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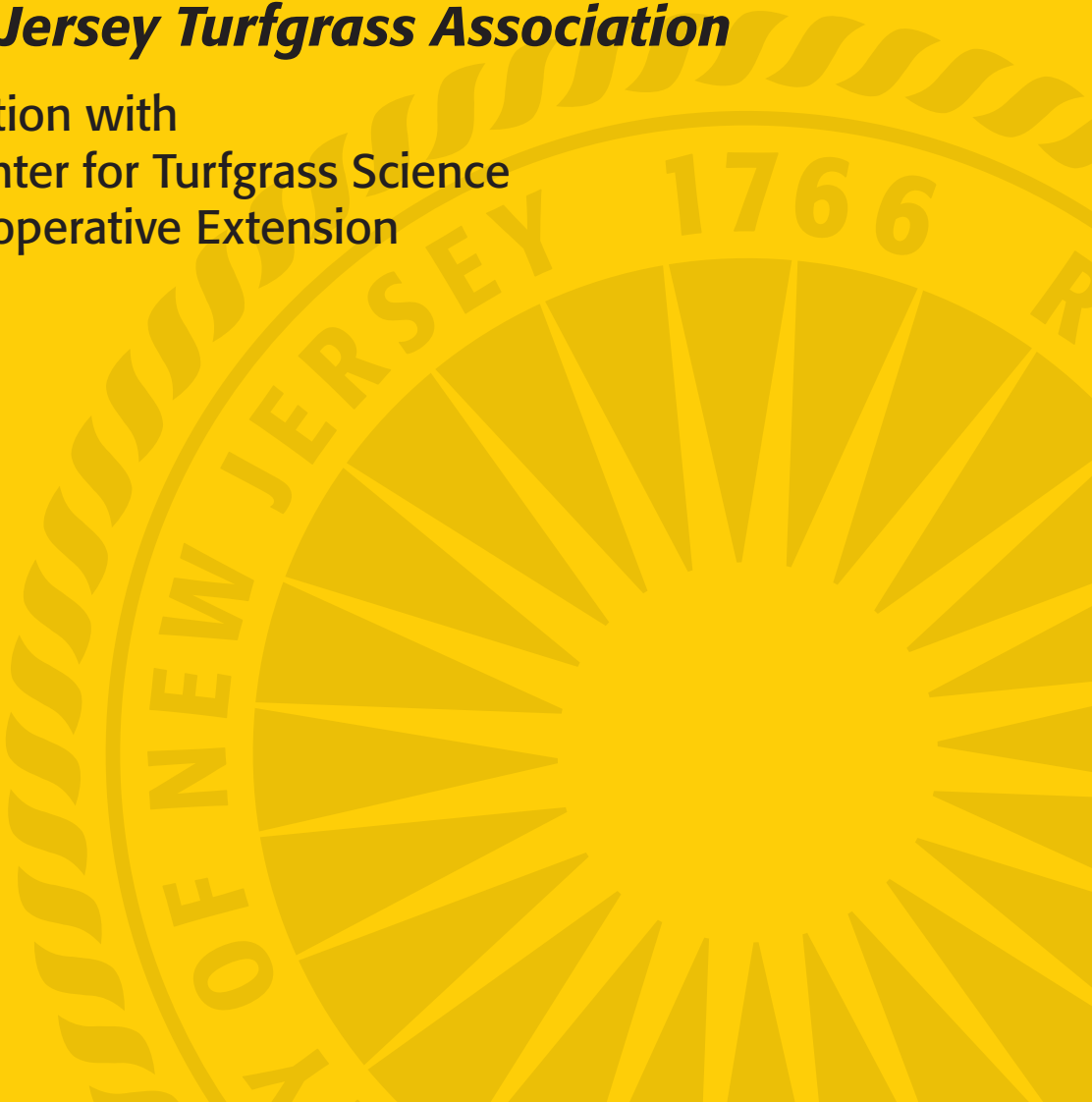

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The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, School of Environmental and Biological Sciences, Rutgers, The State 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.

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Dr. Ann Brooks Gould, Editor
Dr. Bruce B. Clarke, Coordinator

PERFORMANCE OF FINE FESCUE CULTIVARS AND SELECTIONS IN NEW JERSEY TURF TRIALS

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The fine fescues (*Festuca* spp.) are a group of cool-season grasses that have distinct, fine-textured leaves. Compared to other cool-season grasses, the fine fescues are better adapted to cool, dry, and shaded environments. This species group is tolerant of infertile and acidic soils and drought conditions and exhibits the best performance under lower fertility levels. These qualities give the fine fescues a low maintenance reputation. The fine fescues perform best in well drained soils and are not suited for saturated soil conditions (Murphy, 1996). In general, these grasses have poor heat tolerance and lack tolerance to excessive nitrogen fertilization during periods of high temperatures (Meyer and Funk, 1989).

There are many species and subspecies of fine fescue, but only six are generally used as turfgrasses. There are three subspecies of *F. rubra*: strong creeping red fescue (*F. rubra* L. *rubra*), slender creeping red fescue (*F. rubra* L. var. *littoralis* Vasey ex Beal), and Chewings fescue [*F. rubra* L. subsp. *fallax* (Thuill.) Nyman]. Both the strong creeping red and slender creeping red fescues are referred to as creeping red fescues because they spread by rhizomes. As the name infers, the strong creeping red fescues have a more aggressive spreading habit than slender creeping red fescues. Chewings fescue is a dense and low growing bunch type grass with the greatest tolerance to low mowing heights in comparison to the other fine fescues.

Hard fescue (*F. brevilipa* R. Tracey) is a bunch type grass that spreads by tillering. It has a dark green color and forms a dense cover. Compared to Chewings fescue, hard fescue is considered to be more tolerant of heat, drought, and low fertility. The species is widely used in many low maintenance situations due to increased disease resistance, even under low maintenance conditions.

Sheeps (*F. ovina* L.) and blue (*F. glauca* Vill.) fescues are the least widely used species of the fine fescues. They are bunch-type and have a wide variation in color from blue or green to a silvery-blue or silvery-green. These two species are rarely used in seed mixtures because of their color. They have a non-aggressive growth habit which makes them a good addition to wildflower mixes to aid in the prevention of erosion and to add an interesting color to the mix. These species are also becoming more popular in ornamental landscapes due to their color.

When heavily fertilized, fine fescues can become soft, succulent, and thatchy, which makes them more susceptible to diseases and summer stresses. A fertilizer rate of 1 to 2 lb nitrogen per 1000 ft^2 per year is ideal for fine fescues. The increasing demand for lower fertilizer and water usage makes fine fescues an option for use in certain situations to address some of these issues.

Many of the newer fine fescue cultivars contain a *Neotyphodium* endophyte that improves drought tolerance, resistance to above ground feeding insects, and in some cases, diseases. The presence of endophyte can reduce the need for chemical inputs normally used to treat for insects and diseases. *Neotyphodium* is a non-pathogenic fungus that grows intercellularly within the above-ground plant tissue. The beneficial effects of the endophyte are often very evident under stress conditions.

Although the Rutgers turfgrass breeding program has improved many of the characteristics desired for a superior fine fescue turf, further work is needed, particularly in the areas of disease and insect resistance and wear tolerance. Rutgers continues to cooperate with the National Turfgrass Evaluation Program (NTEP), which evaluates many cultivars, collections,

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and experimental selections for turf performance across a wide range of geographical locations.

PROCEDURES

Three fine fescue turf trials were conducted at the Rutgers Plant Science Research and Extension Farm in Adelphia, NJ (Tables 1 to 3). All tests consisted of 3 x 5 ft plots. The fine fescues were sown at 3.7 lb per 1000 ft^2.

Plots were replicated three times in a randomized complete block design. Tests were maintained at different fertility levels depending on the objectives of the test as well as the occurrence of disease or insects. Mowing height and fertilizer inputs of all tests are shown in Table 4. All tests (Tables 1 to 3) were treated with pre-emergent herbicides and broadleaf weed control. The trials were irrigated to prevent severe stress and were mowed frequently with rotary mowers to avoid excessive accumulation of clippings.

EVALUATION

All tests were visually rated throughout the year on a scale of 1 to 9, where 9 represented the most desirable turf quality. Turf quality is a subjective characteristic that includes density, texture, color, growth habit, damage due to diseases or insects, and overall performance. Trials were rated monthly throughout the growing season for turf quality as well as for other characteristics including diseases such as leaf spot (caused by *Bipolaris* and *Drechslera* fungi). Plots were rated by different evaluators to help minimize personal biases towards a particular trait.

Data for all trials were statistically analyzed using analysis of variance, and means were separated using Fisher's protected least significant difference (LSD) means separation test. Results in Tables 1 to 3 are presented with selections grouped according to species and ranked according to best overall, multiple-year turf performance (Tables 1, 2) or turf quality average assessed in 2016 (Table 3).

Care should be used when drawing conclusions from some of these trials. First, these tests were grown as monocultures in full sun. These conditions tend to cause different stresses that may not occur under other conditions. Second, the 2015 test (Table 3) was in its first year of evaluation. Some cultivars perform much differently during establishment than they do after a mature sod has developed.

RESULTS AND DISCUSSION

Turf Quality

As a group, the hard fescues were rated highest for average turf quality, followed closely by the Chewings and strong creeping fescues (Tables 1 to 3).

For the 2013 trial (Table 1), the highest quality selections and cultivars were hard fescues 7H5, DA2 comp, DA3 Comp, and DA1 Comp; Chewings fescues PPG-FRC 107, PPG-FRC 114, and 7W3 Comp; and strong creeping red fescues 2-10 Frr Bulk, Z13-01, 7C5 Comp, and 2-10 Frr-6. The lowest quality selections and cultivars were hard fescues 4-12FF-3, 5-12FF-8, and 5-12FF-5; Chewings fescues PST-4CHY and Ambassador; and strong creeping red fescues 4-12FF-Bulk, 5-12FF-4, and Boreal.

For the 2014 trial (Table 2), which includes all entries from the 2014 NTEP Fine Fescue Trial, the highest quality selections and cultivars were 14H2, 14H5, 7H6, and 7HF hard fescue; PPG-FRC 119, Radar, DLF-FRC 3338, and C571 Chewings fescue; and 14R3, C14-OS3, DLFPS-FRR/3068 strong creeping red fescue. The lowest quality selections and cultivars were Miser and Beudin hard fesuce; Shadow III and Survivor Chewings fescue; and Oracle and Boreal strong creeping red fescue.

For the 2015 trial (Table 3), the highest quality selections and cultivars were FH3 Comp, FH2 Comp, and Gladiator hard fescue; FW3 Comp, FW2 Comp, and LTNW Chewings fescue; and FR3 Comp and FR2 Comp strong creeping red fescue. The lowest quality selections and cultivars were Jetty hard fescue; Enchantment Chewings fescue; and Epic strong creeping red fescue.

Disease Resistance

The performance of the entries in the 2014 and 2015 trials (Tables 2, 3) includes ratings for leaf spot (caused by *Bipolaris sorokiniana*). Leaf spot appears as dark lesions that girdle leaf blades and sheathes, causing yellowing and dieback from the tip. This disease can result in severe thinning of the turf. In general the hard, blue, and sheeps fescues were the most resistant to leaf spot, while the strong

creeping red fescues were the most susceptible. The most tolerant selections and cultivars to leaf spot were Resolute, 14W3, FW1 Comp, FW3 Comp, PPG-FRC 120, and SLS Comp, while the most susceptible selections and cultivars were Boreal, Kent, Syn-4SP24, 4CRD-P, Cascade, PST-4RUE, Seabreeze GT, Fenway (Z1-14-2835), Lighthouse, 4CRD-8, and PPG-FRR 114 (Tables 2 and 3).

SUMMARY

Overall, it is encouraging to see that many of the higher-ranking fine fescues within all species are new experimental selections. Although advances in breeding efforts continue, there is still need for considerable improvement in resistance to red thread (caused by *Laetisaria fuciformis*) and summer patch (caused by *Magnaporthiopsis poae*) (particularly in the hard fescues), and increased seed production.

One little-studied area that could make a significant impact on the use of fine fescues in a wider array of situations is the improvement of wear tolerance, particularly under drought stress conditions. Breeding efforts at Rutgers continue in an effort to develop high quality turfgrasses with the ability to make a great environmental impact with minimal environmental cost.

ACKNOWLEDGMENTS

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

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2014 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.
	HARD FESCUE				
1	7H5	5.6	5.0	6.1	5.6
2	DA2 Comp	5.5	5.4	5.4	5.6
3	DA3 Comp	5.5	5.4	5.5	5.5
4	DA1 Comp	5.5	5.4	5.5	5.5
5	DA5 Comp	5.4	5.1	5.6	5.7
6	7H4 Comp	5.4	5.4	5.3	5.4
7	Jetty	5.4	5.2	5.5	5.4
8	7H2 Comp	5.3	5.3	5.3	5.3
9	PPG-FL 107	5.3	5.0	5.4	5.5
10	PPG-FL 103	5.3	4.8	5.5	5.5
11	7H6	5.3	5.1	5.2	5.5
12	Beacon	5.2	4.5	5.5	5.6
13	DA4 Comp	5.2	4.9	5.5	5.2
14	DA6 Comp	5.1	4.9	5.2	5.2
15	Firefly	5.0	5.2	5.0	5.0
16	7H1 Comp	5.0	5.1	4.9	5.1
17	PSG TH3	5.0	5.1	5.1	4.8
18	7H3 Comp	5.0	5.2	4.6	5.3
19	PST-4A10 Bulk	5.0	4.6	5.1	5.3
20	PST-4BND	5.0	5.1	5.0	5.0
21	SR 3150	5.0	4.7	5.2	5.1
22	PPG-FL 108	5.0	4.4	5.3	5.2
23	MNHD-12	4.8	4.4	4.9	5.3
24	7H6 Comp	4.8	4.4	4.9	5.1
25	Nanook	4.7	4.6	4.7	5.0
26	Spartan II	4.7	4.5	4.7	4.9
27	JF-234	4.7	4.4	4.9	4.7
28	Azay Blue	4.6	4.2	4.7	4.7
29	BlueRay	4.5	4.6	4.6	4.3
30	Rescue 911	4.4	4.3	4.5	4.5
31	Soil Guard	4.2	4.2	4.2	4.2
32	Reliant IV	4.0	3.0	4.5	4.6
33	4-12FF-3	3.2	3.1	3.1	3.3
34	5-12FF-8	3.0	2.7	3.4	3.0
35	5-12FF-5	3.0	2.9	3.1	3.0

(Continued)

Table 1. Fine fescue turf trial, 2013 (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
	CHEWINGS FESCUE				
1	PPG-FRC 107	4.7	5.2	4.2	4.7
2	PPG-FRC 114	4.7	5.3	4.2	4.5
3	7W3 Comp	4.7	5.4	4.3	4.2
4	3W4 Comp	4.6	5.0	4.6	4.3
5	PPG-FRC 113	4.6	5.1	4.2	4.5
6	Radar	4.6	5.1	4.2	4.5
7	3W1 Comp	4.6	4.9	4.5	4.3
8	08-4FC Bulk	4.5	5.0	4.4	4.3
9	3W2 Comp	4.5	4.9	4.3	4.3
10	PPG-FRC 115	4.4	4.4	4.3	4.4
11	3W3 Comp	4.4	4.6	4.2	4.3
12	08-5FCE+	4.3	5.0	3.9	3.9
13	SR 5130	4.3	4.6	4.0	4.2
14	Sonar	4.2	4.6	3.9	4.2
15	Ambrose	4.2	4.7	4.1	3.9
16	7W2 Comp	4.2	4.6	4.0	4.1
17	Shadow II	4.2	4.5	4.2	3.9
18	PST-4SHR	4.1	4.1	4.1	4.2
19	Windward	4.1	4.3	4.0	4.0
20	Zodiac	4.1	4.3	4.1	3.8
21	Enchantment	4.0	4.3	3.9	3.9
22	PSG 50C3	3.9	3.6	3.9	4.3
23	Shadelinks	3.9	4.0	4.0	3.8
24	J-5	3.9	4.1	4.0	3.7
25	PST-4CHY	3.6	3.4	4.0	3.3
26	Ambassador	3.5	2.8	3.9	3.7
	STRONG CREEPING RED FESCUE				
1	2-10 Frr Bulk	4.6	5.1	4.2	4.5
2	Z13-01	4.6	5.2	4.0	4.6
3	7C5 Comp	4.5	5.1	4.5	4.0
4	2-10 Frr-6	4.5	5.0	4.0	4.3
5	PPG-Frr 111	4.4	4.8	4.2	4.2

(Continued)

Table 1. Fine fescue turf trial, 2013 (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
	STRONG CREEPING RED FESCUE (continued)				
6	2-10-Frr-12	4.4	4.9	3.7	4.5
7	Marvel	4.4	4.9	3.9	4.3
8	2-10-Frr-13	4.3	4.7	4.0	4.3
9	PST-4RUE Bulk	4.3	4.4	4.0	4.5
10	2-10 Frr-4	4.3	4.6	3.9	4.4
11	Wendy Jean	4.3	4.6	3.9	4.4
12	7C6 Comp	4.3	5.0	4.1	3.7
13	7C2 Comp	4.2	4.6	4.0	4.0
14	Navigator II	4.1	4.6	3.9	3.8
15	2-10 Frr-8	4.1	4.9	3.9	3.4
16	SR 5250	4.1	4.4	3.8	3.9
17	BMX	4.0	4.4	3.5	4.0
18	Pathfinder	3.9	3.9	4.3	3.6
19	Kent	3.9	4.2	3.8	3.7
20	Jasper II	3.9	4.4	3.4	3.8
21	OR126	3.9	4.6	3.6	3.5
22	Orbit	3.9	4.5	3.6	3.6
23	Audubon	3.9	4.3	3.6	3.8
24	PSG 5RJL-4	3.9	4.3	3.3	3.9
25	PSG 5RJL-1	3.8	4.2	3.6	3.7
26	PSG 5RJL-3	3.8	4.4	3.7	3.5
27	PST-4GRY	3.8	3.7	3.7	3.9
28	FF2	3.8	4.0	3.7	3.6
29	PST-Syn-4SP24	3.7	3.6	3.7	3.9
30	PSG 5RJL-2	3.7	3.9	3.6	3.7
31	Shademaster III	3.7	4.1	3.6	3.4
32	Shademaster III	3.7	3.9	3.6	3.6
33	Gibraltor	3.7	3.8	3.6	3.6
34	Ruddy	3.6	3.5	4.0	3.4
35	BRSO	3.6	3.9	3.4	3.3
36	Gibraltor Gold	3.5	3.8	3.7	3.2
37	Garnet	3.5	4.0	3.6	3.0
38	CRF-11-4A	3.4	3.5	3.4	3.4
39	PST-4SEA	3.4	3.7	3.7	2.9
40	BRSG	3.4	3.3	3.4	3.5

(Continued)

Table 1. Fine fescue turf trial, 2013 (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	2014 Avg.	2015 Avg.	2016 Avg.
	STRONG CREEPING RED FESCUE (continued)				
41	PST-4GRP	3.4	3.5	3.2	3.3
42	5-12FF-6	3.2	3.0	3.2	3.4
43	4-12FF-1	3.1	3.0	3.1	3.3
44	4-12FF-5	3.1	2.9	3.2	3.3
45	4-12FF-2	3.1	3.1	3.1	3.2
46	Oracle	3.1	2.8	3.1	3.4
47	5-12FF-Bulk	3.1	2.7	3.3	3.3
48	4-12FF-Bulk	3.0	2.8	3.1	3.1
49	5-12FF-4	3.0	2.5	3.2	3.4
50	Boreal	2.9	2.5	3.2	3.2
	SLENDER CREEPING RED FESCUE				
1	PPG-FRT 101	4.6	5.1	4.3	4.4
2	Shoreline	4.1	4.3	4.4	3.7
3	Sealink	3.9	4.3	4.3	3.2
4	Seabreeze GT	3.9	4.3	4.2	3.1
5	Sea Fire	3.7	4.0	3.7	3.5
6	Lighthouse	3.0	2.6	3.2	3.3
	SHEEPS FESCUE				
1	Marco Polo	4.6	4.4	4.7	4.6
2	Bighorn GT	4.5	4.5	4.4	4.6
3	PPG-FO 102	4.1	4.1	3.9	4.2
4	Daisy	3.6	3.6	3.9	3.2
	BLENDS				
1	Scottish Links	4.2	4.2	4.3	4.1
	LSD at 5% =	0.5	0.6	0.8	0.6

[1]9 = best turf quality

Table 2. Performance of fine fescue cultivars and selections in a turf trial seeded in September 2014 at Adelphia, NJ. (Includes all entries from the 2014 NTEP Fine Fescue Test.)

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.	Leaf Spot[2] April 2016
	HARD FESCUE				
1	14H2	5.9	5.6	6.2	5.7
2	14H5	5.9	5.8	5.9	5.7
3	7H6	5.9	5.9	5.9	4.7
4	7HF	5.9	5.9	5.9	5.7
5	DLFPS-FL/3066	5.8	5.8	5.8	4.7
6	14H4	5.8	5.5	6.0	5.7
7	Minimus	5.8	6.1	5.4	5.3
8	Extra Hard	5.7	5.5	5.9	3.7
9	14H6	5.7	5.7	5.7	5.0
10	Beacon	5.7	5.8	5.5	4.0
11	Resolute	5.6	5.4	5.9	6.0
12	DLFPS-FL/3060	5.6	5.4	5.8	5.3
13	7H1	5.6	5.5	5.7	5.3
14	7H4	5.6	5.6	5.6	4.3
15	MNHD-14	5.6	5.5	5.7	4.7
16	14H3	5.6	5.5	5.6	4.0
17	H572	5.6	5.4	5.7	5.7
18	Gladiator	5.5	5.5	5.6	4.7
19	7H3	5.5	5.3	5.7	4.7
20	PST-4BND	5.5	5.7	5.3	3.0
21	14H1	5.4	5.6	5.3	3.3
22	Firefly	5.4	5.7	5.1	3.3
23	Jetty	5.4	5.3	5.4	4.7
24	Chariot	5.3	5.7	5.0	3.0
25	14H7	5.3	5.3	5.3	4.3
26	PPG-FL 107	5.3	5.2	5.3	4.0
27	Rescue 911	5.3	6.0	4.6	3.3
28	AHF188	5.3	5.4	5.1	3.3
29	Oxford	5.2	5.2	5.2	4.0
30	4HES	5.2	5.4	5.0	3.7
31	Stonehenge	5.1	5.4	4.8	2.3
32	Blueray	5.1	5.3	4.9	3.3
33	Nanook (4NY)	5.0	5.2	4.9	3.7
34	4BND	5.0	5.3	4.7	3.0
35	Reliant IV	5.0	5.3	4.7	2.7

(Continued)

Table 2. Fine fescue turf trial, 2014 (NTEP) (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.	Leaf Spot[2] April 2016
	HARD FESCUE (continued)				
36	PPG-FL 108	5.0	5.1	4.9	3.0
37	Sword	5.0	4.5	5.4	3.7
38	DLFPS-FRC/3060	4.4	5.2	3.5	2.3
39	Miser	3.7	4.3	3.0	2.7
40	Beudin	3.5	4.2	2.7	2.0
	CHEWINGS FESCUE				
1	PPG-FRC 119	5.0	5.3	4.6	3.7
2	Radar	4.8	5.4	4.2	4.7
3	DLF-FRC 3338	4.8	5.4	4.2	4.3
4	C571	4.8	5.5	4.0	4.3
5	14W3	4.7	4.9	4.6	6.0
6	PPG-FRC 113	4.7	5.3	4.2	3.3
7	14W1	4.7	5.2	4.1	3.0
8	14W4	4.7	4.9	4.4	3.0
9	DLFPS-FRC/3057	4.6	4.9	4.4	4.7
10	Enchantment	4.6	5.2	3.9	3.7
11	14W2	4.6	4.6	4.5	5.3
12	PPG-FRC 115	4.5	4.8	4.1	4.0
13	Fairmont	4.5	4.7	4.2	4.0
14	RAD-FC32	4.5	4.8	4.1	4.3
15	PPG-FRC 107	4.4	4.8	4.1	4.3
16	PPG-FRC 114	4.4	4.8	4.0	3.7
17	Treasure II	4.4	4.7	4.0	3.3
18	BAR VV-VP3-CT	4.4	5.2	3.5	2.7
19	J-5	4.3	4.8	3.9	2.7
20	4CHT	4.3	4.8	3.9	3.3
21	4C30D	4.3	4.9	3.7	3.3
22	Sonar (PPG-FRC 103)	4.3	4.8	3.7	3.0
23	Heathland (R4TC)	4.2	4.6	3.8	3.7
24	Shadow II	4.2	5.0	3.4	3.0
25	Syn-4SWT-13	4.2	4.7	3.6	2.3
26	RAD-FC44	4.2	4.8	3.6	2.7
27	Ambrose	4.2	5.0	3.3	2.7
28	Compass	4.2	5.2	3.1	2.0
29	4SHR-CH	4.1	5.1	3.1	2.3
30	Tiffany	4.1	4.7	3.4	3.3

(Continued)

Table 2. Fine fescue turf trial, 2014 (NTEP) (continued)..

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.	Leaf Spot[2] April 2016
	CHEWINGS FESCUE (continued)				
31	4CHY	4.1	4.7	3.4	2.3
32	BAR 6FR 126	3.8	4.4	3.2	3.0
33	Cascade	3.7	4.5	2.9	1.0
34	Shadow III	3.6	3.8	3.3	2.3
35	Survivor	3.6	3.3	3.8	3.7
	STRONG CREEPING RED FESCUE				
1	14R3	4.8	5.0	4.6	5.0
2	C14-OS3	4.7	4.9	4.4	3.0
3	DLFPS-FRR/3068	4.6	5.0	4.1	3.3
4	14R2	4.4	4.7	4.1	3.0
5	DSRxBLMT	4.4	4.7	4.1	3.3
6	FT345	4.4	4.8	3.9	2.7
7	7C34	4.4	4.9	3.8	2.3
8	14R1	4.3	4.7	3.9	2.3
9	PPG-FRR 115	4.3	4.5	4.0	1.3
10	Soilguard	4.3	4.2	4.3	3.3
11	14R4	4.2	4.6	3.9	4.0
12	Marvel	4.2	4.7	3.7	3.0
13	4CRD-V	4.1	4.4	3.9	2.7
14	DLF-FRR 6162	4.1	4.5	3.8	2.3
15	RAD-FR47	4.1	4.4	3.9	3.0
16	Audubon	4.1	4.5	3.6	2.7
17	ASC 295	4.1	4.8	3.4	2.0
18	PST-4BEN	4.1	4.4	3.7	3.0
19	PennASC295	4.1	4.7	3.4	2.3
20	PPG-FRR 111	4.1	4.3	3.8	2.3
21	Aberdeen	4.0	4.4	3.7	1.7
22	Gibraltar Gold	4.0	4.5	3.5	4.0
23	4RUE	4.0	4.0	4.0	1.7
24	PPG-FRR 110	4.0	4.6	3.4	2.7
25	DLFPS-FRR/3069	4.0	4.4	3.5	2.7
26	PST-4DR4	3.9	4.1	3.7	1.7
27	RAD-FR35	3.9	4.3	3.5	3.3
28	Pennlawn	3.9	4.2	3.7	2.7
29	4BEN	3.9	4.1	3.6	2.3
30	Cardinal	3.9	4.6	3.1	1.3

(Continued)

Table 2. Fine fescue turf trial, 2014 (NTEP) (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.	Leaf Spot[2] April 2016
	STRONG CREEPING RED FESCUE (continued)				
31	4SP14	3.9	4.1	3.6	2.0
32	Pathfinder	3.9	4.7	3.0	1.7
33	Orbit (PPG-FRR 103)	3.8	4.5	3.2	2.3
34	PST-4ED4	3.8	4.1	3.6	2.7
35	4ED4	3.8	4.2	3.4	2.3
36	Navigator II	3.8	4.5	3.1	2.7
37	Gibraltar	3.8	4.3	3.2	2.0
38	PST-4RUE	3.8	4.0	3.5	1.0
39	4DR4-BS	3.8	4.1	3.5	2.3
40	4GRY	3.8	4.0	3.5	3.0
41	Creeper	3.7	4.1	3.3	2.0
42	Crossbow II	3.7	4.1	3.3	2.3
43	4CRD-P	3.7	4.2	3.1	1.0
44	Shademaster III	3.7	4.1	3.2	2.7
45	RAD-FR33R	3.7	4.1	3.2	2.3
46	Syn-4SP24	3.6	4.2	3.1	1.0
47	Kent	3.6	4.3	2.9	1.0
48	FF2	3.5	4.1	2.9	2.0
49	Fenway	3.5	4.1	2.9	1.7
50	Xeric (4CRD-8)	3.5	3.9	3.0	1.7
51	4RED	3.5	4.0	2.9	1.7
52	4GRP	3.4	3.7	3.0	2.3
53	Oracle	3.2	3.6	2.8	1.3
54	Boreal	3.0	3.4	2.5	1.0
	SLENDER CREEPING RED FESCUE				
1	PPG-FRT 101	4.6	5.2	4.0	3.7
2	4SEA	4.0	4.8	3.1	1.3
3	Seabreeze GT	3.9	4.2	3.6	1.3
4	BAR FRT 5002	3.6	4.3	2.8	1.7
5	Lighthouse	3.3	3.7	2.8	2.0

(Continued)

Table 2. Fine fescue turf trial, 2014 (NTEP) (continued).

	Cultivar or Selection	Turf Quality[1] 2014-2016 Avg.	Turf Quality[1] 2015 Avg.	Turf Quality[1] 2016 Avg.	Leaf Spot[2] April 2016
	SHEEPS FESCUE				
1	Marco Polo	4.9	5.3	4.5	4.7
2	Bighorn GT	4.8	5.0	4.5	3.7
3	Quatro	4.6	5.4	3.8	1.7
4	Daisy	4.1	4.4	3.7	2.0
	BLUE FESCUE				
1	Azure	4.7	5.2	4.2	4.7
	BLENDS				
1	Scottish Links	4.5	4.9	4.1	3.3
2	Irish links mixture	3.7	4.1	3.2	2.0
	LSD at 5% =	0.5	0.6	0.6	1.7

[1]9 = best turf quality
[2]9 = least disease

Table 3. Performance of fine fescue cultivars and selections in a turf trial seeded in September 2015 at Adelphia, NJ.

	Cultivar or Selection	Turf Quality[1] 2016 Avg.	Establishment[2] Oct. 2015	Leaf Spot[3] May 2016
	HARD FESCUE			
1	FH3 Comp	5.5	5.7	5.0
2	FH2 Comp	5.5	6.3	5.7
3	Gladiator	5.4	7.3	4.3
4	Minimus	5.3	6.3	4.3
5	FH1 Comp	5.3	6.0	5.7
6	MNHD-15	5.1	6.0	5.7
7	PPG-FL 112	5.1	6.0	5.0
8	PPG-FL 113	5.1	6.0	5.0
9	Sword	5.1	6.0	5.3
10	FH4 Comp	5.1	5.7	4.7
11	Beacon	5.0	6.7	4.3
12	Firefly	5.0	6.7	5.0
13	Stonehenge II	4.9	5.3	4.3
14	H572	4.9	6.0	4.3
15	Blueray	4.7	6.0	5.0
16	Stonehenge	4.6	6.3	3.3
17	4BND	4.6	5.3	4.3
18	PPG-FL 108	4.4	5.7	4.3
19	Reliant IV	4.4	5.3	3.7
20	Viking H20	4.4	6.0	4.0
21	Ecostar Plus	4.3	6.7	4.7
22	Chariot	4.1	6.3	3.7
23	Heron	3.8	4.0	3.7
24	Jetty	2.9	1.3	4.7
	CHEWINGS FESCUE			
1	FW3 Comp	5.2	6.7	6.3
2	FW2 Comp	5.2	7.7	5.0
3	LTNW	5.0	8.3	5.0
4	Radar	4.9	7.3	5.3
5	PPG-FRC 120	4.8	5.7	6.3
6	PPG-FRC 119	4.8	7.3	4.0
7	PPG-FRC 113	4.6	6.3	5.3
8	4CHT	4.5	4.0	4.3
9	FW1 Comp	4.5	5.7	7.0
10	Fairmont	4.5	7.3	4.7

(Continued)

Table 3. Fine fescue turf trial, 2015 (continued).

	Cultivar or Selection	Turf Quality[1] 2016 Avg.	Establishment[2] Oct. 2015	Leaf Spot[3] May 2016
	CHEWINGS FESCUE (continued)			
11	FC32	4.4	7.7	4.0
12	Wrigley 2	4.3	8.7	4.0
13	Sonar	4.2	6.3	4.7
14	PPG-FRC 118	4.1	6.7	4.0
15	4CHY	4.0	2.7	4.3
16	Ambrose	4.0	4.7	5.7
17	Shadow II	4.0	6.3	3.7
18	4SHR-CH	3.8	6.7	3.7
19	Compass	3.7	7.3	2.3
20	Shadow III	3.6	3.3	4.3
21	J-5	3.6	6.7	3.7
22	Enchantment	3.1	2.0	4.3
	STRONG CREEPING RED FESCUE			
1	FR3 Comp	5.4	7.0	5.3
2	FR2 Comp	5.4	6.0	5.3
3	Fenway (Z1-15-DSR)	5.2	5.3	5.7
4	PPG-FRR 115	5.0	6.3	4.7
5	FR1 Comp	4.9	7.0	4.0
6	PPG-FRR 116	4.9	6.3	4.3
7	FR4 Comp	4.6	7.7	4.0
8	PPG-FRR 111	4.5	6.0	4.7
9	Cardinal	4.3	5.3	5.3
10	Fenway (Z1-15-OSBM)	4.3	5.7	4.3
11	Fenway (Z1-15-BRBMX2)	4.3	4.3	4.7
12	RUF1	4.3	4.0	5.7
13	Navigator II	4.3	7.3	4.0
14	ASC 295	4.3	6.7	4.3
15	Shademaster III	4.2	3.3	6.0
16	Marvel	4.1	6.7	4.3
17	4BEN	4.1	7.0	4.0
18	4ED4	4.0	5.7	3.0
19	4DR4	3.9	6.0	4.0
20	Garnet	3.9	4.7	2.7

(Continued)

Table 3. Fine fescue turf trial, 2015 (continued).

	Cultivar or Selection	Turf Quality[1] 2016 Avg.	Establishment[2] Oct. 2015	Leaf Spot[3] May 2016
	STRONG CREEPING RED FESCUE (continued)			
21	SR 5250	3.9	5.7	4.7
22	4GRY	3.9	2.3	4.3
23	FR 35	3.8	6.7	3.7
24	PPG-FRR 114	3.8	6.7	1.7
25	4CRD-P	3.8	7.7	3.7
26	4SP14	3.7	5.0	3.7
27	Orbit	3.7	7.7	3.7
28	Kent	3.5	7.3	3.3
29	4RUE-14	3.5	6.0	2.7
30	Audubon	3.5	8.3	3.0
31	Gibraltor Gold	3.4	5.7	3.7
32	4RED	3.4	2.7	3.7
33	Fenway (Z1-14-2835)	3.4	8.7	1.3
34	4CRD-8	3.4	7.3	1.7
35	4CRD-U	3.4	2.3	5.0
36	Epic	3.3	3.3	2.0
	SLENDER CREEPING RED FESCUE			
1	SLS Comp	4.8	6.7	6.3
2	PPG-FRT 101	4.7	7.3	5.0
3	4SEA	4.0	3.3	3.3
4	Seabreeze GT	3.7	2.3	4.0
5	Lighthouse	2.3	9.0	1.7
	SHEEPS FESCUE			
1	Marco Polo	4.2	7.7	5.3
2	Bighorn GT	4.2	6.7	4.7
3	PPG-FO 102	3.8	5.3	2.3
	BLENDS			
1	Irish Links Mixture	3.5	4.7	3.0
	LSD at 5%=	0.8	1.8	1.8

(Continued)

Table 3. Fine fescue turf trial, 2015 (continued).

[1]9 = best turf quality
[2]9 = best establishment
[3]9 = least disease

Table 4. Yearly nitrogen (N) applied and mowing height (Ht) on fine fescue tests established at Adelphia, NJ.

	2014		2015		2016	
	Ht[2]	N[1]	Ht	N	Ht	NHt
Table 1 (2013)	1.0	2.5	0.5	2.5	1.0	2.5
Table 2 (2014 NTEP)			1.5	2.5	1.5	2.5
Table 3 (2015)					1.0	2.5

[1] Annual N applied (lb/1000 ft^2)
[2] Mowing height in inches