A GREEN SECTION SUPPORTED RESEARCH PROJECT

Pink Snowmold, Fusarium nivale, virulent infection, Western Washington.

Disease Resistance and Quality of Bentgrasses in Washington State

by C. J. GOULD, R. L. GOSS, A. G. LAW AND BUD ASHWORTH*

THE COASTAL PORTION of the Pacific Northwest is a veritable paradise for any number of turfgrass diseases. This region resembles England more than that of any part of the United States, probably because the climate is similar in many respects.

In 1956, the Northwest Turfgrass Association asked us to determine the cause and control of diseases which were causing increasing concern. The first job was to determine the major problems. On bentgrasses in western Washington these proved to be Fusarium Patch *(F. nivale* (Fr) S. & H.*)*, Corticium Red Thread *(C. fuciforme* (Berk.) Wakef.*)*, and Ophiobolus Patch *(O. graminis* var *avenae* (Sacc.) E.M.T.*)*. In eastern Washington the two major diseases are Fusarium Patch and Typhula snowmold *(T. incarnata* Lasch. ex Fr.*)*.

After determining the major causes, we decided that the most rapid control might be achieved with fungicides, but that studies on nutrition and disease resistance should follow as soon as possible. A shortage of both time and money delayed starting the resistance studies until 1971. During that year we solicited seeds and stolons from several available sources and planted 40 types.

During 1971 and 1972 we discovered that many more varieties were available from both foreign and domestic sources, but we lacked funds to expand our testing program. Fortunately, the USGA Green Section Research and Education Fund provided support so that the work could expand.

In 1973, a decision was made to expand the test to use the available seed and stolons for determining their resistance to Snowmold *(Typhula incarnata* and *F. nivale)* in eastern Washington. Plots were established at the Hangman Valley Golf Club near Spokane with 138 of the varieties that had appeared to be most promising at Puyallup.

Although the primary goal was to search for disease-resistant grasses, we were also looking for other desirable qualities. If a resistant variety lacks suitable color, texture, and other desirable characteristics, it is of little value, except as a source of breeding material. It was essential, therefore, that this be a cooperative effort involving

*Plant Pathologist and Agronomist, respectively, Western Washington Research and Extension Center, Puyallup, Wash., Agronomist, Washington State University, Pullman, Wash., and Certified Golf Course Superintendent, Liberty Lake Golf Course, Spokane, Wash.

agronomists and plant pathologists in selecting the best all-around varieties.

MATERIALS AND METHODS

The soil used at the Puyallup Research Center was a 14-inch deep mixture of sand and sawdust over gravel. A complete analysis fertilizer was applied whenever necessary and was supplemented with urea, except during the summer months when ammonium sulfate was used to suppress Ophiobolus Patch. Plot size was five feet square, and the number of replications varied from one to six, depending upon the potential of the variety and the availability of seed or stolons. The number of replications of the least promising types was reduced periodically in order to make room for more promising ones. A minimum of one plot, however, was maintained of all selections except two which died and four cultivars which were discarded to make room for new varieties. The area comprised 392 plots and was surrounded by an eight-foot canvas fence to slow air movement and to promote atmospheric conditions that encouraged diseases.

Forty selections were planted at Puyallup in 1971 and increased to 103 in 1972. The entire area was revamped and enlarged in 1973 to make room for additional varieties. There were 135 by 1974 and 160 by 1976. The data shown in Table 1 are based upon counts made between 1973 and 1977 of varieties numbered 1 through 103 starting in 1973, 104 through 135 in early 1974, and 136 through 160 in late 1974.

In an effort to introduce as many different strains of *F. nivale* as possible, clippings of diseased turf from different golf courses and home lawns were periodically scattered over the surface of the plots at Puyallup. Both Corticium Red Thread and Ophiobolus Patch also invaded these plots and were sometimes sufficiently abundant to permit evaluation of varieties for resistance. However, distribution of these latter two diseases was not uniform, so the varieties which are rated highest in Table 1 may only have escaped the pathogens and may not be inherently resistant to them.

All but two of the 138 varieties at Spokane were planted in 1973, with two five-foot square replications per variety. They were inoculated that fall with several cultures of *Typhula incarnata* which were isolated from diseased golf greens the preceding spring. We expected that *F. nivale* would quickly invade the plots from naturally infected grass nearby, but this did not occur. Even by 1977, about 99 percent of the diseased area was affected only by *Typhula*.

(Above) Fusarium (Snowmold) disease evaluations at the Western Washington Research and Extension Center, Puyallup, Washington.

(Right) Early spring recovery from Typhula incarnata.

Estimates were made periodically of the percent of disease infection and ratings were made of color and texture of the grass. These data were averaged and are shown in Table 1. In an effort to make it easier to compare performances, these averages and ratings were divided into five categories ranging from the best to the poorest. The best (least disease, darkest color or densest turf) were then designated +++++ and the other groups were rated from ++++ to a single +, the symbol which indicates the least desirable reaction.

Twenty-nine of the most promising varieties at Puyallup were planted in 1974 in larger 10-foot square plots and subjected to high and low nitrogen levels with and without fungicides. A full report on these will be made at a later date.

RESULTS

Some selections changed slightly as they matured — usually for the worse, but sometimes for the better, perhaps by selection of resistant clones. None were immune to either *Fusarium* or *Typhula*, but several varieties were not only much

TABLE 2

Average Percentage of Diseases in Different Agrostis Species

Species	No. of Cultivars	Corticium	Fusarium	Typhula*
Canina	2	16.0	0.8	35.4
Palustris	12	3.8	0.6	46.0
Tenuis	5	10.4	2.4	30.1

*Data from Spokane. Other data from Puyallup plots.

We Need Your Assistance - Will You Help?

The American Society of Golf Course Architects Foundation, the National Golf Foundation and the United States Golf Association are jointly involved in this survey to determine the status of the use of recycled water (effluent and other wastewater) on golf course and recreational turfgrasses. Complete confidence will be kept on all individual clubs or organizations reporting. Would you kindly help in this survey by taking a minute to fill out this questionnaire.

1. **Do you presently use recycled water on your turfgrass area?**
   ☐ Yes ☐ No

2. **Are you considering recycled water as a possibility?**
   ☐ Near Future ☐ Distant Future ☐ No

3. **What is your source of recycled water?**
   ☐ Industrial ☐ Military Installation ☐ Housing Development

   Other _____

4. **Number of acres irrigated with recycled water.**

   _____ Greens _____ Tees _____ Fairways _____ Roughs

   Other _____

5. **Type of facility.**
   ☐ Private Club ☐ Public/Municipal Course ☐ Public Course/Privately owned
   ☐ Par 3 Course ☐ Executive Course ☐ Military Course

   Other _____

6. **Do you know of any other turfgrass facility using recycled water?** ☐ No

   ☐ Yes. Type of turfgrass facility _____

   Location (if more than one, attach list) _____

7. **If you use well, city or pond water for irrigation, how many gallons do you use annually?** _____

Form filled out by: _____

_____
Organization or Club (optional)

Please Return Questionnaire to:

USGA Green Section
P.O. Box 1237
Highland Park, NJ 08904

Attn: A. M. Radko

Wastewater Conference Scheduled

On November 13 and 14, 1978, a conference sponsored by the American Society of Golf Course Architects Foundation, the National Golf Foundation and the Green Section of the United States Golf Association will be held at the Arlington Park Hilton, Euclid Avenue and Rohlwing Road, Arlington Heights, Ill. 60006. The theme of the two-day conference is "Wastewater Irrigation of Recreational Turf Areas." The conference's objectives are (1) to produce "State of the Art" information and to document what is now known as it applies to recreational turf; (2) to generate additional information on wastewater uses; (3) to produce guideline information for publication.

Everyone interested in land disposal of wastewater (effluent and other) is cordially invited. A monumental bit of work has been done in this area. Interest in wastewater has quietly mushroomed because of concern for possible future limits on fresh, potable water for recreational purposes. Representatives of all recreation turf installations — golf, park and recreation, industrial, military, government, irrigation, landscape and water works are invited.

Mark these dates on your calendar now — plan to attend! Would you indicate your interest by detaching and mailing the following.

Please mail to:

USGA Green Section
P.O. Box 1237
Highland Park, NJ 08904

Attn: A. M. Radko

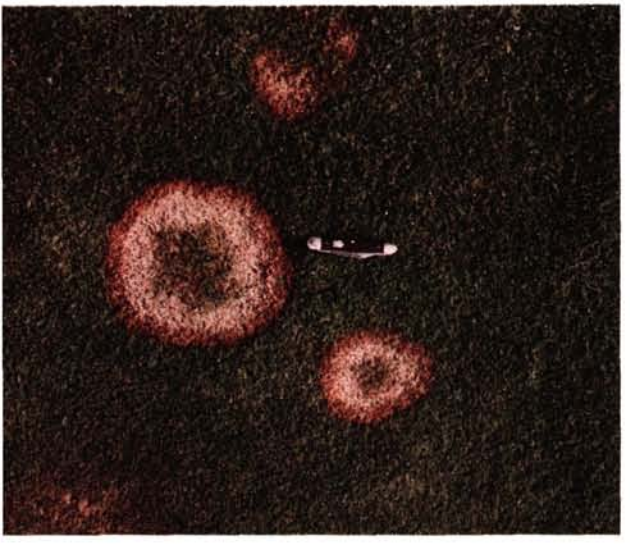
☐ Yes, I plan to attend the November 13-14, 1978, Conference.

_____
(Name)

_____
(Address)

_____

_____
(Number of guests)



more resistant than old varieties such as Highland and Astoria, but also had good cultural characteristics. Some of the others, which showed good disease resistance but had poor color or texture, could serve as sources of breeding varieties specifically adapted to the Pacific Northwest.

In general, varieties or selections from northern climates had the greatest resistance to *Fusarium*, but paradoxically, two of the best were MCC-3 from Oklahoma and ARC-1 from Florida, both *palustris* types. In general, the stolonized bents were more resistant to *Fusarium* than the seeded types, but the reverse was true with resistance to *Typhula*.

There were many interesting results with the various varieties. Some of the velvet *(canina)* bents, such as Kingstown and Novobent, appeared to be very good but may be difficult to maintain without extra care. The *tenuis* variety, Bardot, was rather susceptible to *Fusarium* but recovered more rapidly than other varieties of this species. Many of the selections from Canada and the northern U.S. went off-color in the dormant season during the winter at Puyallup. This feature would not detract from their use in eastern Washington or areas with continental climates, but would be undesirable in coastal areas where grass is normally green all winter. A few varieties developed unusual diseases or disease-like symptoms. For example, a salt tolerant selection (UCR-30) from southern California was the only variety in which sporocarps of *Typhula incarnata* have ever been observed in the Puyallup plots. Some other varieties were even more susceptible in the plots at Spokane.

The differences between varieties are also interesting. The average percentage of disease in varieties in the bent management plots is shown in Table 2. It should be remembered that most of these varieties had been chosen because they had some resistance to *Fusarium*.

Neither the Puyallup (nor Spokane) plots were aerified or dethatched, nor were they subjected to traffic. Therefore, as might be expected, the varieties performed somewhat differently when put into larger plots under a regular management program at Puyallup. Some of the varieties that appeared to be resistant to *Fusarium* in the smaller plots, showed less resistance and also exhibited different cultural responses. Since this management test has not yet been completed, we will not report details here. However, at this time, the most promising commercially available varieties for use in western Washington appear to be:

Seeded: A-75, Bardot, Emerald, Penncross, Tracenta, Kingstown, and Novobent.

Stolonized: Nimisila, Northland, and Waukanda.

Two other stolonized varieties appear very promising but are not yet commercially available. They are the Yale Selection (#65) and Drew Smith's 721 (#93).

Large-scale management tests are planned next for eastern Washington. Pending completion of these tests, the varieties showing most promise at this time are:

Seeded: Boral, Bardot, Enate, Penncross, Tracenta, Ligrette, Saboval, MOM AT4, Hummel, Pipo, Strandhem, and Norfel.

Stolonized: Toronto, Northland, Waukanda, Yale, Smith 736, HVT-2, and Hayden Lake.

Thus we now have available superior bentgrass varieties that are reasonably resistant to the major pathogens in the State of Washington. The adoption of these varieties in conjunction with the proper management, including application of sulfur, will permit a reduction, but not elimination, of the need for fungicides. This will not only lower maintenance costs, but it will also lessen the danger of environmental pollution while providing prospect for better turf than ever before possible in this state.

TABLE 1

Bentgrass Variety Tests. Ratings of Color, Texture, Quality and Disease Resistance

Variety	Species[a]	Western Washington Tests (Puyallup)[b]						Eastern Washington (Spokane)[c]				Disease[d]				
		No. Reps. 1976	Color		Texture/Density		Overall Quality 1977 only	No. Reps. 1977	Overall Ratings			Western Washington			E. Wash. Typhula	
			Summer	Winter	Summer	Winter			Color	Tex/Den	Quality	F. nivale	Corti.	Ophiob.	Amt.	Recov.
1 Astoria	T	2	+++	+++++	++++	++++	+	2	+++	++++	+++	++	++++	++++	+++	++
2 Astra	C	1	+	++	++	+	+	—				+	+	+++++		
3 Avanta	C	2	+++	+++++	+++++	+++++	++++	—	++	+++	++	+++	++	++++		
4 Barbella	C	2	++	+++++	++++	++++	+	2	+++	+++	++	++	+++	++	++	+
5 Barbinet	T	2	+++++	++++	+++++	+++++	++++	2	+++	++++	+++	++	++++	+	+++	++
6 Barida	C	2	+	+++	+	+	++	2	++	++	+	+	+	+++	++	+
7 Bardot	T	4	+++++	+++++	+++++	+++++	++++	2	++++	++++	++++	++	+++++	++	++++	+++
8 Boral	T	2	+++	+++	++++	++++	+	2	++++	+++	+++	++++	++++	++++	+++++	++++
9 Contrast	T	2	+++	+++++	++++	+++	++	2	+++	++++	+++	++	++++	++	++++	++
10 Enbenta	T	2	+++	+++++	+++++	+++++	+++	2	+++	+++	+++	+	+++	+++++	++++	+++
11 EKO	T	2	++++	+++++	+++	++++	++++	2	+++	+	+	+++	+++	+++	++++	++
12 Enosca	C	2	++	+++++	+++++	+++++	++++	2	++	+++	++	+++	+	++	++	+
13 Enate	T	2	++++	++++	+++	+++	+++++	2	+++++	++++	++++	++	++++	++	++++	+++
14 Exeter	T	2	++	+++++	++++	+++++	++	2	++	++++	++	+++	++++	+	++++	+++
15 Highland	T	4	+	++++	+++	++	+++	2	+++	++++	+++	+	+	+++	++	+
16 Holfior	T	2	+++	++++	+++++	++++	+++++	2	+++	++++	+++	++	++++	++	+++	+++
17 Kingstown	C	4	+++++	+++++	+++++	+++++	+++++	2	++	+++++	+++	++++	+	++	++++	+
18 NZ Brntop	T	2	+++	+++++	++	+++	+	2	+++	++	++	+	+++	+++++	++++	++
19 Novobent	C	4	++	+++++	+++++	+++++	+	2	++	++++	+++	+++	+	+	++	+
20 NK N-3-44	T	2	++	+++++	++	+++	+	2	++++	++++	+++	++	+++	+++++	++++	+++
21 Orbico	T	2	++	++++	++++	++++	++	2	+++	+++	+++	+	+++	++	+++	+
22 Penncross	P	4	++++	+++++	+++++	++++	++++	2	++++	+++++	+++++	++++	++++	++	++	+
23 Prominent	P	4	++	+++	+++++	++++	++	2	+++	+++++	++++	++++	+++++	+	++	+
24 Rusta	C	2	+++++	+++	+++++	+++++	++	2	+++	++++	+++	+++	+++	+++	++	+
25 Seaside	P	2	+	++++	++	++	+	2	++++	++++	++++	++	+	++++	+	+
26 Emerald	P	4	++	+++	+++++	++++	++	2	+++	+++++	++++	+++++	++	+	++	+
27 S-4979	P	2	++++	++	+++	++++	++	2	++++	++++	+++	++++	++	+++	+	+
28 Tracenta	T	4	+++++	+++++	+++++	++++	++++	2	+++++	++++	++++	+	+++	++	++++	++++
29 Mikro Dae.		2	++	++++	+++	++++	++	2	+++	+++++	+++	++++	++++	++++	++	+
30 Agrettina	C	2	++	+++++	+++++	+++++	++++	2	+++	++++	+++	+++	+	+++	+++	+
31 Ligrette	T	2	++++	+++++	++++	++++	++	2	++++	+++++	++++	+++	+++	++++	++++	++++
32 Saboval	T	2	++++	+++++	+++++	+++++	+++	2	++++	++++	++++	++	++++	+++	++++	+++
33 Arlington	P	4	+++	+++	++	+++	++	2	++++	++++	+++	++++	++	++++	+	+
34 Cohannsey	P	2	++	++++	+++	+++	+++	2	++	+++	++	+++	++	++	+	+
35 Congress'l	P	2	+++++	+++	+++	++++	++	2	++++	++++	+++	++++	++++	+++	++	+
36 Evansville	P	2	+++++	+++++	++++	++++	++	2	+++++	+++	+++	++	++++	+++++	+	+
37 Old Orch.	P	2	++	+++	+++	++	+++	2	++	+++	++	++++	+++	+	++	+
38 Pennpar	P	2	+++	++	+++	++++	++	2	+++	++++	+++	+++++	+++++	+	++	+
39 Toronto	P	2	+++++	+++	+++	+++++	++	2	+++++	++++	++++	+++	++++	++	+++	++
40 Washington	P	2	++++	++	+++	++++	++	2	+++	+++	+++	++++	++	+++	++	+
41 ACA-61	C	2	++	+++	+++	++	+++		+	+++	+	+	+	+		

42	MOM AT1	T	2	+	+++	+++	++	++	2	+++	++++	+++	+	++++	+++++	++++	++++
43	MOM AT4	T	2	+++	++	+++++	++++	++++	2	++++	+++++	++++	+	++++	++++	+++++	++++
44	Scott A74	P	2	++	+++	++++	++++	+++++	2	++++	+++++	++++	+++	++	+	+	+
45	Scott A75	P/T	2	+++	+++	++++	++++	++++	2	+++++	+++++	+++++	+++	+	+++++	++	+
46	Hummel	T	2	+++	+++	++++	++	++	2	++++	+++++	+++++	+	++	+	+++++	++++
47	Igeka	T	2	++	+++	++++	++++	++	2	+++	++++	+++	+	++	+	++++	++
48	Mamelou	T	2	++	++	+++	+++	+++	2	+++	++++	+++	+	++	+	++++	++++
49	Ohl OE332	T	2	+++	++	+++	+++	++	2	++++	++++	+++	++	+++	++	++++	++++
50	Pipo	T	2	++	++	++++	+++	+++	2	++++	++++	++++	+	++	+	+++++	++++
51	Strandhem	P	2	++	+	+++	++	+++	2	+++	++++	+++	++	+	++++	+++++	++++
52	Tendenz	T	2	+++	++	++++	+++	+++++	2	++++	++	++	++	+++++	+	+++++	+++
62	Nimisila	P	5	++++	+++	+++++	++++	+++	2	+++	++++	+++	++++	+++	++	+	+
63	Northland	P	5	+++	+	+++++	++++	++	2	+++	++++	+++	+++++	+	+++	+	
64	Waukanda	P	5	++++	++	+++++	++	+++	2	++++	++++	+++	++++	+++	++	+++	+
65	Yale Sel	P	5	+++++	++	+++++	++	++++	2	+++++	++++	++++	+++	++	+++++	+	+
66	Keen's 19		4	+++	++++	+++++	+++++	+	2	++++	+++++	++++	++	+	+	+	+
67	Keen's 22		4	++++	+++++	+++++	+++++	++	2	++++	+++++	++++	++	+	++	+	+
68	Keen's 27		4	+++	+++++	++	+	++	2	++++	+++	+++	+	+	++++	++	+
69	Keen's 28		4	++	+++	++++	+++	+	2	++++	++++	++++	++	+	+	+	+
70	Keen's 36		5	+++	++++	++++	++++	+++	2	++++	++++	++++	++	+	+	+	+
71	Keen's 41		4	+	++++	++++	+++	+++	2	++++	++++	+++	+++	+	++	+	+
72	Keen's 42		4	+	++++	+++	++	++	2	++++	++++	++++	+++	++	++	+	+
73	Keen's 43		4	+	+++	+++	+++	++	2	++++	++++	+++	++	+	++++	++	+
74	Keen's 52		4	++	+++	+++	++++	+	2	++++	++++	++++	+	++	++++	+	+
75	Arrowwood		5	++	+++	++++	++++	+	1	+++	++++	+++	++	+	+++	+	+
76	MCC-3	P	5	++	+++++	+++	+++++	+++++	2	++++	++++	++++	+++++	+++	+++++	++	+
77	HCC-7-2	P	5	++	++++	+++	++++	+	2	+++++	++++	++++	+++	++	+++	+	+
78	UCD-1	P	3	+	++	++	++	+	2	++	++	+	++++	+++	+++	++	+
79	UCR-53	P	3	++	+++++	++++	+++++	+++	2	++++	++++	++++	+++	++	++	++	+
80	UCR-30	P	4	+++	+++	+++	++	+++	2	+++	+++	++	+++	+	+++++	+	+
81	UCR-13	P	3	++	+++	+++++	++++	++	2	+++	++++	++	+	++	++	+	+
82	PA Sta. #3	P	2	++++	++	+++	+++	+	2	+++++	++++	++++	+++	++	+++++	+	+
83	PA Sta. #4	P	4	+	+++	+++	++++	+++	2	+++	++++	+++	+++++	+++++	++++	+++	++
84	PA Sta. #5	P	4	+++	++	++++	++	++	2	+++	++++	+++	+++++	+++	+	++	+
85	TS-666	P	2	++++	+	+++	+++	++	2	+++	++++	+++	++++	++++	+	++	+
86	S-704		1	++	+++	+	++	+++++	2	++	+	+	+++++	+++	+++++	+	+
87	S-705		1	+++	++	+++	++++	++++	2	++++	++++	++++	+++++	+++++	+++++	+	+
89	S-707		1	+	++	+	+	++	1	+	+	+	+++++	++	+++++	+	+
91	S-709		1	+	++	+	+	++	2	++	+	+	+++++	+	++	+	+
93	S-721		4	++++	++	++++	+++	+++++	2	+++++	+++++	++++	+++++	++++	+++	++	+
94	S-730		1	+	++	++	+++	+	2	++	++++	+++	+++++	+++++	+++++	+	+
95	S-731		1	+	++	+	+++	+	2	+	++	+	+++++	+++++	+++++	+	+
96	S-732		4	+	+	++	++	++	2	+++	+++	+++	+++++	++++	+++	++	+
97	S-733		1	++	+	+++	++++	+++	2	+++	+++	++	+++++	+++++	+++++	++	++
98	S-734		1	++	+++	++	++	+	2	++++	+++	+++	++++	+++++	+++++	++	+
99	S-735		1	+	++	++	+++	+	2	++	++	+	+++++	+++++	+++++	+	+
100	S-736		4	++	++	+++	+++	+++	2	++++	++++	++++	+++++	+++++	++++	+++	++
101	S-737		1	+	++	++	++	+	2	++	+++	++	+++++	+++++	+++++	+	+
102	S-738		1	+	+	++	+++	++	2	+++	++++	+++	+++++	+++++	+++++	+	+
103	S-739		1	+++	+	++	+	+					+++	+	+++++		
104	HV-T-3	T	1	++++	+++++	+++	+++	++	2	+++	+++	++	+	+++++	+++	+++	++

TABLE 1 *(continued)*

Bentgrass Variety Tests. Ratings of Color, Texture, Quality and Disease Resistance

Variety	Species[a]	Western Washington Tests (Puyallup)[b]						Eastern Washington (Spokane)[c]				Disease[d]				
		No. Reps. 1976	Color		Texture/Density		Overall Quality 1977 only	No. Reps. 1977	Overall Ratings			Western Washington			E. Wash. Typhula	
			Summer	Winter	Summer	Winter			Color	Tex/Den	Quality	F. nivale	Corti.	Ophiob.	Amt.	Recov.
105 HV-TC-4	T	4	+++++	+++++	+++	++++	+++++	1	+++	++	++	++	+++++	++	++++	++++
106 HV-G-5	G	4	++	+	++	+	++	2	+	+	+	++	+++++	++	+++++	++++
107 Atella	T	4	++++	++++	+++	+++	+++	2	++++	+++	+++	+	+++++	++++	+++++	++++
108 Ubiko	P	4	+	+++++	++	++	+	1	++++	+++	+++	+	+	++++	++	+
109 Finesse	T	4	+++++	++	++++	+++	++					+	++++	++		
110 HV-T-2	T	4	+++	+++	++	++	+++	2	+++	++++	+++	+	+++	++	++++	+++
111 ARC-1	P	4	+++++	++++	++++	+++++	++++	2	+++++	+++++	+++++	+++++	+++++	+++	+	+
112 235541	P	3	+	+	+	++	+++	2	++	+++	+	+++	+	++++	+++	++
113 251945	P	4	+	+	++	+	+++	2	+++	+++	++	+++	++	+++	+++	+
114 Norfel	T	4	++	+++	++	+	+	2	+++	+++	++	++	+++	++++	+++++	+++++
115 MSU-18-AP		4	++	+	+++	+++	++	2	++	++++	+++	+++++	++++	+	+	+
116 MSU-28-AP		4	++++	+	++	+	++	2	+++++	++++	++++	+++++	+++++	+++	+	+
117 MSU-38-AP		4	+++	+	++++	++	++	2	+++	+++	+++	++++	+++	++	+	+
118 Baldwin	P	4	++++	+	+++++	++++	+	2	+++	++++	+++	++++	+++++	++	+	+
119 Metrop.	P	4	++++	+	++++	++++	+++	2	++++	++++	++++	+++++	+++++	++	+++	+
120 F-63-10	P	4	+++++	+	++++	+++	++++	2	+++++	++++	+++++	++	+	++	++	+
121 F-67-3	P	4	+++++	+	++++	++++	+++++	2	++++	++++	++++	++++	+++	+++	+	+
122 F-67-9	P	4	+++++	+	+++++	+++	+++++	2	++++	++++	+++	+++++	++++	+++	+	+
123 F-M-63-3	P	4	+++	++	+++	+++	+++	2	+++	++++	+++	++	+++	++	++	+
124 A-24	P	4	+	+	++	++	++	2	+++	+++	++	++++	++	++++	+++	++
125 A-25	T	4	+	+	+	+	+		++	++	++	+	+++++	++		
126 A-44	P	4	++++	+	+++	+++	++++	2	+++	++++	+++	++	+	+	+	+
127 Springfd		4	+++	++++	+++	+++	+++	2	++++	+++	+++	+	+	++	++	+
128 TG040	P	4	++	+++	+++	++++	+	2	++++	++++	+++	++++	++++	+	++	+
129 TG043	P	4	+++	++	++++	++++	++++	2	++++	++++	++++	++	++++	+++	+	+
130 TG052	P	4	+	++	+	+	+	2	+++	++	++	++	+++	+++	+	+
131 TG058	P	3	+	+	+	+	+	2	+++	++	++	+++	++	++++	++++	++
132 C-27	P	4	+++	+	+	+	++++	2	++++	+++	+++	+++	++	++++	+	+
133 Twin Orch	P	4	+++++	+	+++	+++	++++	2	++++	++++	++++	+++++	+++++	++++	+	+
134 Jelling	T	4	++++	+++++	+++	+++	+++++	2	++++	++++	+++	++	++++	++++	++++	++++
135 Z2000	alba	4	++++	++++	+++++	+++++	+++		++	++++	++	+++	+	+		
136 Hay. Lake	P	1	+	+	+	+	+	2	+++	++++	+++	+	++++	+	++++	++++
137 Morrissey	P	1	++	++++	+	+++++	++	2	++++	++++	++++	+	+++	+	++	+
138 Zygma	G	1	+	++++	+	+	+	2	+	+	+	+	+++	+++++	+++++	++++
139 D.S. NFG	G	1	+	++++	+	+	+	2	+	+	+	+	+	+++++	+++++	++++
140 AC-1	C	1	++++	++++	++	++	+	2	+++	+	+	++	+	+++++	++++	+++
141 AC-5	C	1	+	+++++	+	+	+		++++	+	++	++	++++	++++		
142 AP-New.6	P	1	++	+	+	++	+++	1	+++++	++++	++++	+	+	+++++	+	++
143 AP-New.3	P	1	+++	+	+	++	++	1	++++	+++	+++	+	++	+++++	++	++
144 Hya. Vel.	C	1	++++	++++	++	++	+++	1	++++	+++	+++	+	++	+++++	+++	+++
145 AP-6 Cr.	P	1	+	++++	++	++	+++	1	++++	++++	+++	+	++	+++++	+	+

146 AP-3	P	1	++++	++	++	++	+	1	++++	+++	+++	+	+++	+++++	++	+
147 AP-P17-1	P	1	+	++++	+	+	+	1	++++	++	++	+	+	+++++	+	+
148 Skog AP-5	P	1	++++	++	++	+++++	++	1	+++	++++	+++	+	+++	+++++	++	+
149 AP-1	P	1	++	++	++	+++++	+	1	++	++++	+++	+	++++	+++++	++	+
150 AP-D1-1	P	1	++++	++++	++	++	+	1	+++	++++	+++	+	++	+++++	+	+
151 lag 5-60		1	+	++	+	+++++	+					+	++++	+++++		
152 lag 8-60		1	+++	++	+	+++++	++					+	+++++	+++++		
153 WYR 30409		1	+	++++	+	+	+					+	++	+++++		
154 WYR 22009		1	+	++++	+	+	+					+	+++++	+++		
155 N-010	T	1	+	++	+	+	+	2	+	+	+	++	++	++++	+++++	+++
156 PSU-PBCB	P	2	+	++++	++	++	+++	1	+++++	++	+++	+++	++	+	++	++
157 Gognan	T	3	+++	++++	++++	++	+++					++	+++	+++		
158 Parys Mt	T	3	+++++	+++++	++++	++	++++					+	+++	+++++		
159 HV-T-2/3	T	1	+++++	+++++	++++	+	++					++	++++	+++++		
160 PSU FB82	T	3	++++		++		+++					++	+++++	+++++		

[a] A = *alba*; C = *canina*; G = *gigantia alba*; P = *palustris* (& *stolonifera*); T = *tenuis* (& *vulgaris*)

[b] Average ratings for color, density, quality at Puyallup. (10 = best, 1 = poorest)

		+++++	++++	+++	++	+
Color	Summer	8.0-9.0	7.5-8.0	7.3-7.4	6.8-7.2	5.0-6.7
Color	Winter	6.1-7.0	5.7-6.0	5.1-5.6	4.6-5.0	3.1-4.5
Density	Summer	8.5-9.2	8.0-8.4	7.5-7.9	6.5-7.4	2.7-6.4
Density	Winter	8.0-8.9	7.5-7.9	7.2-7.4	6.7-7.1	2.0-6.6
Quality	June 1977	7.0-7.5	6.1-6.9	5.6-6.0	5.0-6.6	2.0-4.9

[c] Average ratings for color, texture/density, and quality in eastern Washington (10 = best, 1 = poorest)

	+++++	++++	+++	++	+
Color	7.0-over	6.5-6.9	5.9-6.4	5.5-5.8	5.4-lower
Density/Texture	8.2-over	7.5-8.1	6.7-7.4	6.0-6.6	5.9-lower
Quality	7.7-over	7.3-7.6	6.8-7.2	6.2-6.7	6.1-lower

[d] Average ratings for disease (based upon percentage of area infected)

	+++++	++++	+++	++	+
Corticium	0-0.7	0.8-1.5	1.6-2.8	2.9-6.3	6.4 & up
Fusarium nivale	0-4	5-7	8-10	11-15	16 & up
Ophiobolus patch	0	0.1-0.9	1-1.9	2-4.9	5 & up
Typhula incarnata	1-19	20-29	30-39	40-49	50 & up
Typhula recovery	80-100	60-79	50-59	40-49	1-39

Average percent of disease turf on May 5 (1975) and 4 (1976) divided by amount on March 26 (1975) and 30 (1976). 80 = 80% recovery.