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N, P, and K Fertilization for Newly Established Tall Fescue

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Abstract

Second-year production of tall fescue was affected by nitrogen (N) and phosphorus (P) fertilization rates at Site 1 in 2014 and only by N fertilization rates at Site 2 in 2015, with little effect from potassium (K) fertilization at either site.

Keywords

pastures, hay

N, P, and K Fertilization for Newly Established Tall Fescue

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Summary

Second-year production of tall fescue was affected by nitrogen (N) and phosphorus (P) fertilization rates at Site 1 in 2014 and only by N fertilization rates at Site 2 in 2015, with little effect from potassium (K) fertilization at either site.

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. 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 soil 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 where 1) four levels of P_2O_5 consisting of 0, 25, and 50 lb/acre each year and a fourth treatment of 100 lb/acre only applied at the beginning of the study; and 2) a 2 × 2 factorial combination of two levels of P_2O_5 (0, 50 lb/acre) 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/acre. 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. Second-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 April 25, 2014 at Site 1 and on April 29, 2015 at Site 2 from a subarea of each plot not used for later spring and fall harvests. Spring yield was measured at R4 (half bloom) on May 22, 2014 at Site 1 and at R4 (half bloom) on

May 19, 2015 at Site 2. Fall harvest was taken on September 24, 2014 at Site 1 and on September 29, 2015 at Site 2.

Results and Discussion

Second-year production of tall fescue (Site 1 in 2014 and Site 2 in 2015) was affected by N and P but not K at Site 1, and predominately only by N at Site 2. At site 1 in 2014, early yield at the E2 (jointing) growth stage to estimate forage available if grazed early, taken in a subarea of each plot not used for later hay harvest, was not affected by P rates (Table 1). At R4 hay harvest in 2014, yields were low at 1.29 ton/acre with no P and approximately 2 ton/acre with P additions of 50 lb P_2O_5/acre. Fall harvest yield was unaffected by P rates. Total yield ranged between 2 and 3 ton/acre as affected by P rates averaged across N rates. In contrast, N rate significantly affected all sampling and harvests in 2014 at Site 1. Early growth at E2 (jointing) was increased by each additional increment of N fertilizer, although the response was less at greater N rates. At R4, yield was not increased above the 100 lb N/acre rate. However, fall harvest and the total (R4 plus fall) yield were increased by each increment of N fertilizer.

For the second year production at Site 2 (2015), yield was mainly affected only by N rate. Sampling at E2 and R4 and fall harvest yields were not affected by P fertilization and response to K fertilization was marginal. Increasing N rates resulted in increased production at the E2 sampling and at the R4 and fall harvests. Lodging at R4 was apparent at the higher N rates. However, lodging with the 150 lb N/acre rate was slightly decreased when 40 lb K_2O/acre was added (data not shown).

Table 1. Second-year yield of newly established tall fescue in the spring and fall 2014 as affected by P_2O_5 and N fertilization rates at Site 1

	Yield			
	Spring			Total
P_2O_5	E2 (jointing)	R4 (half-bloom)	Fall harvest	(R4 + Fall)
lb/acre	ton/a, 12% moisture			
0	0.46	1.29	0.79	2.08
25	0.65	1.65	0.99	2.65
50	0.69	2.06	0.93	2.99
100†	0.51	2.11	0.83	2.94
LSD (0.05)	NS	0.44	NS	0.65
N				
lb/acre				
0	0.22	0.86	0.36	1.22
50	0.53	1.74	0.56	2.30
100	0.71	2.27	1.06	3.33
150	0.85	2.25	1.55	3.81
LSD (0.05)	0.10	0.29	0.13	0.34

†The 100 lb P_2O_5/acre rate was only applied at the beginning of the study (Fall 2012).

Table 2. Second-year yield of newly established tall fescue in the spring and fall 2015 as affected by P_2O_5 and N fertilization rates at Site 2

	Yield				
	Spring			Total	R4
P_2O_5	E2 (jointing)	R4 (half-bloom)	Fall harvest	(R4 + Fall)	lodging
lb/acre	---------------------- ton/a, 12% moisture ----------------------				%
0	0.94	1.76	0.36	2.12	14
25	0.95	1.65	0.33	1.98	22
50	0.91	1.72	0.34	2.05	18
100†	0.99	1.77	0.35	2.13	17
LSD (0.05)	NS	NS	NS	NS	NS
N					
lb/acre					
0	0.14	0.37	0.15	0.53	0
50	0.81	1.39	0.28	1.67	0
100	1.26	2.35	0.40	2.76	13
150	1.55	2.78	0.54	3.33	58
LSD (0.05)	0.14	0.14	0.05	0.15	8

†The 100 lb P_2O_5/acre rate was only applied at the beginning of the study (Fall 2013).