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Alan R. Langille

Annamarie Pennucci

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Alan R. Langille

Professor of Agronomy and Cooperating Professor of Botany

Annamarie Pennucci

Faculty Associate

Horticulture Program
Department of Biosystems Science and Engineering
University of Maine
Orono, Maine 04469 - 5722

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DEDICATION

The authors wish to dedicate this publication to Dr. C. Reed Funk of Rutgers, the State University of New Jersey. Dr. Funk was responsible for initiation of the first perennial ryegrass improvement efforts and has introduced a long list of varieties for the turfgrass industry. His generosity in providing improved germplasm has ensured the success of a continued perennial ryegrass breeding effort around the world. We wish him good health and happiness in a long and pleasant retirement.

INTRODUCTION

The ryegrasses include those popular and extensively used turfgrasses noted for their rapid germination and subsequent swift development into a suitable turf. These grasses are broadly adapted to cool temperate climates and find use in a wide array of habitats: from the seashore to mountain slopes, and in nearly all soil conditions. The ryegrasses require seasonably moist soils, but are intolerant of water inundation or submergence at any temperature; their winter hardiness remains suspect.

The Ryegrasses (*Lolium* L.)

A total of ten species of ryegrasses are included in the genus *Lolium*. They are distributed worldwide primarily throughout the temperate climatic zone. The turf-type ryegrasses include two species. These are perennial or English ryegrass (*Lolium perenne* L.) and annual or Italian ryegrass (*Lolium multiflorum* Lam.).

The qualities of rapid germination and superior seedling growth of both of these ryegrass species has led to their frequent use as nurse crops for other desirable turfgrass seed mixtures. They should not be confused with cereal grain rye (*Secale cereale* L.), which is also often used in locations requiring rapid cover for soil stabilization.

Beginning with the first improved perennial ryegrass variety, Linn, and including a recent emphasis on breeding ryegrasses with improved agronomic traits, the turf-type ryegrasses are widely used in classic, highly managed turf environments such as golfcourse fairways, approaches, surrounds and roughs, estate lawns, and commercial and home lawns. Additionally, they find temporary use in erosion control, pond and roadside bank stabilization efforts.

Perennial ryegrass (*Lolium perenne* L.) is a cool season bunch grass and the most widely used ryegrass for turf purposes. Depending upon the severity of local environmental conditions, perennial ryegrass may behave as an annual, or a short-lived perennial. Here in Maine, we view it as a short-lived perennial usually persisting through two to three winters depending upon the extent and duration of snow cover. The inclusion of the endophyte *Neotyphodium lolii* (formerly *Acremonium lolii*) in many perennial ryegrass varieties has been shown to improve insect resistance, drought tolerance and may improve tolerance to some foliar diseases.

Adaptation and Use

Perennial ryegrass is adapted to cool, moist environments characterized by mild summers and winters that lack temperature extremes. Perennial ryegrass is adapted to a wide range of soil conditions, but performs best in neutral to slightly acid soils of moderate to high fertility. This species has been shown to perform better on soils with organic fractions greater than 4%, and pre-plant soil amendments should include rich composts of municipal sludge or manures. Subsequent fertilizer applications are best made using sources high in organic substrates.

Perennial ryegrass is commonly used as a nurse or cover grass for turfgrass mixtures in both the temperate and transition climatic zones. It is also used extensively in combination with Kentucky bluegrass for highly trafficked athletic turf. Football and soccer fields are often overseeded with perennial ryegrass during autumn to provide rapid cover on areas denuded by play or other high traffic events. Perennial ryegrass is often used in spring to improve playing conditions following winter loss. Overseeding with perennial ryegrass is also a technique used to extend or improve winter play and supply color to dormant or semidormant warm season turfgrasses in the southern states. Particular varieties of perennial ryegrass have been developed exclusively for use as an overseeded winter cover on Bermudagrass greens.

Cultural Requirements for Use as Turf

Perennial ryegrass performs best with moderate management efforts. These include mowing heights of 1.5 to 2 inches and mowing frequencies of once to twice weekly. Visual turf quality often suffers following mowing due to several physiological factors. These include high to excessively high levels of silicon in leaf cells, tough vascular bundles running the length of the leaf blade, and excessively stocky inflorescence stems, which are prominent in two-year-old turf leading to ragged leaves and a reduction in appearance following mowing. The recommended fertilization regime is 2 to 6 lb N/1000 ft²/year and lime applied at least every three years depending upon soil test results. Irrigation is required to ensure survival during extended periods of drought. This grass is less forgiving of summer heat and humidity than are other cool season turf species.

MATERIALS AND METHODS

In May 1995, the National Turfgrass Evaluation Program (NTEP) perennial ryegrass test was established at the Turfgrass Experimental Plots of the Littlefield Ornamentals Trial Garden on the University of Maine campus. The soil, a well-drained Marlowe fine sandy loam, was plowed, disked, rototilled, and stones removed by hand prior to seeding. The soil was amended with 60 lb of lime per 1000 ft² and 20 lb of 10-10-10 per 1000 ft² as per Maine Soil Testing Service recommendations. Seeding was accomplished by using a 5 x 3 ft plywood box to eliminate wind drift, and the seed was raked in by hand. The surface was not rolled. Supplemental moisture was supplied through an in-ground irrigation system controlled by a Toro computer. The test consisted on 97 varieties, which were arranged in randomized complete block design and replicated three times.

This study was conducted in a shade-free area on a maintenance fertility program of 1.0 lb N per 1000 ft² per month of growing season using a commercial 20-5-15 fertilizer with 50% N as a slow-release sulfur-coated urea source. Visual turf quality and disease ratings were made on a monthly basis throughout the growing season.

Mowing was initiated in July 1995 using a 21-inch rotary mower at a height of 2.5 inches and then lowered to a maintenance height of 2.0 inches for the duration of the study. This height was increased to 3.0 inches for October and November to increase leaf area and thus, carbohydrate storage in the crown region to minimize winter loss.

To prevent cross-contamination, clippings were removed and composted off site. Since little thatch or mat developed during the course of the study, the test area was neither aerified nor de-thatched. There also was no evidence of encroachment into adjacent plots by the more aggressive varieties.

No additional wear stress, foot or mechanical treatments, was imposed during the study. Pest control efforts were kept to a minimum, with only annual herbicide applications made to control broadleaf weeds. Two fungicide applications were made to control leaf spot disease, and no insecticides were used during the study. No attempt was made to moderate seasonal fluctuations in temperature, humidity, overland water flow, air flow, or light. Turf covers were not used in winter, and no attempt was made to increase or remove snow and ice burden from the site. Syringing was used occasionally during the heat of the summer days to relieve heat stress.

Visual estimates of turf quality, turf density, color, leaf blade width, weediness, and disease ratings were made each month throughout the growing season. The ranking scale used ranged from 1 = no living turf to 9 = ideal turf. Yearly data were compiled and sent to the NTEP office in Beltsville, MD, for statistical analyses. These data have also been combined for the three years of the study and the means separated and arrayed for each of the factors evaluated.

In November of 1995, a pilot study was initiated to determine the relative winter hardiness of these varieties. Replicate turf plugs, 2.5 inches in diameter and 2 inches deep, were removed from each varietal plot using a standard bulb planter. Plugs were placed in plastic trays, with half the plugs flooded and then rapidly frozen to temperatures of 0°C, -10°C, and -20°C. They were then removed from the freezer and placed in a cool, 60°F greenhouse. Survival was estimated one month later and again in March of 1996.

RESULTS AND DISCUSSION

All of the perennial ryegrass varieties evaluated germinated within one week and statistical differences were noted between varieties for rapidity of germination. Tiller development was rapid and complete turf cover was achieved by all varieties within six weeks.

1995

Ratings for all 97 perennial ryegrass varieties taken in 1995 are shown in Table 1. The top four varieties demonstrated excellent turfgrass quality accompanied by exceptional dark color: LRF-94-C8, Repell III, Prelude III, and Wind Dance. A total of 14 varieties scored an average of 7.6 or above for turf quality with no statistical differences observed between them. Thirty-five of these varieties scored 7.0 or above in turf quality, with all of them scoring greater than 7.7 for turf color.

Turf color was exceptional for the top 35 varieties of perennial ryegrass, and there were no significant differences between them. It should be noted that the top three varieties along with Chapparal, Imagine, Excel, and MB44 all scored a season perfect 9.0 for genetic color in their seeding year.

Little or no disease was evident in plots of LRF-94-C8, Repell III, Prelude III, Wind Dance, Chapparal, or Imagine. In all other cases, tolerance to one to two diseases was offset by susceptibility to one or more other diseases. Leaf spot disease, causal agent

Table 1. Turfgrass quality, genetic color, and disease ratings for perennial ryegrass varieties seeded in May 1995 at the University of Maine. Means are the average of monthly ratings made during the 1995 growing season.

Variety	Quality ¹	Color ²	Leaf Spot ³	Pythium ⁴	Brown Patch
1. LRF-94-C8	8.5	9.0	8.0	7.7	7.7
2. REPELL III	8.4	9.0	6.7	8.7	8.0
3. PRELUDE III	8.1	9.0	8.3	8.7	7.3
4. WIND DANCE	8.0	8.7	8.7	5.3	6.7
5. CHAPARRAL	7.9	9.0	8.0	7.3	7.0
6. IMAGINE	7.9	9.0	8.3	8.3	6.7
7. MB 45	7.9	8.7	8.3	5.7	6.7
8. PANTHER	7.9	8.7	7.7	7.0	7.0
9. CITATION III	7.7	8.7	6.3	6.0	7.7
10. EXCEL	7.7	9.0	7.3	7.0	6.7
11. PALMER III	7.7	8.3	6.7	7.3	7.0
12. DIVINE	7.6	8.7	6.0	7.3	6.3
13. LAREDO	7.6	8.3	7.3	6.3	7.0
14. LINE DRIVE	7.6	8.7	7.0	5.3	6.0
15. CATALINA	7.4	8.3	5.7	5.0	5.7
16. MAJESTY	7.4	8.7	7.0	6.3	6.7
17. BRIGHTSTAR II	7.3	8.7	7.3	7.0	7.0
18. CALYPSO II	7.3	8.3	6.3	6.0	6.7
19. ESQUIRE	7.3	7.7	6.0	6.3	6.7
20. MARDIGRAS	7.3	8.3	6.7	5.7	6.3
21. MB 44	7.3	9.0	7.3	5.0	6.0
22. OMNI	7.3	8.0	6.3	6.7	6.7
23. PREMIER II	7.3	8.7	7.3	7.0	5.0
24. PROTOCOL	7.3	8.0	7.3	5.3	6.7
25. SONATA	7.3	8.3	7.3	5.0	6.0
26. SUNSHINE	7.3	8.3	6.3	6.7	6.0
27. TOP HAT	7.2	7.7	5.7	8.0	7.0
28. ACHIEVER	7.1	8.0	7.7	6.3	7.0
29. HEAD START	7.1	8.0	7.7	6.7	6.7
30. ISI-MHB	7.1	7.7	6.0	6.0	7.0
31. MANHATTAN 3	7.1	8.7	6.3	5.3	6.7
32. RIVIERA II	7.1	8.0	6.3	5.7	5.3
33. TOP GUN	7.1	7.3	6.0	6.0	5.3
34. SECRETARIAT	7.0	8.0	6.3	5.3	4.7
35. WIZARD	7.0	8.0	5.3	7.0	5.7
36. ACCENT	6.9	7.3	5.7	6.7	6.0
37. ASSURE	6.9	7.3	6.7	7.7	6.3
38. BLAZER III	6.9	7.7	5.7	7.3	5.0
39. EDGE	6.9	7.7	7.3	4.7	5.3
40. MONTEREY	6.9	8.0	5.3	6.7	4.3
41. OMEGA3	6.9	7.7	7.3	5.7	6.0
42. PRIZM	6.9	8.3	6.0	5.0	5.7
43. ROADRUNNER	6.9	8.3	6.0	7.0	6.3
44. STALLION SUP.	6.8	7.7	6.0	5.0	6.0
45. ELF	6.7	8.7	7.7	5.7	5.7
46. PENNANT II	6.7	8.7	5.7	4.0	4.7
47. STARDANCE	6.7	7.7	6.0	6.7	6.7
48. CADDIESHACK	6.6	7.7	5.3	4.3	5.3
49. PEGASUS	6.6	7.7	6.7	5.3	5.7
50. SATURN II	6.6	8.0	5.7	6.0	6.3
51. SR 4010	6.6	7.3	7.0	5.3	4.7
52. ACADEMY	6.5	7.7	5.3	3.7	5.3
54. BLACKHAWK	6.5	7.3	6.3	6.3	5.0
55. CAS-LP23	6.5	8.0	5.7	4.3	5.3
56. PS-D-9	6.5	6.7	5.0	4.7	4.3

Table 1. Continued.

Variety	Quality ¹	Color ²	Leaf Spot ³	Pythium ⁴	Brown Patch
57. SPELL BOUND	6.5	7.0	5.7	3.7	4.7
58. STALLION SEL.	6.5	7.0	4.7	3.7	5.0
59. WVPB-PR-C-2	6.5	6.7	5.3	4.3	5.0
60. WX3-91	6.5	7.0	5.0	5.3	6.0
61. ADVANTAGE	6.4	7.3	4.0	6.3	5.0
62. BUCCANEER II	6.4	6.7	6.0	6.3	6.0
63. CUTTER	6.4	7.0	5.7	5.3	4.0
64. NIGHT HAWK	6.4	7.0	5.3	4.3	5.7
65. R2	6.4	6.7	5.0	6.0	5.3
66. SATURN	6.4	6.7	4.0	5.0	4.7
67. SR 4200	6.4	7.0	5.7	6.3	4.7
68. APR 131	6.3	7.0	6.0	4.0	5.7
69. BAR ER 5813	6.3	7.3	6.0	5.3	5.7
70. BRIGHTSTAR	6.3	8.0	5.3	4.7	5.7
71. LEGACY II	6.3	8.0	5.7	3.7	4.7
72. MORNINGSTAR	6.3	7.0	4.3	4.3	5.7
73. MVF-4-1	6.3	7.7	5.3	5.3	5.3
74. NAVAJO	6.3	7.3	5.0	3.3	5.0
75. PST-2CB	6.3	7.3	5.3	4.0	5.7
76. QUICKSTART	6.3	7.7	6.3	3.7	4.7
77. SR 4400	6.3	7.0	7.0	5.3	5.0
78. VIVID	6.3	6.7	4.3	6.0	6.0
79. WIND STAR	6.3	7.0	5.3	6.0	5.0
80. DANCER	6.2	7.3	6.3	4.3	5.7
81. NOBILITY	6.2	7.0	5.7	3.0	4.7
82. DLP 1305	6.1	7.0	5.7	3.3	3.3
83. KOOS 93-6	6.1	6.3	4.3	5.0	4.7
84. NINE-O-ONE	6.1	8.0	4.3	5.0	5.3
85. WX3-93	6.1	7.3	5.7	5.3	5.3
86. EXPRESS	6.0	6.0	3.7	4.7	5.0
87. PASSPORT	6.0	8.0	4.0	4.7	4.0
88. ASP400	5.9	6.3	5.3	5.3	4.7
89. PRECISION	5.9	7.0	4.7	3.7	6.0
90. WILLIAMSBURG	5.9	6.7	5.7	4.3	4.3
91. APR 124	5.8	7.0	5.3	3.7	4.0
92. APR 066	5.5	5.7	5.0	3.3	4.3
93. PENNFINE	5.4	6.3	4.7	3.0	4.3
94. FIGARO	5.2	6.3	3.3	2.3	2.3
95. DSV NA 9402	4.7	4.7	3.3	2.3	3.7
96. DSV NA 9401	4.5	5.0	2.7	1.7	3.3
97. LINN	3.3	4.3	1.3	1.0	2.3

¹ The first 14 varieties did not differ significantly in quality rating.² The first 35 varieties did not differ significantly in genetic color.³ The first 90 varieties did not differ significantly in Leaf Spot rating.⁴ The first 61 varieties did not differ significantly in Pythium rating.

Dreschlera dicctyoides Dreschler f. sp. *andersonii*, was found in all varieties of perennial ryegrass; however, the losses attributed to this disease were slight. Only the Danish varieties, DSV NA 9402, DSV NA 9401, and Linn were severely damaged by one or more infection cycles of leaf spot. Pythium blight, causal agent *Pythium aphanidermatum* f. sp., caused significant losses in turf quality in those varieties ranked in the lower half of the test. Despite the location of the test in mid-Maine, losses attributable to Pythium blight should be expected if pathologically optimum conditions of high heat and humidity prevail. Only the top 30 varieties tolerated brown patch disease (causal agent *Rhizoctonia solani* Kuhn.) without significant loss in quality. Although brown patch occurred later in the growing season than did leaf spot or Pythium blight, it appeared to be capable of causing significantly greater turf loss than leaf spot or Pythium blight. None of the varieties tested here were immune or resistant to brown patch. Of the top 20 varieties, only LRD-94-C8, Repell III, and Citation III had tolerably low infection levels in their first growing season. Although expected, dollar spot disease, causal agent *Sclerotinia homoeocarpa* Bennett, was not evident in this test.

1996

Top-ranking varieties in 1996 included five of those with notable performance scores in 1995 (Table 2). Additionally, Palmer III, Top Hat, and Calypso II appeared far stronger in 1996. Only Repell III averaged quality scores in excess of 8.0. It should be noted, however, that top-ranking 18 varieties did not differ statistically in turfgrass quality. Overall, turfgrass quality scores were somewhat depressed from those of 1995, possibly due to the appearance of inflorescence stalks, which resulted in lowered mowing quality and increased mowing stress.

Turfgrass color ratings remained high in 1996; however, only Imagine retained its near perfect score of 9.0. Nineteen varieties scored 8.0 or higher with an additional 14 varieties having good color scores in excess of 7.0.

Considerable winter damage occurred during the open months of January and February. A warm, moist autumn was followed by rapid freezing conditions and a brief period of heavy snow. By mid-January, the snow cover was nonexistent, and rapid, and extreme temperature fluctuations decimated the ryegrass turf cover. Significant turf losses occurred with less than 25% of the Linn plots surviving. Only four varieties retained 80% or more of their original ground cover: Palmer III, Top Gun,

Mardigras, and Assure. Twenty-three varieties (less than $\frac{1}{4}$ of the test) retained at least 75% turf cover. Fourteen of the grasses evaluated lost half or more of their cover during the first winter.

In a trial established in Amherst, New Hampshire, in August 1992, nearly identical turf losses were reported following the first winter. In that trial, only Yorkshire III retained 80% of its cover; all other perennial ryegrasses lost between 60 and 100% of their cover.

The significant losses observed in turf cover related to winter survival underscore the fact that perennial ryegrass should be considered a short-lived perennial. As such, it should not constitute the primary seed source in mixtures to be used for permanent installations in Maine. Such losses also suggest that spring seeding efforts will be far more successful and retain greater cover than those seedings made in August or September as is commonly recommended.

Freezing study

Very few of the 97 varieties tolerated freezing at any temperature. None of the varieties frozen while submerged showed any signs of regrowth; all 97 varieties were completely intolerant of freezing to any temperature while fully flooded. While several problems were encountered pertaining to the rate of freezing and the stability of the final temperature, the study serves to highlight the freezing intolerance and frozen submergence susceptibility of perennial ryegrass. At this time, it does not appear that there are any varieties with sufficient tolerance to freezing exposures to recommend their continued use in Maine.

1997

Prelude III, Repell III, Palmer III, LRF-94-C8, Top Hat, and Chaparral all repeated as varieties with excellent turfgrass quality and color in 1997 (Table 3). There were ten varieties with season-long quality scores of 8.0 or above; two of these, Prelude III and Palmer III averaged near perfect 9.0 for genetic color. Excellent color was also noted for Excel, Catalina, Quickstart, and Williamsburg although other factors depressed their overall quality scores. No statistical differences were observed between any of these varieties for turf quality or color.

Percentage of ground cover was further reduced during the second winter. Only two varieties retained a fairly high percentage of cover: Buccaneer II retained 85% while Prelude still held 77% cover. Repell III and CAS-LP23 were observed to retain 70% of their turf cover. Only 21 varieties still

Table 2. Turfgrass quality, genetic color and percentage of ground cover for perennial ryegrass varieties seeded in May 1995 at the University of Maine. Means are the average of monthly ratings made during the 1996 growing season.

Variety	Quality ¹	Genetic Color	Ground Cover ²
1. REPELL III	8.10	8.33	76.7
2. PALMER III	7.81	8.33	85.0
3. LRF-94-C8	7.71	8.67	75.0
4. PRELUDE III	7.62	8.33	75.0
5. CHAPARRAL	7.57	8.00	73.3
6. IMAGINE	7.57	9.00	70.0
7. CALYPSO II	7.43	7.67	63.3
8. TOP HAT	7.33	6.33	73.3
9. EXCEL	7.33	8.33	65.0
10. MAJESTY	7.24	8.67	66.7
11. MB 45	7.19	8.33	68.3
12. PENNANT II	7.14	7.67	58.3
13. PREMIER II	7.14	7.00	65.0
14. CATALINA	7.10	8.00	73.3
15. ISI-MHB	7.10	7.00	76.7
16. TOP GUN	7.05	7.33	80.0
17. ESQUIRE	7.05	7.33	76.7
18. ACHIEVER	7.05	7.67	75.0
19. SECRETARIAT	7.00	7.00	73.3
20. LINE DRIVE	7.00	8.00	58.3
21. SUNSHINE	6.95	8.00	65.0
22. MONTEREY	6.95	7.33	70.0
23. MB 44	6.91	8.33	58.3
24. BRIGHTSTAR	6.86	6.33	70.0
25. RIVIERA II	6.86	6.33	75.0
26. OMNI	6.86	7.00	75.0
27. MARDIGRAS	6.81	7.67	80.0
28. ELF	6.76	6.33	68.3
29. LAREDO	6.76	7.33	71.7
30. BLAZER III	6.76	6.67	68.3
31. BRIGHTSTAR II	6.76	8.00	60.0
32. PANTHER	6.71	7.33	78.3
33. DIVINE	6.71	7.67	66.7
34. CAS-LP23	6.71	6.67	78.3
35. ADVANTAGE	6.67	6.67	58.3
36. CADDIESHACK	6.67	7.00	70.0
37. WIND DANCE	6.62	8.33	45.0
38. ASSURE	6.62	6.67	83.3
39. ACCENT	6.62	6.33	68.3
40. WIZARD	6.62	8.00	68.3
41. CUTTER	6.62	7.00	68.3
42. SR 4400	6.57	6.67	75.0
43. BAR ER 5813	6.57	7.00	78.3
44. WIND STAR	6.57	7.00	73.3
45. SR 4200	6.52	6.67	78.3
46. HEAD START	6.52	7.00	71.7
47. EDGE	6.48	7.00	61.7
48. PASSPORT	6.48	6.33	68.3
49. SONATA	6.43	7.00	75.0
50. NIGHT HAWK	6.43	7.33	68.3
51. ROADRUNNER	6.38	8.33	50.0
52. BUCCANEER II	6.33	6.00	78.3
53. PS-D-9	6.33	7.00	63.3
54. PROTOCOL	6.29	6.33	71.7
55. MORNING STAR	6.29	6.67	71.7

Table 2. Continued.

Variety	Quality ¹	Genetic Color	Ground Cover ²
56. ACADEMY	6.29	6.67	70.0
57. DANCER	6.24	6.67	78.3
58. MVF-4-1	6.24	6.00	70.0
59. WX3-91	6.24	6.67	63.3
60. STALLION SUPREME	6.19	7.33	70.0
61. WX3-93	6.19	7.00	60.0
62. SPELL BOUND	6.19	6.33	76.7
62. OMEGA3	6.14	6.67	66.7
63. APR 124	6.14	6.33	58.3
64. STARDANCE	6.14	8.00	60.0
65. KOOS 93-6	6.14	6.67	66.7
66. CITATION III	6.14	8.00	66.7
67. APR 106	6.14	6.00	63.3
68. MANHATTAN 3	6.14	7.33	45.0
69. R2	6.10	6.33	75.0
70. WVPB-PR-C-2	6.05	6.00	76.7
71. WILLIAMSBURG	6.00	5.33	76.7
72. PEGASUS	5.95	7.00	68.3
73. STALLION SELECT	5.95	6.33	76.7
74. SR 4010	5.95	6.67	68.3
75. LEGACY II	5.91	7.00	60.0
76. QUICKSTART	5.86	5.67	61.7
77. EXPRESS	5.86	5.33	76.7
78. SATURN	5.71	5.33	78.3
79. PST-2CB	5.71	5.00	70.0
80. TMI-EXFLP94	5.67	6.33	50.0
81. NINE-O-ONE	5.57	7.00	53.3
82. PRISM	5.57	6.67	56.7
83. NAVAJO	5.48	6.00	56.7
84. VIVID	5.48	6.33	60.0
85. SATURN II	5.43	7.33	56.7
86. DLP 1305	5.43	5.00	65.0
87. PRECISION	5.43	6.67	53.3
88. APR 066	5.19	5.00	61.7
89. APR 131	5.19	6.67	50.0
90. NOBILITY	5.00	5.67	70.0
91. PENNFINE	4.76	4.00	71.7
92. DSV NA 9402	4.71	4.00	60.0
93. FIGARO	4.62	5.33	76.7
94. DVS NA 9401	4.29	4.67	60.0
95. LINN	2.43	4.33	25.0

¹ The first 18 varieties did not differ significantly in turf quality.² Only Linn differed from the other varieties for percentage ground cover.

Table 3. Turfgrass quality, genetic color, and percentage of ground cover for perennial ryegrass varieties seeded May 1995 at the University of Maine. Means are the average of monthly during the 1997 growing season.

Variety	Quality ¹	Genetic Color	Ground Cover ²
1. PRELUDE III	8.5	9.0	76.7
2. REPELL III	8.5	8.3	70.0
3. PALMER III	8.4	9.0	58.3
4. TOP HAT	8.3	8.3	61.7
5. ADVANTAGE	8.1	7.5	58.3
6. LRF-94-C8	8.1	9.0	56.7
7. CHAPARRAL	8.1	8.7	55.0
8. CAS-LP23	8.0	8.7	70.0
9. HEAD START	8.0	8.0	68.3
10. MARDIGRAS	8.0	8.7	50.0
11. BLAZER III	7.8	8.3	43.3
12. DIVINE	7.8	8.3	45.0
13. ISI-MHB	7.8	8.3	41.7
14. LAREDO	7.8	8.3	40.0
15. LINN	7.8	8.0	36.7
16. OMNI	7.8	7.7	51.7
17. ROADRUNNER	7.8	8.5	23.3
18. SECRETARIAT	7.8	8.0	53.3
19. BUCCANEER II	7.7	7.7	85.0
20. ACCENT	7.7	7.7	30.0
21. PREMIER III	7.7	8.7	35.0
22. ELF	7.7	8.7	40.0
23. R2	7.7	8.0	60.0
24. VIVID	7.7	8.0	46.7
25. EXCEL	7.6	9.0	20.0
26. LEGACY II	7.6	8.0	31.7
27. OMEGA3	7.6	8.3	33.3
28. SR 4400	7.6	8.5	33.3
29. J-1706	7.5	7.0	10.0
30. PROTOCOL	7.5	8.0	65.0
31. KOOS 93-6	7.5	8.3	58.3
32. CADDIESHACK	7.5	7.5	23.3
33. NINE-O-ONE	7.5	8.0	28.3
34. ACHIEVER	7.4	8.7	36.7
35. APR 124	7.4	8.3	26.7
36. BAR ER 5813	7.4	8.7	33.3
37. IMAGINE	7.4	8.5	50.0
38. MANHATTAN 3	7.4	8.0	28.3
39. PENNANT II	7.4	8.3	30.0
40. STALLION SUPREME	7.4	8.0	43.3
41. SATURN	7.4	7.5	53.3
42. SR 4200	7.4	7.5	36.7
43. ASSURE	7.3	8.0	63.3
44. BRIGHTSTAR	7.3	8.3	35.0
45. CALYPSO II	7.3	8.3	18.3
46. CITATION III	7.3	8.3	33.3
47. ESQUIRE	7.3	8.3	41.7
48. MB 45	7.3	8.5	41.7
49. PANTHER	7.3	8.3	46.7
50. CATALINA	7.3	9.0	43.3
51. SPELL BOUND	7.3	8.0	23.3
52. ASP400	7.2	8.3	20.0
53. STARDANCE	7.2	8.3	41.7
54. RIVIERA II	7.2	8.0	36.7
55. ACADEMY	7.1	8.5	58.3

Table 3. Continued.

Variety	Quality ¹	Genetic Color	Ground Cover ²
56. BRIGHTSTAR II	7.1	8.0	51.7
57. EDGE	7.1	8.0	35.0
58. MONTEREY	7.1	7.5	38.3
59. MVF-4-1	7.1	7.3	25.0
60. NIGHT HAWK	7.1	8.5	39.0
61. DANCER	7.0	7.3	20.0
62. WIND DANCE	7.0	8.0	10.0
63. SUNSHINE	7.0	8.3	36.7
64. PRECISION	7.0	7.7	36.7
65. PRISM	7.0	8.0	26.7
66. CUTTER	6.9	7.3	31.7
67. MAJESTY	6.9	8.3	25.0
68. SONATA	6.9	7.7	43.3
69. SATURN II	6.9	8.0	13.3
70. WIZARD	6.9	7.7	51.7
71. NAVAJO	6.8	8.3	33.3
72. QUICKSTART	6.8	9.0	1.7
73. STALLION SELECT	6.8	6.7	38.3
74. WIND STAR	6.7	8.3	35.0
75. MB 44	6.6	9.0	18.3
76. WILLIAMSBURG	6.6	7.3	43.3
77. NOBILITY	6.5	7.3	30.0
78. PST-2CB	6.5	7.7	25.0
79. BLACKHAWK	6.5	7.5	6.7
80. LINE DRIVE	6.4	8.0	3.3
81. WX3-91	6.4	8.5	38.3
82. APR 066	6.3	7.5	45.0
83. APR 131	6.3	7.3	15.0
84. EXPRESS	6.3	7.7	28.3
85. FIGARO	6.3	7.3	63.3
86. MORNING STAR	6.3	7.3	38.3
87. DLP 1305	6.2	7.7	36.7
88. DSV NA 9402	6.2	6.7	18.3
89. PASSPORT	6.2	7.0	6.7
90. PEGASUS	6.2	8.0	23.3
91. PS-D-9	6.2	7.3	28.3
92. WX3-93	6.2	7.0	18.3
93. DSV NA 9401	5.9	7.0	12.3
94. PENNFINE	5.8	7.3	28.3
95. WVPB-PR-C-2	5.8	8.0	23.3
96. SR 4010	5.7	7.5	11.7

¹No significant differences in mean quality ratings were observed.

retained more than half of their cover. Unfortunately, a total of 73 varieties or three-quarters of this entire trial retained less than half of their turf cover after two winters.

Three-Year Average

The final rankings of all 97 varieties are presented in Table 4. Repell III, LRF-94-C8, Prelude III, Palmer III, Chaparral, Excel, Imagine, and Top Hat were the top-ranked varieties for turf quality and were significantly better than the other perennial ryegrass varieties evaluated in this test. Additionally, these eight top-rated varieties demonstrated superior turf color (greater than 8.6) and very little evidence of brown patch (tolerance scores of 7.2 or greater) or leaf spot disease (tolerance scores of 7.1 or greater).

Fifty-nine varieties of perennial ryegrass averaged only one quality point below the top-ranking eight; this group included several with excellent dark color (Majesty, Wind Dance, Roadrunner, and MB 44), and one variety that displayed superior leaf spot tolerance (Wind Dance). As previously observed, brown patch disease was an important factor in turfgrass quality. Only seven of the eight top-rated varieties had brown patch tolerance scores greater than 7.2 and, of these, only Repel III maintained a three-year average of 8.1. Statistical analyses of these data suggest that brown patch disease is more important in Maine than was previously thought; only nine varieties were able to maintain a three-year average of 7.0 or above. These included the seven top-rated varieties plus ISI-MHB and Esquire. Fully half of the varieties evaluated in this test had brown patch scores of less than 5.5; it should be expected that half of any area seeded to perennial ryegrass will succumb to severe brown patch during any three-year period.

CONCLUSIONS

The perennial ryegrass varieties evaluated in the 1995 NTEP trial rapidly established and demonstrated superior initial quality, density, leafblade width, color, and disease tolerance. These grasses established quickly and easily following a June planting with little or no post-emergent damping-off. Quality scores for the first growing season, accompanied by extraordinary dark color would suggest a wide range of adaptation and use. However, the first winter irreparably damaged nearly all of the 97 varieties. All of the varieties evaluated demonstrated some turf loss; many of them were so damaged that quality scores the following season were difficult to determine.

The second season saw a slight depression in turf quality scores as a result of inflorescence emergence and summer mowing stress. Overall color remained excellent and suggests that the perennial ryegrasses may be readily mixed with other dark colored grasses such as Kentucky bluegrass or hard fescue.

By the end of the second winter, only the very strongest of the ryegrasses had turf cover over 75% of the plots. The quality and color of the top-ranked varieties remained excellent during the third season; disease scores were good to excellent. Three important diseases of perennial ryegrass may depress turfgrass quality in Maine; brown patch disease appears insidious and occurred as late as September in this trial.

The tremendous loss in turfgrass cover seen with most of these cultivars strongly suggests that winter injury and freezing intolerance will greatly limit the appropriate range of perennial ryegrass use in Maine. Because the environmental conditions during the Maine winter are so variable in both temperature and snow cover, offering little in the way of guarantee of winter protection, perennial ryegrass should no doubt be viewed as a short-lived perennial. Perennial ryegrass will no doubt continue to constitute a nurse crop component of seed mixtures, but the wise turf manager should not rely on that component of the mixture to survive the winter. Laboratory results confirm the immense susceptibility of perennial ryegrass to freezing while saturated with water or covered with ice. Similarly, freezing without standing water did not impart significantly greater protection; field results suggest that open winters and wind desiccation may be just as hazardous to ryegrass survival. Certainly the alternating combination of snow cover, ice deposition and open, deeply frozen soils that characterize the normal Maine winter will severely damage those presently available perennial ryegrass varieties.

We look forward to identifying any recently released superior performers in the 1999 NTEP perennial ryegrass trial; it will be seeded in the spring of 2000. Perhaps further laboratory testing will assist us in locating a perennial ryegrass variety capable of withstanding the rigors of Maine's climates, both winter and summer. Until such an outstanding performer is identified, perennial ryegrasses will continue to be relegated to the role of temporary or short-lived cover.

Table 4. Turfgrass quality, genetic color and disease ratings for perennial ryegrass varieties seeded May 1995 at the University of Maine. Means are the average of monthly ratings made over the three year duration of the study.

Variety	Quality ¹	Genetic Color ²	Brown Patch	Leaf Spot
1. REPELL III	8.3	8.6	8.1	6.9
2. LRF-94-C8	8.1	8.9	7.5	7.4
3. PRELUDE III	8.1	8.8	7.3	7.4
4. PALMER III	8.0	8.6	7.5	7.1
5. CHAPARRAL	7.8	8.6	7.2	7.6
6. EXCEL	7.6	8.8	6.4	7.1
7. IMAGINE	7.6	8.9	7.5	8.1
8. TOP HAT	7.6	7.4	7.4	6.1
9. DIVINE	7.4	8.2	6.5	6.4
10. LAREDO	7.4	8.0	6.9	7.1
11. MARDIGRAS	7.4	8.2	6.9	6.5
12. MB 45	7.4	8.5	6.8	7.6
13. PREMIER II	7.4	8.1	6.4	7.1
14. CALYPSO II	7.3	8.1	6.8	6.5
15. ISI-MHB	7.3	7.7	7.1	6.2
16. OMNI	7.3	7.6	6.9	6.8
17. PANTHER	7.3	8.1	6.9	7.3
18. SECRETARIAT	7.3	7.7	6.3	6.6
19. ACHIEVER	7.2	8.1	6.8	7.1
20. BLAZER III	7.2	7.6	5.7	6.1
21. CATALINA	7.2	8.4	6.5	6.4
22. ESQUIRE	7.2	7.8	7.1	6.4
23. HEAD START	7.2	7.7	6.5	7.0
24. MAJESTY	7.2	8.6	6.7	7.0
25. WIND DANCE	7.2	8.4	6.9	8.1
26. ACCENT	7.1	7.1	6.3	5.9
27. ADVANTAGE	7.1	7.1	5.5	5.0
28. CAS-LP23	7.1	7.8	5.5	7.0
29. MONTEREY	7.1	7.5	5.7	5.8
30. PENNANT II	7.1	8.2	5.8	6.3
31. SUNSHINE	7.1	8.2	6.7	6.3
32. TOP GUN	7.1	7.4	6.3	6.1
33. BRIGHTSTAR II	7.0	8.2	6.8	7.2
34. CITATION III	7.0	8.3	6.8	5.7
35. ELF	7.0	7.9	6.2	6.7
36. LINE DRIVE	7.0	8.3	6.7	6.8
37. PROTOCOL	7.0	7.4	5.9	6.9
38. RIVIERA II	7.0	7.4	5.8	6.2
39. ROADRUNNER	7.0	8.4	6.4	6.4
40. ASSURE	6.9	7.3	6.4	6.3
41. BUCCANEER II	6.9	6.8	5.9	5.9
42. CADDIESHACK	6.9	7.4	6.1	6.1
43. MANHATTAN 3	6.9	8.0	6.5	6.5
44. MB 44	6.9	8.8	6.6	7.1
45. OMEGA3	6.9	7.6	6.2	6.6
46. SONATA	6.9	7.7	5.6	6.2
47. BAR ER 5813	6.8	7.7	5.3	5.7
48. BRIGHTSTAR	6.8	7.6	6.1	5.6
49. EDGE	6.8	7.6	5.7	6.7
50. SR 4200	6.8	7.0	5.4	5.6
51. SR 4400	6.8	7.3	5.5	6.6
52. STALLION SUPREME	6.8	7.7	6.2	6.2
53. WIZARD	6.8	7.9	6.0	6.1
54. R2	6.7	7.0	5.5	4.9
55. SPELL BOUND	6.7	7.1	5.1	5.6

Table 4. Continued.

Variety	Quality ¹	Genetic Color ²	Brown Patch	Leaf Spot
56. STARDANCE	6.7	8.0	6.4	5.9
57. ACADEMY	6.6	7.5	6.1	5.6
58. CUTTER	6.6	7.1	5.6	6.1
59. KOOS 93-6	6.6	7.1	5.6	5.4
60. LEGACY II	6.6	7.7	5.4	5.8
61. MVF-4-1	6.6	7.0	6.0	5.4
62. NIGHT HAWK	6.6	7.5	5.6	5.2
63. APR 124	6.5	7.2	4.9	5.9
64. DANCER	6.5	7.1	5.5	5.3
65. PRISM	6.5	7.7	5.8	5.6
66. SATURN	6.5	6.4	4.9	4.2
67. VIVID	6.5	6.9	5.8	5.6
68. WIND STAR	6.5	7.4	5.9	5.7
69. ASP400	6.4	6.9	5.3	5.4
70. NINE-O-ONE	6.4	7.6	6.1	4.9
71. STALLION SELECT	6.4	6.7	5.0	4.7
72. WX3-91	6.4	7.3	6.1	6.0
73. MORNING STAR	6.3	7.0	5.9	5.1
74. PS-D-9	6.3	7.0	5.4	5.3
75. QUICKSTART	6.3	7.0	5.6	6.4
76. SATURN II	6.3	7.8	5.9	5.6
77. BLACKHAWK	6.2	7.0	5.4	5.9
78. NAVAJO	6.2	7.2	5.2	5.1
79. PASSPORT	6.2	7.1	5.3	4.4
80. PEGASUS	6.2	7.6	5.3	6.4
81. PST-2CB	6.2	6.7	5.4	5.2
82. WX3-93	6.2	7.1	5.9	5.6
83. PRECISION	6.1	7.1	5.4	5.1
84. SR 4010	6.1	7.1	5.4	6.1
85. WILLIAMSBURG	6.1	6.4	4.8	5.2
86. WVPB-PR-C-2	6.1	6.6	5.2	5.2
87. EXPRESS	6.0	6.3	5.4	4.5
88. APR 131	5.9	7.0	5.5	5.6
89. DLP 1305	5.9	6.6	4.4	5.0
90. NOBILITY	5.9	6.7	4.9	5.3
91. APR 066	5.7	5.9	4.8	5.2
92. FIGARO	5.4	6.3	3.0	3.2
94. PENNFINE	5.3	5.9	4.4	3.9
95. DSV NA 9402	5.2	5.1	3.6	3.2
96. DSV NA 9401	4.9	5.6	3.3	3.0
97. LINN	4.5	5.3	2.2	2.6

¹ The first eight varieties did not differ significantly in quality ratings over the duration of the study.² Varieties with genetic color ratings of 8.0 or above were not significantly different.