DEVELOPMENT OF WHEAT STREAK MOSAIC IN SOUTHERN ALBERTA DURING 1964

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Abstract

Wheat streak mosaic was general on winter wheat in the eastern half of the winter wheat growing area of southern Alberta and many severely diseased fields were cultivated out. However, cool temperatures and ample moisture favoured the vigorous growth and development of winter wheat and prevented maximum disease expression. As a consequenqe, satisfactory yields were obtained from many fields that would have been seriously damaged under less favourable growing conditions. The failure of populations of the vector to build up also minimized losses by reducing secondary spread. Observations indicated that fall rye may serve as a reservoir of the virus.

Introduction

During the fall of 1963 a severe outbreak of wheat streak mosaio developed in the eastern half of southern Alberta's winter wheat *growing* area, A previous report (1) presented the results of fall surveys and described the unique sequence of weather events that contributed to the occurrence and determined the localization of this unusual epiphytotic.

The effect of weather on the development of the disease during the spring and summer of 1964 is given in this follow-up report.

Development of the diseass in 1964

Winter survival

Although many fields of early-seeded winter wheat were severely damaged by the disease prior to freeze-up in 1963, very few were cultivated out before spring because of tho danger of soil drifting, The mean temperature at Lethbridge from November 1963 to March 1964 inclusive, was 26.0°F or 2.6° higher than the 62-year average. Because of the relatively mild weather, winter survival of these severely affected crops was higher than would normally have been expected.

Spring surveys

The widespread and unusually pronounced streak mosaic symptoms that developed during the fall of 1963 forewarned farmers and agricultural extension workers of the problems to be faced the following spring. From mid-April through mid-May, 1964, district agriculturists in the affected area inspected hundreds of fields at the request of growers, Reports giving the location and disease severity of the crops inspected were supplied to us by the six district agriculturists located in and adjacent to the major winter wheat growing area.

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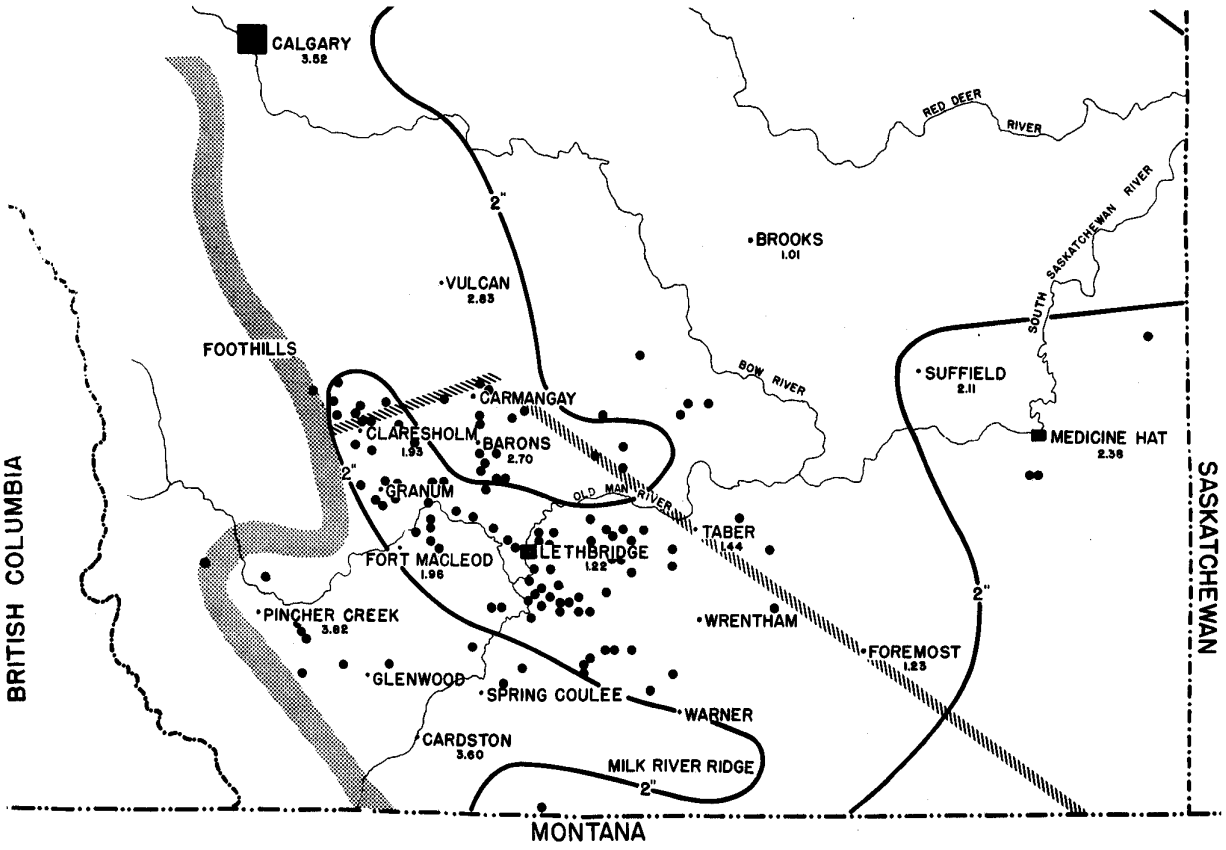

Fig. 1 Distribution of winter wheat fields that showed severe or moderate streak mosaic symptoms in April and May 1964. Winter wheat production is general below the cross-hatched line but diseased crops were most prevalent east of the ischyet, where rainfall from April 1 to June 17 in 1963, totalled less than two inches.

Fig. 2 Winter wheat sown on August 24, 1963, showing severe streak mosaic symptoms on May 28, 1964.

Fig. 3. Mature crop of winter wheat sawn on September 3, 1963, showing sparse and stunted growth resulting from severe streak mosaic infection.

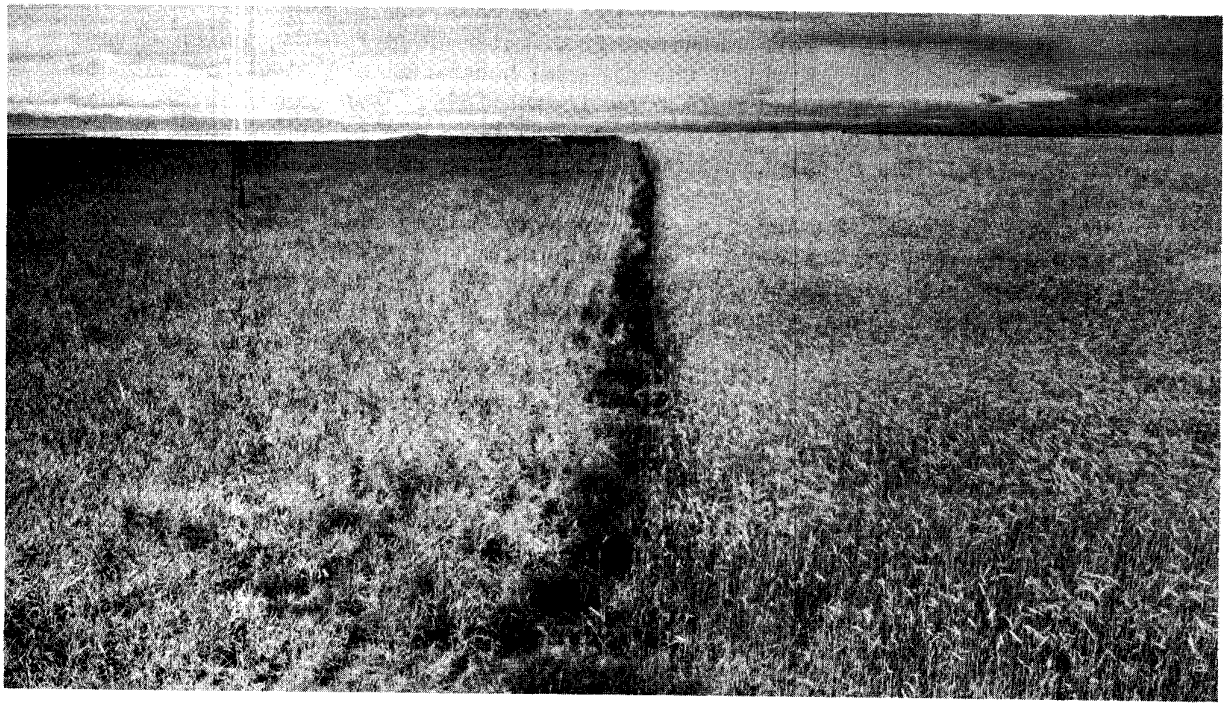

Fig. 4 Streak mosaic symptoms developing on spring wheat (left), adjacent to fall rye, July 15, 1964.

The locations of winter wheat fields visited by the district agriculturists and classified either as 'severe' or 'moderate' are shown on the accompanying map (Pig. 1). These data confirm our earlier report (1) and re-emphasize the major role that the 1963 weather played in determining tho localization of the outbreak. The larger number of diseased fields shown in the eastern than in the western half of the winter wheat growing area accurately represents the relative incidence of streak mosaic and is not due to a heavier concentration of winter wheat in the eastern zone.

Effect of the disease on yield

The degree to which streak mosaic reduced winter wheat yields in 1964 depended primarily on the extent to which the disease had progressed within individual fields the previous fall. This, in turn, was largely determined by date of seeding.

By early May many fields of winter wheat that had been sown in August or early September had taken on the uniformly yellowed appearance that most had displayed the previous fall. Most of these crops were cultivated out and the fields resown to flax, oats, barley or, in some cases, to spring wheat. The few fields of severely diseased wheat that were left growing illustrated the destructiveness of the disease.

The field of severely diseased winter wheat shown in Fig, 2 was sown on August 24, 1963. This 100-acre field yielded 5 bushels per acre. Another field sown on September 3 averaged 7 bushels per acre (Fig. 3). Several other fields that obviously were going to yield little grain were cut for green fed.

Many fields of winter wheat, however, yielded unexpectedly well considering the numbers of diseased plants they contained. For example, a field of registered winter wheat sown on September 6 yielded 26 bushels per acre of cleaned seed. When this field was sampled on May 26, 1964, 19% of the plants were yellow and very stunted, 36% had less severe but distinct wheat streak mosaic symptoms, while only 45% appeared free of the disease. The effect of wheat streak mosaic on the yield of winter wheat in this field was investigated in detail and will be reported elsewhere.

The best yields were obtained from later-sown fields, which either escaped the disease or in which the disease became established too late to cause general and pronounced yellowing in tho fall. For example, the same farmer who harvested only 5 bushels per acre from winter wheat sown on August 24, (Fig. 2), obtained 35 bushels per acre from a nearby crop sown on September 12.

Yields from diseased fields generally ranged from 5 to 25 bushels per acre depending on the severity of infection and general growing conditions. This compares with yields of 30 to 40 bushels per acre for crops free of wheat streak mosaic, and exceptional yields of 55 to 60 bushels per acre. These yields, far above the 10-year average of 22.34 bushels per acre on fallow at Lethbridge (U. J. Pittman, personal communication), reflect the excellent growing conditions that prevailed for winter wheat during 1963-64.

Factors affecting development of the disease in 1964

The wheat streak mosaic epiphytotic, which began in the fall of 1963, did not reach its full potential because of two subsequent developments. These were the cool, moist spring of 1964 and the conspicuous absence of large populations of the mite vector, Acsria tulipae Keifer, throughout both spring and summer.

The mean temperatures recorded at the Lethbridge Research Station for April, May, and June, 1964, of 40.7°, 50.5°, and 59.0° F were close to the 62-year average. Precipitation distributed throughout this same period totalled 9.17 inches, 44% higher than the long-term average. This combination of cool temperatures and ample rainfall favored the vigorous growth and development of winter wheat but did not allow maximum disease expression.

The 1953-54 winter wheat crop in Kansas was exposed to a similar sequence of events (3). A cool, moist spring was credited with minimizing wheat streak mosaic losses. Controlled temperature studies have also shown that the leaf symptoms and stunting effect of streak mosaic are poorly expressed at air temperatures of 60° F or lower (2).

We do not know why significant populations of the mite vector failed to build up during the spring and summer. Perhaps winter survival of the mite population was low and the cool, moist spring did not favor their rapid multiplication. Whatever the reason, the failure of the mites to multiply minimized disease lossos by greatly reducing the spread of the virus both within and between fields.

Fall rye as a reservoir of streak mosaic

During the summer of 1964 conspicuous streak mosaic symptoms created yellow borders on several fields of spring wheat growing between alternate strips of fall rye in the Barons district (Fig. 4). To our knowledge, fall rye has not previously been considered important in carrying the virus and mites over winter. However, careful checking by both ourselves and Dr. J.T. Slykhuis failed to reveal any other likely source of tha disease. Studies of the role that rye varieties may play in the epidemiology of streak mosaic in southern Alberta are in progress and will be reported later,

Streak mosaic outlook for 1965

There was no wheat streak mosaic outbreak in southern Alberta during the fall of 1964. In contrast to the situation a year earlier, few fields of wintar whoat emerged before spring crops had ripened and volunteer whoat was not general. Drought from the last week of June to the end of August brought most crops to maturity during August. Most winter wheat, on the other hand, was sown during the latter half of September not only because rainfall during the first part of the month kept farmers off the land but also because most growers, aware of the streak mosaic danger, deliberately avoided early seeding. Although both mites and disease symptoms were found on volunteer-wheat during the fall, serious streak mosaic-damage is unlikely in 1965.

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Literature Cited

1. ATKINSON, T. G. and J. T. SLYKHUIS. 1963. Relation of spring drought, summer rains, and high fall temperatures to the wheat streak mosaic epiphytotic in southern Alberta, 1963. Can. Plant Disease Survey 43: 154-159.

2. SILL, W. H., JR. and H. FELLOWS. 1953. Symptom expression of the wheat streak-mosaic virus disease as affected by temperature. Plant Disease Reptr. 37: 30-33.

3. SILL, W. H., JR., H. FELLOWS and C. L. KING. 1955. Kansas Wheat Mosaic Situation (1953-54). Plant Disease Reptr. 39: 29-30.

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