Physiological Responses of Kentucky Bluegrass to Simulated Athletic Field Traffic

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Ben Pease, research associate
Adam Thoms, assistant professor
Nick Christians, university professor
Department of Horticulture

Introduction

Present-day sports turf managers are pushing turf stands to perform at higher standards, and for longer periods, than previously thought possible. This is due to turf genetic improvements, advancements in turf culture technology, and pressure from end-users for "better" conditions. Because of these parameters, turf stress research has increased over the past two decades. Most of the research has focused on turf responses to heat, drought, or salinity stress, because mitigation of such stresses can be achieved through altered or improved cultural practices.

This is not the case with traffic or wear stress. Often there are minimal changes a turf manager can implement to alter the type, volume, or pattern of traffic stress, aside from a complete traffic ban for a period of time. For this reason, traffic or wear stress must be tolerated by the turf and planned for by the turf manager. From the current knowledge base, improving traffic tolerance mostly is a function of turf species and cultivar selection, often only addressed during a sports field or golf course renovation. If renovation is not an option, improving traffic tolerance mostly is a function of regulating traffic frequency or severity, assuming all cultural practices are ideal.

The objective of this trial is to measure changes in activities of antioxidant enzymes when turf is subjected to simulated athletic field traffic. Enzyme assays will be performed on ascorbate peroxidase, catalase, and superoxide dismutase to determine the amount of change for each enzyme and when it changes. From this knowledge, baselines can be developed for future trials involving product application to mitigate negative enzyme concentration changes or enhance positive enzyme concentration changes.

Materials and Methods

This trial was conducted at the Iowa State University Horticulture Research Station, Ames, Iowa, on a native soil Kentucky bluegrass (*Poa pratensis*) athletic field. Turf was cut at 2 in. two days/week using a riding rotary mower, with clippings returned. Irrigation was applied as necessary to facilitate optimal growing conditions. Fertility rate was 0.75 lb N/1,000 ft^2/month (May-October) using 28-0-3, a granular slow release fertilizer. Experimental design was split-plot randomized complete block with four replications (Figure 1). Main plots were traffic treatment of 0 or 2 games/week, applied using a modified Baldree simulator. Sub plots were timing of turf sampling: 0, 2, 4, 8, 12, and 24 hours after traffic application. Traffic was applied and turf was sampled on seven dates between August 10 and October 11. This timeframe was chosen to best mimic the Iowa high school football season.

Individual turf blades were cut from each sub plot at the appropriate timing using a straight razor blade. One gram of turf blades was collected in a small paper envelope and immediately submerged in liquid nitrogen, where these were stored until moved to an 80^{o}C freezer at the end of the sampling day. Frozen samples were processed in a cold room workspace (3-4^{o}C). Samples were ground

under liquid nitrogen, weighed into centrifuge tubes, and an extraction buffer was added. Tubes were centrifuged at 14,000g for 20 minutes at 4ºC. Supernatant then was collected and allocated into various micro-centrifuge tubes for later enzyme assay analysis.

Enzyme Assay Reaction Mixtures

Ascorbate peroxidase
50 mM potassium phosphate buffer (pH 7.0)
0.5 mM ascorbic acid
0.1 mM H_2O_2
25 uL supernatant

Catalase
50 mM potassium phosphate buffer (pH 7.0)
15 mM H_2O_2
25 uL supernatant

Superoxide dismutase
50 mM potassium phosphate buffer (pH 7.8)
13 mM methionine
75 uL nitro blue tetrazolium
0.1 mM EDTA
2 uM riboflavin
25 uL supernatant

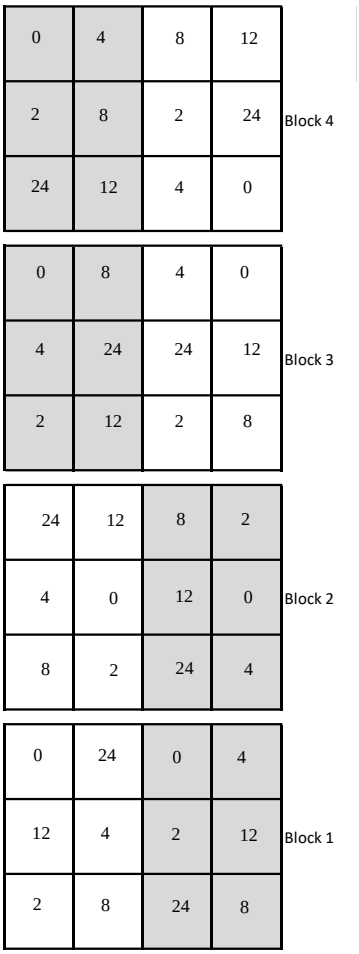

Figure 1. Experimental unit plot plan for athletic field traffic trial, Ames, Iowa, 2018. Shaded units receive traffic. Numbers within units denote timing of turf sampling after traffic application, in hours.

Results and Discussion

This is the first year of a two-year trial. Enzyme assay analysis is ongoing throughout the winter. Year 1 results will be presented in early 2019 and full trial results will be presented in late 2019/early 2020.

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