Tall Fescue Establishment Under Varying Levels of Phosphorous

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Photo by Josh Summerford

Establishment of tall fescue in rootzones varying in soil test phosphorous and either with or without phosphorous fertilization.

Summary. Many regions have placed restrictions on phosphorous (P) fertilizer application, requiring a soil test showing that P is necessary before applications may be made to turfgrasses. Traditionally, P application is recommended when establishing turfgrass. However, P fertilization at establishment and critical soil-test P levels for turfgrasses are not well understood. The objective of this trial was to determine the effects of P fertilizer application on the establishment of tall fescue turf on rootzones with varying soil-test P levels. In soils containing greater than 7 ppm P, P fertilization during seeding had no effect on establishment rate. Therefore, P application to turfgrasses may only be necessary on soils with extremely low soil-test P values.

Abbreviations: P, phosphorous

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Phosphorous is an essential nutrient for turf establishment and growth and is therefore commonly included in starter fertilizer blends. Starter fertilizer blends containing P are often used when establishing turfgrass on soils that may already contain sufficient P for establishment, resulting in excess P on the soil surface. Excessive P fertilization has been linked to deterioration of water quality due to runoff from non-point sources. As a result, many areas have placed restrictions on the use of P, requiring a soil test showing that P is necessary before application. Phosphorous fertilization recommendations for turf are often based on soil-test P levels for agronomic crops and therefore may be higher than necessary for turfgrass, resulting in over-application, potential runoff, and infiltration into water sources. Therefore, the objective of this experiment was to determine the effect of P fertilizer and soil-test P on the establishment of tall fescue.

Materials and Methods

This experiment was conducted from 30 October through 7 December 2009 in a greenhouse on the University of Arkansas, Fayetteville campus. All rootzone blends were made using sand that met United States Golf Association greens construction guidelines, and oven-dried native silt-loam soil with soil-test P values of 4.1ppm, and 11.4 ppm, respectively. Rootzone blends were as follows: 100% sand, 80:20, 60:40, 40:60 20:80 sand to soil respectively, and 100% soil. The soil-test P values for the soil blends are shown in Table 1. Soil-test P was determined by Mehlich-3 extraction at the University of Arkansas Agriculture Diagnostics Laboratory in Fayetteville, Ark. Each rootzone blend was replicated eight times. A turf-type tall fescue blend (*Festuca arundinacea*) was seeded into each pot at a rate of 8 lb/1000 ft^2. Each pot was also fertilized with urea at a rate of 1 lb N/1000 ft^2, then topdressed with 5 g sand to ensure good seed to soil contact. Half of the pots for each rootzone blend (4) received 1 lb P_2O_5/1000 ft^2 as triple super phosphate. Following seeding, irrigation was applied 3 times daily until germination, once daily for the week following germination, and 4 times weekly for the remainder of the trial. Digital images were taken twice weekly to evaluate percent green turf cover. The turf was maintained at a 2-inch height of cut with a mowing frequency of 3 times per week. In early December, the turf appeared chlorotic and the growth rate had slowed, so urea fertilizer was applied on 2 and 9 December at a rate of 0.5 lb N/1000 ft^2 to encourage complete establishment.

Results and Discussion

The effect of P fertilizer on turf coverage depended on the soil blend as well as the evaluation date. On average, the lower rates of sand produced greater green turfgrass coverage compared to the higher rates of sand (Fig. 1). For the first two evaluation dates, there were no significant differences between sand ratio with or without added P. By the third evaluation date, the 40% sand blend had significantly higher turf coverage than the higher two sand rates of 80% and 100% as well as the 0% sand rate. By the fourth evaluation date, the 0% sand rate produced similar cover compared to the 20%, 40%, and 60% sand rates. On the fifth evaluation date, the three lowest sand rates were producing higher turfgrass coverage than the two highest sand rates and the 40% sand rate had greater coverage than the 60% sand rate. This trend continued through the sixth evaluation date. On the seventh, eighth, and ninth evaluation dates, the three lowest sand rates outperformed the three highest sand rates. On the tenth evaluation date, the 0% sand rate had the highest coverage and was significantly higher than the 80 and 100% sand rates. On the final evaluation date, the 0% sand rate had significantly higher coverage than the 100% sand rate.

There was a three-way interaction of soil blend, P fertilization, and evaluation date for turf coverage. The interaction of soil blend by P fertilization was not present until the later evaluation dates and became more pronounced toward the end of the trial. The presence of this interaction on the final evaluation date is shown in Fig. 2. When the soil contained no more than 60% sand (at least 7 ppm P), additional P fertilization at seeding had no effect on turf coverage. There was significantly more coverage on pots receiving additional P at seeding when the soil contained 80% or 100% sand (5.6 and 4.1 ppm P, respectively). At 80% sand, P fertilization increased coverage from 44% to over 80%. At 100% sand, P fertilization increased coverage from 46% to 72%.

The data from this trial suggests that at soil-test P values less than 7.0 ppm, additional P is necessary to optimize establishment. This value is considerably lower than the critical soil-test level (25 ppm) which would trigger a P fertilization recommendation. This indicates that turfgrasses may have a much lower soil-test P requirement than what is traditionally recommended by soil testing laboratories. The lower P requirement of turfgrasses may also be attributed to the dense fibrous root system of turf compared to other field crops, for which the critical P levels were established, allowing turfgrasses to better utilize soil P reserves.

Table 1. Soil and sand blends, and the corresponding P content as determined by Mehlich-3 analysis, that were used in this experiment.

Sand	Soil	P
--------% -------		ppm
0	100	11.4
20	80	9.9
40	60	8.5
60	40	7.0
80	20	5.6
100	0	4.1

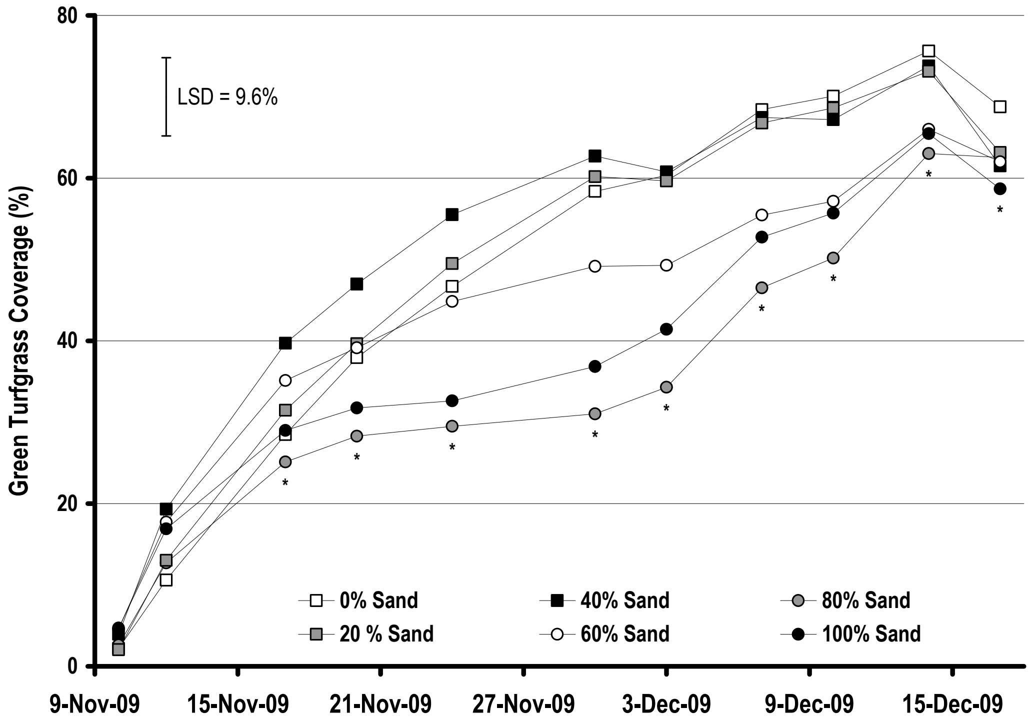

Fig. 1. Percent green turfgrass coverage as affected by rootzone blend. Error bar represents Fisher's least significant difference value (α = 0.05) for comparing rootzone blends within dates. Significant treatment differences were present on evaluation dates denoted with a "*".

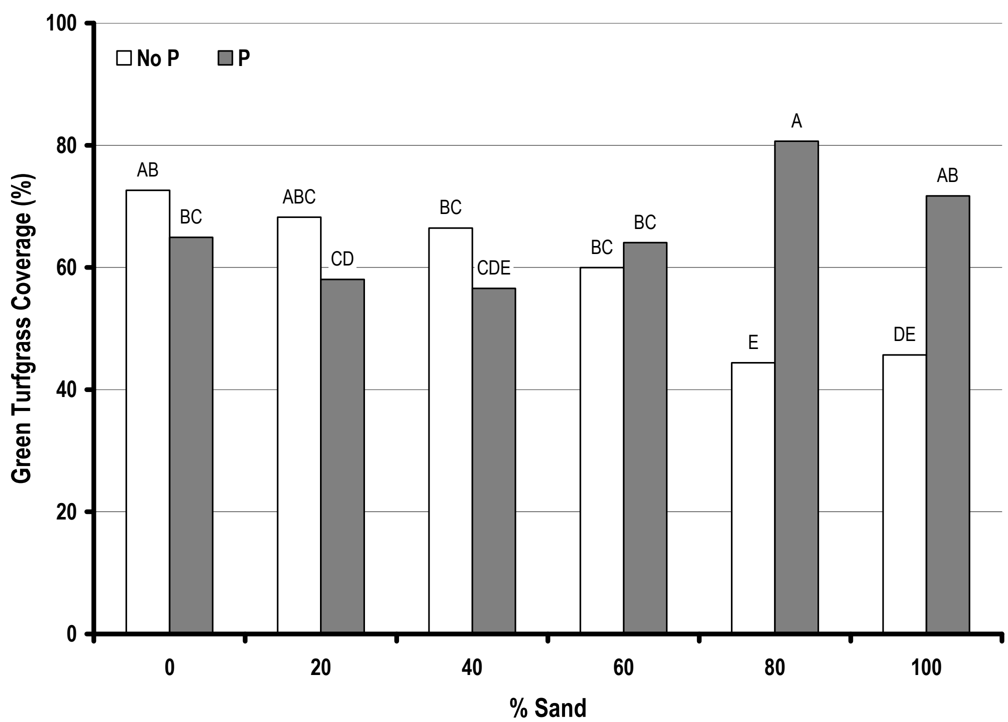

Fig. 2. Percent green turfgrass coverage as affected by rootzone blend. Bars not sharing a letter are significantly different according to Fisher's least significant difference test (α = 0.05).