Management of A,G bentgrasses and 'DW-184', a perennial *Poa annua*, for putting green turf

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INTRODUCTION

Concerns over potentially extremely intensive management requirements have potentially limited the acceptance of the new A and G series bentgrasses by superintendents in Wisconsin. Furthermore, most Wisconsin golf course superintendents struggle to keep *Poa annua* out of their creeping bentgrass greens. A few superintendents have allowed the *P. annua* to "take over" their greens. For those who accept *P. annua*, though, they first have to go through a transition period of natural invasion. Two years ago, however, a commercial strain of *P. annua* var. *reptans*, a perennial type of *P. annua*, became available.

The objective of the study was to determine the aeration and topdressing requirements for A-4, G-2, and Penncross creeping bentgrass along with DW-184 (*P. annua* var. *reptans*).

MATERIALS AND METHODS

Plots of 'Penncross', 'A-4', 'G-2' creeping bentgrasses and 'DW-184' P. annua var. reptans were seeded at 1 lb/1000 ft^2 on a USGA-specified sand based root zone for putting greens (5) in September 1998. A randomized block design with three replications was used, with each plot measuring 180 ft^2. The mowing height was reduced from 9 mm to 3 mm (0.118 inch) over a six-week period in the spring of 1999. Irrigation was supplied 3 times weekly to replace 70% evapotranspiration (ET). Plots were fertilized biweekly with 0.5 lb N per 1000 ft^2 during grow-in in 1999 and four times in 2000 with a total of 3.5 lb N N per 1000 ft^2. Nitrogen carriers were a mixture of fast and slow release sources. Topdressing and aeration treatments were applied as strip-plots following establishment (Table 1).

Topdressing and aeration treatments

Topdressing treatments were started July 1999 using an 80:20 sand:peat mixture that met USGA specifications. Topdressing was applied using a Gandy drop spreader equipped with a deflection shield. Three programs were evaluated: 1) Topdressing at 14 day intervals, 2) Verticutting followed by topdressing at 14 day intervals, and 3) Topdressing at 28 day intervals. For verticutting we used a Toro Greensmaster 1000 equipped with a 19 inch wide verticutter unit. We applied 56 lb topdressing per 1000 ft^2 per application at the two week intervals and 112 lb topdressing per 1000 ft^2 per application at the four week intervals. The topdressing was brushed into the turf after application and the turf was irrigated during the evening.

Aeration treatments were started spring 2000 using a Toro greens aerator. Aeration was applied in strips over the three topdressing treatmentS, either annually or monthly. Quadratines were used for all but one of the monthly treatments; in September the entire area was aerated using 0.5 inch tines. Cores were removed from the turf so as to not cross-contaminate plots. Aeration was timed so scheduled topdressings followed each aeration event.

Table 1. Factors and levels used in management study of new bentgrasses and perennial *Poa annua*.

Main plot: Turfgrass type	**Sub-plot: Aeration†**	**Sub-plot: Topdressing**
'A-4' creeping bentgrass	1x annually (early Oct.)	14 day interval
'G-2' creeping bentgrass	4x annually	14 day interval + verticutting
'Penncross' creeping bentgrass		28 day interval
'DW-184' annual bluegrass		

† Tines used for September aeration were 0.5 inch diameter (annual and monthly treatments); for all other months 0.25 inch diameter tines were used.

Data collection

Clippings and topdressing were collected while mowing the day following topdressing. Topdressing was separated from the clippings by adding water and decanting off the clippings. The samples were oven-dried at 60°C overnight then weighed to determine the amount of topdressing collected.

Plots were rated on a monthly basis to evaluate color, quality and disease when necessary. Color and quality were evaluated on a visual scale from one to nine, with one equal to 100% necrotic turf and nine equal to ideal turf. A rating of six was considered acceptable.

Three cores (1" diameter) were collected from each plot in November 1999 and 2000 to determine organic matter production. The cores were compressed with a 185 gram weight, and the depth of the organic layer (thatch/mat) was measured at 3 equidistant points of the core. Organic matter content by weight were determined using a loss-on- ignition technique.

RESULTS

Significant differences in the percent of topdressing removed were observed in the main treatments of grass type, aeration and topdressing method but no significant interactions were observed between the treatments.

Turf quality and color

Grass types and topdressing method both had a significant effect on turfgrass quality. There were no interactions among grass type, aeration, and/or topdressing method. 'A-4' and 'G-2' creeping bentgrasses consistently provided the best quality turf. The quality of 'Penncross' creeping bentgrass gradually declined during 2000. The 'DW-184' turf was slow to establish and numerous seedheads were apparent throughout 1999. The amount of seedheads declined significantly in 2000, becoming rare by August. As the turf thickened and fewer seedheads were present, the quality of the 'DW-184' turf gradually increased, surpassing the quality of 'Penncross' towards the end of the season. Grass type was the only factor in this study that affected turf color. 'A-4' had the darkest green color followed by 'G-2', 'Penncross' and 'DW-184' respectively.

Topdressing removal

Significantly more topdressing was removed by mowing from 'A-4' plots than from 'G-2' or 'Penncross' plots, with the least amount of topdressing collected from 'DW-184' (Table 2).

Grass type did not affect the particle size of topdressing removed by mowing except for a greater fraction of the fine gravel being removed from the 'DW-184' than from the other grasses except for the fine gravel (Table 3). Approximately two-thirds of the topdressing removed by mowing consisted of the larger sized particles (>0.5 mm; coarse, very coarse, and fine gravel) regardless of the grass type. Five to 10% of the topdressing removed was fine gravel, 20 to 33 % was very coarse sand, and 38 to 47% were coarse particles. Approximately 25% consisted of medium particles and 2% consisted of fine particles.

Aeration frequency corresponded directly with the amount of topdressing removed by mowing (Table 2). Verticutting before topdressing significantly reduced the amount of topdressing collected when mowing. Topdressing on a 28-day interval resulted in removal of 2.3% of the topdressing while 2% of the topdressing was removed using a 14-day interval. Verticutting reduced topdressing removal to 1.7%.

Thatch production

No true thatch layer existed even with the 28-day topdressing intervals. We did find a consistent mat layer (thatch diluted with topdressing). The depth of this layer in 1999 showed 'A-4' produced significantly more thatch/mat than 'G-2' or 'Penncross' (Table 4). 'DW-184' produced the least amount of thatch/mat. Measurements in 2000 showed both 'A-4' and 'G-2' produced equivalent depths of mat which were significantly greater than 'Penncross' or 'DW0184'. Neither topdressing method or aeration frequency affected the depth of the thatch/mat layer.

Table 2. Main effects of grass type, aeration frequency and topdressing method on removal of topdressing by mowers from putting green turf.

Treatment	**% Topdressing removed**
Grass type	
'A-4' creeping bentgrass	2.8
'G-2' creeping bentgrass	1.9
'Penncross' creeping bentgrass	1.8
'DW-184' annual bluegrass	1.4
LSD (0.05)	0.3
Aeration frequency	
Annual	1.8
Four times annually	2.1**
Topdressing method	
14 day interval	2.0
14 day interval + verticutting	1.7
28 day interval	2.3
LSD (0.05)	0.2

** Significant at p = 0.01

Table 3. Size distribution of topdressing removed from grass types.

	Particle size (mm)					
	>2	2-1	1-0.5	0.5-25	0.25-.15	<0.15
	% Fraction in topdressing					
	1.62	2.95	20.87	61.01	12.74	0.81
Grass type	% Fraction removed					
A-4	4.9	33.3	38.4	21.1	2.1	0.1
G-2	7.3	22.1	45.4	22.7	2.3	0.1
Penncross	5.9	19.7	46.9	25.0	2.4	0.1
DW-184	10.1	20.7	40.6	25.7	2.7	0.1
LSD (0.05)	3.2	ns	ns	ns	ns	ns

ns = Not significant at $p < 0.05$.

Table 4. Grass type affects depth of thatch/mat layer in first two years after seeding.

Grass type	**Thatch/mat layer depth (mm)**
1999	
'Á-4' creeping bentgrass	15.7 d †
'G-2' creeping bentgrass	13.9 c
'Penncross' creeping bentgrass	12.6 b
'DW-184'' creeping bentgrass	10.0 a
LSD (0.05)	0.5
2000	
'Á-4' creeping bentgrass	15.9 b
'G-2' creeping bentgrass	16.5 b
'Penncross' creeping bentgrass	13.0 a
'DW-184'' creeping bentgrass	12.2 a
LSD (0.05)	2.0

† Means followed by the same letter are statistically similar.

DISCUSSION

The superior quality of the A and G bentgrasses compared to Penncross has been well documented and is being verified in this study. The gradual improvement of turf quality in the 'DW-184'plots was attributed to 'DW-184' displacing the annual biotype of *P. annua*, which apparently had infested the seed lot and initially dominated the 'DW-184' plots. If 'DW-184' can outcompete the annual types of *P. annua* it should be capable of producing a consistent putting surface.

The effects of topdressing frequency and verticutting before topdressing were expected. By topdressing more frequently with a lighter rate, less material was lost to collection when mowing. Verticutting before topdressing created a more upright turf after treatment, which enabled the topdressing to drop down below the verdure surface.

Consistent removal of the larger sized topdressing particles could in time lead to a fine-textured root zone mix which could possibly cause a layering problem. Since the actual amount

of topdressing removed was less than 3%, however, it is unlikely this effect would ever significantly impact water infiltration.

The greater amount of topdressing removed from the turf with more frequent aeration was an artifact which appeared to result from the deposition of root zone material following core aeration and core removal. In other words, root zone material fell off the cores as they were harvested and some of this material was subsequently picked up with the topdressing. Only once did this occur when topdressing was applied without aeration. Thus we cannot conclude that aeration frequency affects topdressing removal. While the depth of the thatch/mat layer so far has not been affected by aeration, we will continue to monitor this and will determine organic matter production using loss-upon-ignition.

The thatch/mat measurements only reflect the mat layer. No apparent thatch layer was evident in core samples taken from the plots. Loss-on-ignition analysis will be performed on the core samples removed from the plots to determine the organic mater content.

CONCLUSION

The lack of significant interactions among grass type, aeration frequency and topdressing/verticutting methods did not indicate the new "PennPals™" varieties of creeping bentgrass require more intensive management than conventional grass types ('Penncross' and annual bluegrass) during the first two years. 'A-4' and 'G-2' produced more organic matter but the potential thatch was readily changed to a mat layer with even the least-intensive topdressing and aeration programs.

This study will be continued into a third year to determine if management requirements change as the turf matures. We will continue to monitor turf quality, color, disease susceptibility and topdressing loss. We will also collect information on encroachment of other grasses into the turf stands (e.g., creeping bentgrass into 'DW-184' and *P. annua* into creeping bentgrass).

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