Tolerance to Saline, Waterlogging, and Saline-waterlogging in Kentucky Bluegrass Cultivars

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INTRODUCTION

High soil salinity is a major abiotic stress in turfgrass areas, causing a reduction in turf quality and sub-par playing conditions. Waterlogging (i.e. flooding) is commonly seen in salt-affected soils because of shallow water-table or decreased water movement due to sodicity in salt-affected soils. Waterlogging causes oxygen deficiency and oxidative stress in plants, resulted in poor turfgrass stand. Extensive research has been conducted to evaluate the individual effects of salinity and waterlogging on the performance of turfgrass species. However, information on the combined effects of salinity and waterlogging (i.e. saline-waterlogging) on turfgrass growth and development are limited.

OBJECTIVE

To determine the relative tolerance to saline, waterlogging, and the combined saline-waterlogging in eight commercially available Kentucky bluegrass cultivars

MATERIALS AND METHODS

- Eight Kentucky bluegrass cultivars were included in this research: America, Arrowhead, Award, Blue Note, Kenblue, Sudden Impact, Moonlight, and Limousine.
- The grasses were seeded in 4 x 4 inch pots with a sand:peat (9:1, v:v) mixture at 2 lbs pure live seed per 1,000 sq. ft in a greenhouse.
- Saline, waterlogging, and saline-waterlogging conditions were exposed three weeks after seeding.
  - Saline: watering with a Na_2SO_4 + $MgSO_4$ (1:1, M:M) solution at 3 dS/m in Study I and 6 dS/m in Study II
  - Waterlogging: pots were put in a container with tap water up to soil surface
  - Saline-waterlogging: pots were put in a container with a Na_2SO_4 + $MgSO_4$ solution (3 and 6 dS/m in Study I and II, respectively) up to soil surface
- The stress conditions lasted six weeks in Study I and three weeks in Study II.
- The experiments were set up as randomized complete block design with three replicates. Data were collected on shoot and root dry weight and the longest root length (Study II) when the experiments were terminated. Data under stress conditions were expressed as percentage of the control (i.e. non-stress) within each cultivar to minimize genetic variations in growth habits.

RESULTS

Shoot dry weight

- Shoot dry weight was not affected by stress condition, cultivar, or their interaction in either study.

Root dry weight

- A stress condition x cultivar interaction was observed in Study I (Fig. 1). Cultivars such as America and Arrowhead showed high root dry weight under waterlogging condition, while Limousine and Moonlight had good root growth under saline condition. All plants had similar root biomass under saline-waterlogging
- Root dry weight was only affected by cultivar in Study II (Fig. 2). 'Moonlight' and 'Kenblue' had the highest and lowest root dry weight, respectively.

The longest root length (Study II only)

- The longest root length was affected by stress condition and grass cultivar (data not shown).
- The longest root length decreased in the following order: Control > Saline (86.7% of the control) > waterlogging, saline-waterlogging (averaged = 47.9% of the control).
- 'Moonlight' had higher root length than other grasses, except 'Award' (Fig. 3).

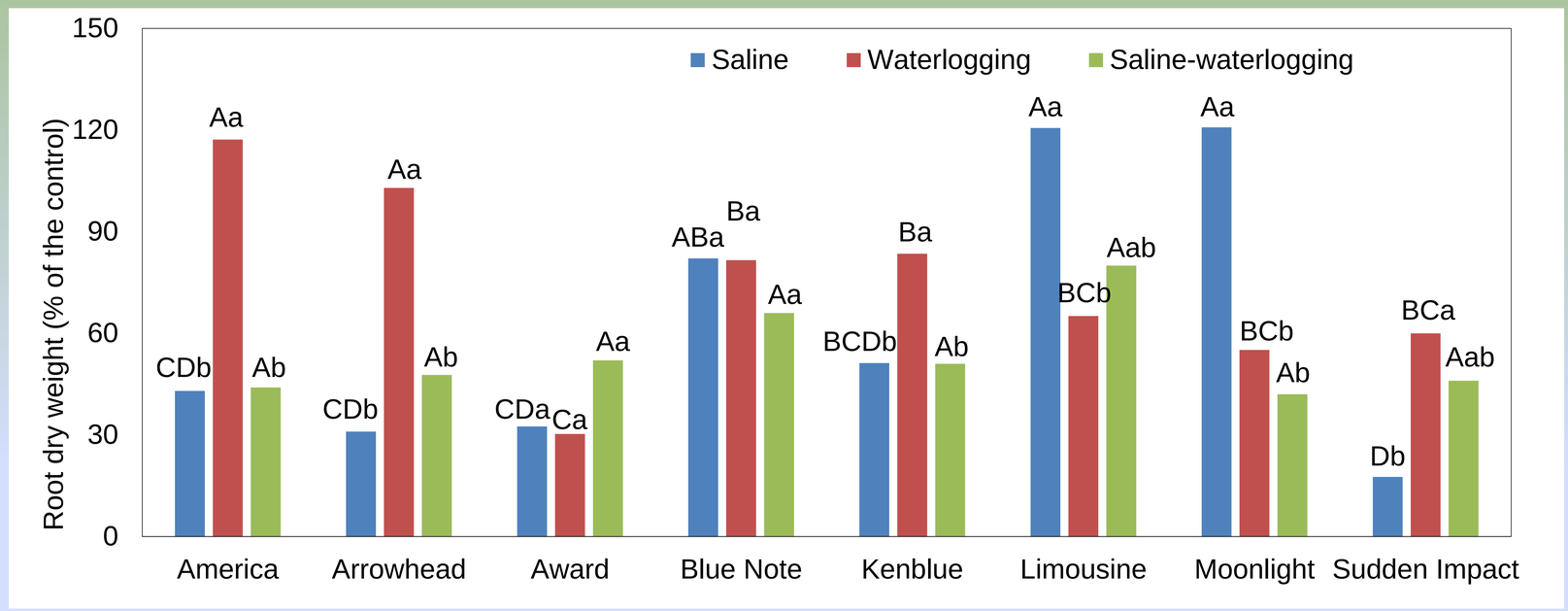

Fig. 1. Root dry weigh as affected by a cultivar x growing condition interaction. Upper and lower case letter indicate significant differences between the cultivars under the same growing condition and between the growing conditions of the same cultivar at $P \leq 0.05$, respectively.

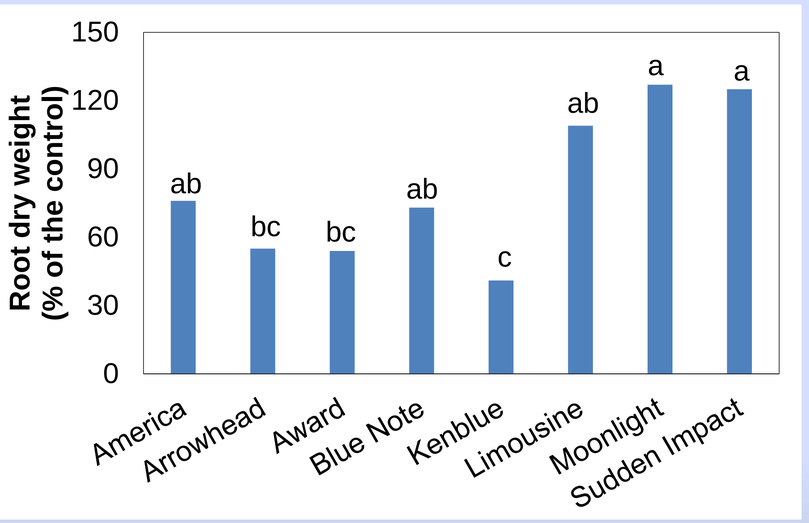

Fig. 2. Root dry weigh in eight Kentucky bluegrass cultivars. Different letters indicate significant differences at $P \leq 0.05$.

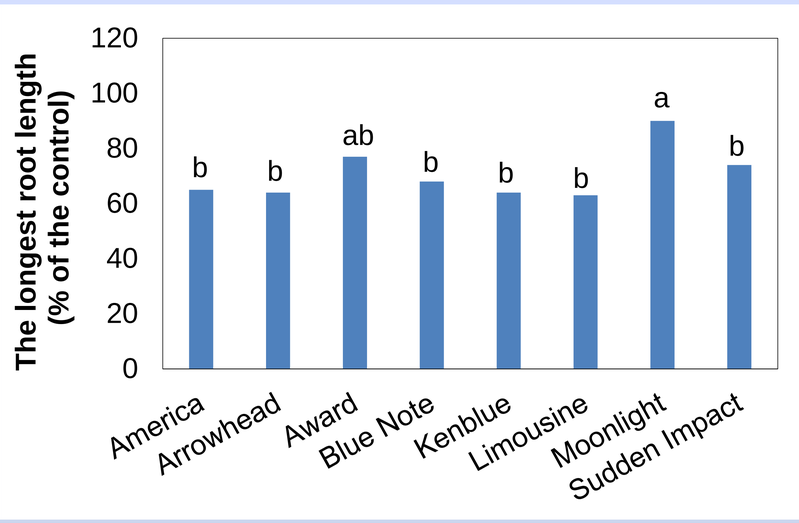

Fig. 3. The longest root length in eight Kentucky bluegrass cultivars. Different letters indicate significant differences at $P \leq 0.05$.

CONCLUSIONS

- There are genetic differences in tolerance to saline, waterlogging, and saline-waterlogging in Kentucky bluegrass.
- Overall, the combined saline-waterlogging conditions causes more severe damage than saline and waterlogging.