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Spaced Plantings of Creeping Bentgrass Cultivars for Evaluation of Lateral Spread

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Abstract
Creeping bentgrass (Agrostis stolonifera L.) is a cool-season species commonly used on golf courses. The name is derived from the vigorous stolons that develop at the surface of the ground and initiate new plants from the nodes. Stolon formation and internode elongation allow creeping bentgrass the ability to spread horizontally. The aggressive lateral spread makes creeping bentgrass well suited for high traffic, heavy use areas.

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Introduction

Creeping bentgrass (*Agrostis stolonifera* L.) is a cool-season species commonly used on golf courses. The name is derived from the vigorous stolons that develop at the surface of the ground and initiate new plants from the nodes. Stolon formation and internode elongation allow creeping bentgrass the ability to spread horizontally. The aggressive lateral spread makes creeping bentgrass well suited for high traffic, heavy use areas.

The cultivar Penncross has been the industry standard since being released in the mid 1950's. More recently, breeders have developed cultivars of creeping bentgrass with increased shoot densities and a more upright leaf architecture. While it is generally agreed that creeping bentgrass possesses aggressive lateral spread, little research has been conducted to evaluate differences between cultivars. The objectives of this research were to evaluate the lateral spread of creeping bentgrass cultivars

Materials and Methods

Twenty-four commercially available cultivars of creeping bentgrass were transplanted into the center of a single 3.3 × 3.3 ft plot at the Iowa State University Horticulture Research Station (Figure 1). The cultivar Penncross served as a control and was replicated twice. The remaining 23 cultivars of creeping bentgrass were considered improved cultivars. Plugs were irrigated daily for the first month to encourage establishment and as needed to prevent drought stress thereafter. Stolons reaching the plot borders were redirected inside the plot via sod staples.

Digital images of each plot were taken at 15, 30, 45, 60, 75, 90, and 105 days after planting (DAP) with a Fuji FinePix F10 camera. Percentage cover was determined by using digital image analysis (Figure 2). Internode lengths were obtained with a dial caliper 120 DAP by measuring the length of the fourth internode from the terminus from three randomly chosen stolons. Measurements were recorded using the ridge of tissue of the sheath attachment to determine the internode termini.

Results and Discussion

Cultivars of creeping bentgrass displayed different coverage, lateral spread, and stolon and internode lengths. Overall, Penncross exhibited a greater capability to cover, faster lateral spread, and longer internodes compared with improved cultivars.

One of the Penncross entries possessed the greatest coverage 30 DAP (Table 1). The cultivars Imperial, Crenshaw, SR 1150, Penn G-6, Putter, and Kingpin all had coverage values similar to Penncross. These cultivars plus L-93, Southshore, Tyee, MacKenzie, Century, and Alpha also had the greatest coverage 105 DAP. The cultivar Bengal had coverage 30 DAP that was less than the mean of 320 cm^2 and had the smallest coverage 105 DAP.

One of the entries of Penncross had the fastest lateral spread rate and Bengal had the slowest (Table 1). All cultivars had lateral spread rates similar to Penncross except T-1, Declaration, Memorial, Independence, Alister, LS-44, and Bengal.

Cultivars of creeping bentgrass also differed in their mean stolon and internode lengths.

Penncross and Bengal had the longest and shortest mean stolon length 45 DAP and mean internode length 120 DAP, respectively (Table 1). The cultivars Century, 007, Declaration, Memorial, Independence, Alister, LS-44, and Bengal had the shortest mean stolon and internode lengths. Internode and stolon length were positively correlated, with cultivars having long internodes also displaying long mean stolon length.

With the exception of Century and 007, the remaining cultivars exhibited the slowest lateral spread (Table 1). Regression analysis revealed a positive relationship between lateral spread and internode length, suggesting that cultivars with longer internodes had a greater capability for lateral spread.

Our findings indicate that faster establishing cultivars of creeping bentgrass produced longer stolons and longer internodes compared with slower establishing cultivars.

Table 1. Creeping bentgrass coverage, establishment rate, mean stolon length, and internode length by cultivar. Numbers represent the mean of eight measurements recorded over 2009 and 2010.

Cultivar	30 DAP† coverage‡	105 DAP coverage	Lateral spread§	45 DAP mean stolon length¶	120 DAP mean internode length#
	cm^2	cm^2	log_e(coverage) d^{-1}	cm	cm
Penncross	391	8,973	0.0434	38.1	3.57
Imperial	376	8,340	0.0430	35.1	3.05
Crenshaw	344	8,754	0.0428	35.8	3.53
SR 1150	337	8,477	0.0425	33.3	3.16
Penn G-6	360	9,237	0.0425	36.4	3.10
Putter	354	8,018	0.0422	36.8	3.02
Penncross	368	7,867	0.0416	33.3	3.33
Kingpin	343	6,791	0.0408	33.4	3.01
L-93	297	7,394	0.0406	36.1	3.60
Southshore	312	7,139	0.0405	34.0	3.29
Tyee	287	7,246	0.0405	33.9	3.14
MacKenzie	299	6,760	0.0402	32.4	3.05
Century	313	7,025	0.0401	32.0	2.94
Pennlinks II	320	6,400	0.0400	34.1	2.80
Alpha	304	6,618	0.0399	34.6	3.01
Crystal Bluelinks	320	6,034	0.0396	29.5	3.03
Penn A-4	294	6,169	0.0393	32.6	3.02
007	319	5,950	0.0392	31.0	2.69
T-1	286	6,030	0.0389	33.1	2.80
Declaration	310	5,803	0.0387	31.1	2.77
Memorial	317	5,803	0.0385	29.6	2.73
Independence	319	5,472	0.0383	29.8	2.72
Alister††	292	5,673	0.0382	30.0	2.68
LS-44	282	5,265	0.0372	28.6	2.99
Bengal	253	4,282	0.0355	28.3	2.46
Mean	320	6,861	0.0402	32.9	3.02
$LSD_{0.05}$	64	2,693	0.0044	5.3	0.58

†Days after planting.

‡Coverage was determined by using digital image analysis.

§Establishment rate was calculated by modeling data to the equation [$\log_e$ (coverage) = (R x DAP) + I], where R is the rate of increase, DAP is days after plugging, and I was equal to the natural logarithm of 93.5 cm^2, which was the starting coverage of all plots.

¶Mean of 32 stolons (four samples $plot^{-1}$ with four replications over two growing seasons).

#Mean of 24 internodes (three samples $plot^{-1}$ with four replications over two growing seasons). Internodes were measured 120 DAP by using a dial caliper.

††Colonial bentgrass cultivar

Figure 1. Twenty-four cultivars of creeping bentgrass were evaluated in a spaced-plant trial. Established plugs were transplanted into the center of a 3.3 × 3.3 ft plot and evaluated for their capability for lateral spread.

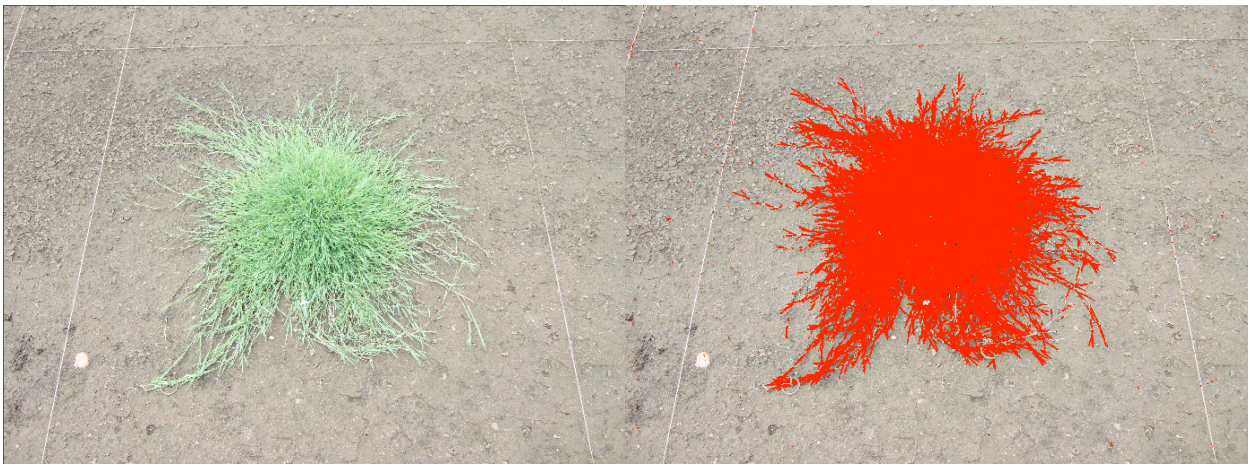

Figure 2. Lateral spread was evaluated by using digital image analysis. A digital image is recorded and the green pixels are highlighted in red. The percentage cover values were used to calculate an establishment rate for each creeping bentgrass cultivar.