

THE IMPACT OF CONTROL OF LEAF SPOTS OF WHEAT ON GRAIN YIELD AND QUALITY

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In the past decade there has been an increase in the incidence of leaf spotting diseases of wheat in western Canada. These are attributed mainly to *Pyrenophora tritici-repentis* (tan spot), *Septoria nodorum* and *S. tritici* (septoria leaf blotch complex). All registered spring wheat cultivars are susceptible to this disease complex (Femandez and DePauw, 1998). Leaf spots have been reported to have a negative effect on yield and quality. *P. tritici-repentis* also causes red smudge/black point on wheat kernels (Femandez et al., 1994a and b). This kernel discoloration causes loss of grade, especially in durum wheat. However, the magnitude of the impact of leaf spots on grain yield and quality of wheat cultivars grown on dryland in southern Saskatchewan, and the minimum disease levels that would have a significant effect on these parameters, are not known.

OBJECTIVES

- (i) To determine the impact of leaf spots on grain yield, kernel weight and test weight of hard red spring and durum wheat;
- (ii) to compare results in different environments.

MATERIALS AND METHODS

Three durum (Durex, Kyle and DT 665) and three hard red spring (AC Domain, Laura and AC Elsa) cultivars were grown on summerfallow at Swift Current and Indian Head in 1998. There were seven fungicide treatments: one application at flag leaf emergence (early), one application at head emergence (late) and two applications of both stages (early+late) with Folicur 3.6 (tebuconazole, 39%) or Bravo 500 (chlorothalonil, 500 g L⁻¹), and untreated. Spray rates were 336 ml ha⁻¹ and 2500 ml ha⁻¹ of product for Folicur and Bravo, respectively, for each application. Folicur is a systemic fungicide and Bravo is a protectant fungicide. Genotypes and treatments were arranged in a factorial, randomized complete design with four replicates. Each plot was 16-row 3m long and 0.23 m apart, with 1 m wide buffer areas seeded to fababean in between plots.

Measurements: Twenty flag leaves and penultimate leaves were taken randomly from each plot within one day before each fungicide application and at late milk stage. Leaf spot severity was determined by estimating the percentage of leaf area covered with leaf spots. The prevalence of each of the leaf spotting fungi was determined by plating eleven leaf samples from each plot on water agar, and determining percent colonization by each of the fungi using the method described by Femandez et al (1996). Grain yields were determined after harvesting plots with a plot combine. Kernel weight, test weight and the incidence of red smudge and black point were also determined after harvest.

Data analysis: Treatment, genotype and location effects, and their interactions were analyzed using ANOVA. Mean comparisons among all treatments were done by LSD.

RESULTS AND DISCUSSION

Weather and Development of Leaf Spots: Precipitation during the growing season (May to August) was 210 mm at Swift Current, which was considered normal (average for that period of 206 mm in recent 98 years). However, most of it fell between mid-June and mid-July. It was hot and dry after the end of July. The weather pattern at Indian Head was similar to Swift Current although the amount of precipitation from May to August (286 mm) was higher than normal (average of 230 mm for recent 97 years).

Tan spot (*Pyrenophora tritice-repentis*) was the most prevalent leaf spotting disease at both locations. Leaf spot severity was low at flag leaf emergence for most cultivars at both sites (mean of 0% at Swift Current and 1% at Indian Head for flag leaves). After head emergence, disease developed markedly. At late milk it was higher at Swift Current than Indian Head (mean of 30% at Swift Current and 11% at Indian Head for flag leaves). In the untreated control, genotype differences in the incidence of leaf spotting diseases were similar at both sites. The mean flag leaf spot severity at late milk in the control treatment for both sites was highest for Durex (27%), followed by AC Domain (17%), Laura (10%), Kyle (8%), AC Elsa (5%) and DT 665 (5%).

Fungicide Effects on Leaf Spot Severity:

Treatment effects on leaf spot severity were significant for both flag and penultimate leaves at late milk stage. Fungicide applications significantly reduced leaf spot severity at both sites (mean reduction of 50% at Swift Current and 68% at Indian Head for flag leaves). In general, Folicur had a greater effect than Bravo (Fig. 1). For Bravo, early applications were more effective than late applications. For both fungicides, applications at both growth stages did not cause a significantly greater reduction in leaf spot severity than early applications. There was a treatment X genotype interaction for the flag leaf. For example, at Swift Current, flag leaf spot severity was significantly reduced for Durex, AC Domain and Laura. The rest, including the most resistant genotypes AC Elsa and DT 665, did not differ significantly in leaf spot severity among treatments. This indicates that fungicides tended to have higher effect on the most susceptible genotypes than the less susceptible ones.

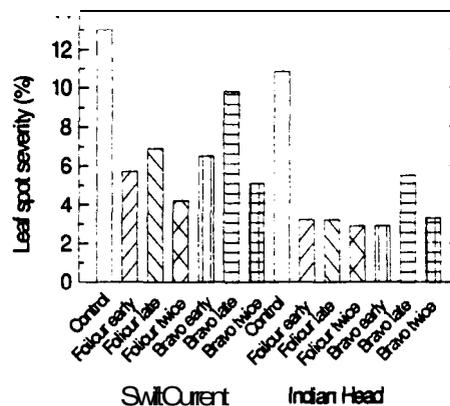


Fig. 1. Means of flag leaf spot severity at late milk.

Fungicide Effects on Grain Yield and Quality: Fungicide application increased yield at Indian Head, but not at Swift Current (Fig. 2). At Indian Head, applications of Folicur and early application

of Bravo resulted in 13% and 7%, respectively, higher yields, and 4% and 3% respectively, higher kernel weight than the control. Folicur treatments had higher yield than Bravo treatments. All fungicide treatments, except late application of Folicur at Swift Current and Folicur treatments at Indian Head, significantly increased test weight (Fig. 3). There was also a treatment x genotype interaction for grain yield indicating the treatment effect on yield was different among genotypes. For example, at Indian Head, all or some of the fungicide treatments significantly increased yield of AC Elsa DT 665 and Durex, but not of AC Domain, Laura and Kyle. However, yield increases did

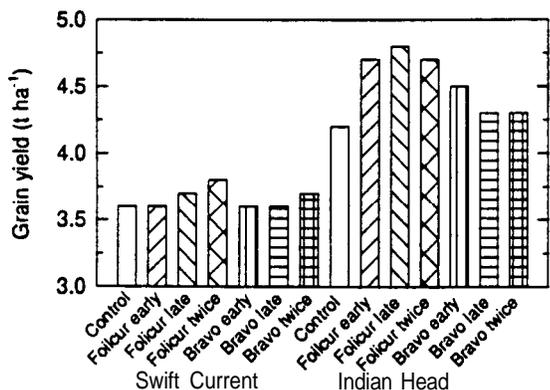


Fig. 2. Means of grain yield.

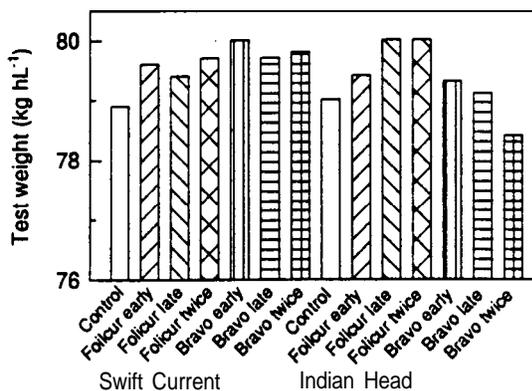


Fig. 3. Means of test weight.

not appear to be related to leaf spot reduction. For example, AC Elsa and DT 665 were the most resistant genotypes, and had only a small reduction in leaf spot severity at Indian Head.

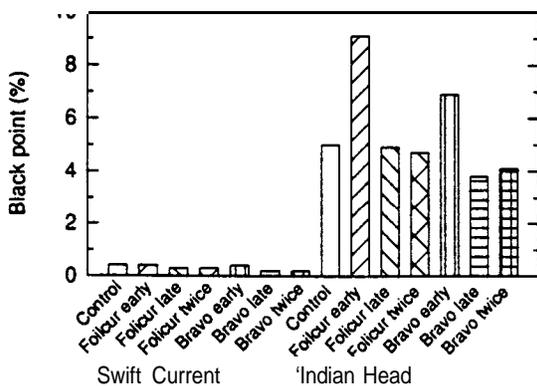


Fig. 4. Means of black point.

Fungicide Effects on Kernel Diseases:

The incidence of kernel black point and red smudge was lower at Swift Current than at Indian Head (Fig. 4). Fungicide effects on kernel diseases were found at Indian Head but not at Swift Current. At Indian Head, late and early+late applications of Bravo reduced black point for all genotypes except AC Elsa and Kyle, which had the lowest levels of black point. However, early applications of both fungicides resulted in an increase in black point, especially for the most susceptible genotypes (Durex and Laura).

CONCLUSIONS

Even though there was an indication that a lower level of leaf spots might contribute to an increase in grain yield and/or quality, chemical control resulted in a positive effect on the most resistant cultivars. This suggests that these benefits depend on the genotype(s) in question and are not necessarily related to the control of leaf spots. This might be attractive to producers provided the benefits are greater than the cost of fungicide application. However, our observations indicate that there might be a negative effect of fungicide application on kernel diseases. Further experimentation, especially in environments with higher disease pressure, will help confirm the results obtained in 1998.

ACKNOWLEDGMENT

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