

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

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Summary

Tall fescue production was measured during the second year of a study with locations started in fall of 2016 and fall of 2017. In the second year at both sites, phosphorus (P) fertilization rate did not affect harvest yields. 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 in 2018 were greater without N, but were greater with spring N application at Site 2 in 2019. In both site-years, the second-year tall fescue total yield rank as affected by N fertilizer timing was late fall=late winter>spring>no N, even though overall yields were greater in 2019 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 superphosphate) 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 1, 2017, March 2, 2018, and April 27, 2018, at Site 1. Nitrogen was applied on December 4, 2018,

March 18, 2019, and April 25, 2019, at Site 2. Second-year harvest dates from each site were as follows: (1) spring yield was measured at R4 (half bloom) on May 17, 2018, at Site 1 and on May 17, 2019, at Site 2; (2) fall harvest was taken on September 12, 2018, at Site 1 and on September 10, 2019, at Site 2.

Results and Discussion

Dry conditions in 2018 resulted in low, second-year tall fescue yields at Site 1 (Table 1). In the second year of the study at Site 1, spring harvest, fall harvest, or total yield of tall fescue was unaffected by P fertilization. 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 more than a 40% reduction in spring yield compared with the more traditional timings of either late fall or late winter. However, at the fall harvest, tall fescue yield was less with N application than without. Average annual total tall fescue yield was increased by applying N. Late fall and late winter application resulted in similar total yields which were 35% to 67% greater than with spring (E2) fertilization or no N, respectively.

Second-year tall fescue spring harvest, fall harvest, or total yields in 2019 at Site 2 were unaffected by P fertilization (Table 2). Spring tall fescue yield was similar with late fall and late winter N fertilization. However, as for the second year at Site 1 (Table 1), both late fall and late winter N fertilization in the first year at Site 2 resulted in greater spring yield than with no N or N applied at the E2 growth stage in spring (Table 2). In contrast to results from Site 1 (Table 1), spring N application did result in greater fall yield than with no N or N applied in late fall or late winter (Table 2). At Site 2, as with Site 1 (Table 1), the second-year tall fescue total yield rank as affected by N fertilizer timing was late fall=late winter>spring>no N (Table 2).

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Table 1. Second-year yield of established tall fescue in the spring (R4-half bloom) and fall 2018 as affected by P₂O₅ fertilization rates and nitrogen (N) application timing at Site 1

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P ₂ O ₅ (lb/a)	----- ton/a, 12% moisture -----		
0	0.82	1.02	1.83
25	1.03	0.99	2.02
50	1.06	1.01	2.07
100 ¹	1.08	1.00	2.08
LSD (0.05)	NS	NS	NS
N application timing			
None	0.31	1.13	1.44
Late fall	1.43	0.96	2.39
Late winter	1.45	0.95	2.41
Spring	0.80	0.96	1.76
LSD (0.05)	0.17	0.15	0.20

¹The 100 lb P₂O₅/a rate was only applied at the beginning of the study (Fall 2016).

Table 2. First-year yield of established tall fescue in the spring (R4-half bloom) and fall 2019 as affected by P₂O₅ fertilization rates and nitrogen (N) application timing at Site 2

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P ₂ O ₅ (lb/a)	----- ton/a, 12% moisture -----		
0	1.84	1.41	3.25
25	1.92	1.34	3.26
50	2.12	1.35	3.47
100 ¹	2.00	1.28	3.28
LSD (0.05)	NS	NS	NS
N application timing			
None	0.62	1.17	1.79
Late fall	2.96	1.20	4.16
Late winter	2.81	1.31	4.12
Spring	1.49	1.70	3.19
LSD (0.05)	0.19	0.16	0.28

¹The 100 lb P₂O₅/a rate was only applied at the beginning of the study (Fall 2017).