The Impact of Pre-Plant Phosphorus and Potassium on Turf Type Tall Fescue Establishment

Glenn Hardebeck1, Cale Bigelow1, Kristina Walker1 and Doug Smith2 (1)Purdue University, (2)USDA-ARS National Soil Erosion Research Laboratory

Agronomy Department, West Lafayette, IN 47906 *ghardebeck@ purdue.edu (http://www.agry.purdue.edu/turf)

Background

Phosphorus (P) is an essential macronutrient found in every living cell, while potassium (K) is not a constituent but is essential for growth and development. P affects the rooting, maturation and reproduction of turfgrasses and is vital during the seedling stage of turfgrass growth and development (Beard, 1973). K is found in turfgrasses in quantities second only to Nitrogen. Young turfgrasses exhibit the highest levels of K decreasing as they near maturity (Beard, 1973). But, in a study by Fitzpatrick and Guillard (2004), yield and quality responses of established Kentucky bluegrass (Poa pratensis L.) were not affected by the addition of K even on soils testing low in extractable K and yield and quality responses were not correlated to tissue K concentration. The utilization of starter fertilizers containing elevated P and K has long been prescribed when establishing turfgrasses, regardless of the existing soil nutrient status. Increased public concern regarding nutrient losses to the environment has brought many traditional fertilization practices such as this into question.

Hypothesis

• The addition of pre-plant P will improve the establishment of turf-type tall fescue TTTF, while the addition of pre-plant K will provide lesser noticeable differences.
• The addition of pre-plant P will improve establishment when attempting to seed at a suboptimum time such as late fall.
• The addition of pre-plant P and K will provide greater benefit on sites with low inherent levels of P and K.

Objectives

• To determine the effect of varying pre-plant, incorporated P and K levels on the establishment of turf-type TTTF.
• Determine if the addition of P and K affects the establishment of TTTF seeded on various dates throughout the fall.
• Determine if the addition of P and K affects the establishment of TTTF on sites with varying inherent P and K levels.

Materials and Methods

A field study was conducted at two locations with varying inherent levels of P (35 vs. 150 ppm) and K (220 vs. 375 ppm) during 2003 and 2004. The experiment was arranged as a 3 x 3 x 2 factorial in a split-plot design with three replicates. Main plots were three seed dates and subplots measuring three rates of P (triple superphosphate, 0-46-0) and two rates of K (potassium chloride 0-0-62) (Table 1). A 50:50 blend of soluble-slow release N (urea, 46-0-0:sulfur coated urea, 31-0-0) was applied to the main plots pre-plant and six weeks after emergence at 49 kg N ha⁻¹. Fertilizers and seed were applied by hand using shaker bottles. Plots were seeded with TTTF at 250 kg ha⁻¹, irrigated and covered with germination blankets to promote germination and mown to a uniform height of 6.4 cm with clippings removed through the fall season. Broadleaf weeds were treated with carfentrazone at 25 g a.i./ha late November through early December across all plots during both years.

Data collection: Establishment was measured as percentage turf cover and initial spring clipping yield. Percentage turf cover were rated visually on a scale of 0-100 where 0 was no turfgrass coverage and 100 was complete turfgrass coverage. Initial spring clipping yield were determined by allowing plots to grow through the spring until mid-May. Plots were then harvested at each location for both years with a bagging attachment and oven dried to determine dry matter yield.

Table 1: Phosphorus and potassium rates and seeding timing

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Application rate</th>
<th>Seeding Timing</th>
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<tbody>
<tr>
<td>Phosphorus</td>
<td>(kg P₂O₅ ha⁻¹)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Late August</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Mid-September</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td>Early October</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>(kg K₂O ha⁻¹)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
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Spring Cover Results
• At the lower P and K fertility location, the addition of 98 kg P ha\(^{-1}\) increased turf cover by 21\% over plots receiving no P (35\% cover) within the Sept. seeding date during year one (Fig. 3 and 4).
• Trends were similar across the remaining seeding dates during both years.

References

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