IMPACT OF VARIOUS NITROGEN SOURCES ON PLANT HEALTH ON A CREEPING BENTGRASS RESEARCH PUTTING GREEN

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INTRODUCTION

Putting greens are the most critical playing surface on golf courses. Many cultural practices have been shown to have an effect on putting green quality, including nitrogen fertilization and nitrogen source. In addition to several commonly available nitrogen sources, lysine sourced nitrogen is being evaluated for suitability as a putting green nitrogen fertilizer. The objective of this study was to evaluate the impact of various nitrogen sources on the quality of and potential injury to a golf course putting green.

MATERIALS & METHODS

This one-year field study was initiated at the Valentine Turfgrass Research Center located in University Park, PA. Soil was a loamy sand that was capped with a 4" layer of USGA sand. Turfgrass used for the green speed evaluation was a 3-year old stand of 'Penn A-4' creeping bentgrass (*Agrostis stolonifera*). The area was maintained as a golf course putting green and mowed five times per week to a height of 0.110 inch. All treatments were applied with a CO_2 pressurized (45 psi) sprayer equipped with an air-induction flat fan nozzle (TeeJet, AI9508EVS) calibrated to deliver 2.0 gal of water 1000 ft^{-2}. The experiment was initiated on 29 Jun and repeated according to the application schedule.

Plots measured 3 ft x 6 ft and were arranged as a randomized complete block design with four replications. Turfgrass quality and/or color were visually rated on a 1 to 9 scale where 1 = entire plot brown or thinned and 9 = optimum greenness and/or density. All data were subjected to analysis of variance and means were separated at $P \leq 0.05$ according to Fisher's Protected least significant difference test.

Figure1. Overhead photo during mowing and rolling stress, 2016.

RESULTS & DISCUSSION

On 27 Jun, all plots had acceptable (≥ 6) turfgrass color (Table 1) and quality (Table 2). After treatments were initiated, however, it was observed that the nontreated control consistently was among the treatments with the lowest color rating, while urea was consistently among the treatments with highest color rating and always significantly higher than the nontreated control (Table 1).

On 5 Jul, only plots treated with Sustain, Milorganite, or potassium nitrate failed to improve color (7.3 to 7.5) when compared to the nontreated control plots (6.8) (Table 1). All other treatments significantly improved color (7.8 to 8.0). On 19 Jul, plots treated with Milorganite (6.3) and the nontreated control plots (6.3) had lower color ratings when compared to all other treatments. On 2 and Aug, urea-treated turf had the highest color rating (7.5 to 7.8) and was the

only treatment with color ratings higher than the nontreated control. However, on one or both dates, color in plots treated with granular lysine, liquid lysine, ammonium sulfate, or potassium nitrate (68 to 7.0) was statistically similar to plots treated with urea.

Turfgrass quality, in terms of uniformity and density, remained high for all treatments during the entire trial (Table 2). Phytotoxic injury to turfgrass was observed and noted on multiple rating dates in plots treated with liquid lysine, ammonium sulfate, and potassium nitrate (Table 3). No treatment produced unacceptable levels (≥ 3) of injury and no discernable injury was observed more than five days after any application.

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Table 1. Color on a creeping bentgrass putting green following the application of various fertilizer products, 2016.

Treatment and rate per 1000 ft^2	Application	Color[z]				
		27 Jun	5 Jul	19 Jul	2 Aug	16 Aug
1 Granular Lysine 0.25 lb N	AC	8.0 a[x]	7.8 a	7.5 a	6.8 ab	7.0 ab
2 Liquid Lysine 0.125 lb N.....	ABCD	8.0 a	8.0 a	7.8 a	6.8 ab	6.8 ab
3 Sustain 0.25 lb N.....	AC	8.0 a	7.3 ab	7.3 a	6.3 b	6.5 b
4 Milorganite 0.25 lb N.....	AC	8.0 a	7.3 ab	6.3 b	6.5 ab	6.5 b
5 Urea 0.125 lb N.....	ABCD	8.0 a	8.0 a	8.0 a	7.5 a	7.8 a
6 Ammonium Sulfate 0.125 lb N	ABCD	8.0 a	8.0 a	7.8 a	7.0 ab	6.8 ab
7 Potassium Nitrate 0.125 lb N	ABCD	8.0 a	7.5 ab	7.3 a	6.5 ab	6.8 ab
8 Nontreated	-	8.0 a	6.8 b	6.3 b	6.3 b	6.3 b

[z] Color was visually assessed on a 1 to 9 scale where 1 = entire plot brown and 9 = optimum greenness.

[y] Treatments were applied on the following dates: A = 29 Jun, B= 13 Jul, C = 28 Jul, and D = 9 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's least significant difference test.

Table 2. Quality on a creeping bentgrass putting green following the application of various fertilizer products, 2016.

Treatment and rate per 1000 ft^2	Application	Quality[z]				
		27 Jun	5 Jul	19 Jul	2 Aug	16 Aug
1 Granular Lysine 0.25 lb N	AC	8.0 a[x]	8.0 a	8.0 a	8.0 a	8.0 a
2 Liquid Lysine 0.125 lb N	ABCD	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
3 Sustain 0.25 lb N	AC	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
4 Milorganite 0.25 lb N	AC	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
5 Urea 0.125 lb N	ABCD	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
6 Ammonium Sulfate 0.125 lb N	ABCD	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
7 Potassium Nitrate 0.125 lb N	ABCD	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a
8 Nontreated	-	8.0 a	8.0 a	8.0 a	8.0 a	8.0 a

[z] Quality was visually assessed on a 1 to 9 scale where 1 = entire thinned and 9 = optimum uniformity and density.

[y] Treatments were applied on the following dates: A = 29 Jun, B= 13 Jul, C = 28 Jul, and D = 9 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's least significant difference test.

Table 3. Injury on a creeping bentgrass putting green following the application of various fertilizer products, 2016.

Treatment and rate per 1000 ft^2	Application	Injury[z]		
		16 Jul	2 Aug	12 Aug
1 Granular Lysine 0.25 lb N	AC	0.0 a[x]	0.0 a	0.0 a
2 Liquid Lysine 0.125 lb N	ABCD	0.5 a	0.0 a	1.3 a
3 Sustain 0.25 lb N	AC	0.0 a	0.0 a	0.0 a
4 Milorganite 0.25 lb N	AC	0.0 a	0.0 a	0.0 a
5 Urea 0.125 lb N	ABCD	0.0 a	0.0 a	0.5 a
6 Ammonium Sulfate 0.125 lb N	ABCD	0.5 a	0.0 a	1.0 a
7 Potassium Nitrate 0.125 lb N	ABCD	0.3 a	0.0 a	0.5 a
8 Nontreated	-	0.0 a	0.0 a	0.0 a

[z] Turfgrass injury was visually assessed on a 0 to 5 scale where 0 = no injury present and 5 = entire plot brown or dead.

[y] Treatments were applied on the following dates: A = 29 Jun, B= 13 Jul, C = 28 Jul, and D = 9 Aug.

[x] Means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to the Fisher's least significant difference test.