Evaluation of Humic Fertilizers on Soil Health with Creeping Bentgrass on a USGA Root Zone

RFR-A1919

A.J. Lindsey, graduate research assistant
Adam Thoms, assistant professor
Nick Christians, university professor
Department of Horticulture

Introduction

Improving soil health has gained popularity over recent years. Humic substances are organic compounds that have been shown to improve nutrient availability for plant absorption, increased soil water holding capacity, and increased cation exchange capacity of soils. There are many claims of the benefits of humic products on turfgrass, which include a better-developed root system, improved stress tolerances, increased nutrient uptake and efficiency, improved soil structure, and increased effectiveness of fertilizers. However, minimal research has been conducted to substantiate these claims. The objective of this study is to evaluate soil health parameters of a sand-based turfgrass fertilized with humic substances. This is part of the first year of a two-year study.

Materials and Methods

Research was conducted at the Iowa State University Horticulture Research Station, Ames, Iowa, on a Penncross creeping bentgrass (*Agrostis stolonifera* L.) putting green established over a root zone substrate meeting United States Golf Association (USGA) specifications. Turf was maintained at a 0.125 in. mowing height (mowed six times/week) and received irrigation as needed to minimize plant stress.

The experimental design was a randomized complete block with three replications. Fertilizer treatments included humic-coated urea (HCU at two rates); HCU + humic dispersing granules (HDG); HCU + black gypsum (BG); urea; HDG; and a nontreated control (Table 1).

Soil parameters measured included microbial biomass, phosphorus and potassium concentrations, pH, cation exchange capacity (CEC), percent organic matter, volumetric water content, and soil compaction. Microbial biomass was determined using the fumigation-extraction method. Microbial biomass carbon and microbial biomass nitrogen were measured using a Shimadzu TOC analyzer. Turfgrass visual quality (1–9, 6 minimally acceptable) was collected biweekly April-October 2019. Phosphorus and potassium concentrations, pH, CEC, and organic matter was determined by sending soil samples to Solum, Inc. (Ames, Iowa). Soil volumetric water content was collected using a FieldScout TDR Meter with 3 in. probes. Soil compaction was determined using a Turf-Tec Penetrometer. All data were analyzed using SAS ($P \leq 0.05$ level). Means separation was performed using Fisher's LSD (least significant difference).

Results and Discussion

Minimal differences occurred in the first year of the study. No differences between treatments were found for volumetric water content and soil compaction (data not shown). There was no treatment effect on phosphorus and potassium concentrations, pH, CEC, or organic matter (Table 2). All treatments that received nitrogen (N) had higher visual turf quality than those without N. Applications of humic substances alone did not improve turf quality relative to the nontreated.

Treatments will be repeated over two years. Additional analysis will occur after the second year data have been collected.

Acknowledgements

The authors would like to thank Anthony "Tony" Goldsby (The Andersons, Inc., Maumee, Ohio) for his assistance and for providing the products used in this research. Appreciation is extended to Isaac Mertz, Simon Mitbo, Tim Dalsgaard, Colin Laswell, Nathan Underwood, Thomas Gould, and Spencer Sherrick for their help with experimental setup, data collection, and plot maintenance.

Table 1. List of fertilizer treatments, application rates, and application timing, Iowa State University Horticulture Research Station, Ames, IA.

Treatment	Application rate	Application timing
Humic-coated urea (HCU)	0.15 lb N 1,000 sq. ft.$^{-1}$	April-October (2 wk intervals)
HCU	0.10 lb N 1,000 sq. ft.$^{-1}$	April-October (2 wk intervals)
HCU + humic dispersing granules (HDG)	0.15 lb N 1,000 sq. ft.$^{-1}$ + 1.14 lb HDG 1,000 sq. ft.$^{-1}$	HCU: April-October (2 wk intervals) HDG: April, May, September, October
HCU + black gypsum (BG)	0.15 lb N 1,000 sq. ft.$^{-1}$ + 3 lb BG 1,000 sq. ft.$^{-1}$	HCU: April-October (2 wk intervals) BG: April, July, October
Urea	0.15 lb N 1,000 sq. ft.$^{-1}$	April-October (2 wk intervals)
HDG	1.14 lb HDG 1,000 sq. ft.$^{-1}$	April, May, September, October
Nontreated	-	-

Table 2. Effect of various fertilizers on soil parameters and visual quality of Penncross creeping bentgrass, Iowa State University Horticulture Research Station, Ames, IA.

Treatment	Phosphorus[1]	Potassium[1]	pH[1]	CEC[1]	Organic matter[1]	Visual quality[2]
	ppm	ppm		$cmol_c\ kg^{-1}$	%	
Humic-coated urea (HCU)	15.3[3]	65.0	7.3	13.6	3.5	7.0[4]
HCU	16.3	64.8	7.3	13.8	3.9	6.8
HCU + humic dispersing granules (HDG)	14.4	62.6	7.3	13.0	3.3	7.0
HCU + black gypsum	15.7	57.0	7.3	14.1	3.5	6.9
Urea	16.8	67.6	7.2	13.2	3.5	6.8
HDG	14.3	55.4	7.4	12.7	3.2	5.3
Nontreated	15.1	62.4	7.4	13.7	3.0	5.4
$LSD_{0.05}$	NS[5]	NS	NS	NS	NS	0.2

[1]Soil samples collected May 13, 2019 (after one fertilizer application) and October 31, 2019 (end of field season). Phosphorus and potassium concentrations, pH, cation exchange capacity (CEC), and organic matter values determined by Solum, Inc. (Ames, Iowa).
[2]Visual quality ratings (1–9, 6 minimally acceptable) taken biweekly April-October.
[3]No interaction between sampling date and treatment effect, means are pooled across dates.
[4]Means are pooled across rating dates.
[5]NS = nonsignificant.