Fungicide Application Timing for Management of Ascochyta Blight in Chickpea

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Key Words: scouting, disease progress, yield loss

Abstract

Ascochyta blight of chickpea [*Ascochyta rabiei*] is an extremely destructive disease capable of causing high yield and quality losses. The disease is widespread in chickpea growing areas of the prairies, and the pathogen can survive in crop debris for several years. Although partially resistant cultivars are available, the disease can still be devastating if weather conditions are favourable, making fungicides an important disease management tool. Trials investigating the effectiveness of different fungicide application timings and sequences were conducted on the desi cv. Myles and the kabuli cv. CDC Yuma at Saskatoon in 2003. The products used included Bravo 500, Headline, and Lance. The first application was made prior to flowering, when disease pressure was still extremely low. Additional applications were made at early flower, mid-flower, late flower or podding, with a maximum of three applications per treatment. In both cultivars, treatments without a pre-flower application of fungicide had higher disease severity and lower yields than treatments with a pre-flower application. Treatments without a pre-flower application that were sprayed three times were still inferior to treatments with a pre-flower application that were only sprayed twice. These results emphasize the need for early and frequent scouting for disease symptoms in chickpea to allow for early fungicide application if it is appropriate.

Introduction

Ascochyta blight caused by *Ascochyta rabiei* can cause yield losses in excess of 90% in Saskatchewan. Difficulties with management of this disease have contributed to the decline in chickpea production on the prairies over the past two years. Some resistance to ascochyta blight is available in chickpea varieties, but disease management relies heavily on the timely use of fungicides. Prior to 2003, Bravo 500 was the only foliar fungicide registered for control of ascochyta blight in chickpea. Lance and strobilurins Headline and Quadris have recently been registered for chickpea, providing more options for producers. Trials were conducted at

Saskatoon and in commercial fields near Dinsmore and Demaine, Sask. to examine the efficacy of different application timings and product sequences. Trials at Dinsmore and Demaine suffered from drought and disease severity was below 10% in the untreated checks. At Saskatoon, temperatures were normal throughout the season and several rain events throughout the season allowed the disease to get established and spread. For these reasons, only the results from Saskatoon are presented.

Materials and Methods

Fungicide trials were conducted at Saskatoon (Kernen Research Farm, University of Saskatchewan) on cultivars Myles (desi) and CDC Yuma (kabuli). The fungicides used included Bravo 500 (contact activity, chlorothalonil, Syngenta), Headline (contact and systemic activity, pyraclostrobin, BASF) and Lance (contact and systemic activity, boscalid, BASF). Fungicide applications were made at pre-, early, mid-, late flower or podding with treatments consisting of one to three applications of the various products (Table 1). Fungicides were applied with 200 L ha^{-1} of water at 275 kPa using standard flat fan nozzles. The experimental design was a randomized complete block design (RCBD) with four replicates.

Plant density was determined 4 weeks after seeding. Disease severity was assessed using a 0-11 scale (Horsfall and Barratt, 1945) at five spots in each plot at each fungicide application and 10 days after the last fungicide treatment. One thousand seed weight and percent seed infection were also determined.
Disease severity at each rating date was plotted against time and the area under the disease progress curve (AUDPC) was calculated. AUDPC and yield data were analyzed using the glm procedure in SAS and means were separated using Tukey's test statistics.

Table 1. Fungicide Treatments Used to Evaluate Different Timings of Fungicide Application.

	Growth stage				
	Pre-Flower	**Early Flower**	**Mid- Flower**	**Late-Flower**	**Podding**
Treatment	(~ 7 days before first flower	10-14 days	10-14 days	10-14 days	10-14 days
1	Check				
2	Bravo 500 [1]				
3	Bravo 500		Bravo 500		
4	Bravo 500			Bravo 500	
5		Bravo 500	Bravo 500		Bravo 500
6	Bravo 500	Bravo 500		Bravo 500	
7	Bravo 500		Bravo 500		Bravo 500
8	Headline [2]	Headline		Bravo 500	
9	Headline		Headline		Bravo 500
10	Headline			Headline	
11		Headline	Headline		Lance[3]
12	Headline	Headline		Lance	
13	Headline		Headline		Lance
14	Headline		Lance		Headline

[1] Bravo 500 rate = 1kg ai/ha
[2] Headline rate = 100 g ai/ha
[3] Lance rate = 300 g ai/ha.

Results

The disease level in untreated control plots was moderate, with 21% in Myles (desi) and 44% in CDC Yuma (kabuli). Results clearly indicated that a pre-flower application of either Bravo 500 or Headline had a significant effect on reducing disease severity. In treatments in which Bravo 500 or Headline were not applied until early flowering, disease levels were comparable to that in untreated check plots. In plots of CDC Yuma, the untreated check as well as three applications of Bravo 500 (treatment 5: early flower, mid-flower and podding) had the highest levels of ascochyta blight infection (Figure 1). Somewhat lower levels were observed in plots where plants were sprayed with Headline at early and mid-flower plus an application of Lance at podding (treatment 11). All other treatments resulted in lower levels of infection relative to the control, but were not different from each other. Similar to CDC Yuma, the highest disease levels in Myles were observed in untreated check plots and in plots with treatment 5. Very little variation was observed among the remaining treatments (Figure 2).

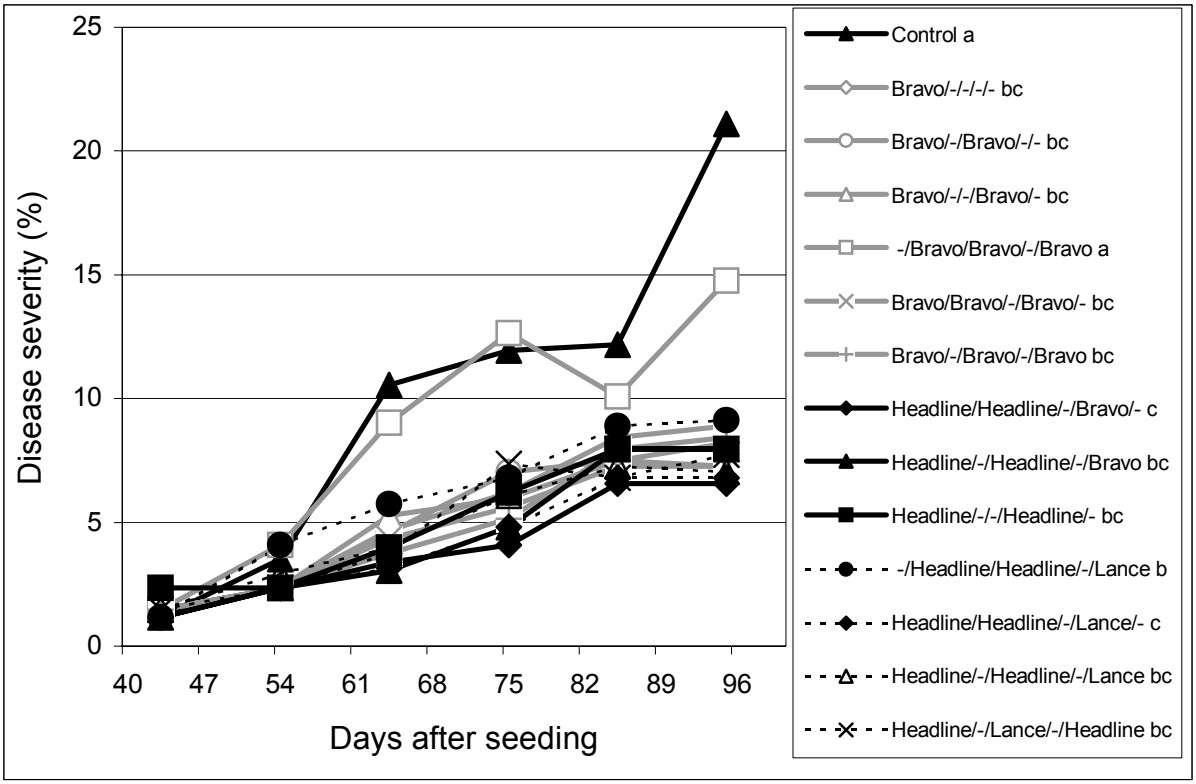

Figure 1: Disease progress in Myles (desi chickpea) sprayed with one to three applications of Bravo 500, Headline or Lance at different times during the growing season.
Treatments followed by the same letter are not significantly different (Tukey's test on area under the disease progress curve (AUDPC), p = 0.05)

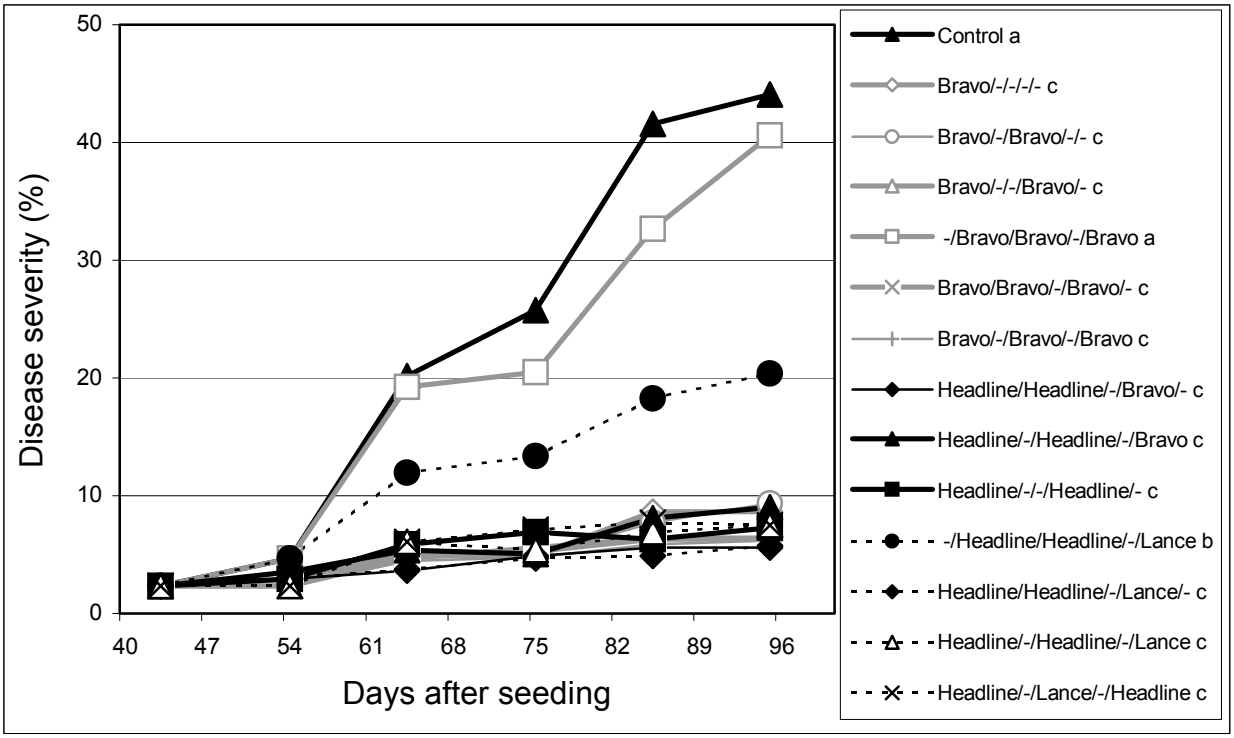

Figure 2: Disease progress in CDC Yuma (kabuli chickpea) sprayed with one to three applications of Bravo 500, Headline and Lance at different times during the growing season. Treatments followed by the same letter are not significantly different (Tukey's test on area under the disease progress curve (AUDPC), p = 0.05)

Fungicide treatments had the same effect on yields of both varieties, so will be discussed based on yield averaged over both varieties (Figure 3). Plots with treatment 12 (pre- and early flower application with Headline, late flower application with Lance) had significantly higher yields (16 to 46 % higher) compared to those of treatments 5, 7, 11, 13, 14 and the untreated check plots. The treatments with reduced yield either had no pre-flower application, or had no early and late flower application. The yield of treatment 12, however, was not significantly different from other treatments (2, 3, and 9) that were also without early and late flower applications. The least effective treatments apart from the untreated check were those without pre-flower application. Even a single pre-flower application, or applications at pre- and mid flower with Bravo 500 resulted in significantly higher yields compared to treatments without pre-flower application, regardless of whether Bravo 500 or Headline was used.

Fungicide treatments had no significant effect on seed infection in 2003, since seed disease levels were extremely low. There was a significant effect of fungicide treatment on Myles seed weight, but not on CDC Yuma seed weight. Myles TSW was higher for treatments 12, 13, and 10 than for treatments 1 and 2 (control and one pre-flower Bravo 500 application). Other treatments did not differ from one another.

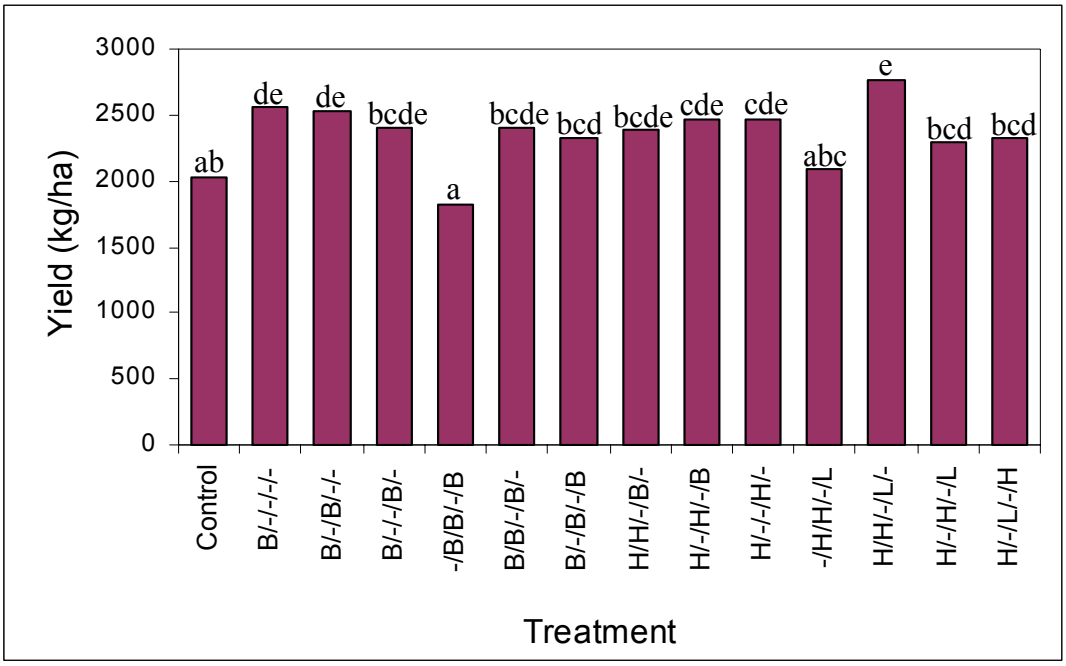

Figure 3: Average yield in field plots grown with Myles (desi chickpea) and CDC Yuma (kabuli chickpea) sprayed with one to three applications of Bravo 500, Headline or Lance at different times during the growing season.
Treatments of Bravo 500 (B), Headline (H) and Lance (L) at pre-flower/early flower/mid-flower/late flower/podding.
Treatments labelled with the same letter are not significantly different, $HSD_{0.05}$ (Tukey's honestly significant difference) = 424 kg ha^{-1}.

Conclusions

Results of these experiments indicate that application of fungicides at the pre-flower stage can be critical for the control of ascochyta blight in chickpea. Early control of the disease at the pre-flower stage, regardless of follow-up applications, was important under the medium disease pressure experienced in 2003.

References

Horsfall, J.G., and Barrett, R.W. 1945. An improved grading system for measuring plant diseases. Phytopathology, 35: 655.