Freezing Tolerance of Selected Zoysiagrass Lines in Field and Controlled Environmental Conditions

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INTRODUCTION

Zoysiagrass (Zostera spp.) is a warm-season grass widely used for golf courses, athletic fields, and home lawns in the southern United States. It has been identified as one of the low-input or low-maintenance species that can be managed with low inputs of water, fertilizer, and pesticide (Beard, 1973). Zoysiagrass has superior turf quality, excellent durability and density (Turgeon, 1991), and excellent heat, drought, and pest tolerance compared to cool-season turfgrasses (Pompelino et al., 2011). However, its ability to survive freezing temperatures is low, which limits its widespread use in the transition zone. Meyer (Z. japonica Steud.) is the industry standard for zoysiagrass in the transition zone because of its heat, drought and freezing tolerance (Grau, 1952; Patton and Reicher, 2007). However, Meyer is relatively slow to establish and its texture is coarse (Okeyo et al., 2011). Development of cultivars with enhanced tolerance to freezing temperatures would improve the adaption and management of zoysiagrass in the transition zone. The most common method to screen cold tolerance is to evaluate the regrowth of plants that have been exposed to freezing temperatures after cold acclimation either in the field or controlled environment (Anderson et al. 1993; Fry et al. 1993).

GOAL AND OBJECTIVES

Goal: To identify zoysiagrass with leaf texture finer than Meyer but with cold tolerance superior or comparable to Meyer.

Objectives: (1) To evaluate the freezing tolerance of seven selected zoysiagrass cultivars in the field and controlled environmental conditions and prediction of freezing temperature (LT50); (2) To examine the relationship of LT50 from the field and controlled environmental conditions.

MATERIALS and METHODS

Plant Materials:
Selected zoysiagrass lines DALZ 1301, DALZ 1304-1309 and commercial check Meyer.

Target soil temperatures: -3, -5, -7, -9, -10, -13 °C.

Field Freezing Tolerance:
Plants were sampled from the replicated field plots in January (Field-1) and February (Field-2), 2014 for freezing tolerance evaluations (Figure 1). The maximum and minimum daily air temperatures were showed in Figure 2. The sampled cores were placed in the growth chamber overnight at -3°C and treated following the procedure of Anderson et al. (1993).

RESULTS

Freezing tolerance LT50 (the temperature resulting in no regrowth from 50% of the plants) of zoysiagrass as determined by nonlinear regression.

Table 1, LT50 values of zoysiagrass lines from Field, GC-1 and GC-2.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Species</th>
<th>Field</th>
<th>GC-1</th>
<th>GC-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meyer</td>
<td>Z. japonica</td>
<td>9.3 c</td>
<td>9.9</td>
<td>9.4 d</td>
</tr>
<tr>
<td>DALZ 1301</td>
<td>Z. matrella</td>
<td>8.5 c</td>
<td>9.3 d</td>
<td>8.5 d</td>
</tr>
<tr>
<td>DALZ 1304</td>
<td>Z. matrella</td>
<td>6.2 ab</td>
<td>4.3 a</td>
<td>6.4 a</td>
</tr>
<tr>
<td>DALZ 1305</td>
<td>Z. matrella</td>
<td>6.0 ab</td>
<td>4.7 b</td>
<td>5.7 ab</td>
</tr>
<tr>
<td>DALZ 1306</td>
<td>Z. matrella</td>
<td>6.6 b</td>
<td>7.6 c</td>
<td>7.1 c</td>
</tr>
<tr>
<td>DALZ 1307</td>
<td>Z. matrella</td>
<td>5.5 a</td>
<td>4.3 ab</td>
<td>5.5 ab</td>
</tr>
<tr>
<td>DALZ 1308</td>
<td>Z. matrella</td>
<td>6.0 ab</td>
<td>1.9 a</td>
<td>6.7 ab</td>
</tr>
<tr>
<td>DALZ 1309</td>
<td>Z. matrella</td>
<td>5.7 ab</td>
<td>2.6 a</td>
<td>6.8 bc</td>
</tr>
</tbody>
</table>


Different letters following values within a column indicate a significant difference at P < 0.05.

There is no significant difference for LT50 from Field-1 and Field-2. Therefore, means of LT50 from Field-1 and Field-2 were pooled together (Field) to show in the Table. Significant differences for LT50 of selected lines were found under GC-1 and GC-2. The data for both GC-1 and GC-2 is presented (Table 1).

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REFERENCES