THE COMPARATIVE COMPETITIVE ABILITY OF THIRTEEN AGROSTIS STOLONIFERA CULTIVARS TO POA ANNUA

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Abstract

Poa annua has been an increasing problem on *Agrostis stolonifera* putting greens, especially with the lowering of the mowing height into the 2.5 to 3.8 mm range. Recently a number of new *Agrostis stolonifera* cultivars have been released for use on putting greens. This investigation assesses the relative competitive ability of 13 *Agrostis stolonifera* cultivars under very closely mowed putting green cultural regime of 3.2 mm. The relative competitive ability is assessed by the transplanting of mature monostands of *Poa annua* into mature turfs of each of the 13 replicated *Agrostis stolonifera* cultivars. Four *Agrostis stolonifera* cultivars ranked superior in competitiveness with *Poa annua*, including Penn G2, Penn G6, Seaside II and Penn A1. Ranking lowest in aggressiveness under the very closely mowed conditions were Penncross and Pennlinks. Those *Agrostis stolonifera* cultivars sustaining shoot densities above 2000 dm^{-2} exhibited the most competitiveness in suppressing the *Poa annua* content in polystands. These findings suggest that significant cultural control of *Poa annua* can be accomplished on closely mowed putting greens by the selection of certain *Agrostis stolonifera* cultivars that can sustain very high shoot densities under close mowing condition.

Keywords:

close-mowing, polystand composition, putting greens, shoot density

INTRODUCTION

Agrostis stolonifera L. is used as preferred turfgrass species on putting greens in Italy. It is uniquely adapted morphologically for use on putting greens (Beard, 1982). Extensive, prostate lateral stem development and high-shoot density have been sustained under frequent, close mowing of 4 to 6 mm, depending on the cultivar. Recently the trend has been to lower cutting heights of 2.5 to 3.8 mm on putting greens.

Penncross has been the cultivar most widely accepted and used throughout the word for the past 35 years. Recently, a number of new *Agrostis stolonifera* cultivars have relased, with some that can sustain extraordinarily high shoot densities and very-low cutting heights of 2.5 to 3.2 mm (Croce *et al*.1998; Croce *et al*. 1994). Historically, *Poa annua* L. has been a significant problem on older putting greens. The objective of this investigation was to determine the comparative competitive ability of 13 *Agrostis* cultivars under a very-closely mowed putting green cultural regime.

MATERIALS AND METHODS

Establishment. Eight commercially available cultivars of *Agrostis stolonifera* were planted onto 600 m^2 specially constructed experimental putting green located in Torino Golf Club. The plot size was 2.0 x 3.5 m, arranged in a randomized block design with four replications. In addition, five genotypes that were advanced experimental selection of *Agrostis stolonifera* from Pennsylvania State University were planted in an adjacent area at the same time. These plots were 2.0 x 1.75 m in size, with two replications in a randomized block design. The root zone profile construction was a high-sand composition meeting USGA/Texas specifications, including a gravel drain bed and subsurface drainage system.

The experimental area was planted on 4 May 1992. Preplant fertilization consisted of 1.0 kg 100 m^{-2} each of nitrogen, phosphorus and potassium incorporated into the upper 100 mm of the root zone. All cultivars were planted at the seeding rate of 0.5 kg 100 m^{-2}, with the seed lightly raked into the surface. Vertical barrier boards were used to avoid contamination of seed between plots. No lateral movement occurred and successful turfgrass establishment was achieved with distinct perimeters between individual cultivar plots.

Cultural practices. During this study the cultural practices on the experimental putting green involved mowing six times per week in multiple directions at the 3.2 mm cutting height by means of a triplex greensmower with the groomer attachment, with clippings removed. The nitrogen fertilization program consisted of 0,375 kg 100 m^{-2} per growing month from March through October, totaling 3.0 kg 100 m^{-2} annually. The base phosphorus and potassium levels were applied as needed to maintain these nutrient levels in the high range based on an annual chemical soil test. The pH of the root zone was 6.8. Supplemental water was applied as needed to prevent visual wilt of the turf via gear-driven, pop-up heads arranged in the tight spacing that sustained uniform moisture conditions across the experimental area. Topdressing was practiced at two-months interval during the growing season at a rate of 0.16 m3 100 m^{-2}, using the same mix composition as the underlying root zone. No turf cultivation or vertical cutting was practiced on the turfed plots, to avoid interplots genotype contamination.

Disease and insect problems were minimal, except for dollar spot (*Sclerotinia homeocarpa* F.T. Bennett), which was allowed to develop with no fungicide applications made during 1993 growing season, in order to assess the relative cultivar susceptibility (Croce *et al*. 1993). A modest preventive fungicides program has been followed since 1995. No insecticides or herbicides have been applied. All emerging weed were manually removed during the 1992 growing season. Subsequently after the turfs had fully stabilized, weed were allowed to develop across experimental area.

Treatments. A single 108 mm diameter mature turf plug of *Poa annua* was transplanted into each replicate cultivar plot of the 13 *Agrostis stolonifera* cultivars. The same study and procedures were conducted in both 1998/1999 and 1999/2000. The plugs were transplanted on 23 April 1998 (first study) and on 20 December 1999 (second study).The data presented will be for the first 1998-99 study, as the second 1999-2000 study simply confirmed the results of the first study.

Assessments. The inward *Agrostis stolonifera* shoot invasion or outward *Poa annua* shoot encroachment were measured at approximately 30 day intervals through the April to October growing season. The base reference used was a template of the 108 mm diameter perimeter placed over the original *Poa annua* turf plug, which had a surface area of 91.5 cm^2. Then two perpendicular diameters of the current perimeter were measured, a mean calculated, the corresponding surface area calculated, and the percent change in area compared to the original turf plug was calculated as a percent change.

Morphological assessments of the 13 cultivars of *Agrostis stolonifera* turfs were made in September 1995, 1997 and 2000. They consisted of actual shoot density counts conducted on a 1,600 mm^2 area of turf.

All the data were summarized at the end of each growing season and processed for statistical assessment with the analyses of variance for the eight older cultivars being analyzed separately from that for the five new cultivars.

RESULTS AND DISCUSSION

Competitive Ability. The relative competitive abilities of thirteen *Agrostis stolonifera* cultivars against a monostand of *Poa annua* are shown in Table 1. Following the April 23, 1998 transplanting of the *Poa annua* turf monostand there is a small decline in diameter of the *Poa annua* plugs across all cultivars, except for Cobra. This is followed by an increase in the diameter of the *Poa annua* monostand for all eight of the older cultivars, and a decreasing trend in diameter of the *Poa annua* monostand in the case of the five newer cultivars. Between August 13 and September 30 of 1998 there was a trend to an increasing *Poa annua* diameter in six of the eight older cultivars, whereas in the case of the five newer cultivars there was a decreasing trend in the *Poa annua* monostand diameter for three of the five cultivars, with the exceptions being Penn G6 and Penn G1.

During 1999 growing season there was a decreasing trend in the size of the *Poa annua* monostand for most *Agrostis stolonifera* cultivars. A distinct shift was noted to a polystand of *Poa annua* and *Agrostis stolonifera* as the dominance of *Poa annua* decreased below 50% of the original transplanted diameter.

Four *Agrostis stolonifera* cultivars ranked superior in competitiveness with *Poa annua*. They were in order: Penn G2, Penn G6, Seaside II and Penn A1. Ranking the lowest in aggressiveness against *Poa annua* under very-close mowing conditions were Penncross and Pennlinks. These data indicated it is possible to achieve significant cultural control over *Poa annua* via the development and use of high-density *Agrostis stolonifera* cultivars that can sustain high shoot densities under very closely mowed putting green conditions.

Shoot density. A high shoot density usually is preferred for putting greens as it results in a more narrow leaf width and a more vertical leaf orientation that contribute to a more uniform surface for ball roll (Beard, 1982). A high shoot density also results in the turf being more competitive against weed, moss and algae invasion. The comparative shoot densities of the 13 *Agrostis stolonifera* cultivars maintained under closely mowed putting green condition in a Mediterranean climate are shown in Table 2. Those *Agrostis stolonifera* cultivars that sustained shoot densities above 2000 dm^{-2} exhibited the most competitiveness in suppressing the *Poa annua* content in polystand maintained under very-closely mowed putting green conditions. Ranking the highest in shoot density were the newer cultivars – Penn G6, Penn A1, Penn G2, Penn G1 and Seaside II.

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Table 1. Comparative mean of percent Poa annua persisting in 108 mm diameter turf plugs being invaded by each of thirteen *Agrostis stolonifera* cultivars.

Cultivars	**Mean percent *Poa annua* content**												
	5/13/98	**6/30/98**	**8/13/98**	**9/30/98**	**4/9/99**	**5/11/99**	**6/16/99**	**7/2/99**	**8/9/99**	**8/30/99**		**9/16/99**	
Southshore	90,9	100,7	72,6	83,1	83,8	70,8	57,9	46,1	43,1	32,7	a*	20,1	a
SR 1020	87,5	97,3	78,8	94,6	90,7	76,2	63,7	49,4	42,0	39,3	ab	27,8	a
Putter	97,5	100,7	77,8	73,6	91,4	81,0	63,0	60,8	50,4	42,0	abc	30,5	a
Cobra	103,1	102,6	83,3	80,1	92,9	72,7	69,4	51,6	44,0	36,4	ab	33,5	a
Penneagle	94,0	101,6	82,0	86,0	88,2	73,7	67,1	57,2	41,1	29,2	a	36,0	ab
Providence	98,1	103,4	75,5	76,2	87,5	62,2	74,1	48,3	51,5	36,3	ab	37,3	b
Pennlinks	92,1	102,2	73,9	80,6	85,5	85,8	64,4	56,0	53,7	55,3	c	51,5	bc
Penncross	96,4	103,5	74,4	84,3	92,5	77,8	73,7	59,7	59,5	50,0	bc	58,4	c
LSD (P=0.05)	5,76	10,92	15,16	17,50	12,55	12,07	15,50	7,22	5,12	13,78		17,16	
Penn G2	93,7	75,5	53,3	46,6	32,2	30,9	36,4	19,4	17,6	8,7	a	0,0	a
Penn G6	84,0	77,6	54,9	54,9	37,7	38,7	35,7	22,5	26,1	0,0	a	3,9	b
Seaside II	90,1	85,9	60,1	55,1	70,7	53,9	42,3	39,3	37,1	24,8	a	3,9	b
Penn A1	91,0	75,7	62,0	51,5	48,7	34,9	41,7	28,3	27,5	16,0	a	8,7	b
Penn G1	94,6	77,5	51,7	60,5	51,7	50,9	36,9	27,1	24,9	11,8	a	23,6	b
LSD (P=0.05)	19,53	35,52	19,67	24,57	22,00	26,11	15,18	10,33	23,57	25,54		23,18	
Mean	95,5	90,5	63,0	72,4	72,1	64,4	55,3	43,4	42,2	30,9		41,0	

* Duncan's test (P=0.05)

Table 2. Comparative shoot density counts of thirteen closely-mowed *Agrostis stolonifera* cultivars.

	Shoot density (dm^{-2})						
Cultivars	**1995**		**1997**		**2000**		**mean**
Southshore	1692	a*	2037	a	1595	a	1775
Pennlinks	1553	ab	2186	a	1431	ab	1723
Providence	1395	b	2080	a	1494	ab	1656
Cobra	1363	b	1873	ab	1622	a	1619
SR 1020	1523	ab	1876	ab	1453	ab	1617
Putter	1356	b	1814	ab	1244	ab	1471
Penneagle	1383	b	1522	b	1398	ab	1434
Penncross	1358	b	1631	b	1119	b	1369
LSD value	214		376		342		
Penn G6	2700	a	3003	a	2199	a	2634
Penn A1	2325	a	2868	a	2175	a	2456
Penn G2	2366	a	2725	a	1941	a	2344
Penn G1	2228	a	2675	a	1772	a	2225
Seaside II	1475	b	2550	a	2241	a	2089
LSD value	538		1333		456		

* - Duncan's test (P=0.05)