

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

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### **Summary**

A tall fescue production study was conducted at two locations, beginning in the fall of 2016 and the fall of 2017. At both sites, phosphorus (P) fertilization rate only affected the spring harvest, with few differences in yield. Applying nitrogen (N) in late fall or late winter resulted in greater spring yields than applying N in spring or not applying N. However, at Site 1 in 2017 fall harvest yields were greater from the spring N application, but this response was less at Site 2 in 2018. In both years, applying N increased tall fescue yield, but at Site 2 the yield differences from N timings were greater.

### **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 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  $2 \times 2$  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 6, 2016, March 8, 2017, and April 19, 2017 at Site 1. Nitrogen was applied on December 1, 2017, March 2, 2018, and April 27, 2018 at Site 2. First-year harvest dates from each site were as fol-

lows: 1) spring yield was measured at R4 (half bloom) on May 15, 2017, at Site 1 and on May 17, 2018, at Site 2; 2) fall harvest was taken on September 13, 2017, at Site 1 and on September 12, 2018, at Site 2.

## Results and Discussion

In the first year of the study at Site 1, spring harvest yield of tall fescue in 2017 was increased with 25 lb  $P_2O_5/a$ , but yield did not increase with greater P rates (Table 1). Fall harvest was unaffected by P rate so that the total annual production mirrored the response measured in the spring harvest. 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 than with no N, delaying N application resulted in more than a 50% 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 greater from spring N applications compared with no N or N applied in either late fall or late winter. Thus, average annual total tall fescue yields were more than doubled by applying N. However, the differences in total yield from different N application timings were small with only late fall N application resulting in a 0.3 ton/a greater yield than applying N in the spring.

Dry conditions in 2018 resulted in low, first-year tall fescue yields at Site 2 (Table 2). Tall fescue yield was greater with 50 or 100 lb  $P_2O_5/a$  than with no P, but the average differences were less than 0.2 ton/a. Phosphorus fertilization rates had no effect on the fall or total harvest yields. Spring tall fescue yield was greatest with late fall fertilization. However, as for the first 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 not result in greater fall yield than with no N and only yielded 0.19 to 0.24 ton/a more than with late fall or late winter fertilization (Table 2). At Site 2, the first-year tall fescue yield rank as affected by N fertilizer timing was late fall > late winter > spring > no N.

**Table 1. First-year yield of established tall fescue in the spring (R4-half bloom) and fall 2017 as affected by P<sub>2</sub>O<sub>5</sub> fertilization rates and nitrogen (N) application timing at Site 1**

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P <sub>2</sub> O <sub>5</sub> (lb/a)	----- ton/a, 12% moisture -----		
0	0.69	1.32	2.01
25	1.11	1.41	2.53
50	1.08	1.35	2.43
100 <sup>1</sup>	1.19	1.23	2.42
LSD (0.10)	0.18	NS	0.34
N application timing			
None	0.20	1.03	1.23
Late fall	1.68	1.16	2.84
Late winter	1.57	1.22	2.78
Spring	0.63	1.91	2.54
LSD (0.05)	0.14	0.21	0.29

<sup>1</sup>The 100 lb P<sub>2</sub>O<sub>5</sub>/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 2018 as affected by P<sub>2</sub>O<sub>5</sub> fertilization rates and nitrogen (N) application timing at Site 2**

Treatment	Spring harvest	Fall harvest	Total harvest (R4 + Fall)
P <sub>2</sub> O <sub>5</sub> (lb/a)	----- ton/a, 12% moisture -----		
0	0.80	0.72	1.53
25	0.87	0.76	1.64
50	0.90	0.72	1.62
100 <sup>1</sup>	0.97	0.84	1.81
LSD (0.10)	0.10	NS	NS
N application timing			
None	0.17	0.88	1.06
Late fall	1.31	0.67	2.17
Late winter	1.19	0.62	1.92
Spring	0.53	0.86	1.45
LSD (0.05)	0.09	0.13	0.13 <sup>1</sup>

The 100 lb P<sub>2</sub>O<sub>5</sub>/a rate was only applied at the beginning of the study (Fall 2017).