Yield losses from blackleg (*Leptosphaeria maculans*) in canola varieties under moderate disease pressure

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ABSTRACT

Canola is an important break crop in the wheat dominant cropping systems of Western Australia. High canola grain prices in recent years have resulted in farmers increasing their canola plantings and as a result tighten rotations; reducing both time between consecutive crops and separation from previous years' stubbles. These practices are putting much higher disease pressure on canola, particularly from blackleg (*Leptosphaeria maculans*). The objectives of the current studies were to examine the effects of blackleg on yield of canola varieties sown under disease pressure relevant to this increased frequency of canola cropping. Trials were conducted in the >450mm average growing season rainfall areas of Western Australia. Ten canola varieties, including five varieties each from CL and TT herbicide tolerance groups, were sown with and without maximum fungicide protection in a paddock containing 18 month old canola residues. The maximum fungicide protection treatment included fluquinconazole seed dressing, flutriafol treated fertiliser and 3 foliar sprays of flutriafol. Trial design was a split-split plot design (Fungicides as main plots, herbicide groups as sub plots and varieties as sub sub plots) with four replications. Blackleg assessments were made three weeks before swathing.

Maximum fungicide treatment significantly reduced the crown canker severity in all varieties compared with the nil treatments. At Wongan Hills, the crown canker severity ranged between 1-14% in plots with maximum fungicide protection treatment compared to 20-75% in plots without fungicide protection. A similar trend was observed at Katanning. Likewise, seed yield was significantly higher with maximum fungicide protection treatment in most varieties at both locations. Yield losses were variable in canola varieties and ranged between 13-35% at Wongan Hills and 10-49% at Katanning.

Key words: Blackleg – canola – yield loss – resistance – crown canker

INTRODUCTION

Blackleg (*Leptosphaeria maculans*) is one of the most important diseases of canola and still a major bottleneck in the expansion and sustainability of canola industry in Australia (Khangura and Barbetti, 2001). Blackleg can infect any part of the plant at any growth stage during the growing season but the major yield loss occurs from cankers that develop early in the season (Barbetti and Khangura, 1999; Khangura and Barbetti, 2002, 2004). Management of blackleg is possible through a combination of strategies as a single strategy on its own does not always provide adequate protection from the disease. Use of resistant varieties is the most economical and effective means of managing blackleg. Current commercial canola varieties range in their resistance to blackleg from R (resistant) to MS (moderately susceptible) (CAA blackleg resistance ratings 2011). Canola varieties are evaluated under severe pressure of blackleg across several locations in Australia to assign blackleg resistance ratings, however, resistance ratings may not be directly related to yield loss. Knowledge of the potential yield loss of a variety to blackleg will help growers choose varieties with appropriate levels of resistance for managing blackleg in their crops.

The aim of the present investigation was to determine the relationship between yield losses from blackleg in commercial canola varieties, with varying resistance levels, under moderate disease pressure situations in Western Australia.

MATERIALS AND METHODS

Trials were conducted to determine the yield loss from blackleg in Clearfield (CL) and Triazine tolerant (TT) varieties at Wongan Hills, and Katanning. Ten canola varieties including 5 varieties each from CL and TT herbicide groups were sown with and without maximum fungicide protection in a paddock containing 18 month old canola residues. The fungicide treatment included fluquinconazole seed dressing @ 2g a.i./Kg, Impact in Furrow @ 250g a i./ha and 3 sprays of Impact @ 250g a.i./ha foliar application. The first fungicide spray was applied at 4 weeks after sowing and followed by two more sprays at the same rate at 4 week interval.

Trial design was a split split plot design (Fungicides as main plots, herbicide groups as sub plots and varieties as sub sub plots) with four replications. Blackleg assessments were made three weeks before swathing. All plots were harvested for yield.

RESULTS

At Wongan Hills, maximum fungicide treatment reduced the crown canker severity in all varieties to levels that are likely to have caused little or no yield loss and significantly improved yield (Table 1). Significant yield losses occurred in all varieties except for 45Y77 and 46Y81 The yield loss in different varieties ranged between 13-35% (Fig. 1).

Likewise, at Katanning, the main effect of fungicide was significant although crown canker severity in the protected plots remained at a level that is likely to have caused yield loss. However, the fungicide protection treatment significantly improved yield, compared with the nil treatments, in most of the varieties (Table 2). The yield loss in different varieties ranged between 10-49% (Fig. 1).

Table 1. Blackleg severity (Percent disease index or PDI) and yield (Kg/ha) of canola varieties with and without full fungicide protection under moderate disease pressure of blackleg at Wongan Hills in 2009.

Variety	Herbicide resistant group	Genotype	BRR	PDI		Yield (Kg/ha)		
				Nil	Protected	Nil	Protected	% inc
43C80CL	CL	NA	MS	41	4	784	933	19
Warrior	CL	NA	MR-MS	45	2	476	734	54
45Y77	CL	RlmS	MR	52	6	685	784	14
46Y81	CL	NA	R-MR	32	2	675	784	16
Hyola 571CL	CL	NA	R	23	1	893	1042	17
Stubby	TT	NA	S	75	14	384	585	52
Boomer	TT	NA	MS-S	71	9	655	923	41
Cobbler	TT	Rlm4, Rlm9 (H)	MS	48	6	635	814	28
Thunder	TT	Rlm4	MR-MS	20	4	496	685	38
Tornado	TT	Rlm4, Rlm9	MR	28	1	536	734	37
Mean				43	5	622	802	
Lsd (*P<0.05*) for the main effect of fungicide					4		41	

NA = Currently no information available
BRR = Blackleg resistance rating
% inc = % increase in yield in protected treatments over control

Table 2. Blackleg severity (Percent disease index) and yield (Kg/ha) of canola varieties with and without full fungicide protection under moderate disease pressure of blackleg at Katanning in 2009.

Variety	Herbicide resistant group	Genotype	BRR	PDI		Yield (Kg/ha)		
				Nil	Protected	Nil	Protected	% inc
43C80CL	CL	NA	MS	66	57	696	936	34
Warrior	CL	NA	MR-MS	55	42	742	1017	37
45Y77	CL	RlmS	MR	76	60	662	1070	62
46Y81	CL	NA	R-MR	64	39	769	1070	52
Hyola 571CL	CL	NA	R	45	30	970	1077	11
Stubby	TT	NA	S	71	60	508	996	96
Boomer	TT	NA	MS-S	69	54	689	883	28
Cobbler	TT	Rlm4, Rlm9 (H)	MS	54	43	843	1043	24
Thunder	TT	Rlm4	MR-MS	48	17	923	1297	40
Tornado	TT	Rlm4, Rlm9	MR	40	22	883	1137	29
Mean				59	42	768	1053	
Lsd (*P<0.05*) for the main effect of fungicide					6		126	

NA = Currently no information available
BRR = Blackleg resistance rating
% inc = % increase in yield in protected treatments over control

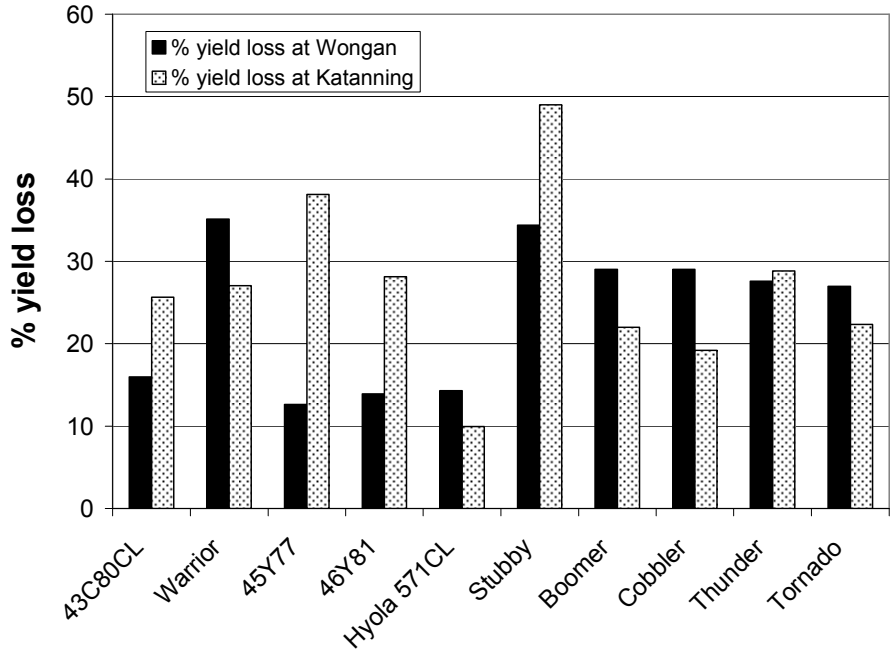

Fig. 1. Percent yield loss in canola varieties from blackleg at Wongan Hills and Katanning in Western Australia.

DISCUSSION

Yield loss from blackleg in canola varieties was variable.. The highest yield loss in the moderately susceptible variety Stubby and the lowest yield loss in the resistant variety Hyola 571CL as expected. Interestingly, the yield loss was also variable between the two locations. For example variety 45Y77 suffered much higher yield loss at Katanning than at Wongan Hills, whereas, varieties like Tornado, Boomer, Cobbler and Warrior suffered higher losses at Katanning than at Wongan Hills. Yield losses didn't appear to be as well related to resistance rating or canker severity. For example, at Wongan Hills yield loss in a Clearfield 'R' variety was not much different from yield loss in a Clearfield 'MS' variety. Generally, canker severity appeared to be related to resistance ratings except for 45Y77 (MR) that had higher severity than expected at both sites and 46Y81 (R-MR) had higher severity at Katanning than expected. These differences may possibly be attributed to the differences in pathogen populations at the two sites and the geographical location. These findings showed that significant yield loss due to blackleg can occur even under moderate disease pressure if the conditions for disease development are conducive. Additionally, this study highlighted the potential importance of breeding for disease resistance since currently no effective in-season control is available.

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