The indigestible indicators commonly used are chromogen and lignin. Cook and Harris (1951) found both indicators to be quite reliable, but found chromagen to work best on young growing plants, and lignin to work better on more mature plants. The percent digestible dry matter can then be determined by the following equation.

$$\text{Digestible dry matter} = 100 \times \frac{\% \text{ indicator in the forage}}{\% \text{ indicator in the feces}}$$

The same principal has also been used when chromic oxide is fed at a constant rate and then measured by the concentration in the feces by grab samples.

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YEARLING STEERS GRAZING FLINT HILLS RANGE

HIGHLIGHT

This study was conducted on Flint Hills range near Manhattan, Kansas in 1973 and 1974. The effect of late spring burning and nitrogen fertilization, alone and in combination on weight gains, diet and dry matter intake were studied. Cattle with esophageal fistulas and fecal collection bags were used to estimate diet composition and dry matter intake.

Burned pastures produced a higher average daily gain and gain per acre compared to nonburned pastures. Forty and 80 lb of nitrogen per acre, reduced average daily gains, but increased gains per acre due to heavier stocking rates.

Burning influenced diet quality by significantly lowering the cellulose and lignin content of the diet samples collected. Crude protein tended to be higher on the burned pasture, but at a nonsignificant level. Burning had no effect on crude fiber, neutral detergent fiber, acid detergent fiber or hemicellulose of the diets samples.

Burning did not have a significant effect on dry matter intake.

METHODS AND MATERIALS

These grazing trials were conducted on the Kansas State University Range Research unit near Manhattan, Kansas during the summers of 1973 and 1974. Big bluestem (Andropogon gerardi Vitaman) and little bluestem (A. scoparius Michx) constitute the majority of the vegetation, with other warm-season grasses, forbs and a few shrubs making up the remainder.

Four pastures were burned April 24, 1973 and again on April 27, 1974. An aerial application of ammonium nitrate fertilizer (34% nitrogen) was made May 2, 1973 and on May 3, 1974. Two burned and two nonburned pastures received no nitrogen, one burned and one nonburned pasture received 40 lb of N/A, and one burned and one nonburned pasture received 80 lb of N/A both years.

The pastures were stocked from May 3 to October 3, 1973 with mixed steers weighing 487 lb, and from May 1 to October 4, 1974 with Hereford steers weighing 408 lb. The pastures ranged in size from 44 to 60 acres, with 20-30 steers per treatment. The nonfertilized pastures, burned and nonburned, were stocked at 3.3 acres per steer, the pastures fertilized at 40 lb of N per acre were stocked at 2.2 acres per steer, and the pastures fertilized at 80 lb N per acre were stocked at 1.8 acres per steer. All steers were identified and weighed the first of each month, following an overnight stand without feed or water. The initial and final weights were taken with all steers mixed together, the monthly weights were taken weighing the steers in pasture groups. Salt was fed free choice, and the steers were gathered and sprayed for flies as needed. In 1974, one half of the steers were implanted with Ralgro and the other half with Synovex S. Weight changes of the steers used for fecal collections were not included in the pasture gain data.

In both 1973 and 1974 four steers from one nonburned, nonfertilized pasture, and four steers from one burned, nonfertilized pasture were trained to carry fecal collection bags. Bags and harness were similar to those described by Lesperance and Bohman (1961). Steers were removed from the pasture for about 30 minutes twice daily to weigh and empty fecal collection bags. A 500 g sample was taken each morning for analysis. In 1973 fecal collections were made on three consecutive days for three collection periods during July and August. In 1974 fecal collections were made for one 24 hr period at approximately 12 day intervals from June 21 to August 7.

Mature Holstein steers that had been esophageally fistulated according to the method of Van Dyne and Torell (1964), were used to collect diet samples during each of the fecal collection periods. In 1973 two fistulated steers, and 1974 one fistulated steer was used to collect diet samples during each fecal collection period. The steers were fasted the night before collection to reduce diet sample contamination due to regurgitation. It took from $\frac{1}{2}$ to $1\frac{1}{2}$ hours to get a 1000 g sample. An effort was made to keep the fistulated steers grazing in the same area as the steer stocked in that pasture.

The 1973 fecal samples were pooled, giving one sample per steer, each collection period. In 1974 one fecal sample per steer was collected each period. All samples were dried in a forced-air oven at 55°C until a near constant weight was achieved, ground in a Cristy-Morris mill (40 mesh screen); and stored in glass bottles for analysis. Crude protein, crude fiber, dry matter, and ash were determined by A.O.A.C. (1970) procedures. Cell wall constituents were estimated according to methods by Goering and Van Soest (1970).

The least squares analysis of variance (Kemp, 1972) and Duncan's New Multiple Range test (Steele and Torrie, 1960) were used for data analysis.

RESULTS AND DISCUSSION

Burning increased the daily gains on fertilized and nonfertilized pastures when compared to gains on nonburned pastures (Fig. 1). Steers on the burned pastures gained .28 lb more per day than steers on the nonburned pasture, which translates to 43 lb more for the 155 day grazing season. This is more than the 23 lb per steer increase reported by Smith *et al.* (1965), but less than the 48 lb increase reported by Woolfolk *et al.* (1973). The average daily gain was not significantly different between the steers implanted with Ralgro or Synovex S.

Fertilization decreased the daily gain on burned and nonburned pastures when compared to gains on the unfertilized pastures (Fig. 1). The pastures fertilized at 40 and 80 lb N/acre reduced the average daily gain .21 lb and .35 lb, respectively. The pastures were stocked at 3.3, 2.2 and 1.8 A/steer on the 0, 40 and 80 lb of nitrogen fertilization treatments, respectively. Increasing the stocking rate increased the gains per acre 14.0 lb and 19.0 lb for the 40 and 80 lb of N per acre rate, respectively (Fig. 2).

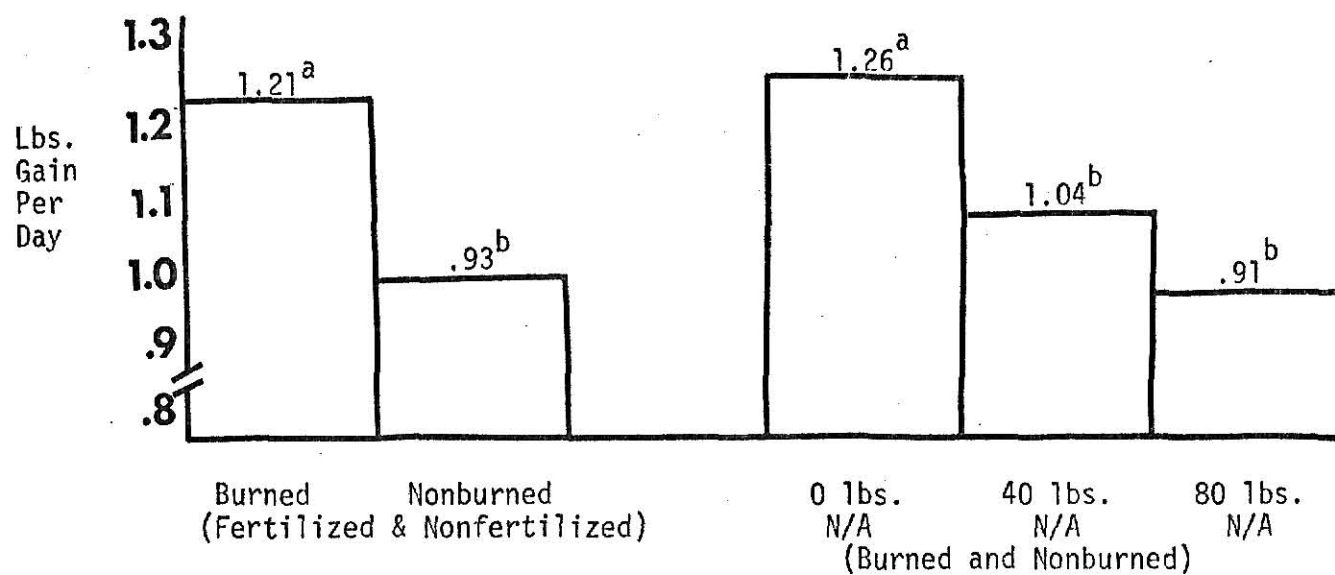
The interaction between burning and fertilization approached a significant level. The burned fertilized pastures tended to have a higher average daily gain (Fig. 3), and higher gain per acre than the nonburned pasture at the corresponding fertilization rate (Fig. 4).

Dry matter intake did not differ between the burned and non burned pasture (table 1). This disagrees with Woolfolk *et al.* (1973) when he found that the control pastures had .16 lb higher dry matter intake per 100 lb body weight. This intake data is valid only for the steers collected, and is an indication of the intake of the other steer on the burned and nonburned pastures.

In 1973 the total fecal collections were made on three consecutive days. Dry matter intake per 100 lb body weight derived from the fecal collections

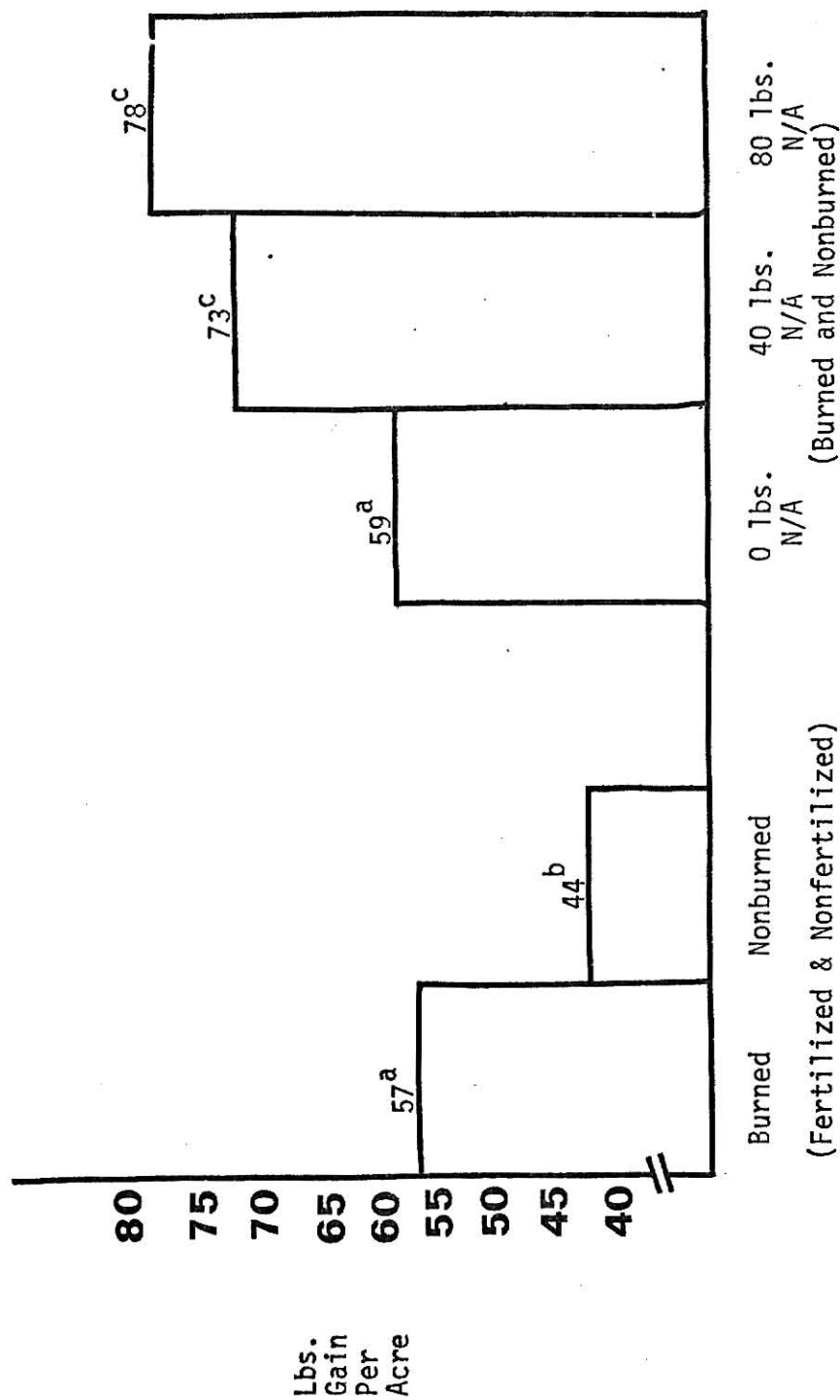
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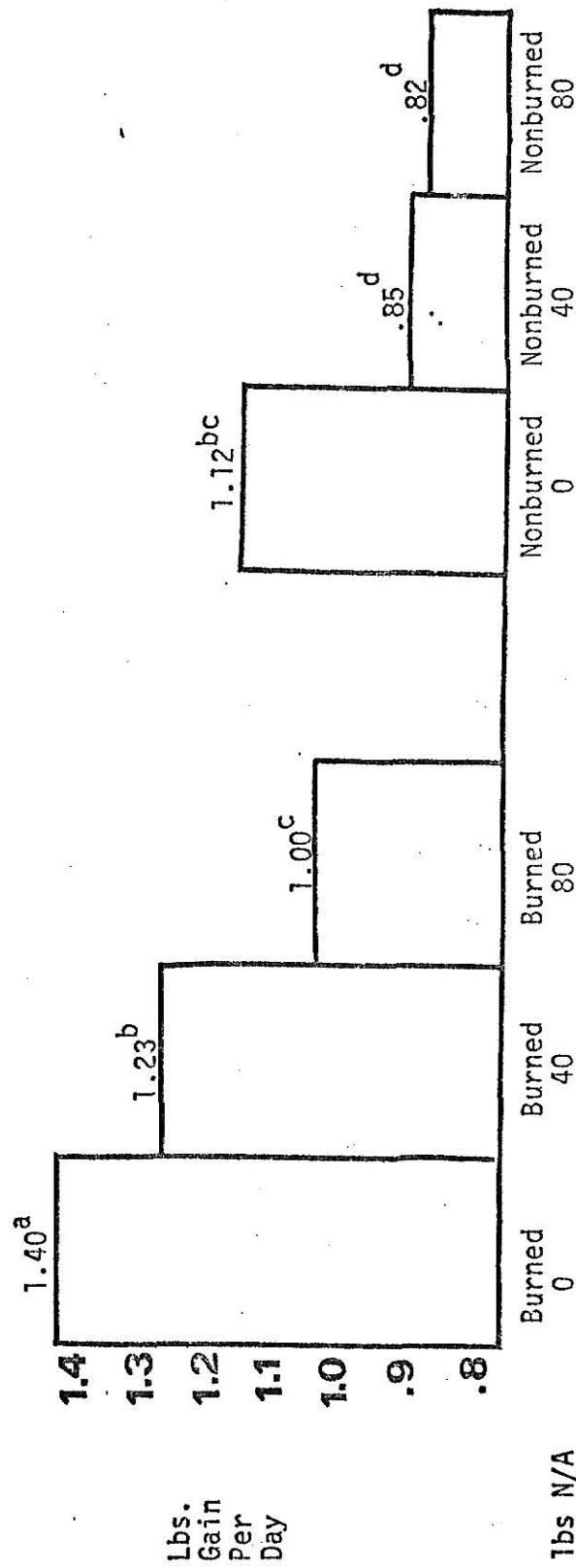
(Fig. 1) Effects of Burning and Fertilization on Daily Gains, 1973-74 data combined.

a,b,c,d Value with similar superscripts are not significantly different ($P < .05$).



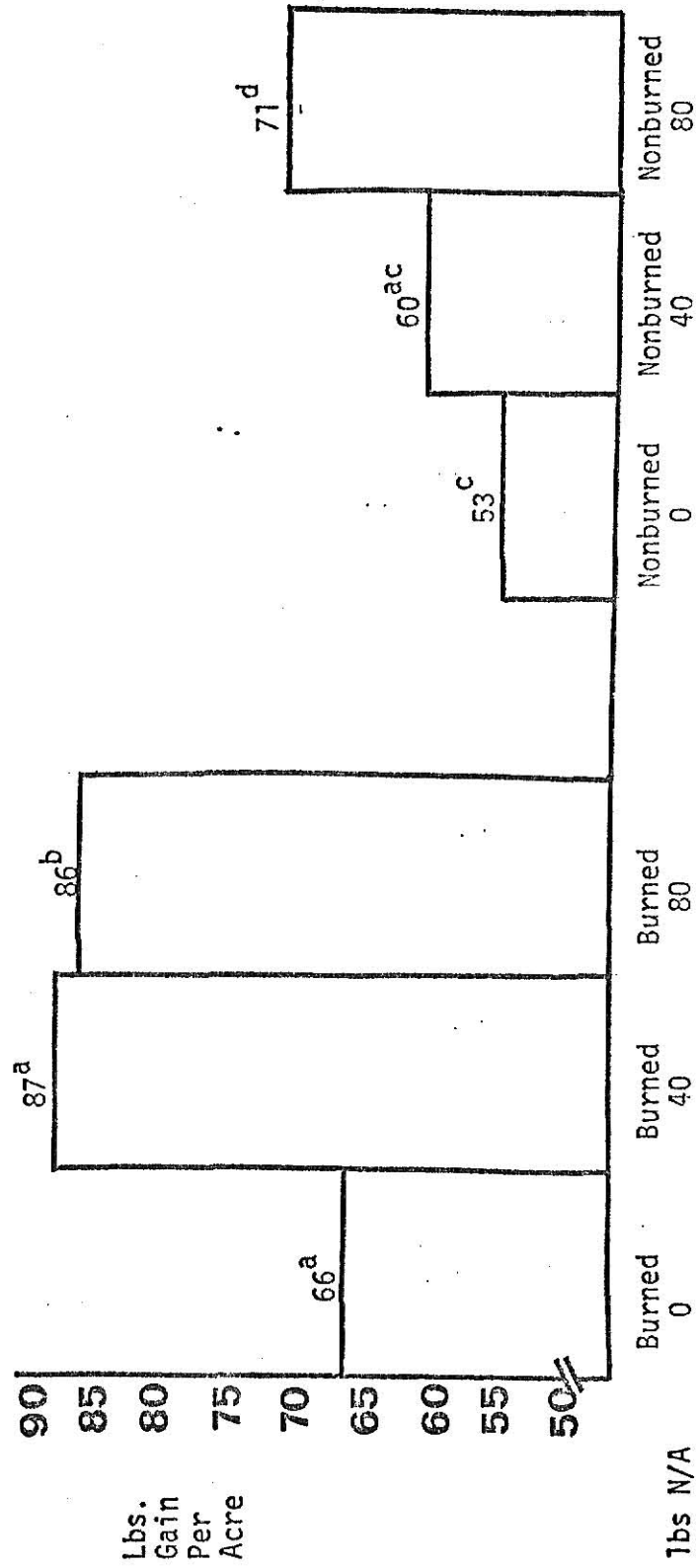
(Fig 2) Effects of Burning and Fertilization on Gains Per Acre, 1973-74 Data Combined.

a,b,c
Values with similar superscripts are not significantly different ($P < .05$).



(Fig 3) Effects of Burning and Fertilization Combinations on Daily Gain, 1973-74 Data Combined.

a,b,c,d values with similar superscripts are not significantly different ($P < .05$).



(Fig 4) Effects of Burning and Fertilization Combinations on Gain per Acre, 1973-74 Data Combined.

a,b,c,d values with similar superscripts are not significantly different ($P < .05$).

Table 1. EFFECTS OF BURNING ON INTAKE AND PERFORMANCE OF STEERS USED FOR FECAL COLLECTIONS - 1973 and 1974.

	Treatments	
	Control	Burned
Dry matter intake (lb/100 lb B.W.)	2.26 ^a	2.23 ^a
Daily gain, lbs. (collection period)	1.06 ^a	1.21 ^b
Protein intake, lbs.	1.22 ^a	1.40 ^b

^{a,b}Values on the same line with similar superscripts are not significantly different at ($P < .05$).

were significantly lower on the third day and tended to be lower the second day (table 2). Only the dry matter intake from the first day was used in estimating the intake for both years.

An estimate of protein intake can be predicted by multiplying the dry matter intake times the protein content of the forage (table 1). The estimated protein intake is about .2 of a lb below that necessary to produce the actual average daily gain according to N. R. C.

Burning tended to increase the crude protein content of the diet samples approaching a significant level. This agrees with data reported by Woolfolk et al. (1973) and Smith et al. (1960). The protein content decreased from June through August, on the nonburned pastures, but the protein content stayed relatively constant on the burned pasture (Fig. 5), accounting for the higher average.

Crude fiber of the diet sample were not significantly effected by burning (Fig. 6). The crude fiber increased for the nonburned pasture, but stayed about constant for the diet samples from the burned pasture.

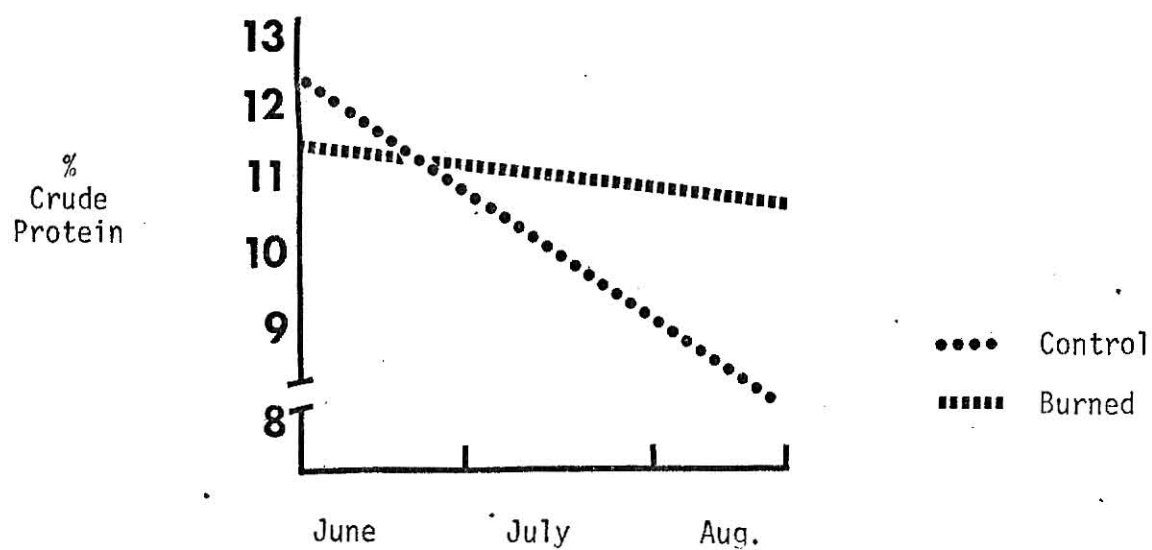
Burning did not significantly effect the neutral detergent fiber (NDF) content of the diet samples (Fig. 7). The NDF fiber content decreased throughout the trial period, and the cell soubles made a corresponding increase. Woolfolk et al. (1973) reported that the NDF stayed at a relatively constant level from June through August, however this data indicates a gradual decline in the NDF content of the diet samples throughout this period.

Acid detergent fiber (ADF) tended to be lower on the burned pasture than the nonburned pasture, but at a nonsignificant level. Woolfolk et al., 1973 reported that the ADF was 2.56% lower for the diet samples collected on the burned pastures compared to the nonburned. Allen et al. (1973) reported that burning lowered the ADF on hand clipped forage samples from

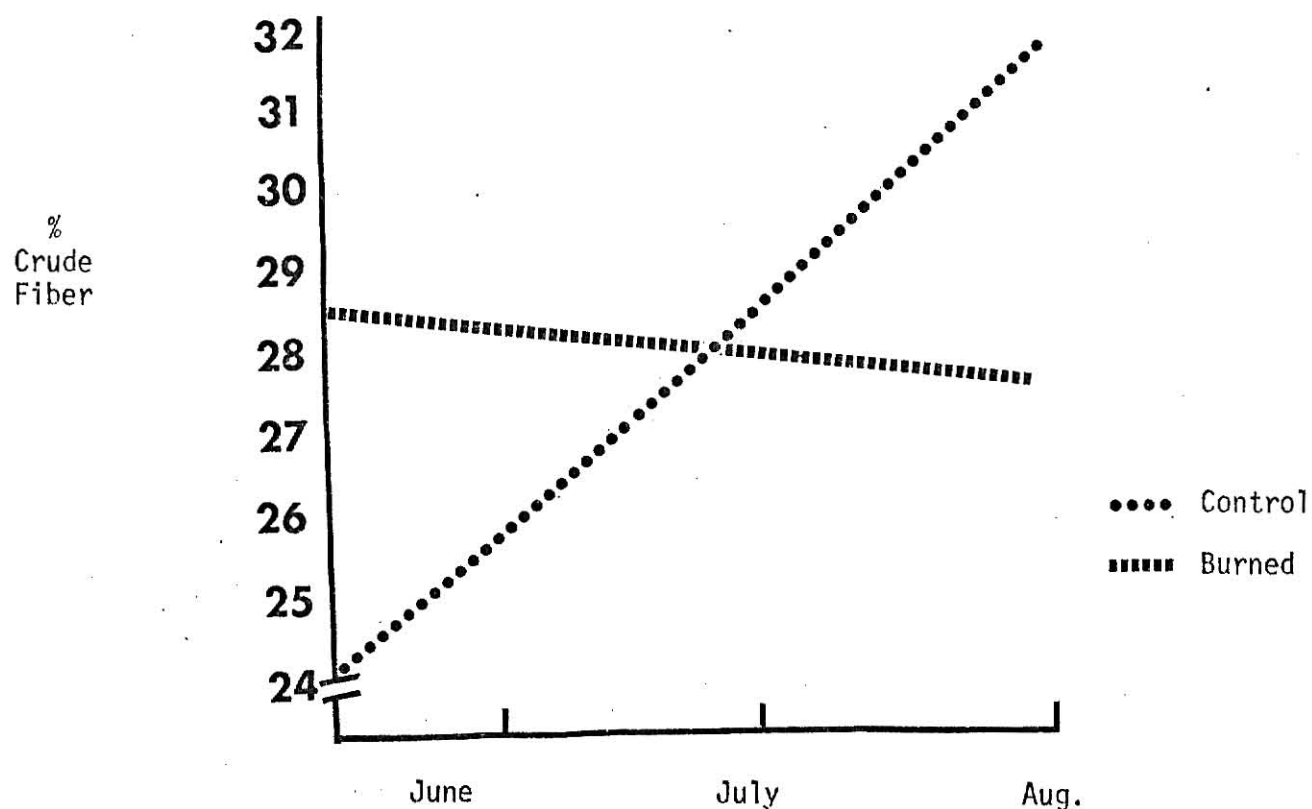
Table 2. STEER DRY MATTER INTAKE DATA ON THREE CONSECUTIVE DAY COLLECTIONS. 1973 (3 trials).

	lbs/100 lbs body wt.	
	Burned	Nonburned
First day	1.92 ^a	2.10 ^a
Second day	1.71 ^{a,b}	1.90 ^{a,b}
Third day	1.55 ^b	1.75 ^b

^{a,b}Values on the same column with similar superscript are not significantly different at ($P < .05$).



(Fig. 5) Protein Content of Diet Samples From Esophageally Fistulated Steers.



(Fig. 6) Crude Fiber Content of Diet Samples From Esophageally Fistulated Steers.

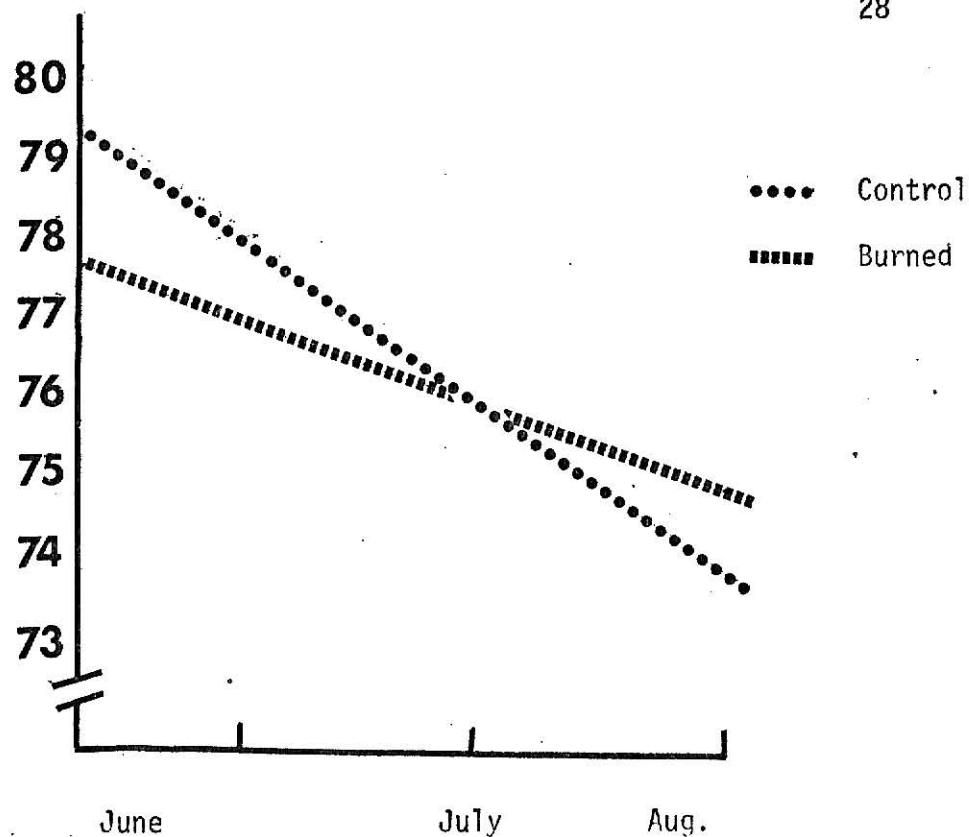
the same pastures. The ADF levels in the diet increased throughout the collection period (Fig. 8).

Burning significantly reduced the cellulose content in the diet samples; 35.63% for the control compared to 35.07% for the burned pasture (table 3). The cellulose content in the diet samples showed no definite trend and the date of collection was not significant. The hemicellulose content was not effected by burning but did decrease during the collection period.

Lignin content of the diet samples were significantly lower on the burned pasture compared to the nonburned pasture. The lignin content of the diet samples increased during the collection period (Fig. 9).

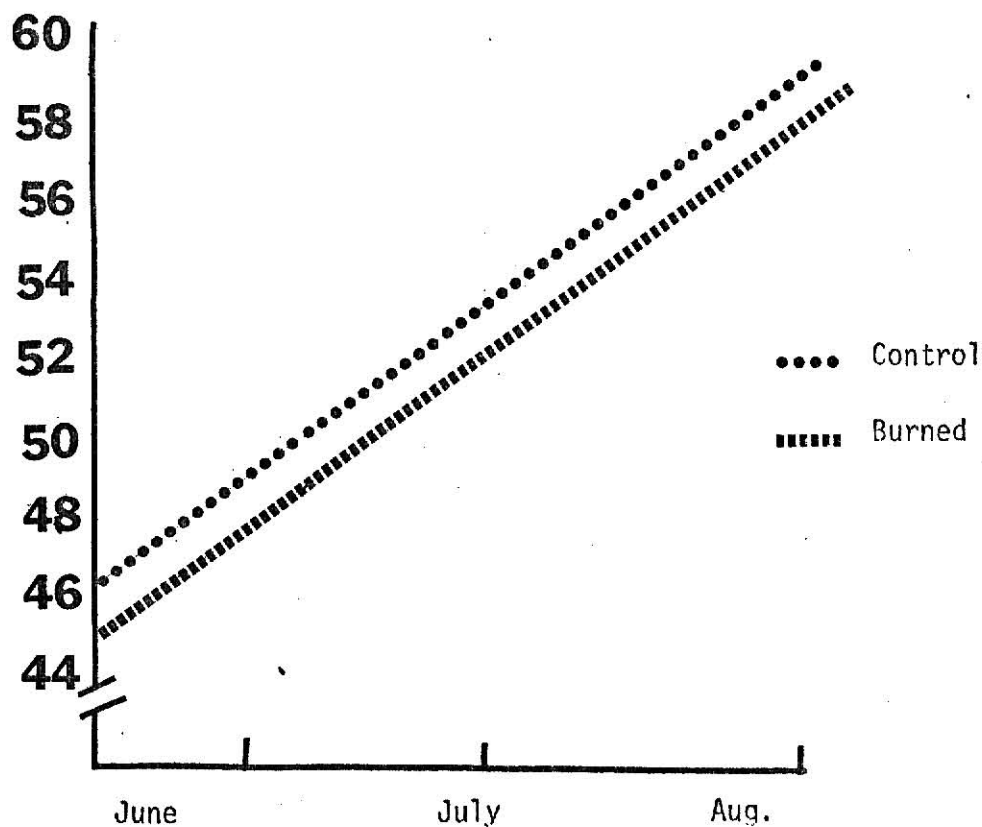
The fecal nitrogen equation (Rao et al., 1972), the lignin ratio technique (Crampton and Harris, 1969) and the summative digestibility equation (Goering et al., 1970) were all used and found to give unsatisfactory results in estimating dry matter digestibility when compared to observed weight gains.

%
N.D.F.



(Fig. 7) Neutral Detergent Fiber of Diet Sample From Esophageally Fistulated Steers.

%
A.D.F.

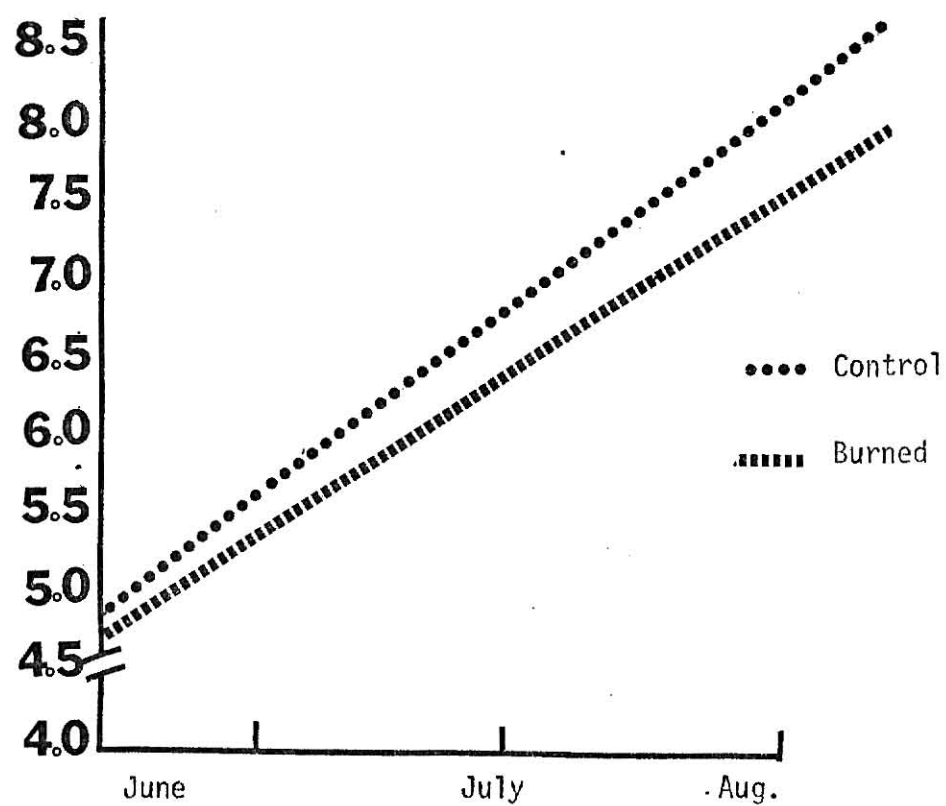


(Fig. 8) Acid Detergent Fiber of Diet Sample From Esophageally Fistulated Steers.

Table 3. EFFECTS OF BURNING ON THE CHEMICAL COMPONENTS OF
DIET SAMPLES FROM ESOPHAGEALLY FISTULATED STEERS.

	Control	Burned
Crude protein	10.87	11.56
Crude fiber	28.46	28.19
N.D.F.	76.93	75.97
A.D.F.	52.15	51.39
Cellulose	35.63 ^a	35.07 ^b
Hemicellulose	31.37	31.11
Lignin	6.66 ^a	6.26 ^b

^{a,b} Means on the same line bearing different superscripts
are different at ($P < .05$).



(Fig. 9) Lignin Content of Diet Samples From Esophageally Fistulated Steers.

CONCLUSIONS

Burning increased average daily gains by .28 lb compared to nonburned pastures. Fertilization decreased average daily gains, but increased gains per acre due to the heavier stocking rate. The burned pasture receiving 40 lb of nitrogen/acre produced the highest gain/acre and the highest average daily gain of the fertilized pastures. The stocking rate of 1.8 acres per steer for the pastures fertilized at 80 lb of nitrogen per acre was too heavy for maximum sustain productivity.

Dry matter intake of the fecal collection steers was not significantly different on the burned and nonburned pasture. In 1973 when total fecal collections were taken for three consecutive days, the estimated dry matter intake on the third day was significantly lower. This reduced intake was probably due to the stress of fecal collections on the first and second day of the period.

The protein intake was lower than that required to support the observed rate of gain according to N. R. C. requirements. One possible reason for this apparent discrepancy is that the diet samples collected may not be representative of the diet of the steers used for fecal collections.

Crude protein, crude fiber, neutral detergent fiber, acid detergent fiber and hemicellulose were not significantly effected by burning. Cellulose and lignin were significantly lower on the burned pastures.

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EFFECT OF LATE SPRING BURNING AND NITROGEN
FERTILIZATION ON PERFORMANCE AND DIET OF
YEARLING STEERS GRAZING FLINT HILLS RANGE

by

LOREN LYNN BERGER

B. S., Kansas State University, 1973

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the
requirements for the degree

MASTER OF SCIENCE

Department of Animal Science and Industry

KANSAS STATE UNIVERSITY

Manhattan, Kansas

ABSTRACT

Four pastures were burned April 24, 1973 and April 27, 1974. Ammonium nitrate fertilizer was applied May 2, 1973 and May 3, 1974. Two burned and two nonburned pastures received no nitrogen, one burned and one nonburned pasture received 40 lb N/A, and one burned and one nonburned pasture received 80 lb N/A.

Pastures were stocked from May 3 to October 3, 1973 with mixed breed steers weighing 487 lb, and from May 1 to October 4, 1974 with Hereford Steers weighing 408 lb. All nonfertilized pastures were stocked at 3.3 A/steer, the pastures fertilized at 40 lb N/A were stocked at 2.2 A/steer, and the pastures fertilized at 80 lb N/A were stocked at 1.8 A/steer.

In 1973 and 1974, four steers from one nonburned, nonfertilized pasture, and four steers from one burned, nonfertilized pasture were trained to carry fecal collection bags. Total fecal collections were made to estimate dry matter intake.

Mature Holstein steers with esophageal fistulas were used to collect diet samples during each of the fecal collection periods.

Burning increased daily gains 28 lbs while fertilizing decreased the average daily gain, but increased gains per acre.

Dry matter intake was not different between the burned and nonburned pastures.

Burning significantly lowered the cellulose and lignin content of the diet.