Verticillium wilt of irrigated alfalfa in Saskatchewan, 1987-89

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Fields of irrigated alfalfa throughout the southwestern portion of the grainbelt in Saskatchewan were surveyed for verticillium wilt *(Verticilliumalbo-atrum)* from 1987 to 1989. Plowing down infected crops followed by crop rotation to cereals was associated with the elimination of the disease from irrigation areas at Outlook and Miry Creek, where it had been observed in the early 1980's. However, in the Chesterfield Flats irrigation project. where minimal control efforts had been made, the disease was present in almost every field. Alfalfa crops in two additional irrigation areas near the Alberta border were also infected. Increased frequency of cutting and overhead irrigation were associated with rapid spread of the disease. Spring black stem *(Phoma medicaginis)* was the most prevalent foliar disease in the survey area.

Can. Plant Dis. Surv. 70:2, 129-131, 1990.

Des luzernieres irriguees du sud-ouest de la zone de culture de cereales en Saskatchewan ont ete examinees a l'égard de la fletrissure verticillienne *(Verticillium albo-atrum)* de 1987 a 1989. L'enfouissement des cultures infectees suivi par le remplacement de la luzerne par des cereales dans la rotation, a permis d'eliminer la maladie des zones d'irrigation de Outlook et de Miry Creek ou on l'avait signalée au debut des annees 1980. Mais dans le cadre du projet d'irrigation de Chesterfield Flats ou des efforts de lutte minimums ont ete deployes, on pouvait constater la presence de la maladie dans presque tous les champs. Les luzernieres de deux zones d'irrigation supplementaires pres de la frontiere avec l'Alberta etaient egalement infectees. L'augmentation de la frequence de coupe et l'irrigation par aspersion etaient associes avec une propagation rapide de la maladie. La tige noire printaniere *(Phoma medicaginis)* était la maladie foliaire la plus frequente dans la zone d'enquête.

Introduction

Verticillium wilt of alfalfa *(Verticilliurn albo-atrum* Reinke & Berth.) is a destructive disease in British Columbia, Ontario, Quebec and throughout large areas of the U.S.A. and Europe. In Alberta, it is an important disease in irrigated fields, but is rarely found in dryland fields (Howard and Moskaluk **1988,** H.C. Huang, personal communication). The disease was first found in Saskatchewan in **1980** in the irrigation areas near Outlook and along the South Saskatchewan River near the Alberta border (Atkinson **1981,** Arnyand Grau **1985).** In **1981,** the disease was still limited to these areas. Growers were advised to plow down infected fields and rotate them out of alfalfa. In **1982,** no infected fields were found. Surveys in **1983** and **1984** revealed that the disease was still present in the Chesterfield Flats (west of Leader, near the Alberta border) and Miry Creek irrigation areas (A. Frowd, Saskatchewan Agriculture, unpublished), and at trace levels near Outlook (J.D. Smith, personal communication). Plowing and crop rotation were again recommended for disease control.

The objectives of this study were to determine the extent and severity of verticillium wilt on irrigated alfalfa in the southwestern portion of the province, where it had been observed in the early 1980's, and to assess the effect of eradication procedures on disease incidence, especially in the Chesterfield Flats and Miry Creek areas. Summaries of the survey results from **1987-88** were published previously (Gossen and Jesperson **1988, 1989).**

Methods

In 1987, 50 irrigated alfalfa fields were examined from **6** July to **26** August. In 1988, 30 fields were examined from 20 July to **5** August. Drought conditions in many areas in **1988** were so severe that growers were unable to irrigate their fields after the first cut. In these areas, poor growth and severe drought stress precluded assessment of many fields. In **1989, 31** fields were examined from **16** July to **29** September. The survey in **1989** was concentrated on fields along the South Saskatchewan River, in areas where infected fields had previously been identified.

Alfalfa crops were examined by walking through the field in a teardrop pattern, and searching for wilting plants. Most of the fields were in the late vegetative or early bud stage when surveyed. Field diagnosis of verticillium wilt, based on symptoms, was confirmed by isolation of the pathogen: stem pieces were surface-sterilized, split, and incubated on water agar on a laboratory bench for at least **14** days. No pathogenicity tests were made on the isolates. Identification of foliar diseases was based primarily on symptoms in the field, but occasionally isolations were made to confirm the diagnoses.

Results and Discussion

In **1987,** verticillium wilt was confirmed from only two fields; one in the Chesterfield Flats irrigation project west of Leader (Figure **1),** and the other less than **15** km upriver (west) from the first, in a separate irrigation area near Estuary. In **1988,**

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Accepted for publication February 13, 1990.

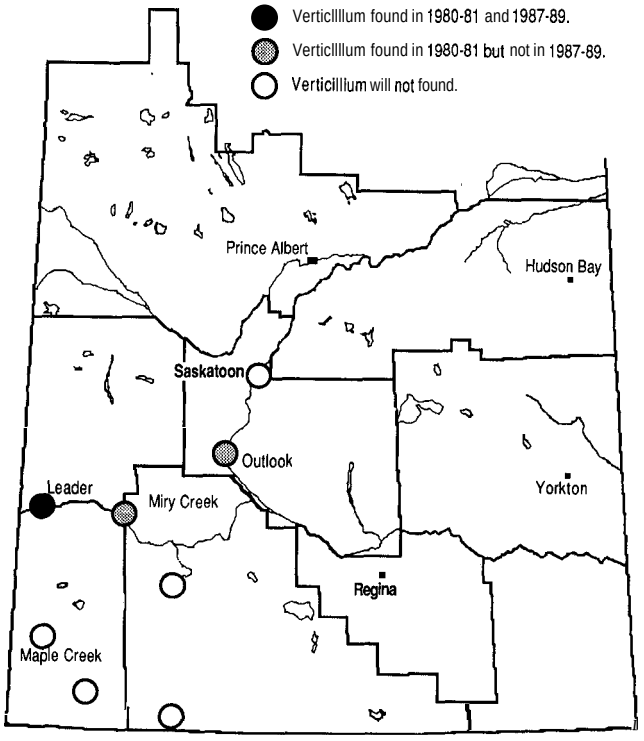

Fig. 1. Distribution of verticillium wilt of alfalfa in Saskatchewan 1980-89.

two additional infected fields were identified; one near Estuary, and another east of Leader. In 1989, five new fields with verticillium wilt were identified; four in the Chesterfield Flats irrigation area, and a fifth at Estuary.

Severity of foliar diseases in the survey area was generally very low over the three years of the study. Spring black stem *(Phoma medicaginis* Malbr. & Roum. var. *medicaginis* Boerema) was the predominant leaf pathogen in southern areas, and was prevalent in central regions as well. However, late in the 1988 season, common leaf spot *(Pseudopeziza medicaginis* (Lib.) Sacc.) developed rapidly to moderate levels (25% of the leaf area affected) in the Outlook area. Downy mildew *(Peronospora trifoliorum* de Bary.) infection was noted at low levels in many locations in 1988-89. A *Colletotrichum* sp. was frequently isolated from the stems of wilted plants from several fields in the Leader and Miry Creek regions in 1988-89.

Although at least some of the fields at Chesterfield Flats had been infected with verticillium wilt for a number of years, disease incidence and severity were low. The stands at Chesterfield Flats were irrigated using gravity-dikes, and were generally old and weedy. They were harvested on a two-cut system. In contrast, in the three infected fields at Estuary and Leader, the disease was observed to spread rapidly, resulting in severe infection. These stands were irrigated with overhead sprinkler systems, and were relatively young, highly productive and aggressively managed (3-4 cuts per year). Both frequency of cutting and irrigation type may have influenced the rate of disease spread, resulting in the differences observed between Chesterfield Flats and the other sites. Each hay cut produces wounds through which the fungus can enter the plant, and spores are inoculated onto the wounds via the cutting blade (Isaac 1957, Christen and Peaden 1982). Therefore, increasing cutting frequency would be expected to increase the rate of disease spread over the course of a season. Also, overhead irrigation results in spores being rain-splashed from infected plants to healthy ones, and produces, temporarily, a moist microclimate within the canopy which is conducive to spore germination and infection. Gravity-dike irrigation does not result in wetting of leaves in the middle and upper portions of the canopy, and so should be less conducive to disease spread.

Discussions with growers revealed that in the Miry Creek irrigation district, wilt-infected fields had been plowed down and rotated to cereals for two years in an effort to eradicate the disease. No verticillium wilt was observed in this area in 1987-89. Similar results were achieved in the Outlook area. In contrast, the age of the stands (some as much as 25 years old) indicated that growers at Chesterfield Flats had not plowed down infected fields. As a result, almost all of the stands in the area were infected in 1989. We conclude that eradication of verticillium wilt in small irrigation areas in Saskatchewan is possible if all the growers in an area are made aware of the problem and are willing to co-operate in an eradication program. Eradication may be more easily accomplished in Saskatchewan than in other areas for two reasons. Firstly, disease spread clearly is restricted by the semi-arid environment, since verticillium wilt occurs almost exclusively on irrigated, and not dryland sites. Secondly, many irrigation areas in the region along the Alberta border are small and relatively isolated, and the potential for introduction or reintroduction of the pathogen from adjacent areas is limited.

All of the owners of affected fields in the Chesterfield Flats irrigation area were contacted in 1989 and advised of the disease problem in their fields. Based on their stated intentions, all of the infected crops will be turned under within the next two years. Growers at the other sites were contacted immediately when infections were diagnosed, and eradication is planned or has already been initiated.

Infected seed is the most probable source of verticillium infection in the fields in southwestern Saskatchewan. Growers with infected crops at Estuary and Leader had all obtained their seed from southern Alberta, where the disease is endemic under irrigated conditions. However, transmission of the disease via contaminated plant material, machinery, insects or irrigation water (summarized in Howard 1985) cannot be ruled out. Growers in this region are being advised to purchase only seed which is certified to be verticillium-free.

Addendum while in press:

Symptoms of *Verticillium albo-atrum* infection were noted in two alfalfa fields in the Miry Creek irrigation area in late June, 1990. The identity of the pathogen was confirmed by isolation.

Acknowledgements

This work was supported in part by a grant from the Agriculture Development Fund of Saskatchewan Agriculture and Food.

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