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# Nitrogen, Phosphorus, and Potassium Fertilization for Newly Established Tall Fescue

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## Summary

First-year production of tall fescue (Site 1 in 2013 and Site 2 in 2014) was affected by nitrogen (N) and phosphorus (P) but not potassium (K) fertilization. Environmental conditions likely influenced the growth of the fescue and the response to fertilizer N and P in the first year of production at the two sites.

## 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, but meadows and pastures are often underfertilized and produce low quantities of low-quality forage. This is often true even when new stands are established. The objective of this study was to determine whether N, P, and K fertilization improves yields during the early years of a stand.

## Experimental Procedures

The experiment was established on two adjacent sites in fall 2012 (Site 1) and fall 2013 (Site 2) at the Parsons Unit of the Kansas State University Southeast Agricultural Research Center. The soil on both sites was a Parsons silt loam with initial soil test values of 5.9 pH, 2.8% organic matter, 4.2 ppm P, 70 ppm K, 3.9 ppm $NH_4$-N, and 37.9 ppm $NO_3$-N in the top 6 in. at Site 1 and 6.5 pH, 2.2% organic matter, 6.7 ppm P, 58 ppm K, 6.8 ppm $NH_4$-N, and 12.3 ppm $NO_3$-N in the top 6 in. at Site 2. The experimental design was a split-plot arrangement of a randomized complete block. The six whole plots were combinations of $P_2O_5$ and $K_2O$ fertilizer levels allowing for two separate analyses: (1) four levels of $P_2O_5$ consisting of 0, 25, 50, and 100 lb/a; and (2) a 2 × 2 factorial combination of two levels of $P_2O_5$ (0, 50 lb/a) and two levels of $K_2O$ (0, 40 lb/a). Subplots were four levels of N fertilization consisting of 0, 50, 100, and 150 lb/a. P and K fertilizers were broadcast applied in the fall as 0-46-0 (triple superphosphate) and 0-0-60 (potassium chloride). Nitrogen was broadcast-applied in late winter as 46-0-0 (urea) solid. First-year samplings and harvests from each site were as follows. Early growth yield as an estimate of grazing potential in early spring was taken at E2 (jointing) growth stage on May 1, 2013, at Site 1 and on May 2, 2014, at Site 2 from a subarea of each plot not used for later spring and fall harvests. Spring yield was measured at R5

(postbloom) on June 7, 2013, at Site 1 and at R4 (half bloom) on May 22, 2014, at Site 2. Fall harvest was taken on September 10, 2013, at Site 1 and on September 24, 2014, at Site 2.

## Results and Discussion

First-year production of tall fescue (Site 1 in 2013 and Site 2 in 2014) was affected by N and P but not K fertilization. At site 1 in 2013, early yield at the E2 (jointing) growth stage to estimate forage available if grazed early, taken in an subarea of each plot not used for later hay harvest, was increased by P rates up to 100 lb $P_2O_5$/a (Table 1). At R5 hay harvest in 2013, yields were high at over 3 ton/a with no P and approximately 4.5 ton/a, with P additions of 25 to 100 lb $P_2O_5$/a. Adding P fertilizer increased lodging and was near 100% for P rates more than 50 lb $P_2O_5$/a. The fall harvest yield declined with increasing P rates. In contrast, increasing N rates tended to decrease yield at R5 but increased yield in the fall. For the first year at Site 2 (2014), increasing N and P rates increased measured yield at E2 and at the R5 hay harvest (Table 2). Lower rainfall amounts resulted in smaller R5 yields (Table 2) and no lodging at that stage (data not shown) compared with Site 1 in the previous year (Table 1). However, June rains in 2014 resulted in increased growth after R5 harvest and resulted in midsummer lodging. By fall harvest, the grass had recovered and measured lodging was minimal, with small amounts of lodging that were unrelated to P fertilization in the 150 lb N/a treatment (Table 2). As in 2013 at Site 1 (Table 1), fall hay yield in 2014 at Site 2 decreased with increasing P rate, but yield increased with increasing N rate (Table 2).

**Table 1. Newly established tall fescue yield in the spring and fall 2013 and R5 lodging visual estimates as affected by $P_2O_5$ and N fertilization rates at Site 1**

| | Yield | | | |
|---|---|---|---|---|
| | Spring | | | |
| $P_2O_5$ | E2 (jointing) | R5 ( postbloom) | Fall harvest | R5 lodging |
| lb/a | ---------- ton/a, 12% moisture ---------- | | | % |
| 0 | 0.30 | 3.41 | 2.05 | 1 |
| 25 | 0.73 | 4.32 | 1.99 | 53 |
| 50 | 1.00 | 4.51 | 1.74 | 97 |
| 100 | 1.70 | 4.47 | 1.48 | 100 |
| LSD (0.05) | 0.32 | 0.63 | 0.29 | 19 |
| | | | | |
| N | | | | |
| lb/a | | | | |
| 0 | 0.86 | 4.48 | 1.61 | 58 |
| 50 | 0.95 | 4.16 | 1.70 | 61 |
| 100 | 0.94 | 4.17 | 1.91 | 67 |
| 150 | 0.95 | 3.89 | 2.04 | 65 |
| LSD (0.05) | NS | 0.33 | 0.15 | NS |

**Table 2. Newly established tall fescue yield in the spring and fall 2014 and lodging visual estimates prior to fall harvest as affected by $P_2O_5$ and N fertilization rates at Site 2**

| | Yield | | | |
|---|---|---|---|---|
| | Spring | | | |
| $P_2O_5$ | E2 (jointing) | R5 ( postbloom) | Fall harvest | Fall lodging |
| lb/a | ---------- ton/a, 12% moisture ---------- | | | % |
| 0 | 0.17 | 1.02 | 1.99 | 7 |
| 25 | 0.38 | 1.25 | 1.89 | 3 |
| 50 | 0.46 | 1.76 | 1.81 | 4 |
| 100 | 0.60 | 1.98 | 1.58 | 4 |
| LSD (0.05) | 0.24 | 0.65 | 0.26 | NS |
| | | | | |
| N | | | | |
| lb/a | | | | |
| 0 | 0.15 | 0.94 | 0.65 | 0 |
| 50 | 0.41 | 1.30 | 1.32 | 0 |
| 100 | 0.49 | 1.86 | 2.34 | 4 |
| 150 | 0.55 | 1.91 | 3.02 | 13 |
| LSD (0.05) | NS | 0.31 | 0.21 | 5 |