Fungicides application timing, sequencing and tank mixing for controlling blight in chickpea

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Abstract

Total crop losses can result from ascochyta blight on chickpea (caused by *Ascochyta rabiei*). A study was conducted to investigate effective fungicide application strategies in particular fungicide application timing as well as product choices, sequencing and mixtures for blight control. In addition, this study is expected to provide information on resistance management through fungicide rotations, mixtures or sequences. Fungicide trials were conducted in Saskatoon and Swift Current using Bravo 500, Quadris, Headline, BAS510 and Dithane in various sequences or tank mixes on cultivars Myles and CDC Yuma. Only Bravo 500 is registered on chickpea. Quadris had emergency registration in 2002. Applications were timed at the seedling stage, pre-flower, early-flower, late-flower and the podding stages. These results relate to the trial at Swift Current. Cultivar CDC Yuma developed higher infection levels than Myles. The level of disease control by each fungicide treatment was dependent on cultivar. The above average rainfall in Swift Current increased the level of blight severity and consequently it required several sprays especially on cultivar CDC Yuma to protect the crop. Cool wet weather towards the end of the season also delayed maturity and affected yield and seed quality. Disease severity was 97% and 82% in the untreated plots of CDC Yuma and Myles, respectively. In treated plots, it ranged from 13-50% in Myles and 15-96% in CDC Yuma. The yields varied from 434 to1956 kg/ha for CDC Yuma and 1430 to 2627 kg/ha for Myles. When spraying started before symptoms (per calender sprays with five applications), the high rate of Dithane at 2.44 kg a.i./ha reduced disease severity and increased yield more than the low rate of Dithane at 1.68kg a.i./ha. Sequencing Headline and Dithane in the per calender spray was better than per calender sprays with Dithane alone on both cultivars. However, per calender spray with a high rate of Dithane alone compared well with some treatments which included Headline or Quadris on Myles. Almost all other sequences were effective on Myles, but on CDC Yuma the most effective were those that included mostly Headline and in some cases Quadris. In general, at least three sprays to Myles and most treatments with at least four sprays to CDC Yuma reduced blight to less than 50% and also increased yields by up to 84% in Myles and up to 351% in CDC Yuma. The results suggest that there could be a range of different fungicides and sequences one might use to adequately protect chickpea, but this will depend on the registration of products other than Bravo 500..

Background

Chickpeas provide producers with a valuable rotational alternative away from traditional cereal and oilseed based systems, with potentially higher income levels. However, crop losses due to ascochyta blight (caused by *Ascochyta rabiei*) limit the expansion of chickpea. The problem of ascochyta blight is part of the reason chickpea production was significantly down in 2002 by 60% (SAFRR) from a record high of 1.1mil acres in 2001.

Although genetic resistance is available in some cultivars, it is only partial and breaks down in adult plants and severe infections can appear after flowering (Chongo and Gossen 2001). High infection levels and disease pressure in many growing areas in recent years show that ascochyta blight has become more widespread and symptoms are now more common on seedlings than before (Chongo et al. 2002a,b). Until more resistant varieties become available that do not heavily rely on fungicide applications, there is a need for efficient fungicide strategies in chickpea. By the 2002 growing season, only Bravo 500 was registered on chickpea, and Quadris had emergency registration. Through collaboration with the agri-chemical industry, new fungicide products will be incorporated into this study as they become available. This will accelerate the registration process and ensure that the research community will have access to the latest independent data for new fungicides.

The objectives are a) to investigate the effect of fungicide application timing on disease control (including pre- and post-flower application). b) to investigate the effect of fungicide sequences and tank mixes on disease control. c) to compare prophylactic per calendar fungicide application versus application based on field scouting.

Materials and methods

Chickpea cultivars CDC Yuma (kabuli) and Myles (desi) were seeded on May 13 at Swift Current and May 27 at Saskatoon. Treatments are listed in Table 1. Per calendar fungicide applications commenced before disease symptoms on June 13 at Swift Current and June 27 at Saskatoon using a low and a high rate of Dithane (mancozeb, Dow-Agro Sciences) applied at approximately 10-14 day intervals and a third one using three sprays with the high rate of Dithane and 2 sprays with Headline (pyrachlostrobin, BASF). Various other fungicides which included Bravo 500 (chlorothalonil, Syyngenta), Quadris (azoxystrbin, Syngenta), Headline and BAS510 F (boscalid, BASF) were used in sequences including a Bravo 500 plus Quadris tank mix treatment (Table 1). A split-block design with cultivar as main-plots and fungicides as sub-plot factors was used.

Fungicides were applied in 200 L ha^{-1} spray volume at 275 kPa using standard flat fan nozzles. An average disease rating in each plot was obtained from plants in five spots per plot at each fungicide application and 1-2 times at 2-3-wk intervals after the last fungicide treatments using a 0-11 scale (Campbell and Madden 1990). Harvesting dates for seed yield were October 9 and 10 for CDC Yuma and Myles, respectively. One thousand seed weight and seed quality assessments were also determined.

Table 1. Fungicide treatments, timing and application intervals.

Treatment	Chickpea Growth Stage				
	Seedling	**Pre-Flower**	**Early Flower**	**Mid-late Flower**	**Podding**
	~4 wks after seeding	10-14 days	10-14 days	10-14 days	10-14 days
1	Check				
2		Bravo		Quadris	
3		Bravo		Headline	
4		Bravo/Quadris*		Bravo/Quadris*	
5		Dithane - L	Bravo 500		Quadris
6		Dithane - L	Bravo 500		Headline
7		Bravo 500	Headline	Headline	Bravo 500
8		Bravo 500	Quadris	Quadris	Bravo 500
9	Dithane - L	Dithane - L	Dithane - L	Dithane - L	Dithane - L
10	Dithane - H	Dithane - H	Dithane - H	Dithane - H	Dithane - H
11	Dithane - L	Dithane - L	Headline	Headline	Dithane - H
12		Dithane - H	Headline	Dithane - H	Dithane - H
13		Headline	Headline	Dithane - H	Dithane - H
14		Headline	Dithane - H	Headline	Dithane - H
15		Headline	Headline	BAS 510 F	BAS 510 F

Fungicides rates: **Dithane** L = 1.68 kg ai/ha, H = 2.44 kg ai/ha; **Bravo 500** 1 kg ai/ha; **Quadris** 125 g ai/ha; **Headline** 100 g ai/ha; **BAS510 F** 300 g ai/ha. *Tank mix.

Results and discussion

Only results from Swift Current are reported. Cultivar CDC Yuma developed higher infection levels than Myles. The level of disease control by each fungicide treatment was affected by cultivars. The above average rainfall in Swift Current increased the level of blight severity and consequently it required several sprays especially on cv. CDC Yuma to protect the crop (Fig. 1). Symptoms were first observed at the second rating on June 26 at Swift Current (Fig. 1). Generally, disease severity in both cultivars first peaked at the third rating during a period of cool wet weather that was characterized by rainfall and maximum daily temperatures around 20^{o}C (Fig. 1). Disease severity then declined at the fourth rating done on July 12, mainly due to hot and dry conditions when daily max temperatures were close to 30°C at the time (Fig. 1). This is also supported by the fact that blight severity in the untreated plots also decreased. In some treatments, blight severity sharply increased more on cv. CDC Yuma than on cv. Myles at the sixth and seventh disease ratings conducted on August 27 and September 19 under cool wet weather (Fig. 1). Cool wet weather at the end of the season resulted in increased infection levels and plant re-growth which also delayed maturity and affected yield and seed quality. Significant differences were observed among fungicide treatments in disease control seed yield. The final disease severity was highest in the untreated control plots; up to 97% and 82% on cv. CDC Yuma and cv. Myles, respectively (Fig. 2 & 4). In treated plots, the severity of ascochyta blight ranged from 13-50% on cv. Myles and 15-96% on cv. CDC Yuma. The yields from plots that were not treated were 434 kg/ha for cv. CDC Yuma and 1430 kg/ha for cv. Myles and in both cultivars the untreated plot yields were significantly lower than yields of treated plots which ranged from 948-1959 kg/ha in CDC Yuma and 1910-2627 kg/ha for Myles (Fig. 2 & 4).

Five preventative or per calendar sprays (where spays began before symptoms) with the high rate of Dithane at 2.44 kg a.i./ha reduced disease severity and increased yield more than five sprays with the low rate of Dithane at 1.68kg a.i./ha (Fig. 3 & 5). Sequencing Headline and Dithane in the per calendar spray was better than per calendar sprays with Dithane alone on both cultivars. However, per calendar spray with a high rate of Dithane alone compared well with some treatments, which included more effective fungicides such as Headline or Quadris on cv. Myles. Almost every fungicide sequence was effective on cv. Myles, but on cv. CDC Yuma the most effective were those that included mostly Headline and in some cases Quadris. In general, at least three sprays to cv. Myles and most treatments with at least four sprays to cv. CDC Yuma reduced blight to less than 50% and increased yields by up to 84% in Myles and up to 351% in cv. CDC Yuma over that of the untreated control.