

RUTGERS

New Jersey Agricultural
Experiment Station

2016 Turfgrass Proceedings

The New Jersey Turfgrass Association

In Cooperation with
Rutgers Center for Turfgrass Science
Rutgers Cooperative Extension



2016 RUTGERS TURFGRASS PROCEEDINGS

of the

GREEN EXPO Turf and Landscape Conference

December 6-8, 2016

Borgata Hotel

Atlantic City, New Jersey

The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State University of New Jersey in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public.

This publication includes lecture notes of papers presented at the 2016 GREEN EXPO Turf and Landscape Conference. Publication of these lectures provides a readily available source of information

covering a wide range of topics and includes technical and popular presentations of importance to the turfgrass industry.

This proceedings also includes research papers that contain original research findings and reviews of selected subjects in turfgrass science. These papers are presented primarily to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

Special thanks are given to those who have submitted papers for this proceedings, to the New Jersey Turfgrass Association for financial assistance, and to Barbara Fitzgerald, Anne Diglio, and Ann Jenkins for administrative and secretarial support.

Dr. Ann Brooks Gould, Editor
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PERFORMANCE OF PERENNIAL RYEGRASS CULTIVARS AND SELECTIONS IN NEW JERSEY TURF TRIALS

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Perennial ryegrass (*Lolium perenne* L.) is a cool-season, bunch type grass that performs well in a wide variety of soil conditions but thrives in dark, rich soils with a pH between 5 and 8 in regions with mild climates (Paterson, 2002; USDA, 2002). Perennial ryegrass is a widely distributed turfgrass because of its ability to germinate quickly, creating an attractive leafy appearance in a short period. It is often used in the southern United States for overseeding dormant lawns, athletic fields, and golf courses. Perennial ryegrass is economically important because it allows for athletic play year-round in areas where warm season turfgrasses go dormant in the winter months. This species is attractive for this purpose because it provides a playing surface during cold weather and dies out in the summer, making way for warm-season grasses to take over.

Perennial ryegrass can also be used as a permanent grass in temperate climates. This species prefers to be planted in full sun but will tolerate low levels of shading. It is often found in mixtures with slower germinating grasses such as Kentucky bluegrass (*Poa pratensis* L.) and the fine fescues (*Festuca* spp.) to help prevent soil erosion during lawn establishment and to increase the traffic tolerance of the turf stand. In mixtures, perennial ryegrass is extremely competitive, and if a high percentage is used, the turf stand will eventually be dominated by this species (Murphy and Mohr, 2002).

In 1967, the first turf-type perennial ryegrass, 'Manhattan,' became commercially available, followed by the release of 'Pennfine' in 1970. Today, many more cultivars have been developed. These cultivars are readily available to turf managers for use

in sports fields as well as home lawns. New cultivars have been improved upon to have increased general stress tolerance, insect and disease resistance, improved mowing quality, dark green color, more uniform leaf texture, and higher shoot density (Murphy and Park, 2004). The development of improved perennial ryegrass cultivars continues at the New Jersey Agricultural Experiment Station as well as at other research facilities.

The center of origin for perennial ryegrass includes Europe, North Africa, and parts of Asia. International collection trips are always underway in an effort to acquire new sources of germplasm. Perennial ryegrass collections have the potential to contain new desirable traits that can then be used to breed the next generation of improved perennial ryegrass cultivars.

Perennial ryegrass is susceptible to an array of diseases such as crown rust (*Puccinia coronata*), stem rust (*Puccinia graminis*), red thread (*Laetisaria fuciformis*), pink patch (*Limonomyces roseipellis*), gray leaf spot (*Magnaporthe grisea*), and dollar spot (*Sclerotinia homoeocarpa*). Crown rust is caused by a fungus where sequential infection of two host plants, called alternate hosts, is needed to complete its complex life cycle. The second host is usually a woody shrub or an herbaceous ornamental plant. The disease first appears on ryegrass as a yellow flecking on infected leaf blades followed by raised pustules that break through the epidermis of the blade to release spores (Smiley et al., 2005). Stem rust is also an important disease of perennial ryegrass and can cause serious problems in seed production fields. Gray leaf spot is an important disease of new

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perennial ryegrass turf stands and of old stands with poor air circulation. This disease can be identified by leaf twist and distortion at the point of infection or by round, tan spots with a dark border on the leaf blade (Smiley et al., 2005). Red thread may be associated with pink patch; the two diseases are commonly found together, but pink patch rarely occurs in the absence of red thread. The symptoms and signs of these two diseases are distinctive: *L. fuciformis* (red thread) produces a pinkish to red mycelium that grows out of infected leaf tips in humid environments, whereas *L. roseipellis* (pink patch) produces pink or red “cotton candy”-like flocks attached to affected leaves. Dollar spot can also be found in perennial ryegrass populations if the weather is hot and humid; hyphae are easily identifiable as a cobweb-like mycelium. Breeding efforts are currently underway to improve resistance to all of these pathogens.

Perennial ryegrasses naturally contain symbiotic fungi, known as endophytes, that live intercellularly within the leaf, sheath, and stem tissues. The presence of this endophyte (*Neotyphodium* sp.) can convey biotic and abiotic stress tolerance in many perennial ryegrasses (van Zijl de Jong et al., 2008). The utilization of ryegrass cultivars containing endophytes can reduce damage from above ground feeding insects, such as billbugs (*Sphenophorus parvulus*), sod webworm (*Toumeyella lirioidendri*), and chinch bugs (*Blissus leucopterus*), due to the production of toxic alkaloids by the endophytic fungi (Ahmad et al., 1986; Funk et al., 1994). Endophytes are an important tool for turfgrass breeders as a biological control agent in an environment where pesticide regulations are eminent and sustainable turfgrass management is becoming more popular. The endophyte is transferred via seed to offspring, thus seed must be stored under cool, dry conditions post-harvest to retain this beneficial fungus. Turfgrass breeders and researchers are continuing to research the beneficial role of endophytes in turfgrasses.

At Rutgers University we continue to use cycles of selection in single-plot progeny, mowed turf trials and clonal evaluation of spaced plants to breed perennial ryegrasses with improved resistance to pathogens that cause diseases such as gray leaf spot, rust, dollar spot, and red thread. Breeding for tolerance to abiotic stresses such as salinity (at both mature and seedling stages) and drought is underway. The main objective of the perennial ryegrass breeding program

is to improve the frequency of traits that will lead to the production of new superior genotypes that are attractive, high yielding, disease tolerant, and tolerant to abiotic stresses.

PROCEDURES

One perennial ryegrass trial was established in 2013 (Table 1), two trials were established in 2014 (Tables 2, 3), and three trials were established in 2015 (Tables 4 to 6) at the Rutgers Plant Science Research and Extension Farm in Adelphia, NJ. All tests were hand sown with 0.88 oz of seed into 3 x 5 ft plots (3.7 lb seed per 1000 ft²).

All trials were arranged in a randomized complete block design with three replications, and plots had a 6-inch unseeded border to limit contamination. Dithopyr was used to control crabgrass on all trials in April and June. A spring application of Rifle (Dicamba, dimethylamine salt) and a fall application of Super Trimec (2, 4-D) were applied to all trials for control of broadleaf weeds. In addition, a late summer application of Segway (Cyazofamid) was conducted for Pythium control

The annual rate of nitrogen (N) and mowing height for each trial are presented in Table 7. Single applications of fertilizer did not exceed 1.0 lb N per 1000 ft². The amount and timing of N applied to the turf varied to encourage diseases and other stresses. Trials were mowed regularly with reel mowers to maintain a 1.5-inch height of cut. All trials were irrigated when necessary to avoid drought stress.

All trials were rated throughout the growing season for visual turf quality (i.e., overall appearance, turf color, uniformity, density, mowing quality, reduced rate of vertical growth, leaf texture, and damage due to insects and diseases). Other characteristics such as spring green-up, stem rust, dollar spot, and gray leaf spot were rated when significant differences were evident. Most ratings were based on a 1 to 9 scale, with 9 representing the best turf characteristic. Plots were evaluated by a number of turfgrass specialists to reduce the impact of personal bias for particular characteristics. All data were summarized and subjected to an analysis of variance. Means were separated using Fisher's protected least significant difference (LSD) mean separation test.

RESULTS AND DISCUSSION

Results for all trials are presented in Tables 1 to 6. All trials are ranked by overall turf quality average, except for the two gray leaf spot tests seeded in 2015 (Tables 4, 5). A high quality average is generally indicative of better disease resistance, a darker, bright green color, higher shoot density, uniformity, finer leaf texture, lower growth habit, improved mowing quality, and less damage due to insects.

Turf Quality

Perennial ryegrass has become a very popular species for home lawns, athletic fields, golf courses, and for overseeding purposes. Substantial improvements have been made to the overall turf quality of perennial ryegrass since the release of the first turf-type cultivars in the 1960s (Huff, 1997). In the 2013 perennial ryegrass trial (Table 1), PPG-PR 229, PPG-PR 245, PPG-PR 240, PPG-PR 243, Evolution, and PPG-PR 241 had the highest quality, while Spreader III, Churchill, and AGRLP-150 had the lowest quality. In the trials established in 2014 (Tables 2, 3), Peridot, Xcelerator, PL 3 Comp, APR9709, APR9707, and PL5 Comp exhibited the best turf quality, while Double Time, Royal Green, Double Up GLS, and PG6-14-R1 exhibited the poorest quality. In the 2015 perennial ryegrass test (Table 6), the experimental selections PPG-PR 315, PPG-PR 372, and PPG-PR 307-C exhibited the best turf quality, and the experimental selections 3998, PST-2M20, and PST-2TETS exhibited the poorest turf quality.

Gray Leaf Spot

Gray leaf spot is an important disease that can cause a leaf blight that kills perennial ryegrass seedlings. Leaves are usually distorted and twisted at the point of infection, forming a characteristic "J"-shaped blade. Gray leaf spot is prevalent during extended periods of high relative humidity and warm temperatures. In the 2015 gray leaf spot trials (Tables 4, 5), 02BS2 Comp, 021 Comp, 023 Progeny Comp, PL5 Comp, NP 2 PPG-PR 326, and PPG-PR 329 were all top performers, while Goalkeeper, Nexus XR, Palmer III, Presidio, and Divine were among the lowest performers.

Establishment

The results of September establishment ratings in Tables 5 and 6 indicate that most cultivars and selections were well established within 2 months of

seeding. Seedling establishment and vigor can be affected by factors such as genetics, seed quality and storage, and environmental conditions. Perennial ryegrass is quick to germinate, which helps to suppress weeds and prevent soil erosion. Cultivars such as Salinas II, Divine, Sox Fan, 3998, Ringles, Stellar 3GL, Rinovo, and Estelle exhibited good establishment, while PPG-PR-339, PPG-PR 350, PPG-PR 343, PPG-PR 348, GO-141E, and PPG-PR 326 had the slowest establishment. Interestingly, quick establishment does not always result in better turf quality.

SUMMARY

Turf type perennial ryegrass cultivars are some of the most versatile grasses available on the market today. The high traffic tolerance, rapid establishment, and deep green color of these cultivars are extremely important traits that are in high demand in the turf grass seed industry. Although considerable improvements have been made to perennial ryegrasses, increased genetically stable resistance to diseases such as crown rust is still needed. Additionally, increased heat and drought tolerance, cold hardiness, salinity tolerance, and the ability to survive under ice sheets for extended periods are also necessary.

ACKNOWLEDGMENTS

New Jersey Agricultural Experiment Station Publication No. E 12194-04-17. This work was conducted as a part of NJAES Project No. 12180, supported by New Agricultural Experiment Station, State and Hatch Act funds, the Rutgers Center for Turfgrass Science, and other grants and gifts from the United States Golf Association. Additional support was received by the New Jersey Turfgrass Association, the New Jersey Turfgrass Foundation, and the National Turfgrass Evaluation Program.

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Table 1. Performance of Perennial ryegrass cultivars and selections in a turf trial seeded in September 2013 at Adelphia, NJ.

Cultivar or Selection	-----Turf Quality ¹ -----			
	2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
1 PPG-PR 229	6.2	6.9	6.1	5.6
2 PPG-PR 245	6.2	6.5	6.1	5.8
3 PPG-PR 240	6.0	6.2	6.1	5.8
4 PPG-PR 243	6.0	6.6	5.9	5.6
5 Evolution	6.0	6.6	5.9	5.5
6 PPG-PR 241	6.0	6.5	6.1	5.2
7 4JPRWA2	5.9	6.0	6.1	5.8
8 PPG-PR 242	5.9	6.7	5.9	5.2
9 Xcelerator	5.9	6.1	5.6	6.0
10 SR4650	5.9	6.4	5.7	5.5
11 CT7	5.7	6.2	5.5	5.4
12 Fastball RGL	5.7	6.2	5.4	5.4
13 PR-2-13-Bulk	5.7	6.1	5.2	5.7
14 PPG-PR 232	5.6	6.2	5.7	5.0
15 PPG-PR 196	5.6	6.3	5.2	5.3
16 PPG-PR 231	5.6	6.2	5.3	5.3
17 PPG-PR 239	5.6	5.8	5.4	5.6
18 PPG-PR 244	5.6	6.5	5.4	4.9
19 4JPRWA1	5.5	5.8	5.3	5.5
20 Pangea	5.5	6.3	5.4	4.9
21 4JPRWA	5.5	5.7	5.4	5.5
22 Rinovo	5.5	6.1	5.0	5.4
23 Wicked	5.5	5.8	5.2	5.5
24 4JPRWA4	5.5	5.4	5.6	5.6
25 Pizzazz 2	5.5	5.9	5.5	5.2
26 PPG-PR 233	5.5	5.7	5.6	5.2
27 Stellar 3GL	5.5	5.9	5.5	5.1
28 Metolius	5.5	5.9	5.5	5.1
29 Rutkus	5.5	6.0	5.4	5.0
30 CHT	5.5	5.8	5.5	5.2
31 PPG-PR 197	5.5	6.3	5.0	5.1
32 PPG-PR 230	5.4	6.1	5.2	5.1
33 PPG-PR 194	5.4	5.7	5.2	5.4
34 Grand Slam GLD	5.4	5.6	5.3	5.3
35 PPG-PR 193	5.4	6.2	5.2	4.9

(Continued)

Table 1. Perennial ryegrass turf trial, 2013 (continued).

	Cultivar or Selection	-----Turf Quality ¹ -----			
		2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
36	2SUPA Bulk	5.4	5.6	5.3	5.2
37	PPG-PR 228	5.4	5.4	5.2	5.5
38	PR15K-3-17	5.4	5.8	5.3	4.9
39	Karma	5.3	5.9	5.1	4.9
40	Benchmark	5.3	5.5	5.1	5.4
41	RAD-PR77	5.3	5.6	5.2	5.0
42	4JPRWA3	5.3	5.4	5.4	5.0
43	PPG-PR 234	5.2	6.1	5.1	4.5
44	2BED Bulk	5.2	5.2	5.1	5.1
45	4DTWA	5.2	5.7	4.8	5.0
46	Syn-2BET	5.2	5.3	4.9	5.3
47	Apple SGL	5.1	5.5	5.1	4.8
48	RAD-PR73	5.1	5.8	5.1	4.5
49	4JPRWA5	5.1	5.4	4.9	4.9
50	Manhattan 6	5.0	5.5	5.2	4.4
51	PR15K-3-19	5.0	5.2	5.0	4.9
52	Saltinas	5.0	5.2	5.2	4.6
53	Sideways	5.0	5.7	4.9	4.4
54	PR201	5.0	5.3	5.0	4.6
55	Home Run	5.0	5.4	4.8	4.6
56	Green Emperor	4.9	4.9	4.9	5.0
57	SR4600	4.9	5.3	5.0	4.6
58	PPG-PR 195	4.9	5.6	4.8	4.4
59	PPG-PR 238	4.9	5.5	4.7	4.4
60	RBL-1-13-3	4.9	5.0	4.7	4.9
61	Dasher 3	4.9	5.7	4.7	4.1
62	Harrier	4.8	5.2	4.9	4.5
63	Phenom	4.8	5.3	4.8	4.4
64	Triathlon	4.8	5.7	4.6	4.2
65	Estelle	4.8	5.0	5.0	4.5
66	PR15K-1-8	4.8	5.2	4.8	4.6
67	2MEW Bulk	4.8	4.6	5.1	4.8
68	SR 4660 ST	4.8	5.6	4.6	4.2
69	Sox Fan	4.8	5.2	4.5	4.6
70	Zoom	4.8	5.2	4.7	4.4

(Continued)

Table 1. Perennial ryegrass turf trial, 2013 (continued).

	Cultivar or Selection	-----Turf Quality ¹ -----			
		2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
71	11-12PR-13	4.7	4.6	4.5	5.2
72	Mighty	4.7	5.1	4.7	4.4
73	GO-SDG	4.7	5.1	4.7	4.4
74	Protégé	4.7	4.8	5.0	4.4
75	2TT Bulk	4.7	4.7	4.7	4.7
76	Slugger II	4.7	4.8	4.9	4.4
77	Calypso 3	4.7	5.2	4.5	4.3
78	08-18Lp AB	4.7	5.1	4.3	4.6
79	Edge II	4.6	5.1	4.6	4.2
80	Defender	4.6	5.0	4.7	4.2
81	RBL-1-13-1	4.6	5.2	4.7	3.9
82	RBL-1-13-4	4.6	4.7	4.4	4.7
83	4CAGL	4.6	5.5	4.4	3.9
84	PR15K-5-24	4.6	4.7	4.7	4.2
85	Express 2	4.5	4.9	4.7	4.0
86	Fiesta 4	4.5	5.1	4.4	4.1
87	Evolve	4.5	4.7	4.5	4.4
88	Manhattan 5 GLR	4.5	5.0	4.4	4.2
89	RBL-1-13-12	4.5	4.6	4.2	4.7
90	RBL-1-13-Bulk	4.5	4.7	4.4	4.4
91	MSP 3999	4.5	4.5	4.7	4.2
92	RBL-1-13-11	4.5	4.4	4.3	4.7
93	RBL-1-13-2	4.5	4.9	4.2	4.3
94	SRPR1-3-2	4.5	4.9	4.5	3.9
95	Hawkeye 2	4.4	4.8	4.5	4.0
96	PR15K-6-29	4.4	4.6	4.4	4.3
97	11-12PR-10	4.4	4.9	4.2	4.1
98	PPG-PR 237	4.4	4.7	4.3	4.2
99	PSPR-09-3	4.4	4.3	4.6	4.3
100	Syn-2MARC3	4.4	4.7	4.0	4.4
101	RBL-1-13-10	4.3	4.5	4.3	4.2
102	Tailgater	4.3	4.6	4.3	4.1
103	Gray Fox	4.3	5.0	4.1	3.8
104	SRPR1Bulk	4.3	4.6	4.4	3.9
105	SRPR1-4-2	4.3	4.4	4.2	4.3

(Continued)

Table 1. Perennial ryegrass turf trial, 2013 (continued).

	Cultivar or Selection	-----Turf Quality ¹ -----			
		2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
106	Blazer 4	4.3	4.7	4.3	3.9
107	Nexus XR	4.3	4.4	4.5	3.9
108	08-20Lp AB	4.3	4.5	4.2	4.1
109	PR15K-2-6	4.2	4.3	4.1	4.3
110	PR-1-13-Bulk	4.2	4.7	3.9	4.1
111	Silver Dollar	4.2	4.5	4.2	4.0
112	SRPR1-2-3	4.2	4.4	4.0	4.2
113	DSL5B-13	4.2	4.8	4.1	3.7
114	4DFHM	4.2	4.3	4.0	4.3
115	SRPR2-3-6	4.2	4.6	4.0	3.9
116	PR15K-5-29	4.2	4.4	4.2	3.9
117	11-12PR-5	4.2	4.4	3.9	4.1
118	11-12PR-7	4.2	4.4	4.0	4.0
119	PRWH2-12	4.2	4.3	4.1	4.0
120	PR15K-2-10	4.1	4.6	4.2	3.6
121	Haven	4.1	4.6	4.2	3.6
122	RBL-1-13-6	4.1	4.1	4.0	4.3
123	SRPR2Bulk	4.1	4.6	3.8	4.0
124	PR-7-13-Bulk	4.1	4.6	4.3	3.5
125	11-12PR-4	4.1	4.3	4.0	4.0
126	Cutter 2	4.1	4.4	4.1	3.7
127	08FTMSESL	4.1	4.1	4.2	3.9
128	Charismatic II	4.1	4.3	3.9	4.0
129	RBL-1-13-7	4.0	3.9	3.9	4.1
130	RBL-1-13-8	3.9	4.0	4.0	3.8
131	Cascadia	3.9	4.2	3.5	4.0
132	MSP 4001	3.9	3.6	4.0	4.1
133	Nexus XD	3.8	4.0	4.0	3.4
134	SRPR2-2-6	3.8	4.5	3.7	3.2
135	PR15K-7-21	3.7	3.9	3.8	3.5
136	MSP 4000	3.7	3.6	3.8	3.8
137	4STD3-13	3.7	3.5	3.9	3.6
138	PNCK-13	3.7	3.8	3.7	3.5
139	Nightsky	3.6	4.0	3.5	3.4
140	PRWH 11-3	3.6	3.6	3.5	3.7

(Continued)

Table 1. Perennial ryegrass turf trial, 2013 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----			
	2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
141 PRWH4-12	3.6	3.7	3.4	3.6
142 SRPR2-1-2	3.6	4.0	3.3	3.3
143 DKDHPR-1-13-Bulk	3.5	3.7	3.3	3.6
144 SRPR2-1-7	3.5	4.1	3.2	3.2
145 Charismatic	3.4	3.4	3.3	3.5
146 Double Up GLS	3.4	4.2	3.1	2.9
147 Double Time	3.4	3.9	3.1	3.1
148 Royal Green	3.3	3.0	3.4	3.6
149 Brighstar SLT	3.3	3.1	3.4	3.5
150 PPG-PR 200	3.3	3.4	3.0	3.4
151 TAG-DP14	3.2	3.2	3.0	3.4
152 Quebec	3.1	3.1	3.1	3.1
153 Spreader III	3.0	2.8	3.2	2.9
154 Churchill	2.9	2.6	3.1	3.0
155 AGRLP-150	2.0	1.7	1.9	2.4
LSD at 5% =	0.5	0.6	0.7	0.7

¹9 = best turf quality

Table 2. Performance of perennial ryegrass cultivars and selections in a turf trial seeded in September 2014 at Adelphia, NJ.

Cultivar or Selection	-----Turf Quality ¹ -----		
	2015-2016 Avg.	2015 Avg.	2016 Avg.
1 Peridot	6.2	6.0	6.4
2 Xcelerator	6.1	5.9	6.3
3 PL 3 Comp	5.9	5.5	6.2
4 FEC3	5.8	5.1	6.5
5 PPG-PR-244	5.8	5.7	5.8
6 PPG-PR-241	5.7	5.5	5.9
7 Pharaoh	5.7	5.5	5.8
8 CT 1196 AR94	5.6	5.4	5.8
9 Benchmark	5.6	5.4	5.8
10 PL 6 Comp	5.6	5.1	6.1
11 Pizzazz 2	5.6	5.5	5.7
12 PPG-PR-243	5.6	5.5	5.7
13 JR-123	5.6	5.5	5.7
14 Stellar 3GL	5.6	5.3	5.9
15 Overdrive 5G	5.6	5.3	5.8
16 PL 4 Comp	5.5	5.3	5.7
17 PPG-PR-229	5.5	4.9	6.1
18 Expedite	5.5	5.3	5.7
19 Fastball RGL	5.5	5.3	5.7
20 Pangea	5.5	5.6	5.4
21 Metolius	5.5	5.3	5.6
22 Sox Fan	5.5	5.2	5.7
23 PPG-PR-233	5.5	5.2	5.7
24 SPP Comp	5.4	5.5	5.3
25 PPG-PR-240	5.4	5.2	5.6
26 Granslam GLD	5.4	5.2	5.5
27 Amazing A+	5.3	5.3	5.4
28 PPG-PR-232	5.3	5.1	5.6
29 PST-2A12	5.3	5.0	5.6
30 PPG-PR-234	5.3	5.1	5.5
31 SPV Comp	5.3	5.1	5.5
32 Slugger II	5.3	5.2	5.4
33 PPG-PR-193	5.3	4.8	5.8
34 PPG-PR-196	5.3	4.9	5.7
35 PPG-PR-230	5.3	5.0	5.5

(Continued)

Table 2. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2015-2016 Avg.	2015 Avg.	2016 Avg.
36 PPG-PR-197	5.3	5.0	5.5
37 SPM Comp	5.2	5.0	5.4
38 Triathlon	5.2	4.9	5.5
39 Green Supreme	5.2	4.9	5.5
40 RICS	5.2	4.8	5.6
41 PST-2BDT	5.2	5.0	5.4
42 PL 5 Comp	5.2	5.1	5.2
43 Apple SGL	5.2	5.1	5.2
44 PPG-PR-231	5.2	4.9	5.4
45 CT 1196WILD	5.1	5.1	5.2
46 CS1	5.1	5.0	5.3
47 APR 2291	5.1	5.2	5.0
48 Gray Fox	5.1	4.8	5.3
49 Exacta II	5.0	5.1	4.9
50 Green Emperor	5.0	5.0	5.0
51 PST 2040	5.0	4.6	5.4
52 GO-DGR	5.0	4.9	5.1
53 PPG-PR-194	5.0	4.9	5.1
54 PPG-PR-228	5.0	4.7	5.2
55 PST-2REB	5.0	5.0	4.9
56 PPG-PR-195	5.0	4.8	5.1
57 CT 1196AR95	4.9	4.7	5.2
58 Radiance	4.9	4.8	5.0
59 Top Gun II	4.9	4.4	5.3
60 La Quinta	4.9	4.7	5.0
61 CUT Comp	4.8	4.8	4.9
62 Salinas	4.8	4.1	5.5
63 GO-SDG	4.8	4.9	4.7
64 Sunrise	4.7	4.7	4.8
65 Accent II	4.7	4.2	5.3
66 CP 1 Comp	4.7	4.6	4.8
67 PPG-PR-238	4.7	4.7	4.8
68 Rinovo	4.7	4.7	4.8
69 Singular	4.7	4.6	4.8
70 GO-SDB	4.7	4.3	5.1

(Continued)

Table 2. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2015-2016 Avg.	2015 Avg.	2016 Avg.
71 PPG-PR-237	4.7	4.7	4.6
72 Ingles Sun	4.6	4.6	4.7
73 Manhattan 6	4.6	4.7	4.6
74 Monterey 4	4.6	4.7	4.6
75 Goalkeeper II	4.6	4.4	4.8
76 Frontier	4.6	4.6	4.5
77 Pasco	4.6	5.0	4.1
78 Haven	4.5	4.2	4.9
79 Charismatic II	4.5	4.3	4.7
80 Protégé	4.5	4.5	4.6
81 Confetti III	4.4	4.4	4.4
82 Green/Royal/Artic	4.4	4.6	4.1
83 Belize	4.4	4.1	4.7
84 Panther	4.4	4.2	4.5
85 Green EmperorxRoyal Green	4.4	4.4	4.3
86 Secretariat II	4.3	4.1	4.6
87 Spreader/Arctic-X block	4.3	4.5	4.1
88 Artic Green	4.3	4.5	4.1
89 Revenge GLX	4.3	4.2	4.4
90 JS 501	4.2	4.2	4.2
91 Barbados	4.1	4.0	4.2
92 PPG-PR-200	4.1	4.3	3.9
93 GO-OM3	4.0	3.8	4.1
94 Kokomo 2	3.9	3.9	4.0
95 Repell GLX	3.9	3.8	3.9
96 Caddieshack II	3.8	3.7	4.0
97 Double Up	3.8	3.7	3.9
98 Paragon GLR	3.7	3.7	3.7
99 Ragnar II	3.4	3.5	3.3
100 Ragnar	3.2	3.5	2.8
101 Double Time	3.1	3.1	3.1
102 Royal Green	2.9	2.9	2.9
LSD at 5%=	0.5	0.6	0.5

¹9 = best turf quality

Table 3. Performance of perennial ryegrass cultivars and selections in a turf trial seeded in September 2014 at Adelphia, NJ.

Cultivar or Selection	-----Turf Quality ¹ -----		
	2016-2017 Avg.	2015 Avg.	2016 Avg.
1 APR9709	5.1	5.0	5.2
2 APR9707	5.0	4.8	5.2
3 PL5 Comp	5.0	5.2	4.7
4 Xcelerator	5.0	4.9	5.0
5 FEC3	4.9	4.5	5.3
6 RAD-PR84	4.9	4.9	4.8
7 PST-2LTD	4.8	4.9	4.7
8 PG3-14-R4	4.8	4.7	4.9
9 RAD-PR86	4.8	4.9	4.7
10 NP3	4.8	4.6	4.9
11 PST-2BDT	4.8	5.0	4.5
12 PPG-PR 228	4.8	4.5	5.0
13 NP2	4.7	4.8	4.6
14 TB-C13-R8	4.7	4.8	4.7
15 PG3-14-R10	4.7	4.8	4.7
16 Evolution	4.7	5.0	4.5
17 Grand Slam	4.7	4.5	4.9
18 APR9702	4.7	4.6	4.7
19 PG3-14-R1	4.7	4.7	4.7
20 PG3-14-R2	4.7	4.8	4.6
21 CP-68	4.7	4.3	5.0
22 PPG-PR 270	4.7	4.8	4.6
23 Salinas II	4.7	4.8	4.5
24 RAD-PR79	4.6	5.0	4.3
25 PG3-14-R9	4.6	4.3	5.0
26 Gray Hawk	4.6	4.6	4.6
27 021 Comp	4.6	4.4	4.8
28 Premium	4.6	4.6	4.6
29 Rinovo	4.6	4.8	4.4
30 PST-2SURV	4.6	4.6	4.6
31 PG3-14-R6	4.6	4.5	4.7
32 PG3-14-R7	4.6	4.5	4.6
33 APR9703	4.5	4.5	4.6
34 Stellar 3GL	4.5	4.5	4.6
35 PPG-PR 232	4.5	4.6	4.5

(Continued)

Table 3. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2016-2017 Avg.	2015 Avg.	2016 Avg.
36 PST-2SHRP	4.5	4.7	4.4
37 HE 231 63432-14	4.5	4.6	4.4
38 PPG-PR 231	4.5	4.6	4.4
39 PPG-PR 229	4.5	4.5	4.5
40 PPG-PR 289	4.5	4.5	4.4
41 PPG-PR 300	4.5	4.9	4.1
42 PPG-PR 301	4.5	4.6	4.4
43 APR9701	4.5	4.4	4.6
44 APR9708	4.5	4.4	4.6
45 PST-Syn-2SUR4	4.5	4.3	4.7
46 CT-7	4.5	4.4	4.6
47 NP1	4.5	4.0	4.9
48 Molalla	4.5	4.5	4.4
49 Syn-2FOX-13	4.5	4.7	4.2
50 PG3-14-R8	4.4	4.3	4.6
51 Expedite	4.4	4.7	4.1
52 PST-2PDA	4.4	4.2	4.6
53 Benchmark	4.3	4.3	4.4
54 PPG-PR 238	4.3	4.1	4.5
55 PPG-PR 271	4.3	4.4	4.2
56 Pangea	4.3	4.6	4.0
57 PST-2TFC	4.3	4.3	4.3
58 PPG-PR 234	4.3	4.5	4.1
59 Silver Sun	4.3	4.2	4.3
60 PST-2DR9	4.3	4.4	4.2
61 PPG-PR 230	4.3	4.3	4.2
62 PPG-PR 233	4.2	4.3	4.1
63 PST-2A12	4.2	4.1	4.3
64 Pistol	4.2	4.2	4.2
65 Dominator	4.2	4.3	4.1
66 PG3-14-R5	4.2	4.0	4.4
67 PPG-PR 268	4.2	4.1	4.3
68 Tailgater	4.2	4.1	4.2
69 PST-Syn-2MAS	4.2	4.5	3.9
70 Estelle	4.2	4.3	4.0

(Continued)

Table 3. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2016-2017 Avg.	2015 Avg.	2016 Avg.
71 Expedite	4.1	4.0	4.3
72 Top Gun II	4.1	4.1	4.1
73 Panther GLS	4.1	4.4	3.8
74 Monterey 4	4.1	4.1	4.1
75 Pacific Gem	4.1	4.1	4.1
76 Pizzazz II	4.1	4.2	4.0
77 APR 2291	4.1	4.7	3.5
78 MSP 4011	4.1	4.1	4.1
79 Amazing A+	4.1	4.0	4.1
80 Fastball RGL	4.1	4.1	4.1
81 GO-14-PRG-EE	4.1	4.2	3.9
82 Manhattan 5 GLR	4.1	4.0	4.1
83 TB-43-2-R6	4.0	4.1	4.0
84 Sox Fan	4.0	3.8	4.2
85 Home Run	4.0	4.0	4.1
86 PG3-14-R3	4.0	4.3	3.7
87 Manhattan 6 GLR	4.0	4.2	3.8
88 Green Supreme	4.0	4.0	4.0
89 SMP Comp	4.0	4.0	4.0
90 Accent II	4.0	4.0	4.0
91 Rutkus	4.0	4.2	3.7
92 Exacta II	4.0	4.0	4.0
93 Ringles	4.0	4.1	3.9
94 APR9712	4.0	3.9	4.0
95 PPG-PR 283	4.0	4.2	3.7
96 Protégé GLR	3.9	4.0	3.9
97 Apple SGL	3.9	3.9	4.0
98 APR9710	3.9	4.1	3.7
99 Soprano	3.9	4.2	3.6
100 Manhattan 6 GLR	3.9	4.3	3.5
101 Artic Green	3.9	4.1	3.7
102 La Quinta	3.9	3.8	3.9
103 Secretariat II	3.9	4.1	3.6
104 Panther H2O	3.9	4.2	3.5
105 PUS Comp	3.9	3.6	4.1

(Continued)

Table 3. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2016-2017 Avg.	2015 Avg.	2016 Avg.
106 Brightstar SLT	3.9	3.8	3.9
107 Salinas II	3.9	4.0	3.7
108 GT24	3.8	3.9	3.8
109 PST-2MAX	3.8	3.8	3.8
110 Quicksilver	3.8	4.0	3.7
111 PPG-PR 282	3.8	4.0	3.7
112 PPG-PR 237	3.8	4.0	3.6
113 Defender	3.8	3.6	4.0
114 GO-14-PRG-LOW	3.8	3.9	3.7
115 Gray Fox	3.8	3.9	3.7
116 Sunrise	3.8	4.0	3.5
117 PST-2RDY	3.8	3.6	3.9
118 PST-2REB	3.8	3.5	4.0
119 MSP 4020	3.7	3.9	3.6
120 Divine	3.7	3.7	3.8
121 Charismatic II	3.7	3.5	3.9
122 Palmer III	3.7	3.8	3.5
123 Green Emperor	3.7	3.9	3.4
124 Silver Dollar	3.7	3.6	3.7
125 PPG-PR 269	3.7	3.8	3.6
126 APR9711	3.7	3.9	3.4
127 Royal Green	3.7	3.5	3.8
128 APR9705	3.6	3.8	3.4
129 Cascadia	3.6	3.8	3.3
130 Saltinas	3.6	3.5	3.6
131 APR 2105	3.6	3.6	3.6
132 PG6-14-R3	3.6	3.6	3.5
133 JS501	3.6	3.7	3.4
134 PG6-14-R2	3.5	3.5	3.5
135 APR 2116	3.5	3.7	3.3
136 Sun	3.5	3.6	3.5
137 APR9706	3.5	3.6	3.4
138 Revenge GLX	3.5	3.5	3.5
139 PS4	3.5	3.6	3.4
140 PG6-14-R7	3.4	3.6	3.2

(Continued)

Table 3. Perennial ryegrass turf trial, 2014 (continued).

Cultivar or Selection	-----Turf Quality ¹ -----		
	2016-2017 Avg.	2015 Avg.	2016 Avg.
141 PPG-PR 272	3.4	3.4	3.4
142 APR9704	3.4	3.6	3.2
143 PG6-14-R4	3.4	3.5	3.3
144 APR 2190	3.4	3.3	3.5
145 PST-2M20	3.3	3.8	2.9
146 PG6-14-R5	3.3	3.5	3.2
147 Replay GLY	3.3	3.5	3.1
148 PG6-14-R8	3.3	3.4	3.2
149 PPG-PR 236	3.2	3.5	3.0
150 PG6-14-R6	3.0	3.1	2.9
151 PST-3IP	3.0	3.3	2.7
152 Double Up GLS	2.8	3.2	2.4
153 PG6-14-R1	2.5	2.7	2.2
LSD at 5%=	0.6	0.6	0.8

¹9 = best turf quality

Table 4. Performance of perennial ryegrass cultivars and selections in a turf trial seeded in September 2015 at Adelphia, NJ.

Cultivar or Selection	Gray Leaf Spot ¹ Sept. 2015 Avg.	Turf Quality ² 2016 Avg.
1 02BS2 Comp	8.7	6.3
2 021 Comp	8.7	6.3
3 023 Progeny Comp	8.7	6.3
4 NP2	8.7	6.9
5 PL5 Comp	8.7	6.3
6 FP1 Comp	8.3	6.0
7 Shield	8.0	6.7
8 022 Comp	8.0	6.4
9 NP3	8.0	6.6
10 Overdrive 5G	8.0	6.4
11 02BS3 Progeny Comp	7.7	5.9
12 NP1	7.7	5.9
13 023 Clone Comp	7.7	6.3
14 FP6 Comp	7.7	6.9
15 02BS1 Comp	7.3	6.1
16 UF4 Comp	7.3	5.9
17 FP2 Comp	7.3	6.2
18 JR-123 Comp	7.3	5.6
19 PUS Comp	7.0	6.0
20 UF3 Comp	7.0	5.8
21 FP3 Comp	7.0	6.0
22 Amazing A+	7.0	5.8
23 Green Supreme	7.0	5.5
24 FP4 Comp	6.7	6.1
25 Rutkus	6.7	5.6
26 UF2 Comp	6.3	5.4
27 Haven	6.3	4.5
28 FP5 Comp	6.0	5.5
29 USR Comp	5.7	5.7
30 Umpqua	5.7	5.7
31 UF1 Comp	5.0	5.5
32 Revenge GLX	4.7	4.7
33 Caddieshack II	2.7	3.1
34 Monterey 4	2.3	3.6
35 Replay	2.3	2.8

(Continued)

Table 4. Perennial ryegrass cultivars turf trial, 2015 (continued).

Cultivar or Selection	Gray Leaf Spot ¹ Sept. 2015 Avg.	Turf Quality ² 2016 Avg.
36 Sunrise	2.3	3.4
37 Nexus XD	2.3	3.7
38 Goalkeeper II	2.0	2.6
39 Nexus XR	2.0	3.5
40 Palmer III	2.0	2.9
LSD at 5% =	1.6	0.8

¹9 = least disease

²9 = best turf quality

Table 5. Performance of perennial ryegrass cultivars and selections in a turf trial seeded in September 2015 at Adelphia, NJ.

Cultivar or Selection	Gray Leaf Spot ¹ 2015-2016 Avg.	Turf Quality ² 2016 Avg.	Establishment ³ Aug. 2015
1 PPG-PR 326	8.7	5.7	5.3
2 PPG-PR 329	8.3	4.8	5.0
3 PST-2A12	8.0	5.5	6.0
4 PPG-PR 307-S	8.0	5.2	5.3
5 PPG-PR 344	8.0	5.2	4.3
6 Provost	8.0	4.9	7.0
7 Spark	8.0	4.8	7.0
8 Vision	8.0	4.6	6.0
9 PPG-PR 320	7.7	5.2	5.7
10 PPG-PR 352	7.7	5.2	4.3
11 PPG-PR 335	7.7	5.1	5.0
12 Evolution	7.7	4.7	6.7
13 PPG-PR 229	7.7	4.6	6.0
14 PPG-PR 331	7.7	4.2	4.7
15 PPG-PR 363	7.7	4.2	4.0
16 PST-2BDT	7.7	4.1	5.0
17 PPG-PR 342	7.7	4.0	3.7
18 PPG-PR 319	7.3	5.7	5.7
19 PPG-PR 310	7.3	5.6	4.0
20 PPG-PR 307-C	7.3	5.6	5.0
21 PPG-PR 317	7.3	5.4	5.0
22 PST-Syn-2FXA	7.3	5.3	6.7
23 PPG-PR 306-C	7.3	5.1	6.0
24 Manhattan 6 GLR	7.3	4.9	6.7
25 Premium	7.3	4.9	6.0
26 Stellar 3GL	7.3	4.8	6.0
27 Intense	7.3	4.7	6.0
28 PST-2PDA	7.3	4.7	6.7
29 PPG-PR 350	7.3	4.5	3.3
30 PPG-PR 353	7.3	4.3	4.3
31 PPG-PR 343	7.3	4.2	3.3
32 PPG-PR 305-C	7.0	5.3	6.3
33 PPG-PR 338	7.0	5.1	3.7
34 PPG-PR 306-S	7.0	5.0	4.7
35 PPG-PR 339	7.0	4.9	3.0

(Continued)

Table 5. Perennial ryegrass turf trial, 2015 (continued).

Cultivar or Selection	Gray Leaf Spot ¹ 2015-2016 Avg.	Turf Quality ² 2016 Avg.	Establishment ³ Aug. 2015
36 Peridot	7.0	4.6	5.3
37 PPG-PR 305-S	7.0	4.6	6.0
38 PPG-PR 348	7.0	4.4	3.3
39 PPG-PR 240	7.0	4.4	5.3
40 PPG-PR 328	7.0	4.4	5.3
41 PPG-PR 318	6.7	5.2	6.3
42 PPG-PR 241	6.7	5.1	5.0
43 PPG-PR 309	6.7	4.7	6.0
44 Benchmark	6.7	4.6	6.3
45 PPG-PR 349	6.7	4.3	4.7
46 PPG-PR 315	6.3	5.6	5.7
47 Gray Hawk	6.3	4.6	5.3
48 PPG-PR 243	6.3	4.5	4.7
49 PST-2REB	6.3	4.3	6.0
50 PST-2DR9	6.0	3.6	6.3
51 PST-Syn-2FOXY	5.7	5.0	5.0
52 02BS1	5.7	5.0	5.0
53 PPG-PR 242	5.7	4.0	4.3
54 Defender	5.7	3.8	6.0
55 Sox Fan	5.7	3.8	8.0
56 PST-2SURV	5.3	4.2	6.7
57 Benchmark	5.3	4.1	7.0
58 PST-2LTD	5.3	3.8	5.3
59 Manhattan 5 GLR	5.0	3.9	6.3
60 Pistol	5.0	3.7	7.0
61 Silver Sun	5.0	3.7	6.0
62 Dominator	5.0	3.4	5.7
63 Primary	4.7	4.0	6.7
64 LCP-186	4.7	4.0	5.3
65 CP-68	4.3	3.9	6.0
66 PST-2TFC	4.3	3.8	6.7
67 Tailgater	4.3	3.7	6.3
68 Gray Fox	4.3	3.5	6.7
69 Estelle	4.3	3.4	6.3
70 Molalla	4.3	3.4	6.0

(Continued)

Table 5. Perennial ryegrass turf trial, 2015 (continued).

Cultivar or Selection	Gray Leaf Spot ¹ 2015-2016 Avg.	Turf Quality ² 2016 Avg.	Establishment ³ Aug. 2015
71 PST-Syn-2MAS	4.0	3.5	5.0
72 PST-2RDY	4.0	3.2	6.0
73 Silver Dollar	4.0	3.2	7.0
74 PST-3IP	4.0	2.4	4.7
75 Cascadia	3.7	2.8	6.7
76 PST-2SHRP	3.3	3.1	6.0
77 Citation Fore	3.0	2.8	7.0
78 Salinas II	2.7	3.0	9.0
79 Prominent	2.7	2.9	6.3
80 Play Fast	2.7	2.7	7.7
81 Presidio	2.3	2.5	5.3
82 Divine	2.3	2.2	8.7
LSD at 5%=	1.4	0.9	1.8

¹9 = least disease

²9 = best turf quality

³9 = best establishment

Table 6. Performance of perennial ryegrass cultivars and selections in a turf trial seeded in September 2015 at Adelphia, NJ.

Cultivar or Selection	Turf Quality ¹ 2016 Avg.	Establishment ² Sept. 2015
1 PPG-PR 315	5.5	4.7
2 PPG-PR 372	5.3	6.0
3 PPG-PR 307-C	5.2	6.3
4 PPG-PR 349	5.1	6.0
5 PPG-PR 363	5.1	7.0
6 PPG-PR 306-S	5.1	5.7
7 PPG-PR 360	5.1	4.7
8 PPG-PR 343	5.0	5.3
9 PPG-PR 344	5.0	5.7
10 NAI-PL2	5.0	4.7
11 PST-Syn-2FLAT	4.9	4.0
12 PPG-PR 352	4.9	7.3
13 Metolius	4.9	7.0
14 PPG-PR 371	4.8	6.7
15 PPG-PR 318	4.8	4.3
16 PPG-PR 329	4.7	5.0
17 Apple SGL	4.7	6.7
18 PPG-PR 240	4.7	4.3
19 PST-2LTD	4.7	6.7
20 Grandslam GLD	4.7	8.0
21 PPG-PR 307-S	4.6	7.0
22 PPG-PR 310	4.6	4.3
23 PPG-PR 317	4.6	4.7
24 PPG-PR 305-C	4.6	6.7
25 PPG-PR 305-S	4.6	6.0
26 PPG-PR 339	4.6	6.3
27 PPG-PR 348	4.6	6.0
28 PST-2A2	4.6	7.3
29 PPG-PR 331	4.6	7.0
30 PPG-PR 338	4.6	5.0
31 PPG-PR 243	4.5	4.7
32 PPG-PR 229	4.5	7.7
33 PST-2A12	4.5	8.0
34 PST-2BDT	4.5	7.7
35 Estelle	4.5	8.3

(Continued)

Table 6. Perennial ryegrass turf trial, 2015 (continued).

Cultivar or Selection	Turf Quality ¹ 2016 Avg.	Establishment ² Sept. 2015
36 NAI-02BS1	4.5	5.3
37 PPG-PR 309	4.4	4.3
38 PPG-PR 320	4.4	5.7
39 PPG-PR 328	4.4	5.3
40 PPG-PR 335	4.4	5.7
41 Rutkus	4.4	7.3
42 PST-2CITM	4.4	6.7
43 PST-Syn-2GTD	4.4	5.3
44 PPG-PR 319	4.4	4.3
45 PPG-PR 306-C	4.3	5.7
46 PPG-PR 353	4.3	7.0
47 PST-Syn-2EGAD	4.3	4.3
48 PST-2SURV	4.2	7.3
49 PPG-PR 241	4.2	5.0
50 PPG-PR 350	4.2	5.0
51 NAI-8CP68	4.2	6.0
52 GO-142E	4.2	4.7
53 PST-2REB	4.2	7.3
54 3997	4.2	5.3
55 Rinovo	4.2	8.3
56 Gray Hawk	4.1	5.7
57 NAI-ST432-15	4.1	7.3
58 Silver Sun	4.1	5.3
59 PPG-PR 342	4.1	6.0
60 3976	4.1	7.7
61 GO-141E	4.1	3.7
62 PPG-PR 326	4.0	3.7
63 GO-143E	4.0	4.0
64 Fastball RGL	4.0	7.7
65 Manhattan 6 GLR	4.0	6.7
66 Home Run	4.0	6.7
67 Palmer III	4.0	6.7
68 4017	4.0	7.3
69 NAI-PL2S-15	4.0	6.7
70 Stellar 3GL	4.0	8.3

(Continued)

Table 6. Perennial ryegrass turf trial, 2015 (continued).

Cultivar or Selection	Turf Quality ¹ 2016 Avg.	Establishment ² Sept. 2015
71 Molalla	3.9	5.7
72 PST-2PDA	3.9	7.7
73 GO-144E	3.9	5.3
74 PPG-PR 242	3.8	5.3
75 4030A	3.8	5.7
76 Gray Fox	3.7	6.0
77 Ringles	3.7	8.7
78 PST-2SHRP	3.7	7.7
79 PST-2TFC	3.7	6.3
80 Double Time GLS	3.7	6.3
81 Pennant H2O	3.7	8.0
82 NAI-PR10-15	3.6	6.7
83 Panther H2O	3.5	7.3
84 4031	3.5	5.0
85 New Sealand	3.5	5.0
86 Sun	3.5	7.0
87 Manhattan 5 GLR	3.4	7.3
88 Silver Dollar	3.4	7.3
89 Flash II	3.4	6.7
90 4029	3.3	4.0
91 GO-AD	3.3	5.7
92 NAI-CP-68	3.3	7.0
93 Brightstar SLT	3.3	6.0
94 NAI-6CP68	3.2	7.0
95 Black Cat II	3.1	7.0
96 Confetti III	3.1	7.7
97 Double Time	3.0	6.0
98 Double Up GLS	3.0	6.3
99 NAI-ALSS-15	3.0	6.3
100 3984	2.9	7.7
101 Academy III	2.8	7.0
102 3998	2.7	9.0
103 PST-2M20	2.5	6.0
104 PST-2TETS	1.3	4.3
LSD at 5% =	0.8	2.3

(Continued)

Table 6. Perennial ryegrass turf trial, 2015 (continued).

¹9 = best turf quality

²9 = best establishment

Table 7. Yearly nitrogen (N) applied and mowing height (Ht) on perennial ryegrass established at Adelphia, NJ.

	2014		2015		2016	
	N ¹	Ht ²	N	Ht	N	Ht
Table 1 (2013).....	1.75	1.5	2.75	1.5	1.0	1.5
Table 2 (2014).....			3.07	1.5	0.5	1.5
Table 3 (2014).....			3.00	1.5	2.0	1.5
Table 4 (2015 Gray Leaf Spot)			0.50	1.5	2.0	1.5
Table 5 (2015 Gray Leaf Spot)			0.50	1.5	2.7	1.5
Table 6 (2015).....				1.5	3.0	1.5

¹Annual N applied (lb/1000 ft²)

²Mowing height in inches