Effect of leaf spot severity on yield and quality of durum wheat in the semi-arid Prairies

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Introduction

Leaf spots in wheat (*Triticum aestivum* L.) are important in Saskatchewan even under dry conditions (Fernandez et al., 2002). Durum wheat (*T. turgidum* L. var. *durum*) cultivars presently grown in western Canada are susceptible to leaf spots. The most common leaf spotting disease in durum wheat is tan spot [*Pyrenophora tritici-repentis* (Died.) Drechs. (anamorph *Drechslera tritici-repentis* (Died.) Shoemaker)]

Leaf spots are believed to cause reductions in yield and quality. The most widely used approach to measure the effect of leaf diseases on yield and its components has been the use of fungicides (Duczek and Jones-Flory, 1994; Eyal, 1972; Hosford and Busch, 1974; Rees and Platz, 1983). Inconsistent results with fungicide use in wheat were also reported (Bailey et al., 1992; Stover et al., 1996; Wang et al., 2002). In some cases, fungicide effects were not directly related to the occurrence of disease (Fehrmann et al., 1978; Wang et al., 2002), which makes them an unreliable tool to assess the effect of leaf spots on plant growth.

To accurately quantify the negative effects of leaf spots on yield and quality, an approach other than disease control by fungicide application is necessary. The objective of this study was to evaluate the use of genotypes near-isogenic for leaf spot reaction to quantify the effect of leaf spots on grain yield and quality of durum wheat.

Materials and Methods

The pairs of durum wheat genotypes near-isogenic for reaction to leaf spots used in this study were F6-derived F8's or F8's. They were grown in four-row plots at Swift Current and Indian Head, Saskatchewan in 2000 and 2001 using a randomized complete block design with three replications. Measurements taken included height, days to physiological maturity, grain yield, 1000-kernel weight (TKWT) and test weight (TEWT). Leaf spot severity was measured at the milk stage by a 0 to 11 scale (Fernandez et al., 1998). Flag leaves with leaf spot lesions were randomly collected from each of the plots for pathogen identification. Analysis of variance was performed on leaf spot data by GLM procedures. Single degree of freedom orthogonal contrasts were also performed to determine significant differences between the more susceptible and resistant member(s) of the near-isogenic pairs.

Results and Discussion

Table 1 shows leaf spot severity, agronomic and yield data for the 'susceptible' and 'resistant'

members of the near-isogenic pairs. There was more moisture in 2000 than in 2001. In most cases in 2000, the leaf spot 'resistant' isolines had greater grain yield and/or TKWT and TEWT than the 'susceptible' isolines. In 2001, differences between isogenic pairs was of a lower magnitude than in 2000 and differences were not consistent. There was no leaf spot differential between members of some of the pairs at the time of sampling in 2001. Single degree of freedom contrasts between all the more susceptible and the more resistant members of the near-isogenic pairs showed that there was a significant difference for leaf spot severity, TKWT and TEWT in both years, and grain yield in 2000. In 2000, an overall leaf spot severity reduction of 25% resulted in a grain yield increase of 10%, a TKWT increase of 4% and a TEWT increase of 1.7%. In 2001, a 7% reduction in leaf spot severity resulted in a 2.4% increase in TKWT and a 0.5% increase in TEWT. In both years, 75% or more of the leaf spots were caused by *P. tritici-repentis* (data not shown).

This study has shown that in the semi-arid environment of the western Prairies, even a small reduction in leaf spot severity improved yield and test weight. Under favourable conditions for leaf spot development, the yield and quality gains were considerable. This does not agree with results from Wang et al. (2002) who found no effect of disease control by fungicides on yield and seed characteristics in the same semi-arid environment this study was conducted. However, when disease levels were low in the dry year (2001) when abiotic stresses were important, leaf spots did not have an apparent effect on grain yield. This study shows the usefulness of using near-isogenic lines for determining yield and quality losses caused by leaf spots, and emphasizes the importance of introducing resistance to leaf spots into adapted germplasm.

Table 1. Leaf spot severity, plant height, days to maturity, grain yield, thousand kernel weight (TKWT) and test weight (TEWT) of near-isogenic lines for leaf spot reaction grown at Swift Current, SK in 2000 and 2001.

	Leaf spots (0-11)	Height (cm)	Maturity (days)	Yield (100kg/ha)	TKWT (g/1000)	TEWT (kg/hl)
2000						
'Susceptible'(n=13)	10.0***[2]	91.1***	98.4	34.5***	40.7***	75.3***
'Resistant'(n=13)	7.5	93.1	98.6	38.3	42.4	76.6
2001						
'Susceptible' (n=18)	8.6***	62.6	100.2***	20.4	40.4***	79.2***
'Resistant' (n=18)	8.0	63.1	100.5	20.6	41.4	79.6

[2] *,**,***= Values within each year are different at P<0.10, 0.05 and 0.01, respectively.

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