RELATION OF SPRING DROUGHT, SUMMER RAINS, AND HIGH FALL TEMPERATURES TO THE WHEAT STREAK MOSAIC EPIPHYTOTIC IN SOUTHERN ALBERTA, 1963

T. G. Atkinson[1] and J. T. Slykhuis[2]

Abstract

A severe epiphytotic of wheat streak mosaic on winter wheat developed during the fall of 1963 in areas of southern Alberta where a severe spring drought delayed the development of spring grains until after heavy rains fell late in June. The resulting predominance of late-maturing spring wheat and barley that harboured the virus and its vector (*Aceria tulipae* K.) until late September, together with record-breaking warm weather throughout September and October favored the exceptional spread and severe development of the disease even on winter wheat sown when normally recommended.

Introduction

The most severe outbreak of wheat streak mosaic ever known to occur in the winter wheat area of southern Alberta prior to freeze-up developed during the fall of 1963. This outbreak was restricted to the eastern portion of the winter wheat growing area. Surveys during October revealed that around Claresholm, Barons, Granum, Lethbridge, Wrentham, and Warner, wheat streak mosaic was more prevalent and severe than it had ever been at that time of year since this disease was first correctly diagnosed in 1952 (3). In contrast, no severely infected crops were found in the Spring Coulee, Cardston, Glenwood, or Pincher Creek districts (Fig. 1).

The development of the disease in the eastern districts can be described as a major epiphytotic. Most early-sown fields of winter wheat were uniformly yellowed by the disease in mid-October and many plants were dying by the end of the month (Fig, 2). Winter survival in such crops is expected to be low, and even surviving plants are not likely to set seed, Wheat sown during the first two weeks of September, normally the recommended period (1, 2, 4), was also severely infected and many fields will produce little or no grain,

This report describes the unique succession of unusual weather conditions, beginning in the spring and continuing into the fall, that determined the localization and allowed the development of this unprecedented epiphytotic.

[1] Plant Pathologist, Canada Agriculture Research Station, Lethbridge, Alberta.

[2] Plant Pathologist, Plant Research Institute, Canada Department of Agriculture, Ottawa, Ontario.

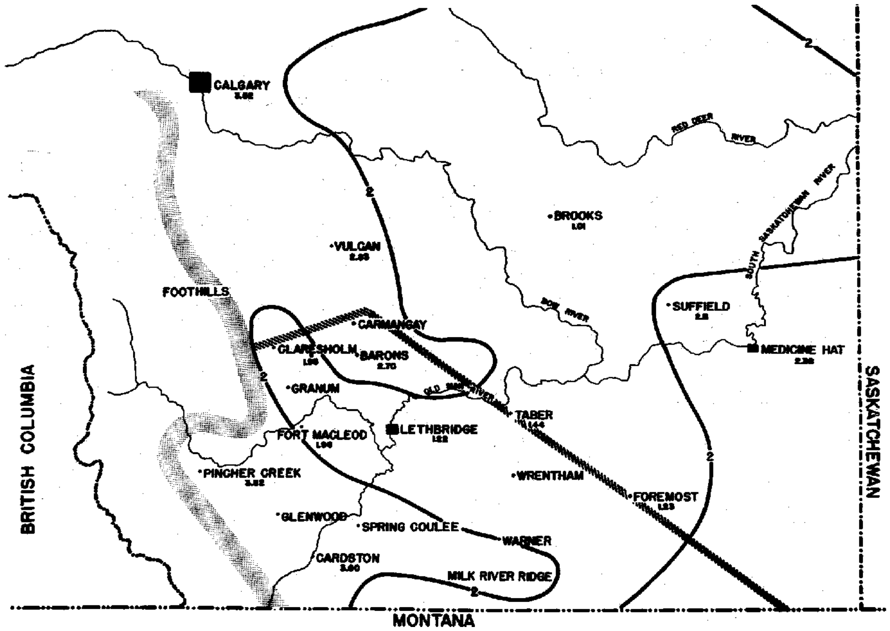


Fig. 1. Distribution of total precipitation, April I-June 17, 1963, in southern Alberta. Winter wheat production is concentrated in the area bounded by the cross-hatched lines, foothills, and Montana border. Notice how the two-inch isohyet divides this area into eastern and western districts.

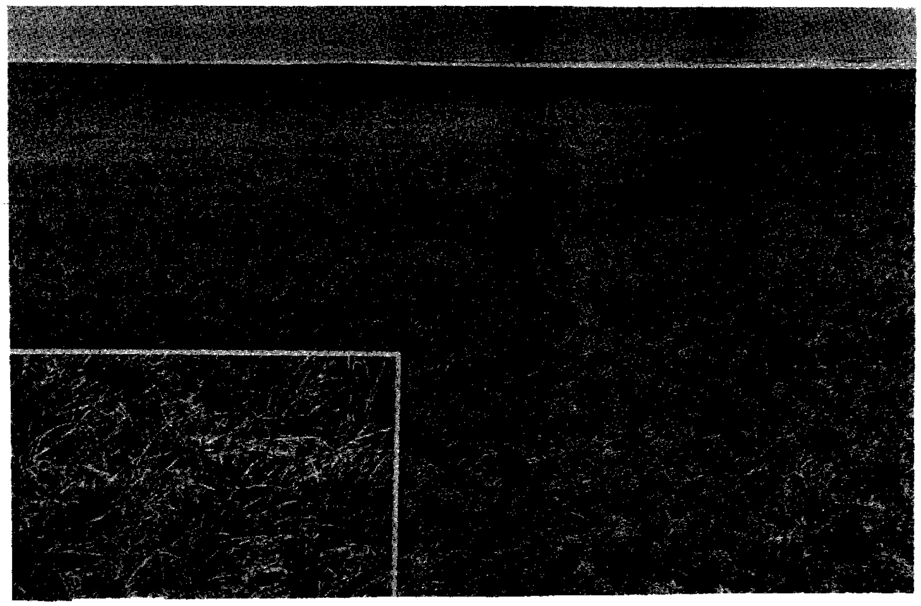


Fig. 2. Uniformly severe wheat streak mosaic symptoms in a field of winter wheat sown August 27, 1963; photographed October 18, 1963. The diseased wheat appears light in contrast to the unaffected wild oats in the center background. Insert shows portion of the same field.

Conditions Promoting the Epiphytotic

Effects of spring drought

The sequence of weather events that provided ideal conditions for the development of an epiphytotic began with a severe spring drought. Throughout all but the foothills area of southern Alberta, spring precipitation in 1963 was much below normal, In the most severely affected area, including the eastern portion of the winter wheat zone, precipitation between April 1 and June 17 totalled less than two inches (Fig. 1). Here, stands of spring-sown grains were extremely sparse and uneven because the soil was so dry that seedlings did not tiller and, in many instances, seed did not germinate. Even volunteer wheat was scarce. In the western part of the winter wheat zone, however, the germination and early development of spring grains followed a normal pattern.

Effects of summer rains

The effects of the severe drought were dramatically reversed by heavy rains on June 21, 22, and again a week later. During that period total precipitation over the winter wheat area averaged more than 4.5 inches. In the drought area, seed of spring wheat and barley that had lain dormant in the dry soil now germinated more than a month late, and the stunted plants in sparse stands tillered abundantly. In addition, late seeding of barley was common as farmers sought to take advantage of the renewed soil moisture. Above-normal precipitation throughout July and near-normal rainfall during August promoted the vigorous development of this new growth and, by reducing the effectiveness of summerfallow operations, permitted the extensive and profuse development of volunteer wheat.

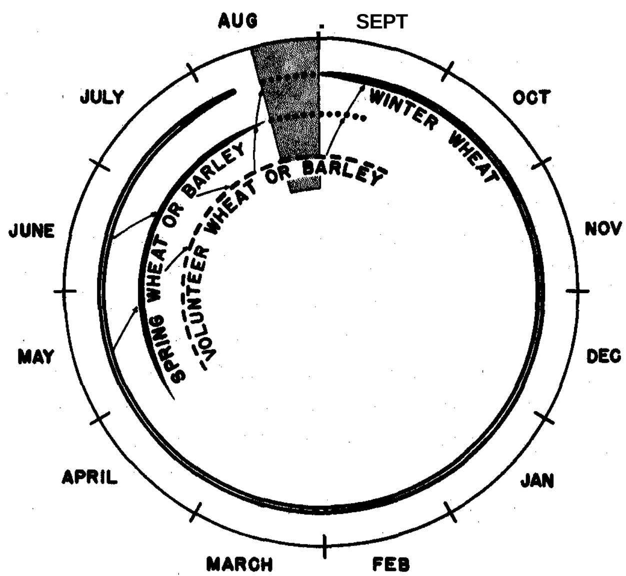
Although surveys in mid-June had revealed an extremely low incidence of wheat streak mosaic throughout the area, these late-developing wheat and barley crops and volunteer plants became massive reservoirs of inoculum as the virus and its mite vector multiplied rapidly during the summer and spread throughout the area, Consequently, in the eastern zone where extensive acreages of wheat and barley did not mature until late in September, winter wheat sown during the first two weeks of September, the normally recommended time, became heavily infected.

Effects of a prolonged warm fall

At Lethbridge, the mean temperature for the month of September was 62° F, almost 10° higher than the 30-year normal, Unseasonably high temperatures continued in October both before and after the first killing frost on October 19, twenty-four days later than the 61-year average date, While this weather was ideal for harvesting the late-maturing crops, it allowed these potent sources of inoculum to be effective until they finally matured in late September. The prolonged period of exceptionally warm weather favored the continued multiplication and dispersal of viruliferous mites throughout the winter wheat fields and was responsible for the unprecedented development of symptoms prior to freeze-up.

Effectiveness of Control Measures

Wheat streak mosaic becomes a serious problem only if the virus and its mite vector are provided with a continuous supply of living host plants, principally spring and winter wheats. Because winter wheat plays a key role in the disease cycle, control recommendations call for the elimination of all sources of infection before the fall crop is sown (Fig. 3). This is achieved by seeding winter wheat only after all spring wheat and barley in the vicinity have matured and by destroying volunteer hosts on or near the field.



Fig, 3. Wheat streak mosaic disease cycle, Control depends upon preventing an overlapping sequence between spring hosts and winter wheat. Shaded area represents period during which effective control is normally achieved, Dotted lines indicate problems presented by early-seeded winter wheat and-or late-maturing spring wheat or barley. Arrows represent mite transfer of virus.

In southern Alberta, spring-sown crops normally mature by mid-August so infection from this source is avoided when winter wheat is sown during the first two weeks of September. This is the planting period recommended for obtaining the most winterhardy crops (1, 2). Control then depends upon the destruction of volunteer wheat or barley, Farmer experience in southern Alberta has strikingly demonstrated the effectiveness of these cultural control practices.

In 1963, the combination of late-maturing crops and a prolonged warm fall complicated effective control of wheat streak mosaic. However, farmers who heeded the special warnings and followed the recommendations issued by the Lethbridge Research Station early in August generally avoided serious infection of their winter wheat, Although the problem of late-maturing spring crops was not as acute in the western as it was in the eastern portion of the winter wheat zone, farmers in the Spring Coulee-Cardston districts, who often seed earlier than recommended, undoubtedly avoided serious infection this year by uniformly delaying their seeding of winter wheat. In contrast, although similar conditions existed in the Barons district, some fields were severely infected because they were seeded before the end of August (Fig. 2). Around Lethbridge, where the epiphytotic was most severe, the only winter wheat that escaped serious infection was that sown after spring grains matured and away from diseased volunteer or early-sown winter whaat.

Literature Cited

1. ANDREWS, J.E., U.J. PITTMAN, J.S. HORRICKS, N.D. HOLMES, D, T, ANDERSON, and A.D. SMITH. 1959. Winter wheat production in western Canada. Can. Dept. Agr. Publ, 1056.
2. PITTMAN, U. J., and J.E. ANDREWS. 1961. Effect of date of seeding on winter survival, yield, and bushel weight of winter wheat grown in southern Alberta, Can. J. Plant Sci. 41: 71-80.
3. SLYKHWIS, J.T. 1953. Wheat streak mosaic in Alberta and factors related to its spread. Can. J. Agr, Sci. 33: 195-197.
4. SLYKHUIS, J.T., J.E. ANDREWS, and U. J, PITTMAN. 1957, Relation of date of seeding winter wheat in southern Alberta to losses from wheat streak mosaic, root rot and rust, Can. J. Plant Sci. 37: 113-127.

CANADA AGRICULTURE RESEARCH STATION,
LETHBRIDGE, ALBERTA.