

The current barley leaf disease situation in Saskatchewan, with emphasis on 'spot-form' net blotch (Pyrenophora teres).

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Introduction

In 1987, a barley leaf disease survey was conducted to determine where the net-form of net blotch and the spot-form of net blotch were predominant in Saskatchewan. Spot-type symptoms caused by Pyrenophora teres were described in Canada in 1967 and became common in eastern Manitoba during the 1970's (Tekauz and Mills, 1974). The spot-form has been found in northern Saskatchewan disease nurseries, over the last three years.

Materials and Methods

Kits containing 25 (20 sites) or 40 (7 sites) barley cultivars were mailed out to co-operating producers. These test lines were then planted on their farms on barley stubble. Plants were sampled at the flag leaf stage, if any disease was present, and at the soft dough stage, whether disease was present or not. Lines were chosen because they were susceptible resistant, or had a noticeably different reaction to the net-form or spot-form of net blotch, or they were scald resistant. Some were included because they had been used as differentials in other studies.

During the winter the presence of net-blotch biotypes was tested for. Spores were isolated from the leaf samples and used to infect a set of ten differential lines: Betzes, Bonanza, C.I. 5791, C.I. 9214, C.I. 9820, Elrose, Fr926-77, Heartland, Kwan Lung 2 and TR490.

Results and Discussion

Survey

Response was good, with diseased leaves obtained from 22 of 27 sites distributed throughout the province (see map). Diseased leaves were also obtained from 7 additional sites. Six fungal leaf diseases were identified: spot form net blotch (Pyrenophora teres f. maculata), net form net blotch (Pyrenophora teres f. teres), spot blotch (Cochliobolus sativus), scald (Rhynchosporium secalis), septoria (Septoria spp.) and leaf rust (Puccinia hordei). Information from the Compendium of Barley Diseases (Mathre, 1982) was used for identification. The characteristic nets of the net form were easily distinguished from the dark brown elliptical lesions of the spot form net blotch. However, the two forms have been known to cross and some of the progeny have an intermediate form (Smedegaard-Peterson, 1976). Since the sexual stage of the fungus occurs under Canadian conditions (Piening, 1968), the forms may be hybridizing here to produce intermediates as well. True spot blotch was suspected when a supposedly net-blotch resistant differential line had large spots.

The disease was then positively identified by microscopic spore examination.

Individual site information is given in Table 1. Spot form net blotch could be found at all sites surveyed throughout the province. Sixteen sites had moderate to heavy infections. Twelve sites had trace infections.

Scald was more common than expected. The northern sites of Lloydminster, Medstead, Marcelin, Rosthern, Watrous, Valpraiso and Edmonton had moderate to heavy scald but Meadow Lake, Mayfair and Shellbrook did not. Unexpectedly, two southerly sites, Saltcoats and Fairlight also had heavy scald infection.

The net form net blotch was less common than the spot form. Greater than trace infections were found at Saskatoon, one of the Shellbrook locations and three sites in the southeast; Stenen, Langenburg and Kipling. There is some evidence that when the spot and net forms are both present, the spot form will dominate. In fields surrounding heavily infected sites traces of net-form were found, but near heavily infected sites only spots were found. The spot-form was found further southwest than expected, at Macklin and Eston. Other disease surveys have indicated that the spot form is becoming more common (Tekauz and Mills, 1984; Tekauz, 1978).

True spot blotch was found in traces at numerous locations, but only at an epidemic level in one field near Regina. This may be due to its warmer optimum temperature for growth (Mathre, 1982). It is important to distinguish whether large spots on varieties considered resistant to Pyrenophora teres are due to a new virulent form of net-blotch or to true spot blotch since P. teres is better adapted and may become a greater problem. Ideally, our varieties should be resistant to both fungi.

A few leaf rust pustules were seen at sites throughout the province, even as far north as Meadow Lake. The disease was only heavy in the southeast at Stenen, Langenburg and Fairlight.

Traces of septoria were found throughout the province. As it did not affect a large percentage of the leaf area, no attempt was made to distinguish the species.

Biotypes

Variation in variety reaction was observed among the different locations during the summer. However, it is difficult to make proper comparisons between samples taken at different times from different environments confounded with other diseases. The winter comparisons, done in the growthroom, also provided evidence for different biotypes existing at different locations and for more than one biotype at a single site.

However, the results are inconclusive since the experiments were done at different temperatures and inoculum density varied. These factors can influence infection (Shipton et al., 1973).

Original work with net-form and spot-form net blotch indicated that their virulence pattern were different (Tekauz and Mills, 1974). Among each of these forms, different biotypes have been identified (Tekauz, 1978; Khan and Tekauz, 1982). Tekauz (pers. comm.) recently identified 32 different isolates of spot-form and 115 isolates of net-form. Differences have also been observed between seedling and adult reactions and due to leaf position (Tekauz, 1986). For instance, Bonanza, depending on the disease biotype, tends to be seedling susceptible and adult resistant and the resistance of Heartland to some spot-form biotypes lessens as it matures. Thus, the adult resistance of Bonanza and Heartland are similar, even though as seedlings Bonanza appears much more susceptible.

Although there appear to be lines which consistently have good resistance to all forms of spot form net blotch, it will be necessary to confirm this without the complications of true spot blotch contamination and variation due to leaf age, position and temperature. Tekauz (pers. comm) found no lines to be totally resistant to all biotypes.

Currently, there is no commercially available two-row barley variety with spot-form net blotch resistance. However, the line TR490, from the University of Saskatchewan breeding program, which has been granted an interim registration, has moderate resistance. Most available six-row barley varieties have fair to good resistance. Over the last three years, Heartland, Argyle, Leduc and Bonanza have been found to have the best resistance to the spot form. Resistance to biotype 858, a predominant net-form biotype is found in Heartland, Diamond and Norbert (Tekauz, 1986). Bonanza and Klages have adult resistance to this biotype.

Resistance to scald is found in Johnston, Leduc, Diamond, Empress, Duke and Winchester. Since these varieties do have occasional scald lesions, this situation should be monitored.

Conclusions

The main leaf disease problem of barley in Saskatchewan in 1987 was spot-form net blotch. Scald was a greater problem than expected.

This type of survey, when lines are grown and sampled by producers has several advantages. The varieties being sampled are known. The most aggressive biotype present, can be picked up by planting resistant lines. New varieties can be tested under situations where they will encounter disease. Information is collected inexpensively and awareness about diseases and the advantages of resistant varieties is increased in the community.

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Locations of Saskatchewan Barley Disease Survey Sites, 1987.

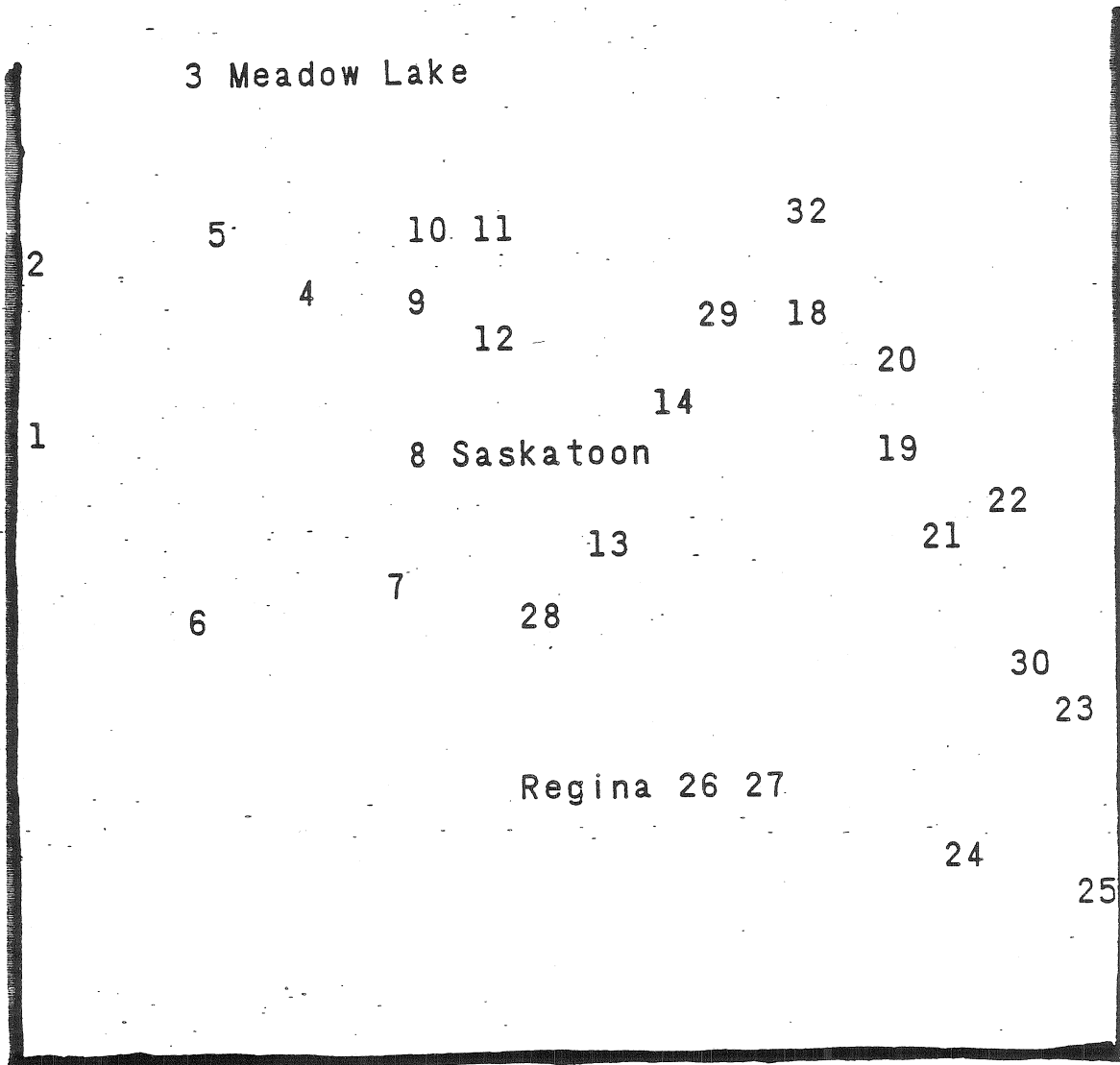


Table 1. Occurrence of barley disease in Saskatchewan, 1987

Disease	Sites with	
	Moderate to heavy infection	Trace infection
Spot form net blotch	* 1,5,7,8,9,10,11,18,19,20,21, 25,26,29,30,32	2,3,4,6,12,13,14, 22,23,24,28,31
Net form net blotch	8,11,22,23,24	2,3,4,5,7,9,10,14, 18,19,20,21
Spot blotch	27	1,2,3,4,7,8,9,11, 13,14,18,19,20,21, 22,25,30
Scald	2,5,9,12,13,18,25,30,31	1,4,7,8,10,14,20, 22
Leaf rust	22,23,25	2,3,7,8,9,14,21
Septoria	-	2,3,4,7,8,10,11, 12,14,18,19,20,21, 22,25

*1-Macklin, 2-Lloydminster, 3-Meadow Lake, 4-Mayfair, 5-Medstead, 6-Eston, 7-Outlook, 8-Saskatoon, 9-Marcelin, 10-Shellbrook I, 11-Shellbrook II, 12-Rosthern, 13-Watrous, 14-Lake Lenore, 18-Valpraiso, 19-Kelvington, 20-Porcupine Plains, 21-Rama, 22-Stenen, 23-Langenburg, 24-Kipling, 25-Fairlight, 26-Regina I, 27-Regina II, 28-Davidson, 29-Melfort, 30-Saltcoats, 31-Edmonton, 32-Nipawin.

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