Enhancement of Seed Germination in Common Carpetgrass and Centipedegrass Seed

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Abstract. Priming or presoaking seed of common carpetgrass (Axonopus affinis Chase) and centipedegrass (Eremochloa ophiuroides Munro, [Kunzii]) increased germination percentage and decreased mean time of germination (MTG) at 20, 25, and 30 °C. The effect of presoaking and priming was dependent on grass species and temperature. The optimum seed germination temperature for both of these warm-season species was 30 °C. Maximum effect on common carpetgrass or centipedegrass seeds was achieved by priming in 2% KNO₃; higher concentrations did not improve germination percentage or MTG, and 4% KNO₃ effect on common carpetgrass or centipedegrass seeds was achieved by priming in 2% age and decreased mean time of germination (MTG) at 20, 25, and 30 °C.

Materials and Methods

We used two grass species (common carpetgrass and centipedegrass), four isothermic germination temperatures (15, 20, 25, and 30 °C), and six seed treatments [0% (distilled water); 1%, 2%, 3%, and 4% KNO₃ solutions; and an untreated control]. These concentrations of KNO₃, provided osmotic pressure of –0.5, –0.9, –1.3, and –1.7 Pa, respectively. For each grass species and four germination temperatures of KNO₃ provided osmotic pressure of –0.5, –0.9, –1.3, and –1.7 Pa, respectively. For each grass species and four germination temperatures, two priming treatments were evaluated separately. A thermo-gradient table (Scientific Systems Corp., Baton Rouge, La.), with four isothermic temperature lanes calibrated at 15, 20, 25, or 30 °C, was sectioned into two blocks. A block consisted of six seed treatments in petri dishes randomized within each temperature lane. Cool-white fluorescent lights (19 µmol·m⁻²·s⁻¹) provided 14 h of daily illumination. The experiment was repeated twice over time for each grass species and germination temperature to establish four blocks.

Centipedegrass (Lot # 95/05; Patten Seed, Lakeland, Ga.) and common carpetgrass (Lot # U4/410; Pennington Seed, Hammond, La.) seeds were soaked for 48 h in aerated distilled water (~0.06 MPa) or primed for 48 h with KNO₃ solutions maintained at 25 °C. The osmolarity of priming solutions (vapor pressure osmometer; Wescor, Logan, Utah) was measured prior to and following the 48-h treatment period. Each solution was aerated using a standard aquarium pump. Following treatments, seeds were rinsed with copious amounts of water, transferred to paper towels, and air-dried for 1 h. Fifty seeds of each seed treatment were placed into separately labeled 6.0-cm-diameter petri dishes lined with Whatman #42 filter papers moistened with 2 mL of distilled water. A control treatment (untreated seed) was also included. Seeds were misted with distilled water daily as needed to prevent desiccation.

Germination counts (radicle protrusion) were taken daily for 21 d and germinated seed discarded. MTG and germination percentage...
of primed seeds were calculated and compared with those of nonprimed seeds (control). MTG was calculated as follows: MTG = (Σ Ti Ni / G, where Ti is the day of germination, Ni is the number of seeds germinating on Ti, and G is the total number of germinated seeds (Hartmann et al., 1990). A tetrazolium test was used to determine the viability of nongerminated seeds (Association of Official Seed Analysts, 1994). Seed germination was calculated based as the sum of percentages of viable seeds and germinated seeds.

The experimental design used for both grass species and temperature was a randomized complete-block with four replications. A general linear model was performed separately on each grass species and germination temperature, using the SAS statistical package (SAS Inst., 1991). Means were separated using Duncan's new multiple range test at P ≤ 0.05.

Results and Discussion

Data for carpetgrass and centipedegrass data were evaluated separately. There were no significant differences over time for either species at P ≤ 0.05. Therefore, the experiment was analyzed as a randomized complete-block design.

Common carpetgrass. Presoaking in distilled water did not significantly improve germination at 15 °C, but affected germination at higher temperatures (Table 1). Presoaking hastened germination significantly at 20 °C, but did not increase germination percentage. Presoaking improved germination percentage at 25 °C but not at 30 °C (Table 1), and reduced MTG at both temperatures by >2 d.

Germination percentage at 15 °C decreased linearly as KNO3 concentration increased (Table 1), but MTG was not significantly reduced by priming. Priming did not increase germination percentage at 20 °C, but MTG increased linearly with increasing KNO3 concentration. Priming in 2% KNO3 significantly increased germination by 23% at 25 °C. Mean time of germination was reduced by 3 d for seeds primed in either 1% or 4% KNO3, Priming increased germination percentage at 30 °C and reduced MTG by >2 d.

Conclusions

Presoaking and priming may be of little value at 15 °C, but priming common carpetgrass and centipedegrass seeds has potential for improving seed germination or reducing MTG at germination temperatures between 20 and 30 °C. Currently, there is no commercial source of primed or presoaked seed of carpetgrass or centipedegrass. However, the results of this study indicate that MTG of both species could be reduced by presoaking and/or priming.

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Table 1. Effects of soaking and/or priming seeds of common carpetgrass and centipedegrass on germination during 21 d incubation at 15, 20, 25, or 30 °C.

| Treatment | KNO3 priming solution (%) | 15 °C | 20 °C | 25 °C | 30 °C | Mean time of germination (days) |
|-----------|---------------------------|-------|-------|-------|-------|-------------------------------|
|           |                           | Ψ (MPa) |       |       |       |                               |
| Carpetgrass |                           |       |       |       |       |                               |
| 0 (Presoaking) | −0.06                     | 4.1 a  | 64.6 ab | 96.0 a | 97.6 a | 13.6 a  | 8.3 b  | 3.2 c  | 2.1 c  |
| 1 | −0.5                     | 5.5 a  | 65.6 ab | 98.5 a | 98.1 a | 15.0 a  | 7.5 b  | 3.3 c  | 2.0 c  |
| 2 | −0.9                     | 6.1 a  | 83.7 a  | 99.0 a | 97.0 a | 14.6 a  | 7.2 b  | 3.6 bc | 2.1 c  |
| 3 | −1.3                     | 2.1 a  | 85.6 a  | 96.9 a | 99.5 a | 12.5 a  | 7.1 b  | 3.4 c  | 2.2 c  |
| 4 | −1.7 (untreated)         | 4.7 a  | 82.7 a  | 96.6 a | 95.9 a | 15.3 a  | 8.0 b  | 4.0 b  | 2.9 b  |
| Control |                           | 6.0 a  | 49.3 b  | 87.9 b | 95.1 a | 12.3 a  | 10.2 a | 5.6 a  | 4.4 a  |
| Linear NS NS NS NS NS NS |                               |       |       |       |       |                               |
| Nonlinear NS NS NS NS NS NS |                               |       |       |       |       |                               |
| Centipedegrass |                           |       |       |       |       |                               |
| 0 (Presoaking) | −0.06                     | 11.0 a | 36.6 a  | 33.5 b | 87.5 a | 14.3 a  | 9.3 bc | 5.7 a  | 2.8 b  |
| 1 | −0.5                     | 12.1 a | 32.8 a  | 35.0 b | 72.0 b | 13.4 a  | 8.0 c  | 4.6 b  | 3.2 b  |
| 2 | −0.9                     | 6.0 a  | 29.0 a  | 58.3 a | 73.6 b | 16.7 a  | 9.4 b  | 5.7 a  | 3.6 b  |
| 3 | −1.3                     | 4.0 a  | 26.7 a  | 36.4 b | 62.0 bc | 17.0 a  | 10.3 ab | 6.4 ab | 3.1 b  |
| 4 | −1.7 (untreated)         | 5.0 a  | 21.0 a  | 30.0 b | 57.0 c | 14.6 a  | 11.0 a | 5.4 b  | 3.1 b  |
| Control |                           | 5.0 a  | 22.2 a  | 34.5 b | 33.0 b | 15.0 a  | 11.4 a | 8.6 a  | 5.5 a  |
| Linear NS NS NS NS NS NS |                               |       |       |       |       |                               |
| Nonlinear NS NS NS NS NS NS |                               |       |       |       |       |                               |

*Mean separation within columns and species by Duncan’s new multiple range test (P ≤ 0.05).

**Nonsignificant or significant at P ≤ 0.05 and 0.01, respectively, within columns and species.