NORTHEAST AGRICULTURE RESEARCH FOUNDATION

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2011 Maximizing benefits from foliar fungicides on wheat and barley

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Objectives

The objective of this project was to demonstrate effectiveness of fungicides on wheat and barley cultivars with differing levels of resistance to leaf spotting diseases. Comparisons involved older vs newly registered funcides, older more susceptible vs newer more resistant cultivars evaluated for levls of disease and impacts on yield and grain quality.

Rationale

The agricultural media and many industry agronomists suggest that producers in northeast Saskatchewan should consider using foliar fungicide treatments as a routine practice in cereal production. The NARF group has long had an interest in this type of work and have experimented at the field scale on-farm. However, the number of cereal varieties and fungicide products that can be tested on-farm is limited. A demonstration of varietal resistance and fungicide product in a replicated test is desired by these cereal producers.

Methodology

WHEAT:

Three Canadian Western Red Spring wheat cultivars: Infinity, 5603HR both rated good for leaf spot disease resistance and AC Barrie, rated poor, according to the Saskatchewan Varieties of Grain Crops 2011, were direct seeded into standing canola stubble on May 10th using an Edward's hoe drill with a 20 cm (8 inch) row space. The 5603 HR cultivar has awned heads while the others are awnless. Fertilizer was applied at soil test recommendations: side-banded urea at 93 kg/ha of actual N and seed-placed 14-20-10-10 at 100 kg/ha. Target seeding rate was 300 plants per meter square, all seed was fungicide treated just prior to seeding with Raxil MD (tebuconazole and metalaxyl) to prevent seed rot and pre-emergent damping off. Plots were 4 X 10 meters arranged in a randomized complete block design with four replicates. Infinity (37.5g/L pyrasulfotole + 210 g/L bromoxynil) and Axial (100 g/L pinoxaden) herbicides in addition to ammonium, were tank mixed with Adigor adjuvant and applied in crop at the 3-4 leaf stage (label rates) to control broadleaf and grassy weeds.

Fungicides were applied when the flag leaf was fully emerged on July 4th using a 2 meter boom mounted on the front of a 4 wheel ATV. Fungicides included an untreated check, Tilt 250E (propiconazole 125 g. ai/ha) and Headline EC (pyraclostrobin 148 g. ai/ha). Headline was applied in 100 L water /ha and Tilt 250E was applied in 200 L water/ha. Plots were monitored for leaf spot symptoms and assessed on August 3rd at the late milk growth stage using a 0-11 point scale (Horsfall-Barratt) converted to a percentage leaf area diseased for flag and penultimate leaves. Plants were also assigned a rating between 0-11 (McFadden scale) based on assessment of disease symptoms on foliage of the whole plant.

Yield measurements were made on harvested samples taken from a 1.3 x 10 meter strip from the centre of each plot on September 6th with a Wintersteiger plot combine. Quality (thousand kernel weight and test weight) was assessed on harvested samples, data analysed using analysis of variance procedures, and treatment means different the unsprayed check determined with Dunnett's t test.

BARLEY:

Barley varieties Newdale, AC Metacalfe and Harrington all 2 row malt was chosen for their resistance or susceptibility to leaf spot diseases. Newdale was considered one of the most resistant varieties and listed as fair/good/fair for net-form of net blotch, spot-form of net blotch

and spot blotch, respectively (Saskatchewan Variety of Grain Crops 2011 Guide); AC Metcalfe is rated poor/fair/fair while Harrington is susceptible to all. Varieties were direct seeded into canola stubble on May 18 using an Edwards's hoe drill with a 20 cm (8 inch) row space. Fertilizer was applied following soil test recommendations: side-banded urea at 105 kg/ha of actual N and seed-placed 14-20-10-10 at 100 kg/ha product. Target seeding rate was 300 plants per meter square. Plots of 4 X 10 meters were arranged in a randomized complete block design with four replicates. Infinity (37.5 g/L pyrasulfotole + 210 g/L bromoxynil) and Axial (100 g/L pinoxaden) herbicides along with ammonium sulphate were tank mixed with Adigor adjuvant and applied in-crop at the 3-4 leaf stage (label rates) to control broadleaf and grassy weeds.

Fungicides were applied at flag leaf fully emerged on July 4th using a 2 meter boom mounted on the front of a 4 wheel ATV. Fungicide treatments included an untreated check, Tilt 250E (propiconazole 125 g. ai/ha) and Proline 480 SC (prothioconazole 149 g. ai/ha). Proline was applied in 100 L water /ha and Tilt 250E was applied in 200 L water/ha as per label directions. Plots were monitored weekly for disease. Ten plants per plot were then assessed on August 9th at the soft dough growth stage using a 0-11 point scale (Horsfall-Barratt), converted to a percentage leaf area diseased for flag and penultimate leaves. Plants were also assigned a rating between 0-11 (McFadden scale) based on assessment of disease symptoms on foliage of the whole plant.

Yield measurements were made on harvested samples taken from the centre of each plot on August 29th with a Wintersteiger plot combine. Quality measurements were taken from harvested samples and data were analysed using analysis of variance procedures and fungicide treatment means deemed significantly different from the check using Dunnett's t test.

Results

WHEAT:

Cool ground and air temperatures delayed the emergence of plots until 17 days after seeding. Moisture conditions were moderate with the first significant rainfall occurring on June 15th. Plant development was normal through June and early to mid-July. By early August, due to heat stress and premature senesce of leaves, the decision was made to rate the plants at the milk stage rather than the soft dough stage so that differences caused by leaf spots could be detected more readily.

Leaf disease severities on the upper leaves (flag and penultimate ratings) and over the whole plant were significantly reduced from the checks on all three cultivars by fungicide treatments (Table 1). Test weights for each of the cultivars were unaffected but an increase in thousand seed weight for varieties AC Barrie and Infinity were detected with the application fungicide. Tilt and Headline fungicides resulted in yield increases of eight and nine bushels per acres for cv. Infinity and eight and ten bushels per acre for cv. AC Barrie over the unsprayed checks. Fungicide treatments improved disease suppression on cv. 5603HR, but did not result in any yield or seed quality benefits.

BARLEY:

Cool ground and air temperatures through May slowed development of plots. Ground temperatures at the time of seeding were 2.8-3.0 C^0 and an air temperature low of -3.5 C^0 was noted on May 24. Moisture at seeding was adequate and plants emerged from the cool ground 10-13 days after seeding. Warm rainfall needed to boost growth didn't arrive until June 15 by which time the plants were showing signs of distress with yellowing and wilting of leaves at the

3-4 leaf stage. Plants recovered and at the time of fungicide application check plots assessed for disease symptoms exhibited trace or no symptoms for any of the cultivars. By early August foliar disease symptoms were quite advanced on the susceptible cultivar check plots and severity levels were assessed on a per plot basis for the entire trial.

The NARF Field Day was held on July 21 and had approximately 165 people in attendance. The Scott Field Day held on July 13th had approximately 200 people in attendance. Due to poor weather during the Scott Field Day we were not able to take attendees to the location of the demonstration, but it was mentioned at the field day. The results from this project were written up in a WARC research update in the winter issue of the CCSA Prairie Steward Newsletter and also presented at the Agronomy Research Update in Saskatoon in December 2011. The results of this demonstration will be included in the NARF and WARC annual reports

Table 1. Effect of fungicide treatments (Tilt and Headline) on cvs. AC Barrie, Infinity and 5603HR wheat. Means for foliar disease symptoms (flag and penultimate leaves and whole plant ratings), yield, thousand kernel weight (TKW) and test weight at Melfort, 2011.

	Yield (bu/ac)	TSW (g)	Test Weight (g/0.5L)	Flag leaf % disease	Penultimate leaf % disease	Rating (McFadden 0-11 scale)
AC Barrie						
Tilt	74.9*	39.2*	412.4	2.6*	5.0*	2.96*
Headline	77.5*	39.1*	416.8	1.6*	2.4*	1.5*
Check	66.7	36.6	414.7	14.0	33.0*	7.1
Infinity						
Tilt	74.7*	35.4*	409.8	2.2*	3.4*	2.2*
Headline	75.9*	36.3*	411.6	2.8*	3.4*	2.1*
Check	66.8	33.8*	404.8	8.8	33.0	7.1
5603R						
Tilt	76.0	36.5	410.8	2.6*	4.8*	2.8*
Headline	78.6	34.6	411.8	1.5*	2.3*	1.6*
Check	72.7	33.5	414.9	9.4	49.1	7.8

* Treatments different from the unsprayed check indicated by an asterisks using Dunnett's t test.

Proline reduced disease severity for the flag, penultimate and whole plant ratings on cv. Harrington and significantly increased yield and per cent plump over that of the unsprayed check. Tilt improved yield over the unsprayed check (cv. Harrington), but did not have any impact on disease severity or on the seed quality. Yields of AC Metcalfe were also increase with the application of either fungicide as well as a reduction in the disease severity of the whole plant. Only Proline showed an advantage of TSW on Metcalfe, while other quality factors did not show an improvement over the check. Application of fungicide to cv. Newdale decreased disease severity from that of the unsprayed check but that did not translate into any other benefit as the yields and quality data remained unaffected.

Yield increases were not realized on the most leaf spot resistant cultivar (cv. Newdale) with the application of either of the two fungicides tested. On the less resistant cultivars either fungicide (Tilt or Proline) was effective in increasing yield over the unsprayed checks, with Proline being advantageous in improving some quality data and suppression of disease

symptoms.

Table 2. Effect of fungicide treatment on three barley cultivars with varying resistance levels to net and spot form of net blotch and to spot blotch. Means are shown for foliar disease severity, yield (kg/ha and bushels per acre), thousand seed weight (TSW), test weight (g per 0.5L), plump (%) and thins (%) at Melfort, 2011. Treatments different from the unsprayed check indicated by asterisks using the Dunnett's t test.

	Yield (bu/ac)	TSW (g)	Plump (%)	Flag leaf % disease	Penultimate leaf % disease	Rating (McFadden 0-11 scale)
Harrington						
Tilt	111*	45.9	89.4	36.4	52.2	8.6
Proline	121*	46.8	92.7*	8.1*	10.3*	5.4*
Check	93	43.1	84.5	61.0	87.2*	10.4
Metcalfe						
Tilt	113*	47.3	95.3	9.0	9.4	5.3*
Proline	119*	47.9*	95.7	5.0	6.0	4.4*
Check	101	43.7	92.5	25.7	37.5	8.0
Newdale						
Tilt	123	44.2	90.6	6.4*	5.6*	4.2*
Proline	121	47.3	92.9	6.1*	4.2*	3.6*
Check	118	44.3	89.5	14.5	19.1	6.8

Conclusions and Recommendations

WHEAT:

Under conditions at Melfort in 2011, a cultivar with good resistance to leaf spot diseases such as 5603HR, did not appear to warrant foliar fungicide application, while Infinity also with good resistance showed a benefit in both yield and quality. AC Barrie with a rating of poor also showed a positive response in terms of reduced disease symptoms and increased yield and quality as a result of foliar fungicides.

BARLEY:

Similar to wheat at Melfort in 2011, the most leaf spot resistant cultivar of barley, Newdale did not require fungicide treatment. Both of the more susceptible cultivars Harrington and AC Metcalfe showed significant yield responses to fungicide treatment, and the highly susceptible cultivar Harrington showed increased percent plump with Proline application.

Acknowledgements

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