Effect of nitrogen in late autumn on microdochium patch on nordic golf greens

Tatsiana Espevig, Trygve S. Aamlid, Trond O. Pettersen and Agnar Kvalbein

Introduction

Microdochium patch, caused by *Microdochium nivale* (Fr.) Samuels & I.C. Hallett, is the economically most important disease on golf greens in the Nordic countries[1,2]. Traditionally, the last seasonal nitrogen (N) fertilization on golf greens is carried out in September-October[3] since later N inputs will stimulate growth and tissue hydration, reduce carbohydrate reserves, and thus, reduce turfgrass winter hardiness[4,5]. The severity of microdochium patch has also been reported to increase with increasing N rate in autumn[6]. However, recent studies[7,8] and new understanding of turfgrass stress physiology suggest that sufficient availability of N in the autumn will improve the winter survival and spring performance of grasses that are genetically adapted to a cold climate[9,10]. The objective of this study was to investigate how N affects turfgrass' ability to resist microdochium patch, and to provide recommendations about optimal autumn fertilization of golf greens.

Material and methods

A two-factorial field experiment with four blocks was conducted on a USGA golf green[11] at NIBIO Landvik (58°20'N, 8°31'E, 10 m a.s.l.). The root zone consisted of 85% sand and 15% *Sphagnum* peat (volum fractions). Factor 1 included two grass species established on 17 June 2014: creeping bentgrass (*Agrostis stolonifera* L.) 'Independence' was seeded at a rate of 7 g m^{-2} and annual bluegrass (*Poa annua* L.) was established from hollow core plugs, col-

		Turfgrass quality		---------------- Color ----------------				Microdochium patch					Height
		13.10.14	16.3.15	8.9.14	6.10.14	27.10.14	20.4.15	8.9.14	6.10.14	3.11.14	8.12.14	7.4.15	growth
		--------------------- Scale 1-9, 9 - best -----------------------						------------------------ % ------------------------					mm d^{-1}
Creeping bent (CB)		7.3 A	6.3 A	6.0	5.2	5.6	4.1 A	0.3 A	0.1 A	0.9 A	1.4 A	1.1 A	0.31 A
Annual blue-grass (AB)		2.8 B	1.2 B	6.0	5.0	5.7	3.0 B	1.8 B	23.6 B	8.4 B	9.1 B	21.7 B	0.49 B
	N-0,	3.6 b	3.4	6.0	2.4 d	2.6 c	1.9 c	0.7	15.1	4.9	5.7	1.1 a	-0.17 d
	N- low	5.5 a	4.3	6.0	4.5 c	6.3 b	4.3 a	0.9	5.6	4.4	4.5	0.6 a	0.36 c
	N-norm	5.5 a	3.8	6.0	6.1 b	6.9 a	4.1 ab	1.4	14.6	4.7	4.9	15.4 b	0.62 b
	N- high	5.6 a	3.5	6.0	7.3 a	6.9 a	3.8 b	1.2	12.0	4.6	6.0	28.6 c	0.78 a
CB	N-0,	6.0	6.0	6.0	2.8	2.8	1.6	0.1	0.3	1.5	2.3	1.1	-0.17
	N- low	7.8	6.8	6.0	4.5	5.8	4.0	0.5	0.0	0.9	1.0	0.5	0.27
	N-norm	7.8	6.4	6.0	6.3	7.0	5.4	0.3	0.0	0.7	0.9	0.7	0.50
	N- high	7.8	5.9	6.0	7.3	7.1	5.3	0.1	0.0	0.6	1.6	2.3	0.64
AB	N-0,	1.1	0.8	6.0	2.1	2.5	2.3	1.3	30.0	8.3	9.0	1.1	-0.16
	N- low	3.3	1.8	6.0	4.5	6.8	4.6	1.3	11.3	8.0	8.1	0.8	0.46
	N-norm	3.3	1.3	6.0	5.9	6.8	2.9	2.5	29.3	8.8	9.0	30.0	0.75
	N- high	3.4	1.1	6.0	7.4	6.8	2.3	2.3	24.0	8.5	10.5	55.0	0.93
P spp		*<.0001*	*<.0001*	–	0.223	0.816	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
P fert		*<.0001*	*0.138*	–	<.0001	<.0001	*<.0001*	*0.205*	*0.065*	*0.994*	*0.824*	*<.0001*	*<.0001*
P spp x fert		*0.746*	*0.926*	–	0.423	0.114	*<.0001*	*0.097*	*0.071*	*0.974*	*0.921*	*<.0001*	*<0.001*

* The same letter indicates no differences between the species or among the N-rates within the same date based on Fisher LSD at 5% probability level. LSDs for significant interactions were not calculated.

Tab. 1: Effect of N-rate from September to November 2014 on growth rate, microdochium patch and quality of annual bluegrass and creeping bentgrass golf green.

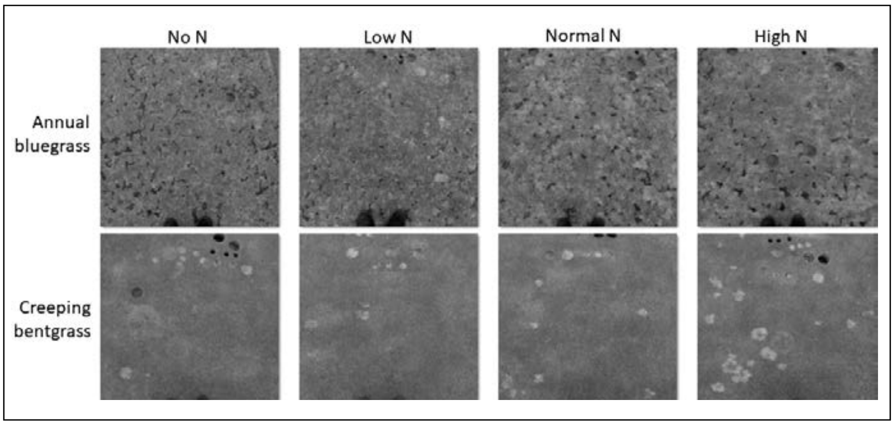

Figure 1: Effect of late N-fertilization from September to November 2014 on microdochium patch and spring performance of annual bluegrass and creeping bentgrass golf green on 16 March 2015. Photo: Agnar Kvalbein.

lected from a 50-yr-old green at Borregaard GC, SE Norway, and distributed at a rate of 1.7 kg m^{-2}. For grow-in from June to September the green was fertilized weekly with a balanced fertilizer and received totally 15 g N m^{-2}. The green was mowed three times per week with a walk behind mower at 7 mm in July and August, 5 mm in September and 6 mm in October and November 2014. Pure silica sand topdressing with was applied every two weeks from June to October at a total rate of 10 kg m^{-2}. The green was irrigated 4-5 mm after fertilization and to field capacity when the soil water content in the upper 12 cm was less than 12 % by volume. In the winter 2014-15 the green was covered with snow for 7, 23 and 5 consecutive days in the period from 24 Dec. 2014 to 29 Mar. 2015, and monthly air temperature in this period was in average 3 °C warmer than 30-yr normal. No fungicides were applied.

Factor 2 consisted of four N-rates: no, low, normal and high N, which were applied weekly from 8 Sep. to 24 Nov. 2014 at linearly decreasing rates. The total N inputs were 0, 2.8, 5.6 and 8.4 N m^{-2}, respectively. Other nutrient were applied to all plots at rates giving a N:P:K:Mg:Ca:S:Fe:Mn:ratio of 100:13:64:7:8:12:0.9:0.36 at the highest N rate[12]. Visual turf quality was registered in October 2014 and in March 2015 using a scale from 1 (uneven and very bad turf) to 9 (even and very good turf) with an acceptability level of 5. Color was assessed three times in autumn and once in April 2015 using scale from 1 (poorest) to 9 (most fresh/intense). Percentage plot area covered with microdochium patch was recorded monthly from September to December 2014 and in April 2015. Turfgrass height was measured weekly prior to the mowing from 15 Sep. to 24 Nov. using a Turfcheck® device (Check Signature Inc, Minneapolis). Daily height growth was calculated as the mean of three readings per plot minus the mowers' setting divided on the number of the days since last mowing and averaged over 11 measurements. The data were analysed using the SAS procedure PROC ANOVA (SAS Institute, version 9.4). Fisher's LSD at P≤0.05 was used to identify significant differences among treatments.

Results and discussion

Increasing N rate in autumn stimulated growth; more in annual bluegrass than in creeping bentgrass (Table 1). The highest N rate in autumn increased microdochium patch in spring by 2 times in creeping bentgrass and 50 times in annual bluegrass as compared with no N. Annual bluegrass suffered from a severe attack of microdochium patch even at the normal N rate (Table 1 and Figure 2). N-applications at low rate in autumn did not result in severe microdochium patch in either annual bluegrass or crepping bentgrass as also shown by Mattox et al.[8]. Both annual bluegrass and creeping bentgrass benefited from N-low treatment in the form of better colour and better turf quality as compared with N-0 treatment. Turfgrass freezing tolerance and N-leakage must also be considered before a giving a final recommendation for N-rates in autumn on Nordic golf greens. These data were collected1 and will be presented in a full paper later.

Acknowlegdements

This research was funded by The Norwegian Research Council, Scandinavian Turfgrass and Environment Research Foundation (STERF), Norwegian Golf Federation (NGF) and Golf industry partners.

Authors:

Tatsiana Espevig & Trygve S. Aamlid & Trond O. Pettersen
NIBIO – Norwegian Institute of Bioeconomy Research

Agnar Kvalbein
Retired NIBIO researcher)

1 Kvalbein A., T. Espevig, W. Waalen, and T.S. Aamlid. 2017. Turf grass winter stress management. Golf course managers' handbook. STERF. http://www.sterf.org/Media/Get/2892/winter-stress-mgmt-handbook (verified 27 Feb. 2018).

2 Kvalbein A., W.M. Marie Waalen, L. Bjørnstad, T.S. Aamlid and T. Espevig. 2017. Winter injuries on golf greens in the Nordic countries: Survey of causes and economic consequences. Int. Turfgrass Soc. Res. J. 13:604-609.

3 Noer O. J. 1963. Winter injury to cool season turf. Golf Course Reporter. 31:38-40.

4 Beard, J.B. 1969. Winter injury of turfgrasses. Proc. Int. Turfgrass Res. Conf. 1:226–234.

5 Powell, A.J., R.E. Blaser, and R.E. Schmidt. 1967a. Physiological and color aspects of turfgrasses with fall and winter nitrogen. Agron. J. 59:303–307.

6 Smith J.D., N. Jackson, and A.R. Woolhouse. 1989. Fungal diseases of amenity turf grasses. London. New York. E. & F.E. Spon.

7 Kvalbein A. & Aamlid T.S. 2012. Impact of mowing height and late autumn fertilization on winter survival and spring performance of golf greens in the Nordic countries. Acta Agric Scand Sect B-Soil Plant Sci. 62:122-129.

8 Mattox C.M., A.R. Kowalewski, B.W. McDonald, J.G. Lambrinos, B.L. Daviscourt and J.W. Pscheidt. 2017. Nitrogen and iron sulfate affect microdochium patch severity and turf quality on annual bluegrass putting greens. Crop Sci. 57:293-300.

9 Kussow, W.R. 1988. Fall fertilization of cool-season turfgrasses. Golf Course Manage. 56:20–30.

10 Bauer S., Lloyd D., Horgan B.P. & Soldat D.J. 2012.Agronomic and physiological responses of cool-season turfgrass to fall-applied nitrogen. Crop Sci. 52:1-10.

11 USGA Green Section Staff, 2004. USGA recommendations for a method of putting green construction. https://www.usga.org/content/dam/usga/images/course-care/2004%20USGA%20Recommendations%20For%20a%20Method%20of%20Putting%20Green%20Cons.pdf (verified 27 Feb. 2018).

12 Ericsson T., K. Blombäck and A. Kvalbein. 2013. Precision fertilisation – from theory to practice. http://www.sterf.org/Media/Get/1228/precision-fertilisation-from-theory-to-practice.pdf (verified 1 Mar. 2018).