



Leaf Rust Lesions in a Susceptible Variety.

The Severity of

WHEAT LEAF RUST IN NORTH DAKOTA

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Each year leaf rust of wheat caused by *Puccinia recondita* Rob. ex. Desm. f. sp. *tritici* reduces the yield and quality of our wheat crop (3, 4, 5). No accurate estimate of losses has been reported for North Dakota, but yield losses in the spring wheat areas of the United States and Canada have been estimated at 40 million bushels annually (3). Yield reductions have been approximately proportional to leaf rust severity (2, 5).

Wheat plants become infected in the early summer when leaf rust uredospores are blown northward from rusted fields south of our state. Conditions necessary for infection include virulent spores, susceptible wheat plants, several hours of moisture on the leaves and proper temperatures. The rate at which leaf rust develops throughout the summer determines the rust severity for that year. This development is conditioned by the number of mild or warm nights with dew formation

and, more importantly, by the genes for resistance or susceptibility in the presently grown wheat varieties. Leaf rust development is rapid if susceptible wheat varieties are grown over large acreages and favorable weather conditions prevail.

Developing leaf rust resistant varieties through breeding has been a good method of controlling this disease. However, rust resistance has not been permanent because the leaf rust pathogen continues to develop new races which may attack a newly developed wheat variety (3). These new races of the leaf rust fungus increase rapidly if they are able to attack a new variety grown over large acreages (1). When this new race increases in the leaf rust population, the variety will be susceptible and heavily rusted. New genes for resistance must then be incorporated into wheat varieties to add the necessary resistance.

Materials and Methods

Commercial wheat fields throughout North Dakota were surveyed for leaf rust during the summer of 1970. Rust severity and host pathogen interactions were recorded on several wheat varieties

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grown in yield trials at six branch stations in North Dakota. Leaf rust ratings were also recorded on winter wheat grown at Casselton.

One hundred eighty leaf rust cultures were collected throughout the state. Single pustule isolates of these cultures were used to identify Unified Numeration (U.N.) races of leaf rust based on resistance or susceptibility of lines with host genes Lr1, Lr2, Lr2D and Lr3.

Results and Discussion

Wheat leaf rust was more severe at the eastern branch stations and at Minot as shown in Table 1. The variety Thatcher, susceptible to prevalent races of leaf rust, was rated 40S at both Williston and Dickinson, 60S at Minot and Carrington, 70S at Fargo and 80S at Langdon. More leaf rust was present on varieties such as Selkirk, Manitou, Justin, Wamduska and Neepawa at the eastern branch stations. Leaf rust surveys taken throughout the summer of 1970 also indicated heavier leaf rust in the eastern part of the state. The first survey taken July 12-15 revealed leaf rust only in the eastern half of the state and at Minot. Surveys made in late July and early August showed that there was less leaf rust in the southwest corner of the state on both spring and winter wheat than was present in other areas of the state. Leaf rust was heavy, however, in certain areas of the west, i.e., north of Williston on Canthatch.

The need for resistant varieties was obvious when wheat fields were surveyed throughout the state. Many adjacent fields varied greatly in the amount of rust present. This variation was apparently due to varietal resistance or susceptibility. Further evidence for benefits obtained by the use of resistant varieties is shown quite clearly in the leaf rust ratings of Table 1. Resistant varieties were relatively free of rust at the same stations where susceptible varieties were heavily rusted.

The variety Waldron had excellent leaf rust resistance at all locations and Polk was also quite resistant (Table 1). Chris was more severely attacked this year than in previous years but still had good resistance. Several isolates of the fungus, virulent on adult plants of Chris, were collected for use in the winter testing program. As expected, the test varieties Exchange and Transfer had either 0 or trace amounts of rust.

The semidwarf varieties tested were generally resistant to leaf rust. Red River 68 and Bonanza had excellent resistance at all locations. Fletcher, Era and World Seeds 1812 had from trace amounts to 10 per cent severity.

The Canadian variety Neepawa was rated 5 per cent in the west and 20-25 per cent in the east. Manitou had more rust than Neepawa and Selkirk was heavily rusted. All three varieties had both resistant and susceptible type pustules on the leaves.

Table 1. Reactions of 25 wheat varieties to leaf rust at 6 locations in North Dakota yield trials of 1970.

	Fargo	Langdon	Carrington	Minot	Williston	Dickinson
Spring Wheat						
Thatcher	70S	80S	60S	60S	40S	40S
Brevit	60S	30S	50M	tR	tM	15M
Lee	50S	50S	60S	25MS	10S	40S
Selkirk	40M	60M	40M	30M	20M	20M
Justin	40S	50S	50S	30S	15S	10S
Wamduska	40MS	40S	40S	40S	5S	15S
Manitou	30M	40M	30M	30M	20M	20M
Neepawa	20M	20M	25M	20M	5M	5M
W. S. 1812	10MR	tR	5MS	tR	tR	tR
Aniversario	10R	10R	10VR	tR	tR	5MR
Chris	5M	5R	2MR	2MR	2M	10MS
Polk	5MR	tR	tR	tR	tR	5MR
Fletcher	5R	10M	tR	3MR	5M	tMR
Era	3R	5R	2R	tR	5R	tR
Waldron	tR	tR	tR	tR	0	tR
Red River 68	tR	tR	tR	tR	tR	tVR
Exchange	tR	0	tR	0	0	tR
Transfer	0	0	tR	0	tR	0
Bonanza	0	tR	0	0	0	0
Durum						
Hercules	5MR	10MR	10S	5MS	tR	tR
Stewart 63	10VR	0	0	0	0	tR
Leeds	5R	tR	tR	tR	tR	0
Wells	5M	tR	tR	tM	tR	0
Ramsey	tVR	tR	0	0	0	tVR
Golden Ball	tVR	0	0	0	0	0

S equals susceptible; R equals resistant; t equals trace; M equals intermediate, both resistant and susceptible reactions; MR equals moderately resistant; MS equals moderately susceptible; VR equals very resistant. Severity is recorded as per cent of infection.

Thatcher was used as a susceptible check and was heavily rusted at all locations. Lee and Brevit were also severely attacked especially at the eastern branch stations. Justin and Wamduška had less rust than Thatcher but were still quite heavily rusted.

The durum varieties Leeds, Wells, Ramsey, Stewart 63, Golden Ball and Hercules did not rust heavily in the yield trials. However, ratings of 30S were recorded on Hercules grown near leaf rust susceptible wheat where the inoculum was high. Cultures of leaf rust which attacked the adult resistance of Leeds were also collected during the summer of 1970. Preliminary greenhouse tests indicate these cultures are quite virulent on both seedling and adult plants of Leeds.

Most of the winter wheat varieties tested were heavily infected with leaf rust. Winoka, rated 20MS, had less leaf rust than the other varieties. Karkof and Hume had less rust than most varieties but were still rated 40MS.

Table 2. Leaf rust severity and reaction types of 13 winter wheat varieties grown at Casselton, North Dakota.

Variety	Severity & Reaction	Variety	Severity & Reaction
Froid	80S	Warrior	50S
Winalta	70S	Trader	50S
Yogo	70S	Scout 66	50S
Lancer	70MS	Cheyenne	50S
Minter	60S	Karkof	40MS
Trapper	60S	Hume	40MS
		Winoka	20MS

Eight different UN races of leaf rust were identified from a total of 180 isolates collected in 1970 (Table 3). The most prevalent races identified were 2 and 3. There were 119 isolates of race 2 and 44 of race 3. The remaining isolates consisted of UN race 1, 5, 7, 10, 17 and 25. More races would have undoubtedly been identified had more differentials been used.

Table 3. UN races of 180 leaf rust isolates collected during the summer of 1970 in North Dakota.

UN Race	Number Isolates
1	2
2	119
3	44
5	2
7	3
10	1
17	2
25	7

Table 4 shows the severity of leaf rust in 103 North Dakota wheat fields surveyed in late July

and early August. The differences in severity were apparently due to the susceptibility of the variety. Thirty seven fields had between 20 and 40 per cent severity and eight had between 50 and 80 per cent.

Table 4. Leaf rust severity of wheat fields surveyed during the summer of 1970 throughout North Dakota.

Severity %	Number Fields
0-t	20
5	12
10	13
15	12
20	14
25	5
30	8
40	10
50	2
60	4
70	1
80	1

Both yield and quality were undoubtedly severely reduced especially in fields with 50 to 80 per cent severity. In contrast, 45 fields surveyed had 10 per cent or less severity. This indicates that many growers throughout the state are taking advantage of current resistant varieties. However, other growers are still realizing losses in yield and quality by using susceptible varieties.

If resistant varieties are not available, leaf rust can be controlled by the use of any one of several protectant fungicides on the market. However, due to the cost of several applications necessary for control, fungicides should be used only if susceptible varieties are planted.

The choice of the best wheat variety is not an easy decision for any grower. The variety must yield well, be of excellent quality and be resistant to several destructive wheat diseases all under a wide variety of environmental conditions. Due to the destructiveness of wheat leaf rust the choice of a variety should be with regard to its resistance to this disease or the grower should plan to initiate a fungicide spray program to control leaf rust.

LITERATURE CITED

1. Anderson, R. G. 1961. **The inheritance of leaf rust resistance in seven varieties of common wheat.** Can. Jour. Pl. Sci. 41:342-359.
2. Caldwell, R. M., H. R. Kraybill, J. T. Sullivan, and L. E. Compton. 1934. **Effect of leaf rust (*Puccinia triticina*) on yield, physical characters and composition of winter wheats.** Jour. Agr. Res. 48:1049-1071.
3. Loegering, W. A., J. W. Hendrix and L. E. Browder. 1967. **The Rust Diseases of Wheat.** USDA Agr. Handbook. 334. 22 p.
4. Samborski, D. J., and B. Peturson. 1960. **Effect of leaf rust on the yield of resistant wheats.** Can. Jour. Pl. Sci. 40:620-622.
5. McDonald, W. C., J. W. Martens, G. J. Green, D. J. Samborski, G. Fleischmann and C. C. Gill. 1969. **Losses from cereal diseases and value of disease resistance in Manitoba in 1969.** Can. Plant Dis. Surv. 49:114-121.