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## Funding Source

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# Fertilization Management to Improve Stockpiled Tall Fescue in the Fall

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## Summary

In 2019 and 2021, a tall fescue fertility study was conducted at the K-State Experiment Station near Columbus, KS. The purpose of the study was to determine the effect of summer fertilization on forage quality and quantity in stockpiled fescue. If a producer can stockpile high-quality forage for late fall and early winter grazing, protein supplementation may not be necessary for fall calving cows.

## Introduction

Tall fescue is a cool-season perennial grass used in many parts of the United States. Fescue can be used for hay production but is more widely accepted as a grazing forage. Grazing endophyte-infected fescue in the summer can be problematic because of its effect on cattle, potentially causing long hair coat, elevated body temperature, and reduced blood flow. However, with cooler temperatures in the fall and winter, the symptoms are less severe, making fescue a more desirable forage at this time. By stockpiling fescue, producers can graze warm-season forages longer and reduce the amount of hay needed to feed cattle during the winter, decreasing overall expenses in the forage-livestock operation.

Additional fertilizer applied in the fall results in more grazable forage and plants with a higher crude protein value well into late fall and early winter, decreasing the need for expensive protein supplements. Fescue grass will actively grow as long as temperatures remain above freezing. Fescue does not mature in the fall as it will in late spring, making it a less fibrous foodstuff and maintaining its crude protein value. Additional techniques such as rotational grazing or strip grazing can further extend the grazing period. However, this study is designed to understand the effect of late-summer fertilization on forage quality. The research will identify if fescue will meet the cow's protein and energy requirements in December, and how much additional forage can be produced.

## Experimental Procedures

The site selected for the trial was tall fescue (Kentucky 31) stand at the Southeast Research and Extension Center field near Columbus, KS, that was established more than 15 years ago. Plots were 30 × 10 ft and replicated 3 times. The soil at the field is a Parsons silt loam soil. The treatments were 6 commercial fertilizer mixes (N at 0, 40, 60, 80, or 120 lb/a, P at 0 or 50 lb/a, and K at 0 or 30 lb/a) and the unfertilized control

(Table 1). The plots were mowed (4-in. height) and treatments were applied in 2019, 2020, and 2021. However, 2020 was not evaluated due to a severe dry period.

Plots were sampled for forage production and quality on December 12, 2019, and December 15, 2021, using a 3-ft Carder Forage Harvester, and samples were collected in a 15-ft length. 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. Forage mass (FM) 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. Crude protein production was calculated by multiplying the FM by the CP content.

### *Conditions*

Overall, 2019 was an extremely wet year (Figure 1A). Fertilizer treatments were applied on September 23, 2019. Moisture was adequate for September and October; however, November was significantly dryer and there was no precipitation in December prior to harvest. The first frost was also early that year, October 12, which may have slowed forage growth (Figure 1B).

In 2021, fertilizer treatments were applied on August 30. Moisture was adequate and the site received 0.98 inches of rain on September 3, which contributed to distribution of the fertilizer into the soil. Favorable conditions continued until harvest. The first frost was on November 4, and temperatures remained above normal through much of November and December, allowing for good growing conditions. The weather was monitored by the Mesonet station in Columbus, located 6 miles from the field (*https://mesonet.k-state.edu/weather/historical*).

## Results and Discussion

In 2019, the fertilizer was applied late in the growing season, thus not allowing the crop to fully utilize the nutrients. However, there was still a significant change in FM and CP produced in the different treatments over the control (Table 2).

In 2021, a more dramatic effect was seen in the plant's response to fertilization, specifically nitrogen. Treatment 2 was 59% higher in FM and 119% higher in weight of CP per acre than the control. A similar response was seen in 2019 as well. The 2021 results continued to show a linear increase in FM and CP produced per acre as an additional 40 pounds of nitrogen was added between treatments 2 and 3. There was an increase of FM (66%) and CP (40%) from treatment 2 to treatment 3. There was no difference in FM between treatments 3 and 4 but there was an increase in CP accumulation, especially in 2021, when an additional 40% increase in CP was measured. Treatment 4 had the cheapest cost of additional lb of crude protein produced (1.7 lb of DM per lb of N applied).

The addition of nitrogen in all treatments increased TDN values to the point that little energy supplementation would be needed for cattle feed, with the exception of treatment 2 in 2021. The TDN values in the fertilized treatments are typically higher than the values producers would have in their grass hays.

Adding additional P to the fertilization package had little effect on FM and CP but the addition of K in 2021 did show a response. The addition of P and K to the treatments would likely contribute to the forage production the following spring.

Overall, fall fertilization of tall fescue grass when used for grazing can be advantageous to producers. Lactating cows require a crude protein diet of about 12%, which was reached with fall nitrogen fertilization of the fescue. The larger the amount of nitrogen applied, the higher crude protein values in the hay.

## Recommendations

Fall fertilization of fescue will increase forage growth, CP, and TDN values of the forage. Higher CP values will decrease the producers' need to feed expensive protein supplements to lactating animals, saving supplementation expenses. Increased forage production will also reduce the need for feeding hay by prolonging the grazing season. Techniques such as stockpiling forage then strip grazing the pasture will further extend the grazing season.

Fertilization rates are recommended at 60 to 80 pounds of nitrogen for increased forage growth, higher crude protein, and TDN levels in the forage. It is uncertain if additional phosphorus or potassium fertilization leads to increased forage growth, but in 2021 treatment 6 presented higher values. Further research is needed, but the general recommendation is to apply phosphorus and potassium according to soil analysis.

## Acknowledgments

Farmers Co-op of Columbus and Baxter Springs, KS, provided the fertilizer for the experiment. The Columbus Unified High School 493 Chemistry II class assisted in applying fertilizer, taking measurements, and harvesting of the plots.

**Table 1. Commercial fertilizer applied in each treatment of fescue, Columbus, KS**

| Treatment | Fertilizer |
|---|---|
| 1 | Control |
| 2 | 40-0-0 |
| 3 | 80-0-0 |
| 4 | 120-0-0 |
| 5 | 120-50-0 |
| 6 | 120-50-30 |
| 7 | 60-50-30 |

**Table 2. Forage mass (FM, lb DM/a), crude protein (CP, %), total digestible nutrients (TDN, %), and CP production (lb/a) in stockpiled fescue, Columbus, KS**

| Treatment* | FM, lb DM/a | CP, % | TDN, % | CP production, lb/a |
|---|---|---|---|---|
| | | 2019 | | |
| 1 | 512 | 7.73 | 54.7 | 40 |
| 2 | 846 | 10.28 | 60.0 | 87 |
| 3 | 788 | 11.98 | 60.6 | 94 |
| 4 | 793 | 12.86 | 62.7 | 102 |
| 5 | 793 | 14.53 | 63.4 | 115 |
| 6 | 692 | 14.09 | 63.5 | 98 |
| 7 | 835 | 10.53 | 61.8 | 88 |
| | | 2021 | | |
| 1 | 632 | 6.57 | 58.8 | 42 |
| 2 | 1007 | 9.11 | 52.2 | 92 |
| 3 | 1673 | 8.85 | 60.6 | 148 |
| 4 | 1630 | 12.53 | 64.1 | 204 |
| 5 | 1732 | 11.60 | 62.0 | 201 |
| 6 | 1915 | 12.22 | 67.1 | 234 |
| 7 | 1503 | 9.47 | 63.8 | 142 |

*See Table 1 for treatment details.

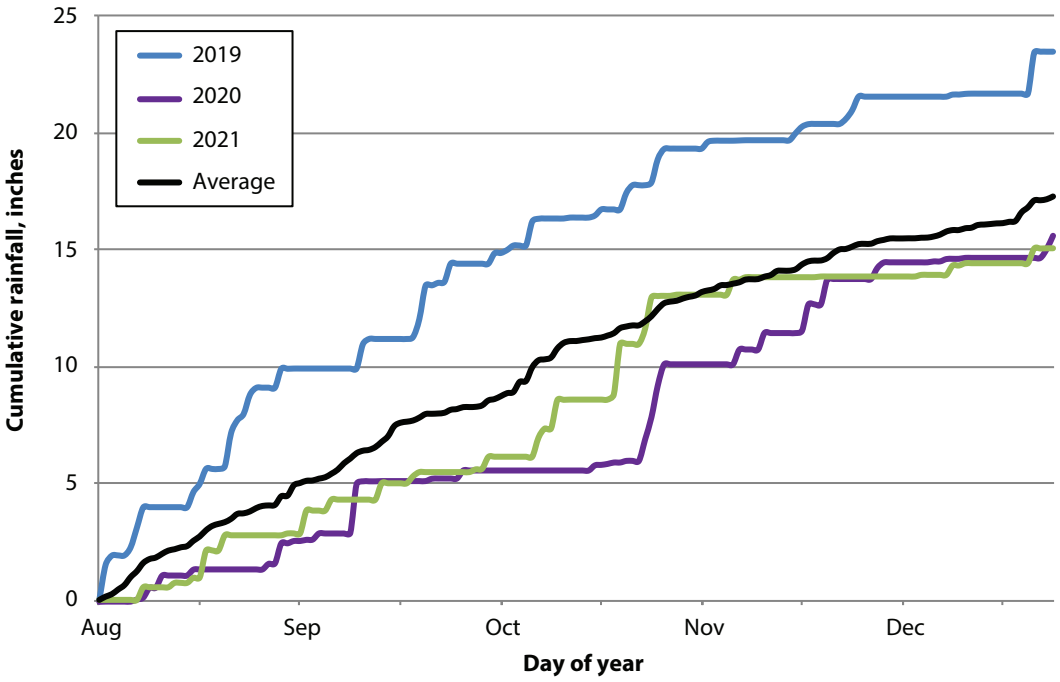


**Figure 1. Cumulative rainfall during the fall season for 2019, 2020, and 2021. The 12-year average rainfall is shown for comparison.**

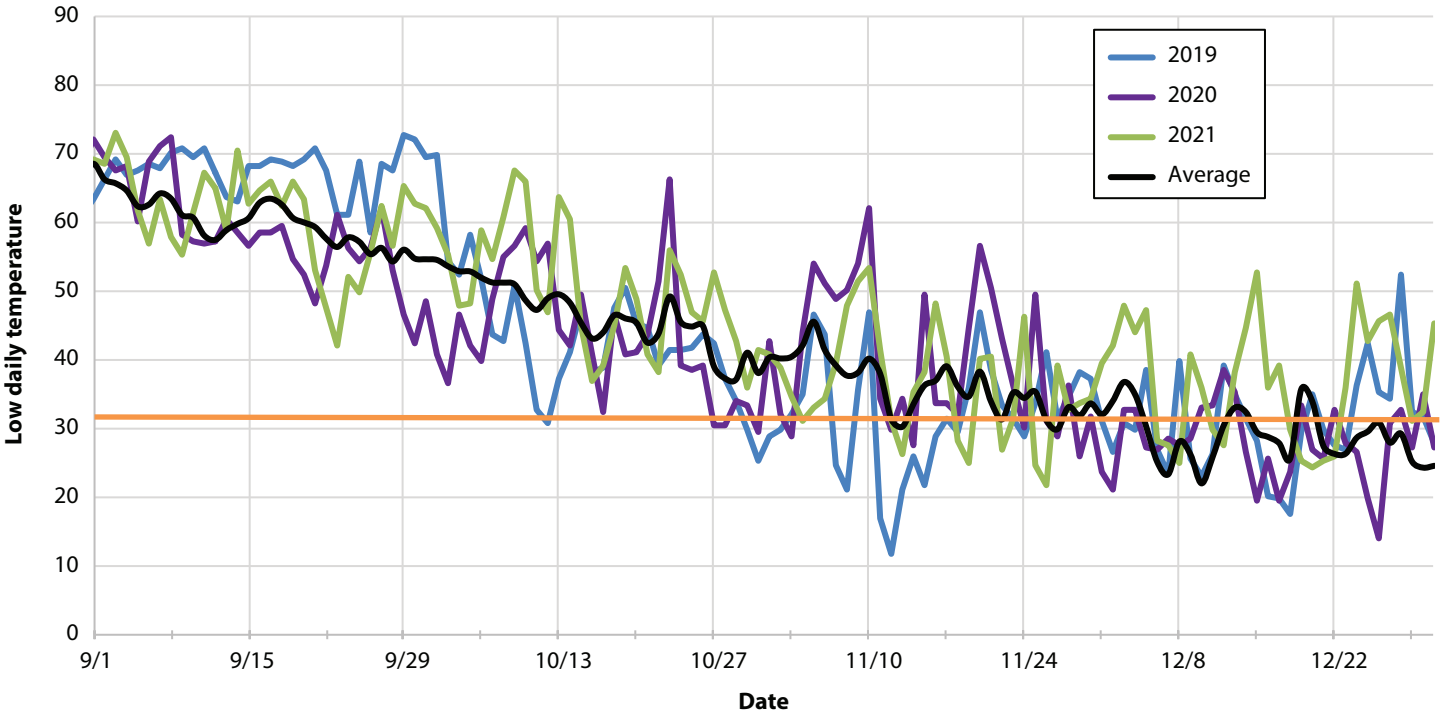


**Figure 2. Low daily temperature for the study period and 11-year average. Freezing temperature (32°F) is marked with a solid orange line.**