Resistance of turfgrasses to low-temperature-basidiomycete snow mold and recovery from damage[1]

J. Drew Smith

Most strains of ***Poa pratensis, Festuca rubra,*** and ***Festuca ovina*** were heavily damaged in tests at Saskatoon when turf plots were inoculated with cultures of the nonsclerotial low-temperature basidiomycete, LTB, grown on sterile rye grain. Suscepts included several of the cultivars favoured for use in other climatic regions where the range of snow molds and other turf pathogens is different from that on the prairies No strains completely resistant to the LTB were found, but some new introductions, selections and established cultivars showed low initial damage and/or rapid recovery. Cultivars require regional testing for disease resistance, especially snow mold resistance, before being recommended for use. Varietal descriptions should specify resistance to a particular snow mold pathogen or pathogens not to "snow mold" since the spectrum of these varies greatly from region to region.

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L'inoculation d'un basidiomycète psychrophile sans sclerotes (LTB) cultivé sur des grains de seigle stériles à des parcelles de gazon a fortement endommage la plupart des lignées de ***Poa pratensis, Festuca rubra*** et ***Festuca ovina*** utilisées dans des essais réalisés a Saskatoon. Plusieurs des cultivars sensibles sont ceux qu'on utilise de preference dans les regions climatiques ou les moisissures niveales et les autres organismes pathogenes du gazon different de ceux des Prairies. Aucune lignee n'a manifeste une resistance complete au LTB, mais quelques nouvelles selections et quelques cultivars établis ont montre peu de dégâts initiaux et (ou) se sont rétablis rapidement. Pour pouvoir être recommande, les cultivars doivent subir des essais multilocaux de resistance a la moisissure nivéale. Les descriptions de variété devraient specifier les types de pathogene de la moisissure nivéale auxquels les cultivars sont resistants etant donne que les pathotypes de ces dernières varient beaucoup d'une region a l'autre.

Snow mold caused by an unidentified, non-sclerotial low-temperature basidiomycete, LTB, is widespread on domestic lawns and other amenity turf in the lower snowfall regions of western Canada and may cause considerable damage in some years (4, 5). LTB snow mold may be controlled by applications of nonmercurial fungicides made before the development of a permanent snow cover. However, severe attacks on susceptible cultivars may require the use of mercurous/mercuric chloride mixtures (6).

Few studies have been made on the resistance to the LTB of cultivars of ***Poa pratensis*** L., ***Festuca rubra*** L. and ***Festuca ovina*** L. The first two species are the most common components of domestic lawns and other amenity turfs in the prairies. Cormack (1) found that ***P. pratensis*** had moderate to high resistance and that ***F. rubra*** and ***F. ovina*** had low resistance under the conditions of southern Alberta. In order to improve control of this disease and reduce the need to rely on fungicides, many introductions and local selections of ***P. pratensis*** and fine-leaved ***Festuca*** spp. were screened for resistance and recovery following artificial inoculation with cultures of the fungus grown on sterile grain. The results of field tests in 1974 are presented here.

[1] ***Contribution No. 592, Research Station, Agriculture Canada, 107 Science Crescent, Saskatoon, Saskatchewan S7N 0X2.***

Materials and methods

Plant materials

Tests 1, 2, and 3 included 99 accessions of ***P. pratensis*** cultivars and selections from many countries and the prairies of Canada. Test 1 comprised 65 accessions replicated six times in random fashion. In test 2, 17 lines were similarly replicated four times. In Test 3, 17 lines were replicated only twice. The numbers of replicates and the seeding rate were governed mainly by availability of seed. Seed was sown with a multiple belt seeder on 3 June 1971. Row spacing was 22.5 cm, row length 3.2 m, with four rows per plot. When established, the grasses were mown at 5 cm height, at first with a rotary mower mounted under a garden tractor and then with tractor-drawn reel mowers. Clippings were returned. Irrigation was supplied when needed. Plots were top-dressed in midsummer with a soil/sand/peat mixture to encourage turf formation. Although tests indicated adequate soil phosphate levels, 3 kg of 16-20-0 and 3 kg of 33-0-0 fertilizer per 100 m^2 were applied per annum.

Test 4 comprised 12 commercial cultivars and 12 selections of ***Poa pratensis*** in 1 m^2 plots replicated four times in a randomized block arrangement. Seeding rate depended on amount of seed available. Seed was sown by hand broadcasting in June 1972. Fertilization was similar to Tests 1, 2, and 3; mowing was done with a domestic rotary or small, self-propelled reel mower to 5 cm height. Clippings were returned.

Test 5 comprised 6 cultivars and 10 selected lines of F. *rubra* (56-and 42-chromosome types) and 3 lines of F. *ovina* in 1 m^2 plots replicated four times in a randomized block arrangement. Seeding, fertilization and mowing were identical with that in Test 4.

Test 6. Where seed was in shorter supply than in Test 5, it was only possible to sow duplicate plots of a further 12 lines of F. *rubra* and four of F. *ovina.* Seeding, mowing and fertilizing were the same as in Tests 4 and 5.

Tests 7 and 8. Where seed from only a few plants was available or that available was of poor germination, it was sown in soil in 30 X 42 cm greenhouse flats. This sowing was done in late winter; when coherent turf was available in spring, it was removed from the flat and laid on a levelled soil bed. With suitable topdressing and judicious mowing, a well-grown turf became available for testing in the fall of the same year. Test 7 comprised 48 lines of *P. pratensis.* Test 8 comprised 37 lines of *F. rubra* and 7 of F. *ovina.* In both tests, each line was replicated three times.

Inoculation

The LTB isolate Ju714a used to establish an epidemic was derived from diseased patches of *Agrostis* sp. from the sixth green at the Golf and Country Club, Moose Jaw, Saskatchewan, in spring 1971. It had been proved highly pathogenic on *P. pratensis* and *F. rubra* in seasons previous to 1973 (6). It was grown on sterile, moist rye grain in 1.14 liter milk bottles at 6°C for 3 months, air-dried, crushed, and stored at -10°C until required. Seventeen kilograms of the dried inoculum was applied to 2125 m^2 (8 g/m^2) of the test areas by hand broadcasting in several directions on 5 and 7 September 1973.

Rating for disease

This was done on 23 April and 6, 15, and 24 May 1974. The percentage area affected by the disease was recorded.

Results

Susceptible strains of *P. pratensis,* and *F. rubra,* and *F. ovina* were heavily damaged by the LTB isolate in all tests (Tables 1 to 8 and Figs. 1, 2, & 3). Many of the F. *rubra* and some of the F. *ovina* strains showed more than 80% damage (Tables 5, 6, & 8 and Fig. 1) on 23 and 29 April, 2 and 3 weeks respectively after the snow cover had gone. However *P. pratensis* strains (Tables 1, 2, 3, 4, & 7 and Fig. 1) generally did not show as much initial damage and they recovered more rapidly from damage. This is apparent when percent damage for the *P. pratensis* strains on 15 May (Tables 1, 2, 3, & 4) is compared with that for F. *rubra* and *F. ovina* on the same date (Tables 5 & 6). Similar differences in rate of recovery are apparent when data for *P. pratensis,* F. *rubra* and *F. ovina* are compared in the microplot tests (Tables 7 & 8, and Fig. 3). In some tests, a strain was entered twice with seed from different lots; for example IH 2079, Primo (Table 1), Reptans (Table 5), Olds (Table 6), Dawson, Boreal, Goldfrood, Reptans, and Olds (Table 8). Differences between ratings of the same cultivar were not significant. None of the strains were completely resistant to the LTB, but the *P. pratensis* lines S-7763 (Table 1), S-8606 (Table 2), K35584 and K35605 (Table 7) showed high resistance and, except for K35605, rapid recovery from damage. F. *rubra* line S-1765 (Tables 6 & 8) and F. *ovina* lines 2069 (Table 5), 2065 (Table 6), S-1758, S-1733, S-1792, and S-3482 (Table 8) were outstanding in resistance. In some of the moderately resistant *P. pratensis* strains, eg. in those with initial ratings of less than 40% infection (Table 1), recovery was generally rapid.

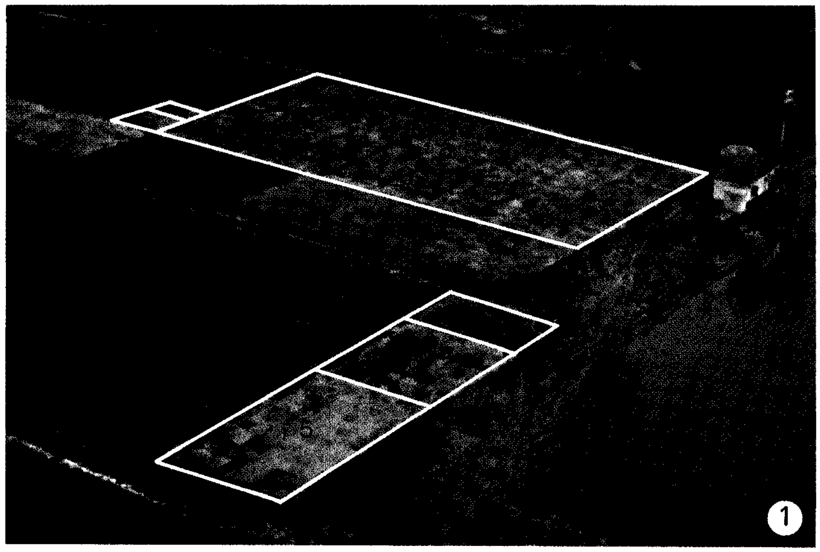
Discussion

The considerable differences in susceptibility to the LTB snow mold found among strains of *P. pratensis,* F. *rubra,* and *F. ovina* and in rate of recovery from damage suggest that field pathogenicity tests of the kind employed are suitable for the selection of disease resistant lines. The row method of seeding employed in Tests 1, 2, and 3 permitted additional data to be obtained on susceptibility of entries to powdery mildew *[Erysiphe graminis* DC. ex Mérat] and rust *[Puccinia poae-nemoralis,* Otth.]; in the central prairie region these diseases are much more prevalent on *Poa pratensis* in spaced rows than in mown turf. Row seeding also allows the formation of turf from smaller amounts of seed than conventional broadcast sowing. Additional data may also be obtained on rapidity of turf formation by selections. The knitting together of turf may be encouraged by top-dressing. However, mature turf suitable for inoculation and disease studies may require several years to develop. Both the row seeding and the microplot method (Tests 7 and 8) minimized risk of test failures due to "washout", common in this region, and eliminated the need to await calm conditions necessary for successful multiple plot seedings. The microplot technique provided a very effective rapid screening

Figure 1. Aerial view of low-temperature basidiomycete (LTB) test plots on 29 April 1974, about 3 weeks after snow melt. Some recovery is apparent in *Poa pratensis* lines in particular (Tests 1-4). Key to test plots: 1-4, 7 *Poa pratensis*; 5,6,8 *Festuca rubra* and *F. ovina*.

Figure 2. LTB test plots, 8 May 1974. *Poa pratensis* plots (Test 4) below line; Festuca spp. plots (Tests 5 and 6) above line. Considerable recovery has taken place in several *P. pratensis* lines, less frequently in fescues.

Figure 3. LTB test plots, 8 May 1974. Microplots of Festuca spp. (Test 7) below line; microplots of *Poa pratensis* (Test 8) above line. Considerable recovery has occurred in most *P. pratensis* lines and in some Festuca spp. lines.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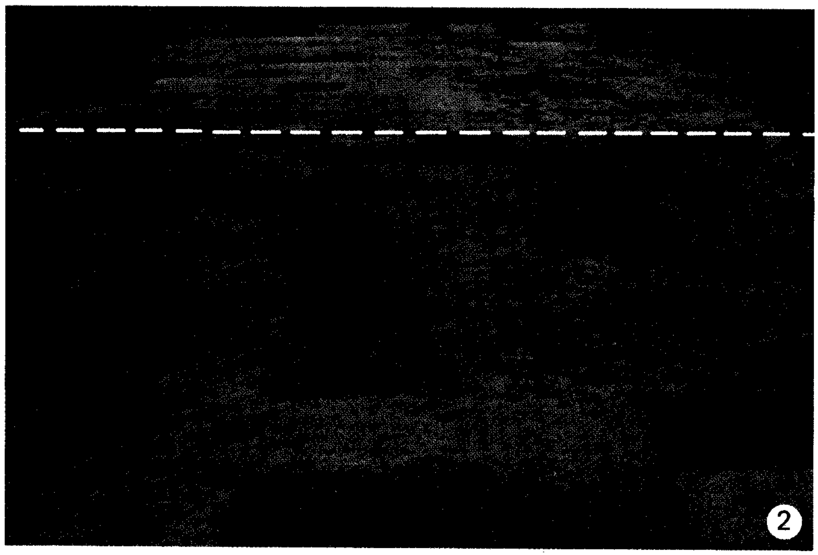
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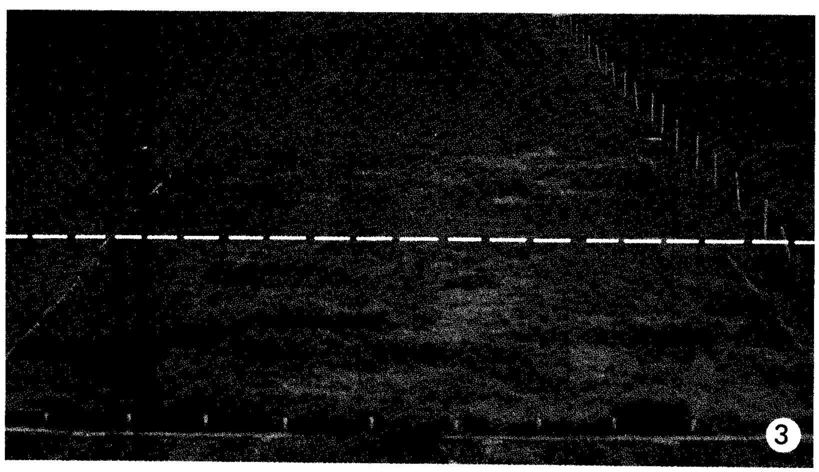
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Table 1. Resistance and recovery of ***Poa pratensis*** lines from LTB snow mold, 1974: Test 1 (6 replicates)

Cultivar or line	Origin'	Percent area of turf affected 23 Apr	6 May	15 May	Avg
S-7763	USSR	16	7	1	8
S-7766	Canada	27	19	5	17
Park	USA	29	18	8	18
Norma Øtofte	Denmark	27	24	7	19
Mostovskij	USSR	38	18	3	19
Hunsballe	Denmark	30	25	4	20
Captan	Neth.	41	16	3	20
s-7759	Canada	38	21	2	20
S-7764	Canada	31	24	6	20
IH 2079	Canada	34	22	5	20
EFS64	Denmark	34	25	5	21
Kahnstein	Germany	33	24	8	22
Skandia II	Sweden	35	25	6	22
Delta	USA	32	25	10	22
K22011	USSR	43	23	6	23
S-7760	Canada	38	30	3	23
S-8598	Canada	30	26	19	25
S-7762	Canada	37	29	9	25
S-7767	Canada	40	29	8	26
Delft	Neth.	36	28	15	26
IV-89-61	Hungary	33	32	16	26
S-8595	Canada	33	27	19	26
S-7765	Canada	41	28	13	27
Line 59	Neth.	29	32	22	27
Adorno	Neth.	38	27	18	27
S-8596	Canada	46	30	8	28
IH 2079	Canada	36	34	7	28
K35603	Estonia	40	34	13	29
Troy	USA	51	28	9	29
S-8597	Canada	41	27	12	30
S-8599	Canada	34	32	13	30
Atlas	Sweden	39	33	18	30
Golf	Sweden	42	35	17	31
SK 46	Poland	41	30	13	31

Table 1 (continued)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	Avg
Tygera	USSR	30	33	32	31
S-8600	Canada	40	37	18	32
Kentucky	USA	37	36	23	32
K 31808	Latvia	43	33	23	33
S-8611	Hungary	48	35	18	33
S-7758	Canada	48	33	21	34
Steinacher	Germany	49	41	13	34
RVP	Belgium	44	40	25	36
MLM 18006	Unknown	36	48	26	37
Arista	Neth.	45	43	23	37
Baron	Neth.	36	41	27	38
Windsor	USA	44	44	25	38
Primo	Sweden	41	40	33	38
S-8601	Canada	48	48	18	38
Monarch	England	42	42	32	39
S-7761	Canada	41	48	28	39
Nike Daehnfeldt	Denmark	49	47	22	39
Newport	USA	45	44	31	40
Sydsport	Sweden	43	49	35	42
Nugget	USA	48	43	38	43
S-8591	Canada	48	44	40	44
Primo	Sweden	50	52	33	45
S-8592	Canada	53	51	32	45
S-7756	Canada	54	51	40	48
Fylking	Sweden	55	47	46	49
S-5894	Canada	61	51	39	50
S-7768	USSR	65	58	32	51
MLM 18005	Unknown	63	48	41	51
s-7757	Canada	53	51	32	52
IV-89-24	Hungary	61	55	43	53
Barkenta	Neth.	65	64	56	62
LSD 1%		30	29	21	

'Neth = The Netherlands

method for lines where seed supply was short. Turf can be produced in the winter for planting the following spring. The method probably suffers from deficiencies inherent in very small plot studies; there is an "edge effect" and great heterogeneity in resistance and susceptibility between adjacent components in a small area. This probably affects the progress of the infection. So far no satisfactory laboratory or greenhouse technique has been developed which can satisfactorily simulate the conditions of turf under a snow cover, which is necessary for this disease to develop. In culture the LTB isolate used produces hydrocyanic acid, which is probably important in pathogenesis.

Of the ***P. pratensis*** strains tested, S-7763, an introduction from the Murmansk region of the USSR, showed high resistance and recovery in the row-seeded (Table 1) and broadcast (Table 4) tests. This strain in these, and other tests, shows early winter dormancy and more rapid spring regrowth than any other strain so far tested at Saskatoon. These are probably desirable characters for this region. It shows high resistance to ***E. graminis*** and moderate resistance to ***P. poae-nemoralis*** in seed rows (unpublished). It is an excellent seed producer and highly apomictic. Other lines showed considerable resistance and quick recovery from damage or, while apparently susceptible to attack, showed quick recovery from damage. For example, in the broadcast seeded plots an introduction from Italy, S-8606, rated significantly better in both characters than the cultivars Prato, Cougar, and Fylking (Table 2). In the microplot tests (Table 7), K35584 from the USSR was outstanding in resistance and recovery from damage, but six other lines from the USSR, Canada, and the USA, namely K35605, 19, C68-79, 2, K28704, and 145, had fair resistance, and, except for K35605, good recovery.

The poor resistance and slow recovery of many well known ***P. pratensis*** strains, some of which are commonly sold for turf formation in the prairies, are major findings

Table 2. Resistance and recovery of *Poa pratensis* lines from LTB snow mold, 1974: Test 2 (4 replicates)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	Avg
S-8606	Italy	20	6	3	10
S-8604	Italy	26	13	5	15
S-8605	Italy	30	13	8	17
170	England	24	18	11	18
K28704	USSR	31	16	6	18
K27874	USSR	49	19	5	24
IV-89-59	Hungary	36	25	18	26
K27307	USSR	44	25	13	27
C68-79	USA	43	26	13	27
S-8602	USSR	46	33	19	33
Rogue	Canada	44	34	21	33
Dasas	Denmark	56	36	15	36
K35602	Estonia	54	45	30	43
K35604	Estonia	58	49	39	48
Prato	Neth.	65	45	41	50
Cougar	USA	64	53	48	55
Fylking	Sweden	64	49	53	55
LSD 1%		43	32	23	

Table 3. Resistance and recovery of *Poa pratensis* lines from LTB snow mold, 1974: Test 3 (2 replicates)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	Avg
S-7831	Unknown	28	23	6	19
S-8603	England	50	23	11	28
S-8741	Unknown	40	23	23	28
S-7840	Unknown	33	23	38	31
S-7835	Unknown	35	28	35	33
S-7839	Unknown	55	33	20	36
S-7830	Unknown	70	35	6	37
Stensballe	Denmark	65	33	15	38
S-7837	Unknown	60	43	18	40
S-8609	Canada	76	35	10	40
Merion	USA	55	40	28	41
S-7834	Unknown	63	38	33	44
S-8610	Canada	65	50	16	44
S-7832	Unknown	73	50	33	52
S-7838	Unknown	68	45	43	52
S-7836	Unknown	63	58	40	53
S-7833	Unknown	83	65	30	59

of the tests. Many of these were developed for use in turf or pastures elsewhere. Barkenta, Fylking, Primo, Nugget, Sydsport, Windsor, and Baron (Table 1); Fylking and Cougar (Table 2); Merion (Table 3); and Cougar, Merion, Baron, Arista, Fylking, Barenta, Nugget, Primo, and Sydsport (Table 4) performed poorly. Some of these have received good ratings for resistance to certain diseases (2) that do not usually cause significant damage in the Saskatoon region or in adjacent areas with similar climatic conditions. On the other hand, the superior performance of Park (Tables 1 & 4), Captan (Table 1), and Delta (Table 4) is apparent.

All *F. rubra* strains tested (Tables 5, 6, and 8), except S-1765 (Tables 6 and 8), a 1947 introduction from Kazakstan in the USSR, showed heavy damage following snow melt. The only cultivar which approached S-1765 in resistance was Arctared, but strains K34675, K25236, and K22609 (Talbe 5) showed a significantly faster rate of recovery than any other strains in Test 5, including all Canadian cultivars.

The *F. ovina* L. var. *saximontana* Rydb. entries 2069 (Table 5) and 2065 (Table 6), which were Saskatchewan selections from the Cypress Hills, S-1758, S-1733, and S-1792 from Kazakstan in the USSR, and S-3482, a hard fescue, *F. ovina* var. *duriuscula* L., of unknown origin (Table 8) showed considerably greater resistance to LTB damage than the remainder. The cultivar Barenza and the strain 2107 (Tables 6 & 8) suffered severe damage which resulted in death of most of the turf on these plots.

Of the winter diseases, snow mold caused by the LTB is probably the most prevalent in the prairies on bluegrass/fescue turf commonly used in the formation of domestic lawns and other irrigated amenity turf. It is also the most difficult to control. Particularly in a cool, dry spring following heavy damage recovery is slow and turf may be severely thinned out. Observations of field cases suggest that the prolongation of vegetative growth into late fall by heavy or late summer nitrogen applications increases turf susceptibility to LTB, as with disease caused by *Fusarium nivale* (3). Winter dormancy is a mechanism related to the survival of the perennial grasses through an unfavorable period when turf is prone to attacks of psychrophilic fungal pathogens. The onset of this dormancy is signaled by a slowing of leaf production and by leaf death and attendant chlorophyll loss, which may be referred to as "browning off". *P. pratensis, F. ovina,* and *F. rubra,* cool season grasses, do not have a complete winter dormant period and are capable of growth during the winter in mild, bright periods, for example, in midwinter thaws in "chinook" regions. However, the earliness and completeness of the "browning off" process in early winter varies from strain to strain. Since it is thought that pathogenesis in the LTB is related to tissue damage from hydrocyanic acid production (7), it is possible that this production is dependent on the chemical composition or condition of the substrate (the turf grass plant), which may influence the amount of plant damage caused. Early and deep dormancy may also conserve soil nitrogen and husband stored plant food reserves which allows rapid "take-off"

Table 4. Resistance and recovery of ***Poa pratensis*** lines from LTB snow mold, 1974: Test 4 (4 replicates)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	Avg
S-7763	USSR	28	6	0	11
IH2079	Canada	29	26	4	20
S-7760	Canada	39	23	8	23
s-7759	Canada	39	24	13	25
Delta	USA	40	26	15	27
Park	USA	48	31	15	31
K35603	Estonia	61	25	9	32
S-8596	Canada	45	15	9	33
K35602	Estonia	60	45	28	44
Sydsport	Sweden	50	58	46	51
Primo	Sweden	55	56	43	51
Steinacher	Germany	73	55	35	54
Nugget	USA	61	53	51	55
Barkenta	Neth.	81	68	49	59
K35604	USSR	69	73	45	62
S-8591	Canada	68	62	58	62
Fylking	Sweden	65	66	58	63
Arista	Neth.	69	70	55	65
Baron	Neth.	68	74	66	69
Merion	USA	78	73	65	72
S-7756	Canada	75	71	70	73
Line 59	Neth.	84	78	70	77
s-7757	Canada	88	80	76	78
Cougar	USA	83	83	83	83
LSD 1%		50	44	44	

Table 5. Resistance and recovery of ***Festuca rubra*** and ***Festuca ovina*** lines from LTB snow mold, 1974: Test 5 (4 replicates)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	24 May	Avg
F. rubra						
K34675	Latvia	90	38	9	13	27
K25236	USSR	80	30	10	4	31
K22609	USSR	83	53	19	9	41
K27390	Lithuania	79	68	39	35	55
K31197	USSR	90	79	48	40	64
Olds	Canada	88	81	58	63	69
S-7850	Canada	83	81	63	54	70
Reptans	Neth.	80	79	73	64	74
Reptans	Neth.	78	78	74	68	74
Durlawn	Canada	88	89	79	50	76
Dawson	England	94	86	76	53	77
Baron	Neth.	63	85	74	78	77
K35599	Estonia	95	89	70	61	79
Pennlawn	USA	88	91	83	76	84
Canada No. 1 (S-7374)	Canada	90	91	86	76	86
K31286	Latvia	99	94	91	63	87
MLM 15010	Unknown	91	93	92	92	92
F. ovina						
2069	Canada	4	33	3	8	12
1811-456	Armenia	45	40	29	25	35
562	Germany	97	92	86	68	86
LSD 1%		38	40	33	39	

Table 6. Resistance and recovery of ***Festuca rubra*** and ***Festuca ovina*** lines from LTB snow mold, 1974: Test 6 (2 replicates)

Cultivar or line	Origin	Percent area of turf affected 23 Apr	6 May	15 May	24 May	Avg
F. rubra						
S-1765	**U.S.S.R.**	15	15	15	15	15
Sceempter	Neth.	65	75	60	60	65
1081	Canada	70	85	55	60	68
1079	Canada	85	90	70	50	74
Duraturf	U.S.A.	100	93	70	55	79
Olds (1098)	Canada	100	90	80	50	80
Oasis	Neth.	100	97	78	55	82
1120	Canada	90	93	85	87	86
1118	France	90	93	88	75	86
1111	Canada	95	93	85	75	87
KL257	Unknown	95	95	85	80	89
Olds (1084)	Canada	100	95	88	75	89
F. ovina						
2065	Canada	13	10	8	10	10
2066	Canada	28	70	40	30	42
2107	Neth.	95	98	85	85	91
Barenza	Neth.	90	98	93	95	94
LSD 1%		55	35	49	51	

in growth and hence recovery from disease damage in spring when favorable climatic conditions occur.

Because of different climatic conditions and a different range of snow mold and other pathogens, including the LTB and a highly pathogenic ***Typhula*** sp. at present designated ***Typhula*** FW (6), ***P. pratensis, F. rubra,*** and ***F. ovina*** cultivars recommended for use elsewhere should not be employed for turf formation on the prairies on a large scale without adequate regional testing. Varietal descriptions may be faulty when the generic term "snow mold" is used to indicate disease resistance without specifying which pathogen is concerned.

Acknowledgments

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Literature cited

1. Cormack, M. W. 1952. Winter crown rot or snow mold of alfalfa, clovers and grasses in Alberta. II. Field studies on host and varietal resistance and other factors related to control. Can. J. Bot. 30:537-548.
2. Ormrod, D. J. 1973. Diseases of lawns. British Columbia Dep. Agr., Victoria, B.C. 7 pp.

Table 7. Resistance and recovery of ***Poa pratensis*** lines from LTB snow mold 1974: Test 7 (Microplot, 3 replicates)

Cultivar or line	Origin	Percent area affected 24 Apr	6 May	Avg.
K35584	USSR	5	0	2
K35605	USSR	10	7	8
19	Canada	18	3	11
C68-79	U.S.A.	17	5	11
2	Canada	20	3	12
K28704	U.S.S.R.	18	7	12
14	Canada	18	10	14
21	Canada	23	10	16
K27307	U.S.S.R.	22	17	19
K27397	U.S.S.R.	30	10	20
18	Canada	25	15	20
145	Canada	37	7	22
74	England	27	20	23
S-8610	Canada	22	25	23
16	Canada	33	15	24
23	Canada	38	13	26
73	England	27	27	27
20	Canada	38	17	27
17	Canada	40	15	28
15	Canada	40	17	28
S-7844	Canada	42	18	30
K28748	U.S.S.R.	38	22	30
1	Canada	40	20	30
22	Canada	40	22	31
IV-89-59	Hungary	40	22	31
K28748	U.S.S.R.	43	22	32
80	U.S.S.R.	37	28	32
72	England	43	28	36
Dasas	Denmark	43	28	36
S-7845	Canada	48	23	36
K27874	Lithuania	47	27	37
Fylking	Sweden	43	33	38
9	Canada	47	32	39
141	Hungary	43	37	40
83	U.S.S.R.	43	43	43
81	U.S.S.R.	50	42	46
71	Hungary	60	37	48
79	U.S.S.R.	53	47	50
78	U.S.S.R.	57	52	54
Stensballe	Denmark	63	45	54
IV-89-24	Hungary	60	52	56
S-8609	Canada	67	53	60
136	Hungary	70	53	62
85	U.S.S.R.	70	60	65
Prato	Neth.	77	57	66
82	U.S.S.R.	75	63	70
131	U.S.S.R.	77	68	72
77	U.S.S.R.	82	70	76
LSD 1%		47	38	

Table 8. Resistance and recovery of ***Festuca rubra*** and ***Festuca ovina*** lines from LTB snow mold, 1974: Test 8 (microplots, 3 replicates)

Cultivar or line	Origin	Percent area of turf affected 24 Apr	6 May	Avg.
F. rubra				
S-1765	U.S.S.R.	2	10	6
Arctared	U.S.A.	30	20	25
Oasis (1108)	Neth.	32	23	28
Boreal (1105)	Neth.	50	33	42
Duraturf	U.S.A.	47	38	43
1084	Canada	58	33	46
Dawson (1133)	England	52	40	46
1120	Canada	53	42	48
Golfrood (1079)	Neth.	53	43	48
Dawson (1104)	England	60	38	49
s59	U.K.	62	38	50
Pennlawn (1087)	U.S.A.	60	43	52
Sceempter	Neth.	67	38	53
Pennlawn (1078)	U.S.A.	68	38	53
1101	U.S.A.	60	48	54
1114	Canada	60	53	57
Polar	U.S.A.	70	43	57
Golfrood (1103)	Neth.	62	53	58
Boreal (1106)	Canada	67	48	58
1108	Neth.	67	48	58
1112	Canada	62	53	58
1102	Canada	70	50	60
1111	Canada	73	52	63
s-7374	Canada	67	60	63
KL257	Unknown	73	55	64
Fallade	Neth.	72	57	64
Brabantia	Neth.	77	60	68
Ruby	U.S.A.	72	63	68
Reptans (1095)	Sweden	78	61	70
Reptans (1098)	Sweden	82	63	73
Agio	Neth.	80	65	73
Olds (1097)	Canada	77	70	73
Olds (1098)	Canada	70	67	73
1118	France	85	63	74
MSG Flevo-2	Neth.	82	67	74
Novorubra	Neth.	90	67	78
Highlight	Neth.	90	77	83
F. ovina				
S-1758	U.S.S.R.	2	0	1
S-1733	U.S.S.R.	2	5	3
S-1792	U.S.S.R.	3	7	5
Durar	U.S.A.	7	13	10
Biljart	Neth.	27	23	25
Barenza	Neth.	65	65	65
2107	Neth.	70	65	68
LSD 1%		44	49	

3. Smith, J. Drew. 1957. The control of certain diseases of sports turf grasses in the British Isles. M.Sc. Thesis, University of Durham. 266 pp.
4. Smith, J. Drew. 1973. Overwintering diseases of turfgrasses in Western Canada. Pages 96-103 *in* Proc. 25th N.W. Turfgrass Assoc. Conf., Harrison Hot Springs, British Columbia. 1973.
5. Smith, J. Drew. 1974. Winter diseases of turfgrasses. Pages 20-25 in 25th Annu. Nat. Turfgrass Conf., Roy. Can. Golf Assoc., Winnipeg, Manitoba 1974.
6. Smith, J. Drew. 1974. Snow molds of turfgrasses in Saskatchewan. Pages 313-324 *in* E.C. Roberts, ed., Proc. 2nd Intern. Turfgrass Res. Conf., Blacksburg, Virginia. June 18-21, 1973. Amer. Soc. Agron.
7. Ward, E. W. B., and J. B. Lebeau. 1962. Autolytic production of hydrogen cyanide by certain snow mold fungi. Can. J. Bot. 40:85-88.