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Fungicide and Variety Effects on Foliar Diseases and Yield of Wheat and Barley

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Introduction

Whether to spray a cereal crop with a fungicide and which fungicide to apply is a question many producers wrestle with each growing season. On wheat, the most prevalent leaf spotting diseases were tan spot (*Pyrenophora tritici-repentis*) and septoria complex (*Septoria spp.*) and on barley, net blotch (*Pyrenophora teres*) and spot blotch (*Cochliobolus sativus*). Leaf spotting diseases can infect growing wheat and barley plants at any time during development but are most damaging when the upper leaves (flag and penultimate) are severely infected. This reduces photosynthetic area resulting in less grain filling and lower yields. Factors such as varietal resistance will have an impact on the benefits obtained from use of fungicides.

Objective

The objective of this study was to observe the impact of five fungicides on disease severity and yield of leaf spot susceptible and less susceptible varieties of wheat and barley.

Materials & methods

Experiments were conducted at Melfort in 2009, with varieties Infinity (less susceptible) and AC Barrie (susceptible) wheat and 2 row malt barley varieties Newdale (less susceptible) and Harrington (susceptible). Fertilizer for each crop was applied at soil test recommendations of 70 kg/ha N, 20 kg/ha P₂O₅, 10 kg/ha of K and S. Target seeding rates were 300 plants m⁻² in 4 X 12 m plots arranged in an RCBD with four replicates. Fungicides (Table 1) were applied at flag fully emerged on both wheat and barley. Plots were assessed for leaf spot severity at soft dough on 25 flag and penultimate (upper) leaves (% severity) and over the whole plant (0-11 scale).

Yield was measured from a 1.3 by 9 meter strip harvested from the center of each plot. Quality measurements were taken from harvested samples and data analyzed using analysis of variance procedures and fungicide treatment means deemed significantly different from the check using Dunnett's t test.

Table 1. Fungicide products examined in this study

Product	Manufacturer	Active Ingredient	Application rate
Folicur 432 F	Bayer Crop Science	tebuconazole	95 g a.i./ha
Headline EC	BASF	pyraclostrobin	148 g a.i./ha
Proline 480 SC	Bayer Crop Science	prothioconazole	148 g a.i./ha
Stratego 250EC	Bayer Crop Science	propiconazole + trifloxystrobin	125 g a.i./ha
Tilt 250E	Syngenta	propiconazole	125 g a.i./ha *

* All products applied in 100 L of water ha-1, except Tilt 250E which was applied in 200 L of water ha-1

Results

Conditions were dry and very cool at Melfort in the spring and early summer of 2009. Wheat and barley plots emerged evenly but were slow to develop and were delayed by as much as two weeks in mid July. Disease development at the time of fungicide application was slight; symptoms on lower leaves were observed on both crops beginning late July. Disease symptom development progressed rapidly to high levels by assessment in mid August.

In wheat (Table 2), differences between varieties were significant for each of the factors measured. Infinity wheat had a greater yield than that AC Barrie by 10%, but lower TW and TKW. Leaf disease severities on upper leaves and over the whole plant were significantly lower on Infinity, which is rated fair for leaf spots, than on AC Barrie, which is rated poor. Fungicide treatments dramatically reduced leaf spot severity on the upper leaves of both varieties compared to the unsprayed check. Results were similar when leaf spot severity over the whole plant was assessed. Leaf spot severity was slightly lower on Infinity than AC Barrie in the unsprayed checks and yield 16.5% greater for Infinity over AC Barrie. All fungicide treatments increased yield of both varieties over that of the check. Fungicide treatment increased yield of AC Barrie by as much as 28.5% (Headline), while maximum yield improvement was 19.0% on Infinity

(Proline). All fungicides, except Folicur on Infinity, improved TKW over that of the check, but no difference between any fungicide treatments and the check were detected for TW. In barley (Table 3), disease severity was reduced on the upper leaves and the whole plant by Headline and Proline on either variety. Tilt reduced leaf spot severity from that of the unsprayed check on Newdale, but not Harrington, Stratego reduced disease symptoms on the upper leaves, but not over the whole plant of both varieties and Folicur did not reduced disease symptoms under that of the unsprayed check for either variety. There was a marked difference between varieties for leaf spot symptoms, yield, TW, but not TKW. Fungicide application increased the yield of Harrington by as much as 1420 kg ha⁻¹ (27.5%) over the unsprayed check, but resulted in no yield improvement on Newdale. Fungicides were not effective on either variety to improve TKW, TW, % plump and thin kernels over that of the unsprayed checks.

Table 2. Effect of fungicide treatment on foliar disease symptoms (flag and penultimate leaves and whole plant), yield, test weight (TW) and thousand kernel weight (TKW) on AC Barrie and Infinity wheat at Melfort, 2009. Treatments different from the unsprayed check indicated by asterisks using the Dunnett's t test.

	Leaf spot severity upper leaves (%)	Leaf spot severity whole plant (0-11)	Yield (kg/ha)	TKW (grams)	TW (kg/hl)
<i>AC Barrie</i>					
Tilt	12.8 *	6.2 *	4752 *	39.6 *	78.2
Folicur	22.2 *	7.5 *	4840 *	38.2 *	76.4
Headline	5.2 *	4.0 *	5157 *	39.2 *	76.9
Proline	16.7 *	6.6 *	4961 *	39.7 *	77.5
Stratego	8.1 *	5.1 *	4861 *	39.1 *	77.2
Check	72.5	10.0	4012	34.4	77.2
<i>Infinity</i>					
Tilt	11.1 *	6.0 *	5345 *	34.8 *	74.0
Folicur	16.0 *	6.7 *	5215 *	34.3	72.8
Headline	6.0 *	4.1 *	5235 *	37.4 *	74.5
Proline	12.3 *	5.1 *	5562 *	35.0 *	73.9
Stratego	8.8 *	4.9 *	5462 *	35.5 *	73.9
Check	59.1	9.8	4674	32.6	75.3

Table 3. Effect of fungicide treatment on foliar disease severity, yield, thousand kernel weight (TKW), test weight (TW), and percentage plump and thin kernels on Newdale and Harrington barley at Melfort, 2009. Treatments different from the unsprayed check indicated by asterisks using Dunnett's t test.

	Leaf spot severity upper leaves (%)	Leaf spot severity whole plant (0-11)	Yield (kg/ha)	TKW (grams)	TW (kg/hl)
<i>Harrington</i>					
Tilt	40.1	9.0	5100*	41.0	62.1
Folicur	46.4	9.8	4840	40.2	62.4
Headline	15.7*	6.7*	5675*	43.2	64.5
Proline	15.8*	6.9*	5871*	43.7	64.7
Stratego	27.0*	8.4	5233*	41.9	63.7
Check	57.5	10.0	4451	41.7	62.6
<i>Newdale</i>					
Tilt	5.5*	4.3*	6379	43.1	64.8
Folicur	14.2	6.1	5714	42.2	64.4
Headline	3.9*	3.6*	6138	43.9	64.6
Proline	4.0*	3.2*	6622	42.8	64.1
Stratego	8.3*	4.9	5905	42.4	64.5
Check	14.6	6.8	6029	41.0	63.8

Conclusions

The benefit of fungicide treatment was evident on both wheat varieties and on the leaf spot susceptible barley variety, Harrington, where reduced disease severity was usually associated with increased yield. All fungicide treatments resulted in a yield increase in both wheat varieties and in the barley variety Harrington (except Folicur on Harrington). However, on the barley variety less susceptible to leaf spots (Newdale), fungicide treatment was not warranted. The results indicate that cereal growers need to consider agronomic and management factors, such as choice of variety, when deciding to apply a fungicide for leaf spot disease control.

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