

Seed Vigor Testing Among Cultivars of Creeping Bentgrass

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Objectives

The objectives of this research were to determine differences in germination speed, synchrony, percentage, and weight within and among cultivars of creeping bentgrass, and to investigate the relationship between these germination characteristics and seed weight.

Rationale for Research

Since its introduction, Penncross has set the standard for creeping bentgrass (*Agrostis stolonifera* L.) cultivars. Recently released cultivars of creeping bentgrass possess improved vegetative characteristics compared to Penncross but the germination characteristics have not been studied. Germination characteristics such as speed, synchrony, and viability determine the success of newly seeded areas. Traditional establishment from seed involves sowing seed into bare soil or turf which have been treated with non-selective herbicides. In either case, the newly emerging seedlings face little competition from surrounding plants. While germination characteristics are important when using traditional establishment methods, superior germination characteristics may be necessary when using non-traditional seeding methods such as interseeding.

Methods

The cultivars L-93, T1, Apha, Penn A-1, Penn A-4, Crystal Bluelinks, Pennlinks II, Penncross, Tyee, 007, MacKenzie, SR1150, Memorial, Independence, and Declaration were evaluated in this study. Each cultivar was represented by two to four seeds lots from production year 2007. Standard germination tests were conducted according to the rules established by the Association of Official Seed Analysts (AOSA) (Images 1-4). Germination was deemed complete when the radical protruded approximately 2 mm and germination was recorded once or twice daily for 14 days. A logistic function was used to obtain parameters for mean germination time (MGT) as a measure of germination speed, T_{10-90} as a measure of germination synchrony, and final germination percentage (FGP) as a measure of germination capability. Seed weight was determined by using an Ames blower to separate 0.25 grams of seed into two seed weight fractions.

Results and Discussion

Differences were observed for all germination parameters ($p < 0.01$) among cultivars of creeping bentgrass and improved varieties exhibited superior MGT ($p < 0.01$), T_{10-90} ($p < 0.01$), and FGP ($p < 0.05$) compared to Penncross (Table 1.)

Mean germination time. MGT values ranged from 3.46 to 4.19 days among cultivars of creeping bentgrass (Table 2). Pennlinks II germinated faster (smaller MGT) compared to all other cultivars. In addition, cultivars Penn A-4, Crystal Bluelinks, Declaration, T-1, Independence, and Penn A-1 had MGT values significantly smaller than Penncross.

Germination synchrony. T_{10-90} values ranged from 1.30 to 2.04 days among cultivars of creeping bentgrass (Table 2). T-1 and Penncross had the smallest and largest T_{10-90} , respectively. The T_{10-90} value for T-1 was significantly different compared to the T_{10-90} of cultivars Memorial, MacKenzie, Penn A-1, Tyee, Pennlinks II, SR 1150, Penn A-4, and Penncross. In addition, cultivars L-93, Alpha, Crystal Bluelinks, Independence, Declaration, and 007 all had T_{10-90} values significantly different compared to Penncross.

Final germination percentage. Values for FGP ranged from 98.4 to 93.5 percent among creeping bentgrass cultivars (Table 2). T-1 and Declaration had the largest and smallest FGP values, respectively. The FGP for T-1 was significantly different compared to FGP values for cultivars Crystal Bluelinks, Memorial, Independence, Penncross, and Declaration. In addition, cultivars L-93, MacKenzie, 007, Penn A-1, Tyee, and SR 1150 had FGP values significantly greater compared to Penncross.

Seed weight. Cultivars T-1 and Alpha had seed weight significantly greater compared to Penncross and 007 and MacKenzie had seed weights significantly less than Penncross. Seed weight was negatively correlated with germination speed ($r^2 = 0.22$, $p = >0.0001$). However, seed weight does not significantly influence germination synchrony or percentage.



Image 1. Four reps of 100 seeds each were placed onto two layers of blotter paper that had been dipped in a 0.2% solution of potassium nitrate (KNO_3).



Image 2. The germination boxes were placed in plastic bags and set into a chill-chamber operated at 5° C in order to remove any physiological dormancy.



Image 3. Following the pre-chill treatment, the germination boxes were placed into a germination chamber maintained at 15/30° C darkness/light for 16/8 hour per day.



Image 4. Germination was recorded twice a day for the first 5 days and once a day after that. Germination was deemed complete when the radical had protruded approximately 2 mm from the seed coat.

Table 1. Cultivars of creeping bentgrass differ in their mean germination time (MGT), time from 10 to 90% germination (T_{10-90}), final germination percentage (FGP), and weight. Improved cultivars have different MGT, T_{10-90} , and FGP compared with Penncross.

Significance	Germination parameters			Weight
	MGT	T_{10-90}	FGP	
	**	**	**	**
	Mean			
	d		%	g
Penncross	4.09	2.04	94.9	0.11
Improved Cultivars	3.90	1.61	96.7	0.12
Significance [#]	**	**	*	NS

† *F*-test to determine differences among all cultivars of creeping bentgrass. NS, *,** Nonsignificant and significant at $P \leq 0.05$ and $P \leq 0.01$, respectively.

‡ *F*-test to determine differences between Penncross and improved cultivars of creeping bentgrass. NS, *,** Nonsignificant and significant at $P \leq 0.05$ and $P \leq 0.01$, respectively.

Table 2. Predicted values for mean germination time (MGT), time from 10 to 90% of germination (T_{10-90}), and final germination percentage (FGP) for 15 creeping bentgrass cultivars. Values represent means from eight experimental units.

Cultivar [‡]	Germination Parameters [†]			Weight [§]
	MGT	T_{10-90}	FGP	
	d		%	g
Pennlinks II	3.46	1.79	96.7	0.14
Penn A-4	3.66	1.93	96.9	0.13
Crystal Bluelinks	3.74	1.43	96.3	0.09
Declaration	3.77	1.56	93.5	0.14
T-1	3.82	1.30	98.4	0.16
Independence	3.82	1.46	95.2	0.14
Penn A-1	3.90	1.75	97.2	0.12
Alpha	3.92	1.40	96.8	0.15
Memorial	3.93	1.69	96.3	0.09
L-93	4.03	1.40	97.9	0.12
Tyee	4.08	1.76	97.1	0.11
Penncross	4.09	2.04	94.9	0.11
007	4.11	1.56	97.4	0.07
SR1150	4.14	1.84	97.0	0.13
Mackenzie	4.19	1.72	97.5	0.07
Mean	3.91	1.64	96.6	0.12
LSD [¶]	0.17	0.39	2.1	0.03

† Germination data was modeled by using Eq [1], $Y = A / \{1 + B * \exp[-(C * \text{day})]\}$. The predicted values were used to obtain values for MGT, T_{10-90} , and FGP.

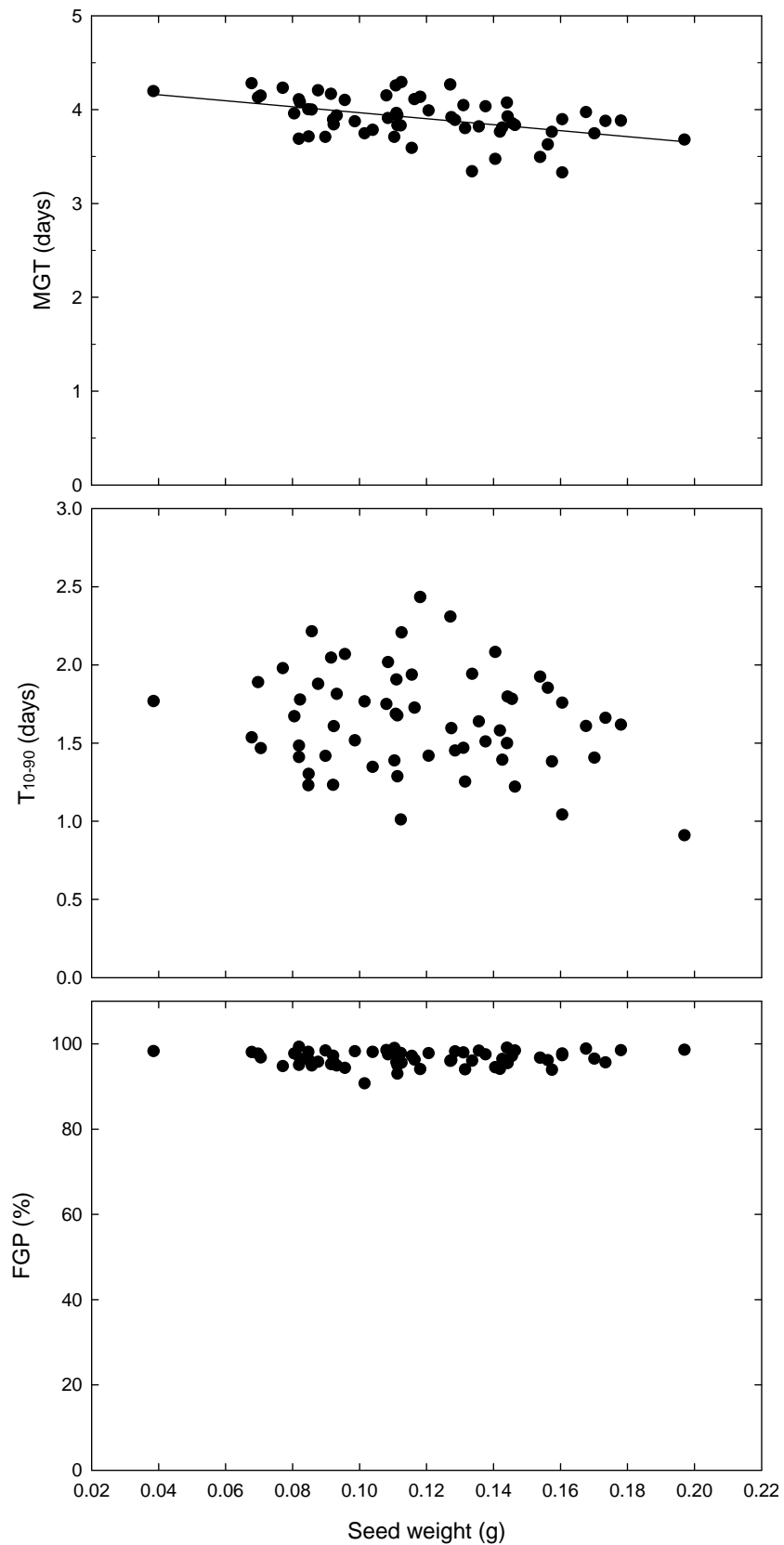


Figure 1. Seed weight influences (A) mean germination time (MGT), but not (B) time from 10-90% germination (MGT) or (C) final germination percentage (FGP). Significant at the $p < 0.0001$ level (***) or not significant (NS). Note that the scale on the y axis differs among germination parameters.