

Soil pH Effect on Anthracnose of Annual Bluegrass

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Introduction

- Anthracnose, caused by Colletotrichum cereale, can be a severe disease on annual bluegrass [*Poa annua* L. forma *reptans* (Hausskn.) T. Koyama] putting green turf.
- Previous research indicated that the optimum soil pH to suppress anthracnose disease is between 6.0 to 6.5. However, due to the solubility of gypsum, the effect of soil Ca was unclear.

Objective

Determine the impact of soil pH and calcium on anthracnose severity of annual bluegrass maintained as putting green turf.

Table 2. The analysis of variance of soil amendment and year effects on anthracnose severity (AUDPC; 2019, 2020, 2021), mat layer pH, mat layer Ca, and shoot tissue Ca (2019, 2020) on an annual bluegrass turf mowed at 2.8-mm in North Brunswick, NJ.

Results

Source of Variation	AUDPC	Mat Layer pH Mat Layer		Shoot Tissue Ca				
		P of significant F						
Soil Amendment	* * *	* * *	* * *	* * *				
Year	**	NS	NS	*				
Soil Amendment × Year	* * *	NS	* * *	*				

> Soil amendment had a significant effect on AUDPC, mat layer pH, mat layer Ca, and shoot tissue Ca in all years.

> Mat layer pH response to soil amendment was independent of year; whereas the response of AUDPC, mat layer Ca, and shoot tissue Ca to soil amendment was not independent of year.

Materials & Methods

- A field study initiated in 2011 on a 9-yr-old annual bluegrass turf by Dr. Charles Schmid was continued through 2021.
- Turf was grown on 70-mm deep mat layer produced by topdressing with medium sand over a sandy loam in North Brunswick, NJ.
- Plots were mowed at 2.8-mm (bench set) five to six times wk⁻¹. **Experimental Design**
- Nine treatments were arranged in a randomized complete block design with four blocks. Plot size was $1.8 - \times 1.8 - m$. **Treatments**
- Table 1. The annual quantity of soil amendments applied to annual bluegrass in 2019, 2020 and 2021 in North Brunswick, NJ.

Amendment	Rate	2019 ^a	2020 ^b	2021 ^c
			kg ha ⁻¹	
Control	Non-treated	0	0	0
Lime	Very low	0	108	162
Lime	Low	0	312	482
Lime	Medium	0	960	1,440
Lime	High	0	2,880	4,320
Lime	Very high	0	8,639	12,958
Gypsum	Low	3,025	3,025	3,025
Gypsum	High	6,050	6,050	6 <i>,</i> 050
Sulfur	Low	0	25	25
Sulfur	High	0	49	49

Table 3. Anthracnose severity (AUDPC; 2019, 2020, 2021), mat layer pH, mat layer Ca, and shoot tissue Ca (2019, 2020) responses to applications of lime, gypsum and sulfur on annual bluegrass turf mowed at 2.8-mm in North Brunswick, NJ.

					Mat Layer				
			AUDPC ^a		рН ^ь	Mat La	yer Ca ^b	Shoot T	issue Ca ^b
					Pooled				
Amendment	Rate	2019	2020	2021	2019/2020	Sep. 2019	Sep. 2020	Sep. 2019	Sep. 2020
		%			kg ha ⁻¹		mg kg ⁻¹		
Control		1,615 f	1,957 cd	2,770 bc	5.70 b	620 ab	599 ab	3,385 a	3,012 ab
Lime	very low	1,515 ef	1,950 cd	2 <i>,</i> 609 b	5.64 b	727 ab	718 ab	3,775 a	2,753 ab
Lime	low	1,403 def	2,004 cd	2 <i>,</i> 645 b	5.91 cd	1,158 bc	1,102 bc	3,830 a	3,220 b
Lime	medium	1,329 cde	1,590 bc	1,065 a	6.03 de	1,347 c	1,627 c	5,369 b	4,568 c
Lime	high	842 a	1,050 a	686 a	6.16 ef	3,944 e	3 <i>,</i> 656 d	6,925 d	4,855 c
Lime	very high	887 ab	1,023 a	731 a	6.27 f	6,545 f	8,149 e	6,326 c	4,853 c
Gypsum	low	1,237 cd	1,401 ab	2296 b	5.29 a	1,522 c	1,017 ab	6,565 cd	4,694 c
Gypsum	high	1,119 bc	1,193 ab	2441 b	5.37 a	2,556 d	1 <i>,</i> 605 c	6,474 cd	5,845 d
Sulfur	low	1,486 ef	1,863 cd	2300 b	5.77 bc	629 ab	603 ab	3,762 a	2,763 ab
Sulfur	high	1,866 g	2,027 d	3311 c	5.59 b	477 a	553 a	3,793 a	2,589 a

^a Three years (2019, 2020, 2019) of disease data has been collected and analyzed.

^b Three years of mat layer pH, mat layer Ca and shoot tissue Ca samples have been collected but only 2 years of samples have been analyzed.

^a Four split applications of gypsum were made on 24 May, 26 June, 26 July, and 23 Aug. 2019. Lime and sulfur relied on residual effects of previous applications in 2019.

^b All amendments applied on 17 Feb. 2020. Three additional split applications of gypsum made on 22 May, 4 July, and 16 Aug. 2020. ^c All amendments applied on 10 Mar. and 12 Apr. 2021. Three additional split applications of gypsum made on 21 May, 2 July, and 13 Aug. 2021.

Field Maintenance

- Irrigation applied at 65% ET two to three days after rain and supplemented with hand-watering when necessary.
- Field was rolled 2- to 3-d wk⁻¹ with a pavement roller (Wacker RD11A Vibratory Double Drum Roller; 1,043 kg).

Data Collection

- Anthracnose severity was evaluated periodically after the onset of disease using a grid-count method with 273 intersections per plot.
- Disease severity was summarized for each year as the area under the disease progress curve (AUDPC)

AUDPC

- increased (analysis not shown); the greatest reduction occurred at the high and very high lime rates.
- > Gypsum treatments decreased disease in 2019 and 2020 compared to the control but had no effect in 2021.

> Disease severity in sulfur plots was equivalent to the control except > Sulfur rate had no effect on mat layer pH and Ca or shoot tissue Ca for the high sulfur rate, which increased disease severity in 2019. compared to the control.



Figure 1. Anthracnose severity response to control, medium lime rate, high lime rate, high gypsum rate and high sulfur rate on annual bluegrass in 2020.

Discussion and Conclusions

> Under acidic soil conditions, both lime and gypsum reduced anthracnose severity compared to the control although the effect of gypsum was not consistent. Inconsistency may be related to differences between gypsum and lime effects on mat layer pH and Ca, shoot tissue Ca, or other nutrients.

Mat Layer pH and Ca, and Shoot Tissue Ca

- > There was a linear decrease in anthracnose severity as lime rate > There was a linear increase in mat layer pH and Ca and shoot tissue Ca in 2019 and 2020 as lime rate increased (analysis not shown).
 - > Gypsum plots had slightly lower pH compared to the control; whereas mat layer Ca and shoot tissue Ca increased linearly or quadratically as the rate of gypsum rate increased (analysis not shown).

Clippings collected on 8 Sep. 2019, 9 Sep. 2020 and 20 Sep. 2021 to determine shoot tissue nutrient concentration.

Six subsamples per plot collected on 9 Sep. 2019, 10 Sep. 2020 and 21 Sep. 2021 to determine mat pH and Ca (Mehlich 3 extraction).

effects (soil amendment Analyzed fixed and year) using GLIMMIX (SAS version 9.4.) for 3 years of AUDPC data and 2 years for other responses. Mat layer pH, mat layer Ca, and shoot tissue Ca samples collected in September 2021 not yet analyzed.

Fisher's protected LSD used to detect differences among soil amendments.

> Further data analysis needed to clarify the extent to which anthracnose severity is affected by mat layer pH and Ca, shoot tissue Ca, or other nutrients.

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