Kansas Agricultural Experiment Station Research Reports

Volume 7
Issue 2 *Southeast Research and Extension Center Agricultural Research*

Article 8

2021

Nitrogen Fertilizer Timing and Phosphorus and Potassium Fertilization Rates for Established Endophyte-Free Tall Fescue: Year 3

D. W. Sweeney
Kansas State University, dsweeney@ksu.edu

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

J. L. Moyer
Kansas State University, jmoyer@ksu.edu

See next page for additional authors

Nitrogen Fertilizer Timing and Phosphorus and Potassium Fertilization Rates for Established Endophyte-Free Tall Fescue: Year 3

Cover Page Footnote

This work is supported by the U.S. Department of Agriculture National Institute of Food and Agriculture, Hatch project KS00-0104-HA.

Authors

D. W. Sweeney, J. K. Farney, J. L. Moyer, and D. A. Ruiz Diaz

K-STATE Research and Extension

2021 SEREC AGRICULTURAL RESEARCH

Nitrogen Fertilizer Timing and Phosphorus and Potassium Fertilization Rates for Established Endophyte-Free Tall Fescue: Year 3

D.W. Sweeney, J.K. Farney, J.L. Moyer, and D.A. Ruiz Diaz[1]

Summary

Tall fescue production was measured during the third production year of a study with locations started in fall of 2016 and fall of 2017. Phosphorus (P) fertilization rate affected spring harvest yield at Site 1, but not at Site 2. Applying nitrogen (N) in late fall or late winter resulted in greater spring yields than applying N in spring or not applying N. However, fall harvest yields at Site 1 were greater with spring N application, but not at Site 2. The third-year tall fescue total yield rank as affected by N fertilizer timing was late winter>late fall=spring>no N at Site 1 and late winter=late fall>spring>no N at Site 2.

Introduction

Tall fescue is the major cool-season grass in southeastern Kansas. Perennial grass crops, as with annual row crops, rely on proper fertilization for optimum production; however, meadows and pastures are often under-fertilized and produce low quantities of low-quality forage. The objective of this study was to determine the effect of N fertilizer timing and P and potassium (K) fertilization rates on tall fescue yields.

Experimental Procedures

The experiment was conducted on two adjacent sites of established endophyte-free tall fescue beginning in the fall of 2016 (Site 1) and 2017 (Site 2) at the Parsons Unit of the Kansas State University Southeast Research and Extension Center. The soil at both sites was a Parsons silt loam. The experimental design was a split-plot arrangement of a randomized complete block. The six whole plots received combinations of P_2O_5 and K_2O fertilizer rates allowing for two separate analyses: 1) four rates of P_2O_5 consisting of 0, 25, and 50 lb/a each year and a fourth treatment of 100 lb/a only applied at the beginning of the study; and 2) a 2 × 2 factorial combination of two rates of P_2O_5 (0 and 50 lb/a) and two levels of K_2O (0 and 40 lb/a). Subplots were four application timings of N fertilization consisting of none, late fall, late winter, and spring (E2 growth stage). Phosphorus and K fertilizers were broadcast applied in the fall as 0-46-0 (triple super-

[1] Department of Agronomy, College of Agriculture, Kansas State University, Manhattan, KS.

phosphate) and 0-0-60 (potassium chloride). Nitrogen, as 46-0-0 (urea) solid at 120 lb N/a, was broadcast applied to appropriate plots on December 4, 2018, March 18, 2019, and April 25, 2019, at Site 1. Nitrogen was applied on December 5, 2019, March 3, 2020, and April 15, 2020, at Site 2. Third-year harvest dates from each site were as follows: (1) spring yield was measured at R4 (half bloom) on May 17, 2019, at Site 1 and at R5 (post anthesis) on May 17, 2020, at Site 2; (2) fall harvest was taken on September 10, 2019, at Site 1 and on October 22, 2020, at Site 2.

Results and Discussion

In the third year of the study at Site 1 in 2019, spring harvest and total yield of tall fescue was increased by P fertilization, but was unaffected by rate (Table 1). Spring harvest yield was greatest when N was applied either in late fall or late winter. Even though applying N fertilizer at the E2 growth stage in spring resulted in greater yield compared with no N, delaying N application resulted in about a 35% reduction in spring yield compared with the more traditional timings of either late fall or late winter. However, fall harvest tall fescue yield increased with more recent N applications. Average annual total tall fescue yield was approximately doubled by applying N. Late winter application resulted in greatest total yield than with either fall or spring (E2) fertilization.

Third-year tall fescue spring harvest, fall harvest, or total yields in 2020 at Site 2 were unaffected by P fertilization (Table 2). As for the third year at Site 1 (Table 1), spring tall fescue yield was greatest with late fall or late winter N fertilization compared with N fertilizer applied at the E2 growth stage or with no N (Table 2). In contrast to results from Site 1 (Table 1), there were no differences in fall yield as affected by N fertilizer treatments (Table 2). Third-year tall fescue total yield mirrored spring yields.

Potassium fertilization resulted in inconsistent and small third-year yield responses in different harvests at the two sites (data not shown). Adding 40 lb K_2O/a resulted in less than 0.40 ton/a increase in yield in the fall harvest at Site 1 in 2019 and in the R4 harvest at Site 2 in 2020.

Acknowledgment

This work is supported by the U.S. Department of Agriculture National Institute of Food and Agriculture, Hatch project KS00-0104-HA.

Table 1. Third-year yield of established tall fescue in the spring (R4-half bloom) and fall 2019 as affected by P_2O_5 fertilization rates and nitrogen (N) application timing at Site 1

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P_2O_5 (lb/a)	---------- ton/a, 12% moisture ----------		
0	1.26	1.79	3.05
25	2.04	1.64	3.68
50	2.18	1.60	3.77
100[1]	1.92	1.46	3.38
LSD (0.05)	0.35	NS	0.40
N application timing			
None	0.77	1.28	2.05
Late fall	2.50	1.43	3.92
Late winter	2.53	1.73	4.25
Spring	1.61	2.05	3.66
LSD (0.05)	0.22	0.13	0.27

[1]The 100 lb P_2O_5/a rate was only applied at the beginning of the study (fall 2016).

Table 2. Third-year yield of established tall fescue in the spring (R4-half bloom) and fall 2020 as affected by P_2O_5 fertilization rates and nitrogen (N) application timing at Site 2

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P_2O_5 (lb/a)	---------- ton/a, 12% moisture ----------		
0	2.00	0.98	2.98
25	2.24	0.99	3.23
50	2.53	1.05	3.59
100[1]	2.34	1.07	3.41
LSD (0.05)	NS	NS	NS
N application timing			
None	1.04	1.06	2.09
Late fall	2.93	1.04	3.97
Late winter	3.01	1.01	4.00
Spring	2.13	0.99	3.14
LSD (0.05)	0.22	NS	0.31

[1]The 100 lb P_2O_5/a rate was only applied at the beginning of the study (fall 2017).