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Bermudagrass Fertility Trial in Southeast Kansas, 2020

D. Helwig
Kansas State University, dhelwig@ksu.edu

M. Haywood
Kansas State University, mhaywood@k-state.edu

J. K. Farney
Kansas State University, jkj@ksu.edu

See next page for additional authors

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Bermudagrass Fertility Trial in Southeast Kansas, 2020

Abstract

In 2020 a bermudagrass fertility study was conducted at the K-State Research and Extension experiment station outside of Columbus, KS. The purpose of the study was to simulate forage producer practices of managing bermudagrass and determine how each practice affects forage production and quality. Addition of fertilizer, and mowing were tested to determine the impact on forage biomass production and quality. Fertilizer increased both biomass production and forage quality. However, greater improvements in forage quality were observed by mowing the bermudagrass.

Keywords

Bermudagrass, forage, pasture, fertility, biomass production

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Cover Page Footnote

We gratefully acknowledge the support from Farmers Coop of Columbus and Baxter Springs, KS, for providing the fertilizer for the experiment.

Authors

D. Helwig, M. Haywood, J. K. Farney, B. C. Pedreira, and G. F. Sassenrath

Bermudagrass Fertility Trial in Southeast Kansas, 2020

*D. Helwig,¹ M. Haywood,¹ J. Farney, B.C. Pedreira,
and G.F. Sassenrath*

Summary

In 2020 a bermudagrass fertility study was conducted at the K-State Research and Extension experiment station outside of Columbus, KS. The purpose of the study was to simulate forage producer practices of managing bermudagrass and determine how each practice affects forage production and quality. Addition of fertilizer, and mowing were tested to determine the impact on forage biomass production and quality. Fertilizer increased both biomass production and forage quality. However, greater improvements in forage quality were observed by mowing the bermudagrass.

Introduction

Bermudagrass is a high yielding summer perennial and an efficient nitrogen (N) user. Under high fertility and ideal growing conditions, bermudagrass is capable of producing large amounts of high-quality forage that can be harvested multiple times a year. Producers take different approaches to forage production, ranging from no fertilizer, differing amounts of fertilizer, and frequency of fertilizer application. Another main difference in management is whether the producer allows the forage to grow during the season or if the producer harvests the forage, returning the grass to a vegetative state.

This study compared different fertilizer rates, timing, and harvesting scenarios corresponding with how producers manage their own fields to determine forage quality and production.

Experimental Procedures

The site selected for the trial was a bermudagrass stand at the Southeast Research and Extension Center field outside of Columbus, KS, that has been established for more than 15 years. Plots were 60 × 30 ft and replicated 3 times. The soil at the field is a Parsons silt loam soil. Lack of management had allowed other grasses to enter the stand. Before the bermudagrass broke dormancy in March, the stand was sprayed with glyphosate at the rate of 32 oz per acre to eliminate many of the cool season grasses that had encroached on the stand.

¹ Cherokee County K-State Research and Extension, Columbus, KS.

Treatments included addition of nitrogen fertilizer and mowing (Table 1). Control plots (treatments 1 and 2) received no fertilizer. Treatments 3 and 4 received 150 lb of N early in the spring (April 23, 2019). Treatment 5 received 150 units of N in the spring, and 100 lb N after each harvest (August 20 and October 9, 2020). Treatments 2, 4, and 5 were harvested by mowing on June 11, August 20, and October 9 after biomass sampling. This simulated harvesting of the forage for hay and encouraged regrowth. From April 23 to June 11, rainfall totaled 10.52 inches as recorded by the Mesonet station in Columbus, located 6 miles from the field (<https://mesonet.k-state.edu/weather/historical/>). However, from June 11 until August 20, rainfall only totaled 3.2 inches with 2.03 inches from July 27 to August 16. June and most of July were extremely dry, stunting the growth of the grass.

All plots were sampled for biomass production and forage quality on June 11, August 20 and October 9, 2020, using a 3-ft Carter Harvester and samples were collected in bags. The entire sample was weighed for fresh weight determination on an area basis. Hand samples were taken from the plot sample to determine moisture, dry weight, and quality and converted to area basis based on total harvested weight. Biomass was determined after drying samples at 120°F for 3 days. Forage quality analysis was performed at SDK Labs, Hutchinson, KS. Total protein produced was calculated by multiplying crude protein (CP; %) by biomass (lb/acre).

Results and Discussion

Bermudagrass is a forage that responds well to nitrogen fertilization. By June 11, 2020, the control plot with no fertilizer only produced 1325 lb of dry matter (DM) per acre compared to the fertilized plots that each produced greater than 2330 lb of dry matter per acre (Table 2). Total DM production increased 1191 lb DM/acre for the unmowed plots with the addition of fertilizer (treatments 1 and 3) to 1628 DM/acre for the mowed treatments (2 and 4). Under adequate rainfall conditions, bermudagrass should have produced significantly more, but the dry weather stunted production. Under more favorable moisture conditions from August 20–October 9, treatment 5 produced an additional 2621 lb of dry matter per acre while treatment 4 only produced 1525 lb of DM by October 9. Dry matter production continued to increase in all plots but was much greater in the fertilized plots by the final harvest, with total DM of just over 3400 lb/acre for the unfertilized plots compared to more than 4600 lb/acre DM for the fertilized plots. The additional 100 units of N per acre in treatment 5 after mowing on June 11 and August 20 resulted in greater dry matter production at both subsequent harvests (August 20 and October 9; Table 2). Treatment 5, which received a total of 350 lb of N, produced a total of 6198 lb DM/acre.

Mowing reduced dry matter production of bermudagrass in the subsequent harvests. Moreover, total DM production was increased with mowing only for those plots that were fertilized (Table 2). The additional fertilizer applied to Treatment 5 further increased DM production.

Forage quality was also improved with increased fertility and mowing. Crude protein levels were greater in fertilized than in unfertilized plots in June, with CP at 8% in unfertilized plots, and from 9.7% CP to 10.1% CP in the fertilized plots (Table 3). This

increase in CP% continued throughout the season, with much higher total %CP/acre in the fertilized plots. The additional fertilizer added to treatment 5 increased the crude protein level to 11% and 16.4% compared to only 8.7% and 9.9% CP in treatment 4 at the August 20 and October 9 harvest dates, respectively.

Nitrogen fertilizer increased total crude protein and %CP of the forage, from an average across all harvest dates of 7.5% CP to 8.6% CP for unmowed, and 8.3% CP to 9.6% CP for mowed, in unfertilized versus fertilized, respectively. Interestingly, treatment 2, which did not receive N but was mowed, had a higher crude protein content at the August 20 and October 9 sampling times than was observed in either treatment 1 or 3 (Table 3). This highlights the importance of the harvest management to enhance forage quality. In treatment 1, with no fertility or mowing, the crude protein level was only 6.9% on August 20 and 7.6% on October 9. Treatment 3 received 150 lb of N but was not mowed and had crude protein levels of 7.4% and 8.7% on August 20 and October 9, which were slightly higher than treatment 1 but less than treatment 2. Treatment 2 had no added fertilizer, but was mowed and had 7.9% and 9.1% CP (August 20 and October 9, respectively) demonstrating that mowing plays a role in forage quality. Interestingly, mowing also increased CP% (7.5% vs. 8.3%, unfertilized; 8.6% vs. 9.6% fertilized, across all harvest dates). The change in CP during the growing season was also influenced by mowing. Treatment 5 had a crude protein level of 16.4% at final harvest, while treatment 4 only had 9.9% CP. Observations of the forage indicated a darker green in treatment 5 than in all other treatments, showing the effects of the nitrogen. Treatment 5 did have a significant amount of cool season grass in the plots, which could have affected the crude protein levels.

Total protein produced in treatment 1 was 262.9 lb/acre compared to the mowed treatment 2 of 283 lb/acre, an increase of 7.6%. Treatment 3 produced 408 lb CP/acre compared to the mowed treatment 4 that produced 492 lb/acre, an increase of 20.5%. By increasing fertility and mowing, crude protein production increased to 799 pounds per acre (treatment 5), 62% more protein than treatment 4.

Mowing impacted total digestible nutrient levels (TDN) in the forage. The %TDN was higher in all fertilized treatments than in unfertilized treatments (Table 3). Mowing increased the %TDN, but only in the fertilized plots (compare Treatments 3 to 4 and Treatments 1 to 2). At the final harvest, the TDN level measured in treatment 4 was 56.8% while treatment 3, which received the same fertility, was 50.5%. Only a slight increase in %TDN was observed between the unfertilized treatments (compare 1 vs. 2). Treatment 5, with higher levels of N and mowing, had the highest reported %TDN (59.5%).

Recommendations

Though fertility is beneficial to pasture production and quality, mowing may play a larger role in forage quality than fertility. Mowing the grass after it reaches maturity resets the plant to a vegetative state and improves quality and the amount of protein produced per acre. After bermudagrass reaches maturity, it will continue to produce biomass, but nutrient values will decrease unless it is harvested and returned to a vegetative state. The continued increase in %CP with the addition of fertilizer in treatment 5

demonstrates the importance of continually fertilizing bermudagrass after every harvest to boost quality.

In bermudagrass pastures, harvest management along with fertility will provide the highest production and quality of bermudagrass forage. Mowing bermudagrass when it heads out or matures to reset it to a vegetative state will increase forage quality regardless of the addition of nitrogen. Adding nitrogen and mowing the grass throughout the year will give the best results for bermudagrass production and quality.

If bermudagrass is used for summer grazing, once it matures it needs to return to a vegetative state. If not, the forage will fail to meet the animal's nutritional requirements. Nitrogen application will also enhance dry matter production and protein value of the forage to help meet the animal's nutritional needs.

Acknowledgments

We gratefully acknowledge the support from Farmers Coop of Columbus and Baxter Springs, KS, for providing the fertilizer for the experiment.

Table 1. Timeline of fertility and mowing treatments

Treatment	Fertilizer			Mowing		
	April 23	June 11	August 21	April 23	June 19	August 21
1	none	none	none	none	none	none
2	none	none	none	full	full	full
3	150 lb N	none	none	none	none	none
4	150 lb N	none	none	full	full	full
5	150 lb N	100 lb N	100 lb N	full	full	full

Table 2. Bermudagrass biomass production

Treatment	Dry matter, lb/acre			Total
	June 11	August 20	October 9	
1	1325	2010	3477	3477
2	1325	995	1088	3408
3	2408	2699	4668	4668
4	2663	847	1526	5036
5	2330	1247	2621	6198

Table 3. Bermudagrass forage quality

Treatment	Crude protein, %			Total, lb CP/acre	Total digestible nutrients, %		
	June 11	August 20	October 9		June 11	August 20	October 9
1	8	6.9	7.6	262.9	51.6	50.2	50
2	8	7.9	9.1	283.0	51.6	55.7	50.9
3	9.7	7.4	8.7	407.9	54.3	50.8	50.5
4	10.1	8.7	9.9	492.2	53.2	55.3	56.8
5	10	11	16.4	799.0	54.6	58.7	59.5

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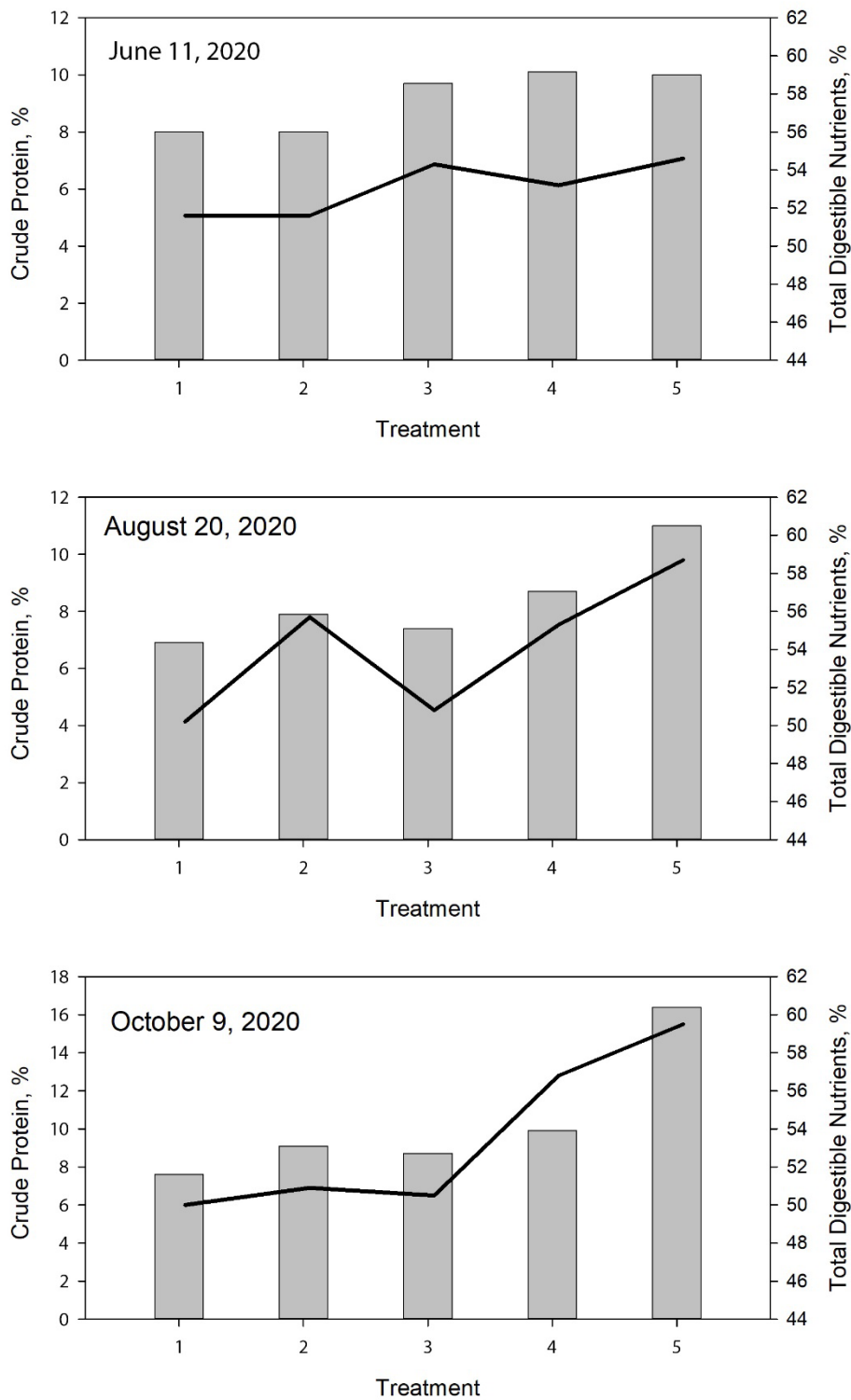


Figure 1. Crude protein (CP) percent (bars, left axis) and total digestible nutrients percent (line, right axis) for bermudagrass plots with different fertility and mowing treatments at three sampling times. Note change in scale for %CP on October 9.