DIDYMELLA STEM EYESPOT OF FESTUCA SPP. IN NORTHERN ALBERTA AND BRITISH COLUMBIA IN 1970 AND 1971'

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Abstract

Infection of red fescue (Festuca rubra) with the stem eyespot fungus, Didymella festucae (imperfect state, Phleospora idahoensis), was generally light in 1970 but severe in 1971 in the main seed-arowina areas of the Peace River region of Alberta and British Columbia. In- 1969- the disease had been severe. Disease severity was reflected in seed yield and dockage at a major seed cleaning plant. Actual yields in a very severely infected area near Beaverlodge, Alberta, in 1971 were only 20-25% of the expected yield. Infected native sheep's fescue (Festuca ovina var. saximontana) found in areas of sandy soil within the main seed-growing region seems the most likely natural inoculum reservoir for infection of introduced fescues. However, the more ecologically adaptable introduced red fescue planted along roadsides in the western Canadian provinces may pioneer infection corridors. In a fertilizer test using nitrogen, phosphorus, potassium, and sulfur on red fescue on sulfur deficient soil, nitrogen exercised the greatest influence in reducing disease. In another test within a heavily infected red fescue field, litter removal was ineffective in reducing disease severity.

Introduction

Surveys of the stem eyespot disease of seed crops of red fescue, Festuca rubra L., caused by Didymella festucae (Weg.) Holm (2, 5, 6) (imperfect state, Phleospora idahoensis Sprague) were made in 1969 (3). Yield estimates indicated that considerable seed losses could result from severe infections (2, 3).

Results

1970 Survey

In early September 1970 inspections were made of red fescue in stubble or on roadsides at 23 locations from Grande Prairie in northern Alberta to Fort St. John, British Columbia, and thence to 75 km west of Dawson Creek, B. C. Except for two places west of Dawson Creek less than 35% of stems (stubble) were infected. At 15 points incidence was 1% or less. At six places there was no disease. Berkenkamp (1) found light infections in a survey of nine fields earlier in the season in this region.

1971 Survey

Between 24 and 29 June 1971, 77 seed fields of red fescue in the Peace River regions of Alberta and British Columbia were surveyed for the disease. An estimate was made of the percentage of infected culms on samples plucked at random on one or more transects of each field: the acreage involved was also estimated (Table 1). Approximately half of the 67 fields surveyed in Alberta were very severely infected, whereas only 1 of the 10 in British Columbia was in this category. In Alberta most of the heavily infected fields were in the region 38 km north and south of Highway 2 from Hythe to Grande Prairie. Little infection was found in fields north of Highway 49 from Donnelly to the British Columbia border.

A second short survey was made in early August from Grande Prairie to Goodfare, Alta., near the British Columbia border. Of a total of 11 fields examined, 10 (225 ha) showed 100% stem eyespot incidence and one (32 ha) showed 90%.

Didymella stem eyespot was also found on a seed crop of red fescue near Valleyview, 105 km east of Grande Prairie. It occurred at several roadside locations on that species and on native sheep's fescue (F. ovina L. var. saximontana (Rydb.) Gleason,) as far south as Whitecourt, 272 km southeast of Grande Prairie. A disease rating of 1% was recorded in a hay crop 112 km north of Dawson Creek, British Columbia, off the Alaska Highway. Infected sheep's fescue was found 8 km south of Grande Prairie and on the north

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bank of the Redwil r River due south of Beaverlodge. This is e southern part of the main red fescue s 1-growing area.

The survey resu s indicate that the disease on seed crops as much more severe in 1971 than in 1970 id as severe as that reported in 1969 (3). This is reflected in the seed yield sta stics for the 3 years. Canadian seed product on of red fescue in thousands of metric ons (millions of lb. in brackets) was 5.1 (11 5) in 1969, 11.1 (25.0) in 1970, and 5.1 (11.5) in 1971 (data on production from Plant Products Division, Production & Marketing Branch, CDA, Ottawa!. Most Canadian red fescue seed is produced in Alberta and practically all of the remainder is grown in British Columbia. Estimated yields in kg/ha (lb/ac in brackets) of creeping red fescue seed produced in 1969, 1970, and 1971 were respectively: Alberta 140 (125), 246 (220), 118 (105); and British Columbia 129 (115), 375 (335), and 196 (175). These yields have been calculated from data supplied by the Alberta, British Columbia, and Canada Departments of Agriculture. Dockage figures from a major red fescue seed cleaning plant at Beaverlodge showed an average cleanout of 25% in 1969, 18% in 1970, and 32% in 1971 (personal communication, N. Foster, Foster's Seed & Feed, Beaverlodge, Alta., Jan. 1972). This fluctuation coincides with trends in disease severity shown by the surveys and with seed yields. At Fort St. John, B. C., average cleanout was 20% in 1971 and this probably reflects the lower disease ratings in British Columbia (Table 1). An estimate of yield made at heading on 180 ha of red fescue in the very severely diseased area near Beaverlodge in 1971 was 250-300 kg/ha; however only 60 kg/ha of clean seed was harvested (personal communication, N. Foster, Jan. 1972). While there is no doubt that total production of red fescue is influenced by factors other than disease, it is our experience, and that of growers, that once seed heads have been formed yields can usually be accurately predicted.

The significance of the finding of infected native sheep's fescue in the main red fescue seed-growing area is that the native grass is the likely natural reservoir of inoculum which infects the introduced species. However, it does not invalidate the possibility that "seed" borne transmission also occurs. It seems probable that the incidence of the disease on the introduced red fescue on roadsides is related to the presence of adjacent infected native sheep's fescue. It is also likely that the sowing of a susceptible, ecologically adaptable species such as red fescué on the sides of highways through areas of light sandy soil which harbor infected F. ovina serves to develop "infection corridors". These may pioneer the spread of infection to disease-free areas where fescue seed production is contemplated (6). The mowers used on road verges may be potent: instruments in short-distance disease transmission by infected stem fragments.

Effect of nitrogen, phosphate, potash, and sulfur fertilizers on the incidence and severity of the disease

Differences in the incidence and severity of stem eyespot were found in 1971 in a field test of red fescue designed to study the effects of fertilizers on seed yield.

Red fescue was seeded 20 June 1968 in 6-meter rows spaced 30 cm apart on a sulfur deficient, gray wooded sandy loam (Demmitt series) near Beaverlodge. Fertilizer treatments of P K S, N P K, and N P K S were applied at time of seeding at the following rates in kg/ha; N, 15; P, 20; K, 25; and S, 10. The fertilizer treatments were repeated in the autumns of 1969 and 1970 except for N which was applied at 30 kg/ha. Fescue shoots were clipped from all the rows on 28 June 1971 and 100 of the stems, drawn at random from each of the four replicates of each treatment, were rated for disease on the 0 to 3 scale used in a disease loss study (3). Treatment effects were determined by analysing infection index data calculated from the disease ratings (Table 2).

All fertilizer treatments lowered the eyespot index compared with no fertilizer. The decline was greatest where N P K S were applied, but the difference between the complete fertilizer and the N P K treatment was so small that it seemed that sulfur was not a major factor, even on this sulfur-deficient soil. On the other hand where N was omitted, as in the P K S treatment, the index increased sharply. It appeared from this that N was exercising a major influence on the disease index. The combination P K S reduced the disease index significantly but it was uncertain which of the nutrients had the greatest effect. Until further tests are made all that can be concluded is that nitrogen applications are likely to reduce the incidence of didymella stem spot.

Effect of mowing and litter removal

After harvest, in mid-September 1971, the effect of litter removal treatments on the disease were compared in a heavily infected commercial crop of red fescue near Beaverlodge. The previous crop has been heavily infected with stem eyespot. Treatments were replicated six times on 200-m^2 plots. Treatments following harvest were: 1) check, combined swath left on; 2) straw raked off; 3) and 4) mown at 5 cm, clippings returned (3) and removed (4); 5) and 6) mown at 10 cm, clippings returned (5) and removed (6).

None of these treatments had any noticeable effect on disease incidence or severity in stem samples collected on 2% June 1971. More than 90% of these were in the category rated most severe. The inoculum may have come from a heavily infected field that surrounded the test area or, if the treatments were inefficient in inoculum

Table 1. The incidence of infected culms in crops of red fescue in the Peace River region of northern Alberta and British Columbia in 1971

British Columbia			Alberta		
Infection (%)	Number of crops	ha*	Infection (%)	Number of crops	ha*
0	0	0	0	7	284
0-0.5	2	97	0-0.5	4	150
0.6- 25	6	151	0.6- 25	13	361
26- 50	1	65	26- 50	2	97
51- 90	0	0	51- 90	5	164
91–100	1	10	91-100	35	1183

* To convert hectares to acres multiply by 2.47.

Table 2. The effect of nitrogen, phosphorus, potassium, and sulfur fertilizers on didymella stem eyespot. of red fescue

Treatment	Disease index (avg of 4 replicates)
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No fertilizer	65.7
P, K, S	59.7
N, P, K	41.4
N, P, K, S	40.6

* Calculated fromdisease ratings on a 0 to 3 scale (3), where 0 is no disease and 3 the most severe category:

$$\text{Disease index} = \frac{(0 \times n_1) + (1 \times n_2) + (2 \times n_3) + (3 \times n_4) \times 100}{300}$$

** L.S.D. 5% 5.76
1%8.28

removal, from within the plots. Further studies with isolated tests are needed to resolve these points.

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