Barley smuts in Manitoba and eastern Saskatchewan, 1975-77[1]

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Losses from barley smuts in Manitoba and eastern Saskatchewan were calculated to be 0.9% in 1975, 0.6% in 1976 and 0.5% in 1977. The incidence of ***Ustilago nuda*** remained low, despite the predominance of a biotype that was virulent on all varieties that were commercially important in the survey area. Bonanza appears to be more susceptible than Conquest to the current population of surface-borne smuts.

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Les pertes causees par les charbons aux cultures d'orge du Manitoba et de l'est de la Saskatchewan ont été évaluées a 0.9% en 1975, 0.6% en 1976 et 0.5% en 1977. La frequence de ***Ustilago nuda*** demeure faible malgre la dominance d'un biotype qui manifeste de la virulence envers toutes les variétés commerciales importantes. Bonanza semble être plus sensible que Conquest a la population actuelle de charbon portee à la surface des grains.

Annual losses due to the barley smut fungi ***(Ustilago nuda*** (Jens.) Rostr., ***U. nigra*** Tapke, and ***U. hordei*** Pers. (Lagerh.)) in Manitoba and Saskatchewan were less than 1% during the period **1969-74 (1).** The major change in the distribution of smut, during this period, was an increase in incidence on six-rowed varieties, accompanied by a decrease on two-rowed varieties. A new biotype of ***U. nuda,*** virulent on varieties possessing the Jet type of resistance, was first detected in **1972** and was found to be widespread in **1973.**

Surveys were conducted in Manitoba and eastern Saskatchewan in **1975, 1976** and **1977.** The objectives of these surveys were to estimate losses caused by the smut fungi on barley, to observe changes in the incidence of the biotype of ***U. nuda*** virulent on Jet and to collect smutted spikes to test for virulence patterns on varieties of current commercial importance.

Incidence of smut in farm fields

An estimate of the percentage of smutted plants was made while walking an ovoid path of approximately **100** m in each field. Levels of smut greater than trace were estimated by counting plants in a 1 m^2 area at at least two sites on the path.

Smut was found in a majority of fields examined each year (Table 1). Both the proportion of fields affected and the mean percentage of smutted plants decreased in **1977,** despite the high proportion of fields that were affected in **1976.** This reduction was probably due to a decrease in infection by ***U. nuda*** and ***U. nigra*** (Table **2).** The mean percentage of plants infected by ***U. hordei*** appears to have increased slightly. The two-rowed varieties continued to exhibit less smut than the six-rowed varieties.

Virulence of *U.* nuda

The method of inoculating barley with ***U. nuda*** was described previously **(1).**

The collections of ***U. nuda*** from **1974-77** were screened on Conquest, to determine those that were capable of infecting varieties with resistance from Jet. The results, compared to those from **1972-73 (1),** are shown in Table **3.** The biotype that is virulent on Conquest has become predominant in the survey area. However, the number of farm fields affected by ***U. nuda*** remains low (Table **2).** Therefore, the predominance of this biotype, despite its virulence on all varieties of commercial importance, does not appear to pose a threat to barley production.

The survey collections of ***U. nuda*** from **1975-77** were also screened on CI **13662,** a variety carrying the ***Un8*** gene for resistance to loose smut. None of the collections smutted this variety, indicating that ***Un8*** can be used when breeding for resistance to ***U. nuda.***

Virulence of *U. hordei* and *U. nigra*

According to reports by the three Pool Elevator Companies, the varieties Bonanza, Conquest, Fergus and Herta accounted for at least **90%** of the area sown to barley in Manitoba from **1972-77.** The survey collections of *U. hordei* and *U. nigra* from **1974-76** were therefore screened on these varieties to detect the potential effects of current strains of smut on these varieties. Inoculations were done as described previously **(1),** using **200** ml of inoculum, in a Waring Blendor, for each **200** seeds. The infection data for each year were averaged (Table 4) because (a) the bulk of the data could be reduced in this manner, (b) the individual collections yielded data that were similar in infection level and pattern to those found for the **1972** collections **(1).** and (c) the averages

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Table 1. Incidence of smut in barley in Manitoba and eastern Saskatchewan, 1975-77

Year	Number of fields examined		% of fields affected			Mean % smutted plants		
	2-rowed	6-rowed	2-rowed	6-rowed	All varieties	2-rowed	6-rowed	All varieties
1975	43	80	56	80	72	0.2	1.2	0.9
1976	42	102	55	86	77	0.1	0.9	0.6
1977	19	39	21	74	57	0.2	0.7	0.5

Table 2. Incidence of three species of *Ustilago* on barley in farm fields, in Manitoba and eastern Saskatchewan, 1975-77

Ustilago species and type of barley affected		% fields affected			Mean % smutted plants		
		1975	1976	1977	1975	1976	1977
U. nuda	2-rowed	21	19	0	tr*	tr	0
	6-rowed	15	13	5	0.4	tr	tr
	all varieties	16	15	3	0.3	tr	tr
U. nigra	2-rowed	14	29	0	0.1	tr	0
	6-rowed	65	67	23	0.4	0.4	tr
	all varieties	47	56	16	0.3	0.3	tr
U. hordei	2-rowed	35	14	21	0.1	tr	0.2
	6-rowed	40	58	46	0.5	0.5	0.7
	all varieties	38	45	38	0.3	0.3	0.5

*tr = trace, <0.1%

Table 3. Infectivity to Conquest barley of *U. nuda* samples collected from farm fields in Manitoba and eastern Saskatchewan, 1972-77

Year	# of samples	% of samples infecting Conquest
1972	18	17
1973	55	22
1974	23	43
1975	21	57
1976	21	57
1977	4	50

illustrate the infection potential of the natural populations.

The results from 1974-76 for the two-rowed varieties corroborate those from 1972 in showing that Fergus is less susceptible, to the surface-borne smuts, than Herta. In four years of tests, *U. hordei* caused 31-63% less smut on Fergus than on Herta, while *U. nigra* caused 48-71% less.

The six-rowed variety Conquest was consistently less smutted than Bonanza, ranging from 17-25% less for *U. hordei* and 25-40% less for *U. nigra* (Table 4). The two varieties were previously thought to have the same reaction to smut because the relatively low level of infection rendered their difference in resistance difficult to recognize when dealing with individual collections. The difference in resistance would help to explain the previous report of an increase in smut on six-rowed varieties versus two-rowed varieties (1), because the area sown to Bananza in Manitoba increased from zero in 1969 to 34% in 1977 while Conquest decreased from 61% to 20% during the same period (data reported by the Federal Grain Company 1969-71 and the three Pool Elevator Companies, 1972-77).

The yearly variation in mean percentage infection on individual varieties (Table 4) probably reflects differences in the environmental conditions under which the tests were grown, rather than variations in virulence levels caused by different biotypes in the survey collections.

Table 4. Infectivity on four barley varieties of samples of the surface-borne smuts collected from farm fields in Manitoba and eastern Saskatchewan, 1972-76

	% infection by *U. hordei*					% infection by *U. nigra*				
Year	#of collections	Bonanza	Conquest	Fergus	Herta	#of collections	Bonanza	Conquest	Fergus	Herta
1972	26	12	9	7	19	21	8	6	8	28
1974	69	8	6	6	10	57	10	6	8	16
1975	43	12	10	9	13	59	18	12	11	21
1976	82	16	12	9	23	79	15	10	18	43

Conclusions

These survey results show that a majority of fields are affected each year, by strains of smut fungi that are capable of causing serious losses. However, losses from barley smuts continue to be less than 1% per year. The factors that will maintain this low yield loss are: environmental conditions that decrease the incidence of smut, effective use of seed-treatment fungicides by the growers and the release and promotion of resistant varieties.

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Literature cited

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