EVALUATION OF THE AMELIORATION OF DOG URINE DAMAGE TO TURFGRASS BY WASTE-BASED FERTILIZER

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Sponsor: Rothsay

OBJECTIVE

The objective of this research project is to determine the effect of the sponsor's waste-based fertilizer products on phytoxicity of dog urine to cool season lawn turfgrass (Kentucky bluegrass, perennial ryegrass, fine fescue).

Data collected included observation of the rate (timing and percentage) of germination of seed, the total shoot and root growth of seedlings, and the survival and recovery rate.

EXPERIMENTAL DESIGN / METHODS

The treatments were waste-based fertilizer (Rothsay Renew 9-3-3) and an equivalent defined N-P-K fertilizer treatment at equal N rates (5 g m^{-2}), as well as an unfertilized check, and 3 turfgrass species (Table 1). Each treatment was replicated 10 times in 10 cm plastic pots filled to the rim (approx. 3/4 litre) with 80:20 (v:v) sand/peat rootzone mix. Seeding rate was 20 g m^{-2} ('Barrister' Kentucky bluegrass), 30 g m^{-2} ('SR 5100' Chewings fescue) and 40 g m^{-2} ('Futura 3000' perennial ryegrass blend, which is 1/3 cv 'Cutter', 1/3 cv 'Edge', and 1/3 cv 'Fiesta III'). Pots were seeded June 7, 2006. Treatments were placed in a randomized complete block plot layout in the greenhouses at the Bovey Bldg., University of Guelph.

Pots were kept moist until germination began, and thereafter were irrigated to prevent stress. Germination and establishment was assessed visually. Fertilizer treatments were applied once germination was complete (beginning June 21, 2006). The granular applications of Rothsay fertilizer were added June 21, as well as 40% of the liquid defined N-P-K fertilizer. The balance of the liquid fertilizer was added July 13 (30%) and July 20 (30%).

On August 14, 2006 (68 days after seeding, 54 days after application of the granular fertilizer), dog urine treatments were applied to all pots. Dog urine supplied by the sponsor was heated in a water bath to 104°C, and 30 mL was applied to each pot. Treatments were monitored visually and with a Spectrum CM1000 chlorophyll meter to determine phytotoxic effects. Pots were maintained for 10 weeks after dog urine treatment to determine recovery rates from treatment.

All measurements were analysed by appropriate statistical analyses (general linear models).

Table 1. Treatments

Treatment	Fertilizer	Grass species
1	None	Kentucky bluegrass (cv 'Barrister')
2	Rothsay Renew 9-3-3 – 5 g m^{-2} N	Kentucky bluegrass (cv 'Barrister')
3	Defined N-P-K[1] – 5 g m^{-2} N	Kentucky bluegrass (cv 'Barrister')
4	None	Perennial ryegrass (Futura 3000 blend)
5	Rothsay Renew 9-3-3 – 5 g m^{-2} N	Perennial ryegrass (Futura 3000 blend)
6	Defined N-P-K – 5 g m^{-2} N	Perennial ryegrass (Futura 3000 blend)
7	None	Fine fescue (cv 'SR 5100' Chewings)
8	Rothsay Renew 9-3-3 – 5 g m^{-2} N	Fine fescue (cv 'SR 5100' Chewings)
9	Defined N-P-K – 5 g m^{-2} N	Fine fescue (cv 'SR 5100' Chewings)

[1]Defined N-P-K was an aqueous solution of 1.374 g/L NH_4NO_3, 0.273 g/L $NH_4H_2PO_4$, and 0.268 g/L KCl, to give a 9-3-3 analysis matching the granular fertilizer. 100 mL of solution was added to each pot in 3 applications to prevent leaching of the fertilizer.

RESULTS

Growth of turf, response to fertilizer. Germination was good for all three species (Figure 1). Response to the fertilizer applications was rapid for the defined N-P-K solution, and slower for the organic granular fertilizer (Figure 2). By the time of treatment with the dog urine, 68 days after seeding, the unfertilized pots were beginning to suffer from nutrient deficiency (Figure 3).

Phytotoxicity of dog urine treatments. Visible phytotoxic symptoms (chlorosis of leaf tissue) were evident in all pots within 3 days after treatment (Figure 4). The phytotoxicity was particularly pronounced in the unfertilized pots (Table 2), which by 7 days after treatment were essentially dead, as estimated visually and by chlorophyll index. By 3 weeks after treatment, all pots, regardless of species or fertility treatment, showed no living leaf tissue (Figure 5). There were some differences among the treatment in the development of phytoxic effects, particularly in the perennial ryegrass, where the phytotoxicity as measured by chlorophyll index after one week was lower in the Rothsay treated pots than in the defined N-P-K or untreated pots. The chlorophyll index readings observed by 3 weeks after treatment (70-90) are typical of bare soil, and indicative of complete death of leaf tissue in all pots.*Turf recovery.* There was some very limited regrowth in some pots by 10 weeks after the dog urine treatment (Table 3, Figure 6). Most of the regrowth was in perennial ryegrass, and specifically in the pots treated with the Rothsay fertilizer.

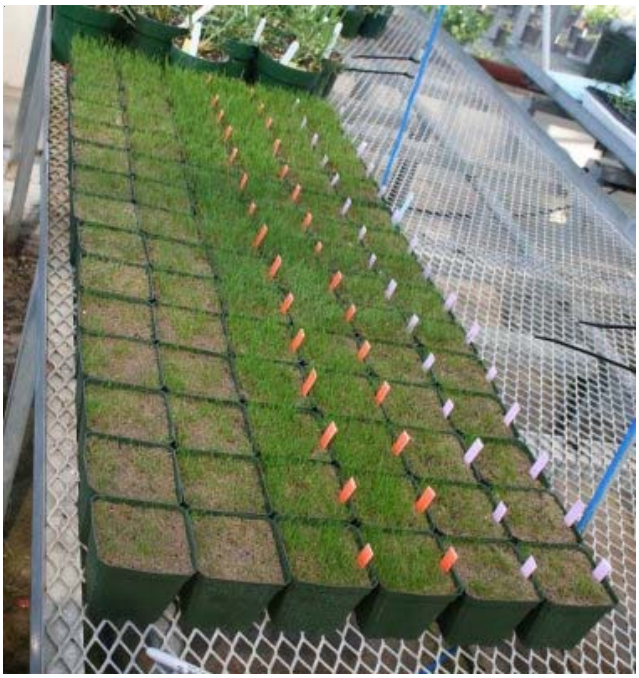

Figure 1. Experimental pots 21 days after seeding.

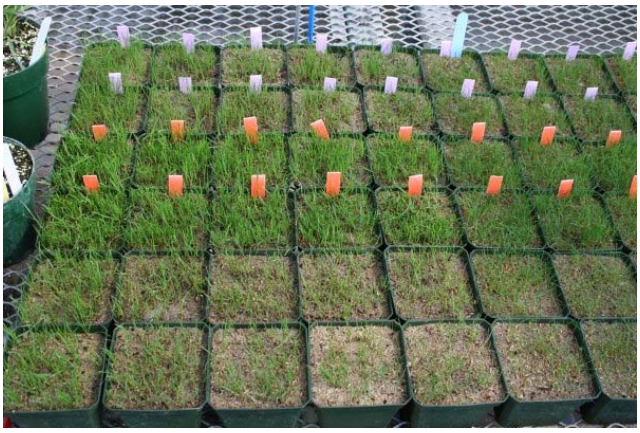

Figure 2. Perennial ryegrass pots 21 days after seeding, 7 days after fertilizer application. Front 2 rows: no fertility; orange labels: defined N-P-K; pink labels: Rothsay fertilizer.

Figure 3. Experimental pots 68 days after seeding (just prior to dog urine application). Top 5 rows: no fertility; orange labels: defined N-P-K; pink labels: Rothsay fertilizer.

CONCLUSIONS

Neither of the fertility treatments provided fully adequate protection against the acute

Figure 4. Experimental pots 3 days after dog urine treatment (Aug. 17, 2006).

Table 2. Phytotoxicity of dog urine treatment as estimated by chlorophyll index in treated pots.

Fertility treatment	8/18 4 DAT	8/19 5	8/21 7	9/03 20	9/06 23
	Fine fescue				
None	171.0[1]	131.1	78.9 b	77.6	76.3
Defined	188.6	129.7	109.5 a	79.3	74.4
Rothsay	156.3	128.8	104.3 a	78.2	75.2
lsd p=0.05	NS	NS	6.2	NS	NS
	Kentucky bluegrass				
None	181.8	125.1	76.0 b	80.4 b	78.7
Defined	172.1	134.0	91.3 a	80.6 b	77.0
Rothsay	184.9	138.1	93.3 a	82.8 a	77.3
lsd p=0.05	NS	NS	2.6	2.1	NS
	Perennial ryegrass				
None	159.2	115.9	73.0 c	83.8 ab	86.5 a
Defined	156.9	124.2	98.1 b	79.0 b	72.7 b
Rothsay	185.6	139.0	103.7 a	86.4 a	84.6 a
lsd p=0.05	NS	NS	5.4	5.2	6.9

[1]Chlorophyll index (0-1000), measured with Spectrum CM1000 chlorophyll meter; higher value indicates more absorbance of light at 740 nm and by inference a higher chlorophyll concentration. Means of 2 readings x 10 replicates. Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).

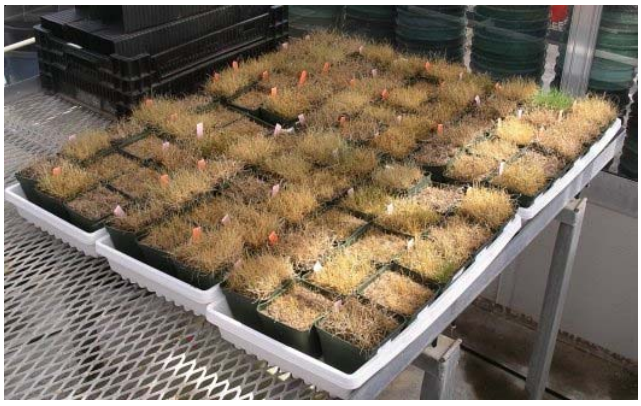

Figure 5. Experimental pots 9 days after dog urine treatment (Aug. 23, 2006).

Table 3. Recovery of turfgrass after dog urine treatments. All living plants harvested at 10 weeks after treatment (Oct. 18, 2006).

Fertility treatment	Plants/pot	Shoot dry weight (g)/pot
	Fine fescue	
None	0.0	0.0000
Defined	0.1	0.0006
Rothsay	1.7	0.0251
lsd p=0.05	NS	NS
	Kentucky bluegrass	
None	0.0	0.0000
Defined	0.1	0.0057
Rothsay	0.7	0.0484
lsd p=0.05	NS	NS
	Perennial ryegrass	
Defined	5.9 b	0.086 b
None	0.1 b	0.001 b
Rothsay	29.5 a	0.207 a
lsd p=0.05	13.4	0.111

Figure 6. Experimental pots 63 days after dog urine treatment (October 16, 2006), showing some regrowth in perennial ryegrass pots.

phytotoxic effects of the dog urine as applied: plants of all three species fertilized with either the Rothsay product or the defined N-P-K fertilizer had no living leaf tissue by 3 weeks after treatment. The Rothsay treatment, particularly in the perennial ryegrass pots, did appear to slow down the development of phytotoxic effects slightly, and reduced the amount of total plant death in perennial ryegrass, allowing some recovery by 6 weeks after treatment.