NITROGEN NUTRITION IMPACT ON INCIDENCE OF RHIZOCTONIA INFECTION OF AGROSTIS STOLONIFERA

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ABSTRACT

Creeping bentgrass (*Agrostis stolonifera* L.) is tolerant of short mowing and high traffic, but these conditions increase pathogen susceptibility. A prevalent disease on bentgrass golf course greens and tee boxes is Brown Patch (*Rhizoctoniasolani*). One potential component of integrated pathogen management is correct nitrogen (N) fertilization. Bentgrass was grown in a chamber hydroponically at deficient, optimum, and excessive levels of N (2.5, 10, and 80 mM; equivalent to 6.9, 27.5, and 220 lb/ac) with or without Rhizoctonia inoculation and grown for 56 d. Not surprisingly, increasing solution N resulted in increased shoot and decreasing root biomass. Rhizoctonia inoculation did not appear to dramatically impact biomass. However, infection resulted in near total necrosis of all tissues at the low rate of N for inoculated plants, but plants at higher N rates and those not inoculated were healthy. The project will be concluded following another study with Rhizoctonia and PCR analysis of the roots and crowns from both studies.

INTRODUCTION

*Rhizoctoniasolani*can cause brown patches to appear in stressed turf. While Creeping Bentgrass on golf greens can tolerate low mowing heights and high traffic, itbecomes more susceptible to disease under these conditions. One preventative measure includes the use of a fungicide to maintain the health of the turf. An alternative measure to excessive fungicide includes the proper use of fertilization to maintain plant health.Each species of turf has a unique threshold for optimal fertilization, but how this optimum relates to disease resistance is less obvious. Nitrogen (N) fertilization is known to have the largest impact on nearly all growth parameters of turf, especially verdure (visual assessment) and shoot biomass. The objective of this study was to determine if there is an interaction between Rhizoctonia infection and N nutrition with regard to verdure and root and shoot biomass.

METHODS

Initial Nitrogen Testing (Study 1)

The *Agrostis stolonifera* (var. putter) seed was selected for this experiment and was grown in a hydroponic growth chamber for 16 hrs in light conditions at 25ºC (77ºF) and 8 hrs in dark conditions at 15ºC (59ºF).The seed was suspended on agar/netting in a 38 mm fitting. A total of 9 treatments were conducted with various levels of nitrogen including: 1.25, 2.5, 5, 10, 20, 40, 80, 160, 320 mg N L^{-1} (3.4, 6.9, 13.8, 27.5, 55.1, 110, 220, 441, and 881 lb N/ac, respectively). The grass was trimmed every other day to approx 1-2 cm (0.4-0.8 in.).

Pathogen Testing (Study 2)

The previous setup was utilized for 6 treatments with 3 levels of Nitrogen (2.5, 10, 80 mg N L^{-1}) (6.89, 27.54, 220.32 lb N/ac), and each level of N is with or without *Rhizoctoniasolani*.Half of the treatments were inoculated with *Rhizoctoniasolani* when beginning nitrogen treatments.

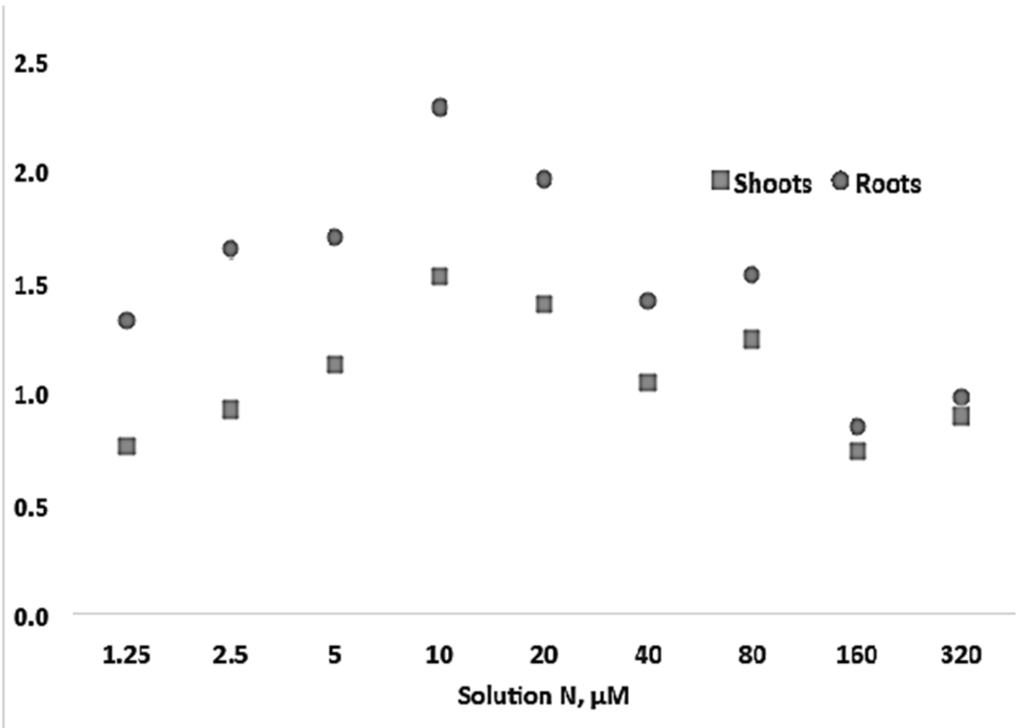

Fig. 1. Study 1 - Shoot and Root Biomass(g/pot) for*A. stolonifera* at nine N treatments. Measurements were used to determine optimum, deficient, and excessive treatments for use in study 2.

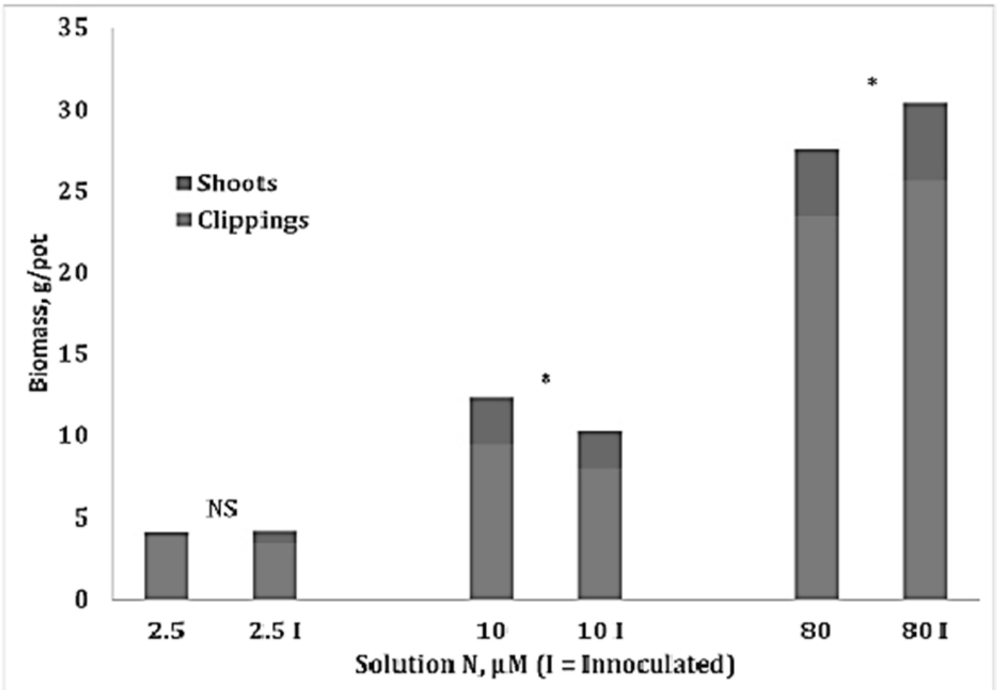

Fig. 2. Study 2 - Shoot Biomass for*A. stolonifera* at three N treatments, both inoculated and uninoculated. (NS= not significant and * significant at P<0.05).

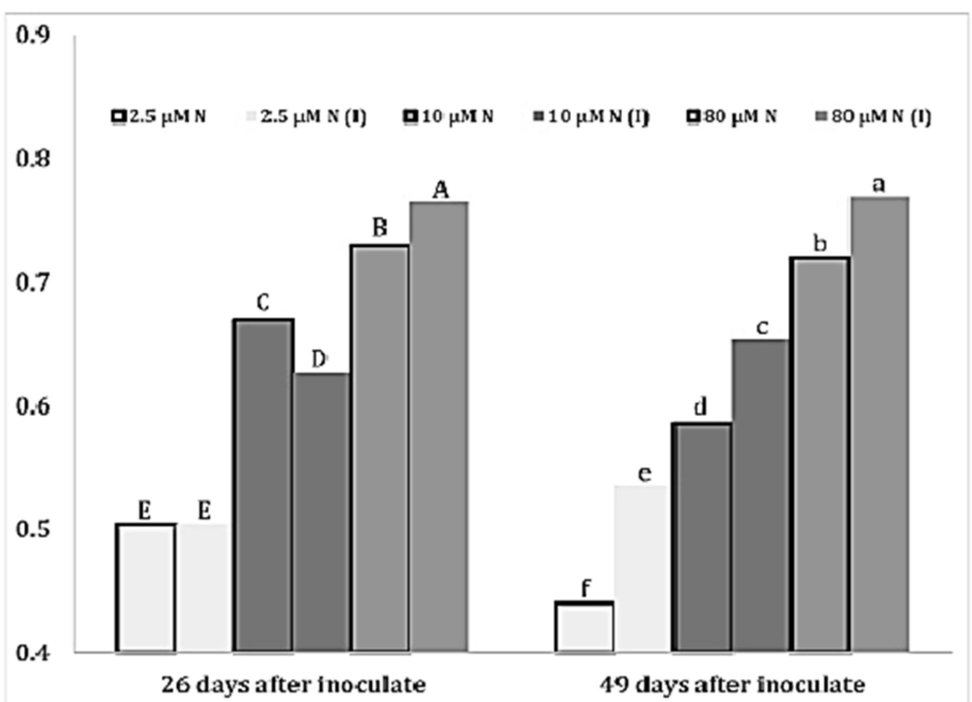

Fig. 3. Study 2 - NDVI Readings for *A. stolonifera* at three N treatments, both inoculated and not inoculated, at 26 and 49 days after inoculation.

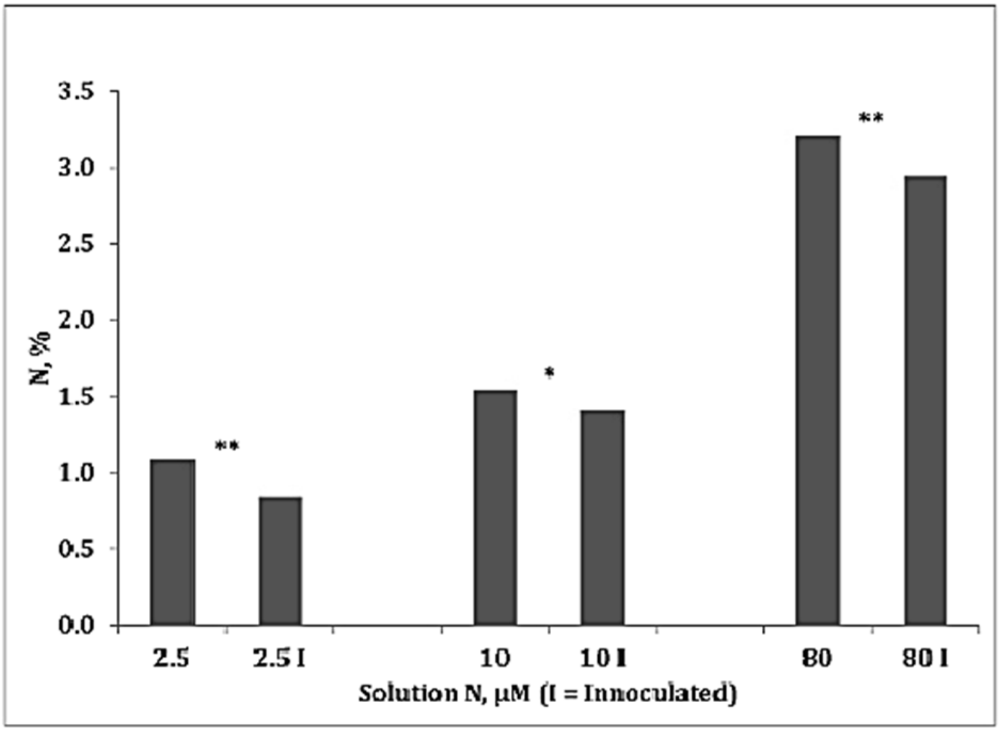

Fig. 4. Study 2 - Nitrogen Readings for *A. stolonifera* at three N treatments, both inoculated and uninoculated. (NS= not significant, * significant at P<0.05, ** significant at P<0.01).

RESULTS

The results of study 1 were used to identify deficient, optimum, and excessive levels of solution N supply for creeping bentgrass grown hydroponically (Fig. 1). For the deficient category, we selected 2.5µM Nrather than 1.25 µM Nbecause the growth was almost nonexistent at the very lowest level. We selected 10 µM N for the optimum level, as both shoot and root growth peaked at this concentration. We opted for 80 µM Nfor excessive because both shoot and root growth were significantly decreased and yet the N concentration was not so high as to cause death.

As expected, shoot growth was proportional to N supply (Fig. 2). Inoculation did not impact shoot growth at the deficient level of solution N, increased it at the optimum, but decreased it at the excessive levels. This may be due to an interaction with root growth. Visually root growth was clearly greatest at the optimum level of N, but actual weights have not been measured yet (roots are currently being processed for pathogen DNA analysis and, as such, are not dried at this time).

Shoot verdure, as indicated by NDVI (Fig. 3) and visual ratings (not shown), increased with increasing N rate. When contrasting inoculated vs. non-inoculated plants, results were mixed for the first reading part way through the study, but by harvest the inoculated plants were consistently lower in NDVI values than non-inoculated plants.

As expected, shoot N concentration increased significantly with increasing N supply, but inoculated plants had significantly lower N concentration than non-inoculated plants (Fig. 4).

DISCUSSION

Other than sod farmers, turfgrass managers tend to apply excessive N rates. This is especially true for the golf course and sports turf industries where aesthetics are vital and budgets are relatively high. The notion of “if some is good, then more must be better” is very applicable amongst these managers. A unique aspect of these industries is that the turfgrasses are mowed very short and, as such, have increased opportunity for pathogen infection. It is common to apply fungicides on a routine basis, whereas venues where turf is mowed at optimum rates rarely need fungicides—especially in the arid west. From an environmental standpoint, there is concern with high application rates of both pesticides and fertilizers. The ideal is to find the rates where optimum verdure and plant health are achieved. The preliminary results of this study show that optimum N rates not only have adequate verdure, but shoot growth is moderate (less mowing/clipping waste) and root growth is maximized. Analysis of thepathogen aspect of the study is still underway, but there is certainly an impact on N uptake and growth for Rhizoctonia infected plants.

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