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Bermudagrass Under Different Fertility and Harvest Management Practices

B. C. Pedreira
Kansas State University, pedreira@ksu.edu

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

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

See next page for additional authors

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Cover Page Footnote
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Authors
B. C. Pedreira, D. Helwig, M. Haywood, J. K. Farney, and G. Sassenrath

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Summary

A second year of a bermudagrass fertility study was conducted at the K-State Research and Experiment Station outside of Columbus, KS, in 2021. The purpose of the study was to simulate forage producers' practices of managing bermudagrass and determine how each practice affected forage production and quality.

Introduction

Bermudagrass is a high-yielding summer perennial that is an efficient user of nitrogen. Under high fertility input, bermudagrass is capable of producing large amounts of high-quality forage. With ideal growing conditions, bermudagrass can be harvested multiple times a year.

Producers have many different management approaches for their forage production. Fertilizer management options include no fertilizer, differing amounts of fertilizer, and frequency of application. A second management decision is whether the producer allows the forage to grow during the season with no harvesting, or whether the forage is harvested at intervals during the growing season. Harvesting the forage returns it to a vegetative stage.

This research was conducted to test the impact of fertilizer rates, timing, and harvesting scenarios on bermudagrass production and quality. Treatments were selected to correspond with how producers manage their fields.

Experimental Procedures

The site selected for the trial was a Wrangler bermudagrass stand at the Southeast Research and Extension Center field outside of Columbus, KS that was established more than 15 years ago. Plots were 60 × 30 ft and replicated 3 times. The soil at the field is a Parsons silt loam. Lack of management had allowed other grasses to enter the stand. In March of 2021, before the bermudagrass broke dormancy, the stand was sprayed with glyphosate at the rate of 32 oz/a to eliminate many of the cool-season grasses that had encroached on the stand.

Plots were sampled for forage production and quality on July 7, August 12, and September 29 using a 3-ft Carder Forage Harvester. A 15-ft length of each plot was sampled. The entire sample was weighed and a sub-sample was taken to determine moisture, dry weight, and quality. Measurements were converted to an area basis based on total harvested weight. Biomass was determined after drying samples at 120°F for 3 days. Samples were sent to a commercial laboratory for quality analysis: crude protein (CP) and total digestible nutrients (TDN) contents.

Treatments 1 and 3 were harvested and mowed on September 29. Treatments 2, 4, and 5 were completely mowed on July 7, August 12, and September 29 after forage sampling. The purpose of harvesting mid-season was to promote regrowth. The remaining treatments were allowed to grow without mowing and were harvested at the end of the growing season (September 29; Table 1).

Conditions

Fertilizer was first applied on May 24. Rainfall in 2021 was very close to average, with consistent rain received throughout the year (Figure 1). Soil moisture was plentiful at the time of first fertilization. Temperatures in 2021 were cool during the early and mid-growing season (Figure 2) but increased later in the season to near-normal conditions. The month of May was unseasonably cool with good moisture which may have slowed the initial growth of the bermudagrass. Weather conditions were monitored at the Mesonet station in Columbus, located 6 miles from the field (*https://mesonet.k-state.edu/weather/historical/*).

Results and Discussion

Bermudagrass is a forage that responds well to added nitrogen. At the July 7 harvest, the control plot with no fertilizer produced 2010 lb/a, whereas treatments 3, 4, and 5 each produced 4065, 3480, and 4670 lb/a respectively (Table 2). Protein levels were significantly different in treatment 1 than in treatments 3, 4, and 5. Crude protein for treatment 1 was 8%, while treatments 3, 4, and 5 ranged from 9.95 to 11.38%.

After the July 7 harvest, treatment 5 received an additional 100 lb of N/a. When directly comparing treatments 4 and 5 with the same management, treatment 5 produced 3285 lb/a while treatment 4 produced 2264 lb/a. The additional N applied at the August 12 sampling in treatment 5 only added about 1000 lb/a but resulted in 45% more forage than treatment 4. This return on investment of N is comparable to that observed in 2020 in which Treatment 5 had 47% more forage produced with the additional N application. Moreover, the crude protein (CP) level of treatment 5 was 12.98% compared to treatment 4, which was 10.24% CP. In the control with no fertility or management, crude protein level was 7.25% and treatment 3 was 6.9% CP. In comparison, treatment 2 which had been mowed, had a CP value of 8.82%. It demonstrates that harvesting the forage, returning it to a vegetative stage, will increase CP values and overall CP accumulation for the field.

Management or mowing played a large role in the overall performance of all the plots. Comparing treatments 1 and 2, total forage accumulation was 5030 lb/a in treatment 1 and 5330 lb/a for treatment 2 (Figure 3). However, total CP production was significantly different. Treatment 1 produced 231 lb of CP/a while treatment 2 produced 434 lb of CP/a. That is an 88% increase in protein per acre by harvesting the forage throughout the year and keeping the grass in a vegetative phase. Similar results were observed when comparing treatments 3 and 4. Forage accumulations were similar between treatment 3 and 4 (6385 and 6680 lb/a). However, there was a significant difference in CP production with 272 lb/a in treatment 3 and 654 lb/a in treatment 4, a 140% increase in CP production.

When adding additional nitrogen throughout the year and managing the growth of the forage, CP production of bermudagrass was greatly improved. Treatment 5 produced an additional 2866 lb/a of forage and 547 lb/a of CP when compared to treatment 4. Adding a second and third application of nitrogen and keeping the forage in a vegetative stage by mowing improved the CP production by 84% over treatment 4.

The TDN values were similar among treatments in each harvest date. However, greater TDN values were observed from the August 12 sampling, after the plots being mowed in July, averaging 61%. After mowing, old tissues are removed and the new forage mass is mostly composed of new leaves, resulting in greater nutritive value.

Recommendations

Management or mowing may play a larger role in forage quality than fertilization. Fertilization is extremely beneficial, but only if it is properly managed.

Effective fertility management practices will provide the highest production and quality of bermudagrass forage. Mowing bermudagrass when it heads out will increase forage quality regardless of nitrogen and contributes to resetting it to a vegetative phase. Adding nitrogen and mowing the grass throughout the year will give the best production and quality for bermudagrass.

If bermudagrass is used for summer grazing, when 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 forage production and protein value, helping to meet the animal's nutritional needs.

Acknowledgments

Farmers Co-op of Columbus and Baxter Springs, KS, provided the fertilizer for the experiment.

Table 1. Treatments, mowing, and nutrient management in bermudagrass, Columbus, KS

Treatment	Fertilizer (May 24)	Mowing	Fertilizer (July 9)	Mowing	Fertilizer (August 13)	Mowing
1	None		None		None	
2	None	July 7	None	Aug. 12	None	Sept. 29
3	100 lb N		None		None	
4	100 lb N	July 7	None	Aug. 12	None	Sept. 29
5	100 lb N	July 7	100 lb	Aug. 12	100 lb N	Sept. 29

Table 2. Forage accumulation (FA, lb/a), crude protein (CP, %), and total digestible nutrients (TDN, %) in bermudagrass, Columbus, KS

	FA, lb/a	CP, %	TDN, %
	July 7, 2021*		
Treatment 1**	2010	8.18	51.55
Treatment 3***	4065	10.0	52.45
Treatment 4	3480	9.95	51.79
Treatment 5	4670	11.38	49.61
	August 12, 2021		
Treatment 1	2460	7.25	62.12
Treatment 2	2105	8.82	60.15
Treatment 3	4145	6.9	60.81
Treatment 4	2265	10.24	60.36
Treatment 5	3285	12.98	61.77
	September 29, 2021		
Treatment 1	5030	4.59	50.69
Treatment 2	1220	6.93	49.2
Treatment 3	6385	4.25	47.12
Treatment 4	940	8.13	48.58
Treatment 5	1590	15.26	50.90

*Sampling dates.
**See Table 1 for the explanation of treatments.
***At the July 7 harvest, treatment 1 and 2 are the same.

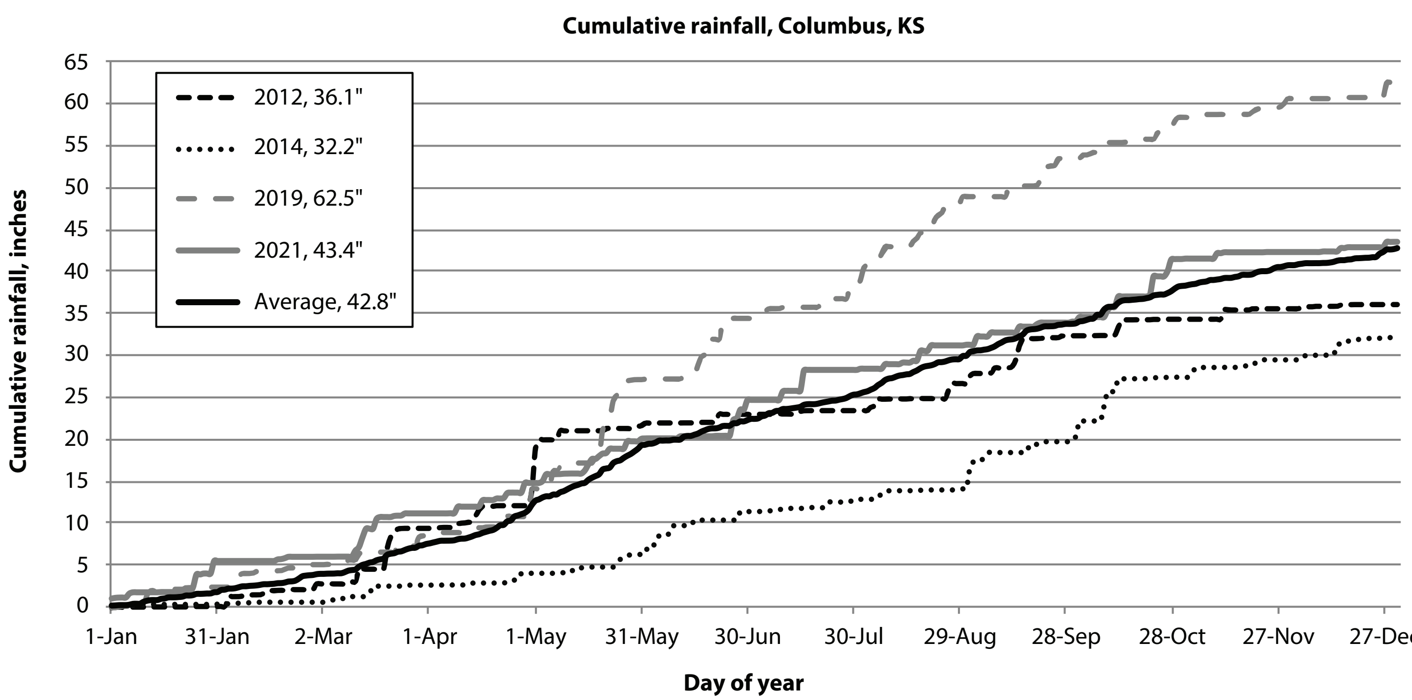

Figure 1. Cumulative annual rainfall. Extreme years (2014 and 2019) are shown in comparison with the 12-year average.

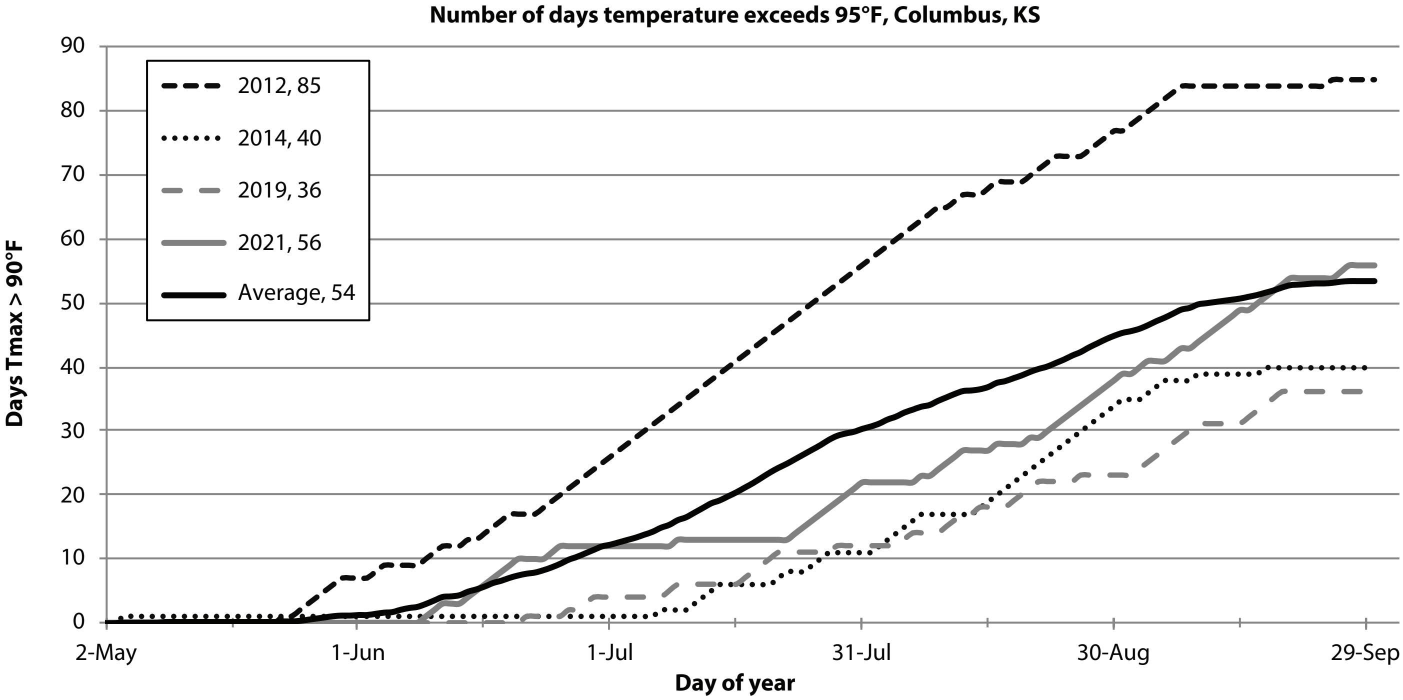

Figure 2. Cumulative number of high temperature days during the summer season.

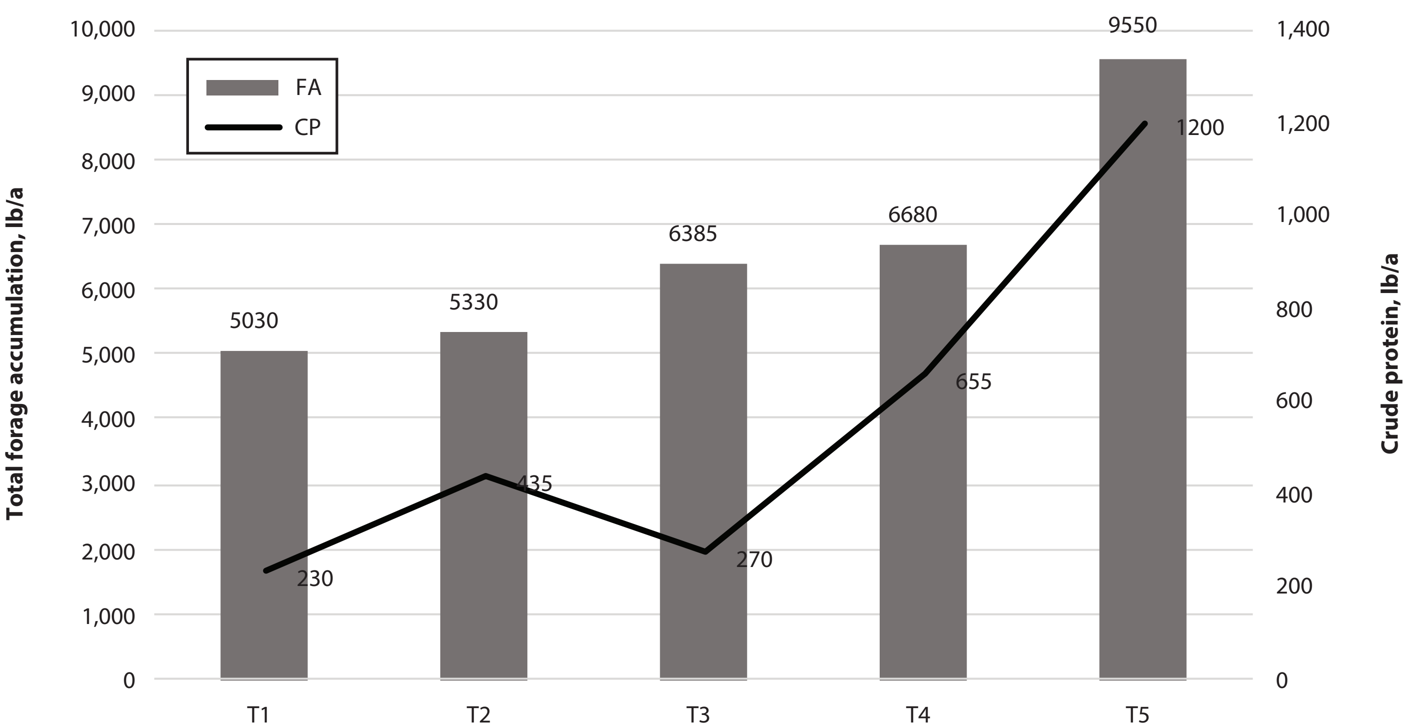

Figure 3. Total forage accumulation and crude protein production in bermudagrass, Columbus, KS.