Moss Control on Putting Greens

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Silvery thread moss *Bryum argenteum* is a relatively new pest that infests golf course putting greens in Iowa. Moss initially occurs in small areas about the size of a quarter, but within a year can cover areas 6 inches in diameter. The dense growth of moss is too competitive for grass plants and it is unlikely that cultural practices alone would be sufficient to reestablish turf. Moss can spread by propagation when small clipped parts of the moss plant reestablish. Various products have been used with a varying degree of success for moss control, i.e. metal products - Iron sulfate, Junction ®(copper hydroxide); soaps and salts; Dawn Ultra, Baking soda (sodium bicarbonate), TerraCyte™ (sodium carbonate peroxyhydrate), and herbicides; Quicksilver (carfentrazone). Essential oils have been shown to have herbicidal tendencies on some plants. The influence of oregano oil on turfgrass and moss has not been determined.

Objective

To evaluate oregano oil for moss control in putting greens.

Methods

The study area was a mature stand of 'Penncross' creeping bentgrass *Agrostis stolonifera* L. growing on a sand based rootzone that was heavily infested with silvery thread moss. A grid of 0.5 ft by 0.5 ft plots were arranged on the putting green. Each plot was initially rated for percent moss cover on 6 Jul 2006 and only plots greater than 50% moss cover were used in the study. Table 1 shows the 79 treatments used to investigate, product type, concentration, application volume, and surfactant. An essential oil extract from oregano (ORG) was compared with the herbicide Quicksilver (carefentrazone) and a non-treated control. Sequential application of both products was evaluated as either 1, 3, or 4 applications. Treatments were made on 6 and 20 Jul, 17 Aug, 12 Sep, and 9 October 2006 using a one quart pump spray bottle that delivered 2.8ml of solution per pump onto an area that was 4 inches by 4 inches. Carefentrazone and ORG were applied on the same sequential application schedule using 1,3, or 4 applications. Each carefentrazone application was made at the recommended rate of 6.7 fl.oz. product/A. The experimental design was a randomized complete block with 79 treatments and 5 replications. The data were analyzed using PROC ANOVA of the SAS software, Version 8 of the SAS System for Windows (SAS Institute, 1999). Means were separated ($\alpha = 0.05$) by Fischer's protected LSD (Fischer, 1966).

Turf quality was rated on a scale of 1-10, where 10= best turf with no phytoxicity, 6= lowest acceptable turf quality and turf phytotoxicity, 1= worst turf quality with most phytotoxicity and completely brown turf. Moss quality was rated on a similar 1-10 scale where 10= green moss with no moss kill or phytotoxicity and 1 = most phytotoxicity with moss turning completely black or brown.

Results

Table 1 shows turf quality, moss quality, and % moss cover for the treatments in the study. On 9 Oct 2006 the non-treated control showed heavy moss infestation with 82% moss cover. An effective moss control product will reduce moss population with minimal turf phytotoxicity. On 9 Oct 2006 several ORG treatments (treatment #'s 24, 26, 35, and 38) had lower moss levels (approximately 20% moss cover) compared to the non-treated control (82% moss cover) or any of the carfentrazone treatments (treatment #'s 73-78 with moss cover ranging from 48-77%). Carefentrazone treatment resulted in no turf phytotoxicity. If some reduction in turf quality were allowed to occur then even more moss can be eliminated with ORG. For example, ORG treatment #54 had an acceptable turf quality level ranging from 6.8 to 7.8 during the study with a final moss cover of less than 10% on 9 Oct 2006. Spot spray treatments of ORG can effectively control silvery thread moss on creeping bentgrass putting greens.

Table 1. Turf quality, moss quality, and moss cover when various treatments of oregano oil (ORG) and carfentrazone are applied to a creeping bentgrass putting green to control silvery thread moss.

		Turf Quality	Moss Qulaity	Turf Quality	Moss Qulaity	% Moss Cover	Turf Quality	Moss Qulaity	% Moss Cover	Turf Quality	% Moss Cover
Trt no.	Trt	20 Jul		17 Aug			12 Sep			9 Oct	
1	ORG A-11	10.0	9.4	10.0	9.4	58.8	10.0	10.0	60.0	10.0	58.0
2	ORG A-13	9.6	9.6	10.0	9.6	64.0	10.0	10.0	79.8	10.0	69.8
3	ORG A-16	9.8	9.6	10.0	10.0	77.0	10.0	10.0	81.8	9.8	66.8
4	ORG A-21	10.0	10.0	10.0	10.0	78.8	10.0	10.0	77.0	10.0	74.0
5	ORG A-23	9.0	9.0	10.0	10.0	73.0	10.0	10.0	74.0	10.0	74.0
6	ORG A-26	10.0	10.0	10.0	9.6	59.0	10.0	10.0	73.0	10.0	56.0
7	ORG A-41	10.0	9.6	10.0	10.0	67.0	10.0	10.0	71.0	10.0	62.0
8	ORG A-43	9.4	9.2	10.0	10.0	50.8	10.0	10.0	61.0	10.0	61.0
9	ORG A-46	10.0	9.6	10.0	10.0	59.8	10.0	10.0	58.0	10.0	62.0
10	ORG AS11	10.0	9.8	10.0	10.0	71.0	10.0	10.0	76.6	10.0	67.6
11	ORG AS13	9.8	9.8	10.0	10.0	63.0	10.0	10.0	66.0	10.0	67.0
12	ORG AS16	9.8	9.4	10.0	10.0	83.0	10.0	9.8	82.0	10.0	71.8
13	ORG AS21	10.0	9.8	10.0	10.0	92.8	9.6	9.0	88.6	10.0	90.6
14	ORG AS23	10.0	9.6	10.0	10.0	66.0	10.0	10.0	84.0	10.0	70.0
15	ORG AS26	9.6	9.2	9.8	9.6	71.0	10.0	10.0	74.0	10.0	78.0
16	ORG AS41	10.0	9.2	10.0	10.0	39.8	10.0	9.0	61.0	10.0	59.0
17	ORG AS43	9.4	8.8	10.0	9.0	59.0	10.0	9.4	69.0	9.6	61.0
18	ORG AS46	9.0	9.0	9.8	9.6	57.0	10.0	9.6	56.4	10.0	51.8
19	ORG B-11	9.8	9.2	10.0	10.0	87.8	10.0	10.0	75.0	10.0	78.0
20	ORG B-13	9.0	8.4	9.8	9.8	65.0	10.0	10.0	51.8	10.0	50.0
21	ORG B-16	9.6	9.2	10.0	10.0	66.0	10.0	10.0	56.0	10.0	45.0
22	ORG B-21	9.6	9.0	9.6	9.0	53.0	9.6	9.4	50.0	10.0	53.0
23	ORG B-23	9.8	9.8	9.8	8.0	51.0	10.0	8.8	39.0	10.0	30.0
24	ORG B-26	9.4	9.2	10.0	7.8	34.0	10.0	9.4	21.0	10.0	20.4
25	ORG B-41	9.2	8.4	10.0	7.6	40.0	10.0	10.0	58.0	10.0	41.0
26	ORG B-43	10.0	8.2	10.0	5.6	13.0	10.0	8.6	5.2	10.0	8.0
27	ORG B-46	9.8	8.8	9.2	6.2	15.0	9.6	9.0	9.6	9.2	10.6
28	ORG BS11	10.0	9.8	10.0	10.0	72.0	10.0	10.0	76.0	10.0	61.0
29	ORG BS13	8.8	9.2	10.0	9.4	75.0	10.0	9.4	71.0	10.0	79.0
30	ORG BS16	9.0	9.4	10.0	10.0	75.0	10.0	10.0	70.0	10.0	66.0
31	ORG BS21	10.0	9.8	10.0	10.0	69.0	10.0	10.0	61.2	10.0	66.0
32	ORG BS23	9.6	8.4	10.0	9.8	47.0	10.0	10.0	54.2	10.0	46.0
33	ORG BS26	9.8	9.6	10.0	10.0	66.0	10.0	9.4	36.0	10.0	46.0
34	ORG BS41	8.2	7.8	9.6	7.6	56.0	8.8	7.8	48.0	9.6	58.0
35	ORG BS43	10.0	9.2	10.0	9.0	42.0	10.0	8.8	8.8	10.0	17.4
36	ORG BS46	8.8	8.4	9.4	7.2	31.0	9.0	7.6	16.4	8.8	22.0
37	ORG C-11	9.2	8.2	10.0	9.6	30.0	10.0	9.8	44.0	9.8	36.0
38	ORG C-13	8.8	7.2	9.6	6.8	24.0	9.0	6.6	13.0	8.8	20.2
39	ORG C-16	9.0	8.0	9.2	6.6	31.0	9.2	7.4	15.4	8.0	20.0
40	ORG C-21	8.0	5.4	10.0	6.8	16.0	10.0	9.6	20.4	9.8	20.0
41	ORG C-23	8.8	6.4	7.6	4.4	12.0	8.2	6.6	3.6	8.6	12.0
42	ORG C-26	8.2	6.8	8.0	4.6	10.6	6.6	5.8	1.8	5.8	6.4
43	ORG C-41	6.4	4.8	9.4	4.2	8.0	9.4	8.2	13.0	9.4	17.0
44	ORG C-43	7.2	3.8	8.0	3.2	5.0	5.8	4.0	2.0	7.2	13.0
LSD.05		1.52	1.47	1.27	1.52	26.3	1.25	1.73	27.1	1.54	27.7

		Turf Quality	Moss Qulaity	Turf Quality	Moss Qulaity	% Moss Cover	Turf Quality	Moss Qulaity	% Moss Cover	Turf Quality	% Moss Cover
Trt no.	Trt	20 Jul		17 Aug			12 Sep			9 Oct	
45	ORG C-46	7.8	5.6	6.6	3.2	3.0	6.6	4.8	2.6	3.8	1.2
46	ORG CS11	9.4	9.4	10.0	10.0	44.0	9.8	9.4	68.0	10.0	55.0
47	ORG CS13	8.8	8.2	10.0	8.4	54.0	10.0	10.0	24.2	10.0	38.0
48	ORG CS16	9.6	9.4	10.0	9.6	56.2	9.4	8.4	33.4	8.2	37.4
49	ORG CS21	8.6	7.8	9.6	7.8	44.0	10.0	9.0	57.0	9.6	40.4
50	ORG CS23	9.2	8.8	9.6	7.8	27.0	8.8	6.6	10.4	9.2	20.0
51	ORG CS26	9.2	8.2	9.0	6.8	43.0	8.2	6.2	17.4	6.8	19.4
52	ORG CS41	7.4	6.2	9.8	5.8	14.0	9.8	8.6	27.0	10.0	35.0
53	ORG CS43	7.8	6.2	7.6	5.0	10.0	6.8	4.8	5.2	7.0	9.8
54	ORG CS46	6.2	5.0	5.8	3.4	6.6	4.8	3.6	2.6	4.8	3.2
55	ORG D-11	6.6	6.6	9.0	5.8	23.0	10.0	7.8	30.0	10.0	29.0
56	ORG D-13	6.0	5.2	4.8	2.2	2.2	3.6	2.8	4.2	3.4	9.4
57	ORG D-16	6.8	5.8	5.2	3.2	4.8	4.0	2.8	1.6	2.6	1.4
58	ORG D-21	4.4	4.0	6.2	3.8	11.2	8.0	6.4	11.8	8.6	24.2
59	ORG D-23	5.0	4.6	2.8	1.4	1.2	2.0	1.6	1.4	3.0	5.8
60	ORG D-26	4.8	4.2	3.0	1.8	1.0	2.0	1.6	1.4	1.8	1.4
61	ORG D-41	3.2	3.4	5.6	2.8	5.0	6.2	3.8	4.0	6.2	11.4
62	ORG D-43	2.6	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0
63	ORG D-46	3.2	3.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
64	ORG DS11	6.0	5.4	8.8	5.2	22.0	8.4	7.4	32.0	9.2	45.0
65	ORG DS13	6.8	5.2	6.0	2.4	3.4	4.8	3.0	5.2	5.0	13.4
66	ORG DS16	5.8	5.2	6.0	3.0	9.0	5.6	3.6	4.0	4.0	3.4
67	ORG DS21	5.0	4.2	8.4	3.6	4.4	9.2	7.4	9.2	9.6	25.0
68	ORG DS23	4.4	4.4	2.6	1.6	1.2	2.4	2.0	1.4	2.6	3.2
69	ORG DS26	4.8	4.4	3.0	1.8	1.2	2.0	1.4	1.4	2.0	1.0
70	ORG DS41	3.0	3.0	4.0	2.2	2.0	4.8	3.4	3.0	6.2	14.2
71	ORG DS43	2.2	2.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.2
72	ORG DS46	4.2	3.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.8
73	Carfentrazone-11	9.6	9.4	10.0	9.6	60.0	10.0	10.0	66.0	10.0	48.0
74	Carfentrazone 13	10.0	9.8	9.6	8.6	68.8	10.0	10.0	73.8	10.0	70.8
75	Carfentrazone 16	10.0	9.8	10.0	10.0	58.0	10.0	10.0	59.0	9.6	55.0
76	Carfentrazone S11	10.0	10.0	10.0	10.0	82.0	10.0	10.0	65.8	10.0	77.0
77	Carfentrazone S13	10.0	9.8	10.0	10.0	81.8	10.0	10.0	75.0	10.0	63.0
78	Carfentrazone S16	10.0	10.0	10.0	9.8	55.8	10.0	10.0	61.8	10.0	55.8
79	Control	9.8	9.2	10.0	10.0	78.0	10.0	10.0	80.8	10.0	82.8
LSD.05		1.52	1.47	1.27	1.52	26.3	1.25	1.73	27.1	1.54	27.7