Variety selection and grain yield potential are key to manage septoria tritici blotch (STB) in wheat in the medium and low rainfall regions of Southern Australia

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Background

Septoria tritici blotch (*Zymoseptoria tritici*), is a stubble-borne fungal disease of wheat, that is now widespread and damaging in many parts of Victoria and South Australia. In recent years, it has become the most prevalent disease across Southern Region's medium (MRZ) and low (LRZ) rainfall zones with grain yield losses of greater than 20 per cent in susceptible crops. During 2022, field experiments by Agriculture Victoria and the South Australian Research and Development Institute (SARDI) demonstrated up to ~43 per cent yield loss and quality reductions in susceptible varieties during seasons with wet conditions.

Agriculture Victoria in partnership with the SARDI, with supporting investment from GRDC, has conducted 45 field experiments in the past three seasons to determine the impact of STB and identify best management practices for control suited to LRZ and MRZ. This research found yield losses can be significantly reduced by avoiding susceptible varieties, rotating wheat with other crops for a minimum of at least one season and using foliar fungicides. This article summarises results from four field experiments conducted in different regions of Vic and SA during 2023 evaluating variety selection as a strategy to manage STB.

Aim

To evaluate the impact of Septoria tritici blotch on wheat of different resistant ratings and determine yield loss in the MRZ and LRZ of the Southern Australia.

Methods

Four field experiments were conducted during 2023 to evaluate yield and quality loss in wheat cultivars with contrasting resistance/susceptibility to STB. One experiment each was conducted in the MRZ and LRZ regions of both Victoria and South Australia. Each experiment had six commercial wheat varieties, two treatments: 1) Maximum disease and 2) Minimum disease with six replications arranged in split plot designs with treatment considered as the main plot and varieties as subplots.

Plots were visually assessed for STB severity on multiple occasions during the season and then harvested for grain yield. A sub-sample of grain from each plot was quality tested for protein percentage, screenings (percentage of grain less than 2.2 mm in width), retention (percentage of grain greater than 2.5 mm width) and grain weight. All data was analysed by ANOVA using Genstat.

Trial details

Locations:

Location	Rainfall zone	Soil type	Growing season (Apr – Nov) rainfall (mm)
Longerenong (VIC)	MRZ	Clay	331
Hart (SA)	MRZ	Clay loam	281
Kinnabulla (VIC)	LRZ	Clay	219
Booleroo (SA)	LRZ	Red loam	221

Treatments:

1. Minimum disease – Seed + foliar applied fungicides at Z31 and Z39
2. Maximum disease - No disease control with 1 Kg STB infected wheat stubble/plot or inoculated with spore inoculum at a concentration of > 10,000 spores/ml.

Varieties:

Variety	Resistance Rating[A]
LRPB Lancer	MS
Hammer CL Plus	MSS
Scepter	S
Calibre	S
Razor CL Plus	SVS
LRPB Impala	SVS

[A]*Hollaway, McLean and Dadu (2023) Cereal Disease Guide 2023*

Trial design: Split plot design

Replicates: 6

Sowing and harvest details:

Location	Rainfall zone	Sowing date	Sowing rate (plants/m^2)	Harvest date	Trial average yield (t/ha)
Longerenong (VIC)	MRZ	26th April 2023	150	4th December 2023	6.1
Hart (SA)	MRZ	18th May 2023	150	3rd November 2023	3.0
Kinnabulla (VIC)	LRZ	1st May 2023	150	21st December 2023	5.1
Booleroo (SA)	LRZ	1st June 2023	150	25th November 2023	2.0

Trial inputs: UREA and MAP applied and managed as per best practice and kept weed and pest free. Tebuconazole was applied at 145mL/ha to all plots at both in Longerenong and Kinnabulla, Victoria to selectively control stripe rust.

Chemical applications*:

Fungicide application timing	Product	Active ingredient (gai/L)#	Rate
Seed	Jockey Stayer®	Fluquinconazole 167g/L	300 mL/100 Kg seed
Foliar at Z31	Soprano®	Epoxiconazole 500 g/L	125 mL/ha
Foliar at Z39	Elatus Ace®	Benzovindiflupyr 40g/L + Propiconazole 250g/L	500 mL/ha

*# gai = grams active ingredient *Tebuconazole applied at 145mL/ha to all plots and sites in Victoria to selectively control stripe rust.*

Results

Severe STB developed at three trial sites which reduced grain yield by 5 – 28% or 0.26-1.48 t/ha (Tables 1 & 2). In addition, STB infection caused minor reductions in grain quality of susceptible varieties at both the trial sites of Victoria and at Hart (MRZ) in South Australia (data not shown). Disease severity and yield losses during 2023 were similar to 2022 despite below average spring rainfall in the southern region. Grain yield losses were also measured for the first time in Mallee where STB impact was usually considered low. This is due to substantial inoculum carry over from 2022 in addition to the inoculum supplied through STB infected stubble and wet winter conditions during 2023 which sustained the disease pressure across the season leading to yield losses. The widespread presence of susceptible varieties and implementation of stubble retention systems have led to increase in prevalence of stubble borne diseases impacting grain yield and quality of wheat crops. Surveillance conducted in Victoria (particularly in Wimmera and Mallee) during 2019-2023 found STB prevalence increased up to 56% with a gradual increase in severity from 0 to 22% in 2023 (DJP2103_005RTX). Between 2019 and 2023, there was a change in varieties grown in the region with most now being susceptible to very susceptible to STB.

Consistent with the previous seasons, susceptible varieties including Hammer CL Plus (MSS), Scepter (S), Calibre (S) and LRPB Impala (SVS) were the most affected due to STB during 2023. The susceptible to very susceptible variety Razor CL Plus was the hardest hit among all varieties with 28% yield loss at

Longerenong (MRZ). This once again reiterated the importance of avoiding highly susceptible varieties to manage STB. The results from the last three seasons indicated that to manage STB without fungicide intervention, varieties with a rating of at least moderately susceptible (MS) or moderately susceptible to susceptible (MSS) should be considered in MRZ and LRZ respectively.

In comparison to Victoria, no yield losses were found in South Australian trial sites due to STB (Tables 3 & 4). At Hart (MRZ), greater disease severity was found but no yield losses were measured. This is likely due to the low grain yield potential (<3 t/ha) at the site which did not allow differences between minimum and maximum disease treatments. This was also in agreement with the last three seasons results where yield losses were only found when the yield potential was greater than 3 t/ha suggesting that STB is likely to have no economic impact where the grain yields are less than 3 t/ha. Where yields are more than 3 t/ha, using less susceptible varieties showed less disease incidence and fewer yield losses. At Booleroo (LRZ), there was less disease incidence and no yield loss in any of the varieties assessed.

Table 1: Septoria tritici blotch severity (% leaf area affected) and associated grain yield loss of six wheat varieties treated with low and high disease levels at Longerenong (MRZ), VIC during 2023.

Variety	Rating	Severity (%LAA)[A] in Max. treatment			Grain yield (t/ha)		Yield loss (%)[D]
		06-July[B]	14-Aug	13-Oct			
		Z25-31	Z39	Z75	Min.[C]	Max.	
LRPB Lancer	MS	1[a]	5[a]	23[a]	6.16	5.87[ns]	-
Hammer CL Plus	MSS	2[b]	11[b]	46[b]	6.19	5.21**	16
Scepter	S	3[c]	22[c]	79[c]	6.45	5.37**	17
Calibre	S	3[b]	21[c]	78[c]	6.60	5.74**	13
Razor CL Plus	SVS	3[c]	24[c]	96[d]	5.35	3.87**	28
LRPB Impala	SVS	3[bc]	21[c]	91[d]	5.76	4.88**	15
P		<0.001	<0.001	<0.001			
LSD (0.05)		0.6	3.4	6.4			

*[A]Within column means with one letter in common are not significantly different. ** = statistically significant at 5% LSD. [B]Date of assessment made and Zadoks growth stages Z31, stem elongation; Z39, flag leaf emergence; Z75, Milk development according to Zadoks et al. (1974). First two assessments were average of single plot assessments while the third assessment was average of the top three leaves of ten tillers per plot. [C] Max. = Maximum disease treatment; Min. = Minimum disease treatment. [D] Yield loss % for each variety was presented as percentage yield decrease vs the minimum disease treatment.*

Table 2: Septoria tritici blotch severity (% leaf area affected) and associated grain yield loss of six wheat varieties treated with low and high disease levels at Kinnabulla (LRZ), VIC during 2023.

Variety	Rating	Severity (%LAA)[A] in Max. treatment			Grain yield (t/ha)		Yield loss (%)[D]
		10-Aug[B]	08-Sep	19-Sep			
		Z37	Z59	Z65	Min.[C]	Max.	
LRPB Lancer	MS	8[a]	5[a]	5[a]	5.15	5.14[ns]	-
Hammer CL Plus	MSS	12[b]	9[b]	8[a]	5.26	5.00**	5
Scepter	S	21[e]	27[de]	32[b]	5.77	5.21**	10
Calibre	S	19[cd]	25[cd]	41[c]	5.44	4.76**	13
Razor CL Plus	SVS	21[de]	29[e]	55[d]	4.38	4.01*	8
LRPB Impala	SVS	18[c]	24[c]	27[b]	4.79	4.42*	8
P		<0.001	<0.001	<0.001			
LSD (0.05)		1.8	2.8	5.5			

*[A]Within column means with one letter in common are not significantly different. ** = statistically significant at 5% LSD. [B]Date of assessment made and Zadoks growth stages Z37, flag leaf emergence; Z59, ear emergence; Z65, flowering according to Zadoks et al. (1974). First two assessments were average of single plot assessments while the third assessment was average of the top three leaves of ten tillers per plot. [C] Max. = Maximum disease treatment; Min. = Minimum disease treatment. [D] Yield loss % for each variety was presented as percentage yield decrease vs the minimum disease treatment.*

Table 3: Septoria tritici blotch severity (% leaf area affected) and associated grain yield loss of six wheat varieties treated with low and high disease levels at Hart (MRZ), SA during 2023.

Variety	Rating	Severity (% LAA) in Max. treatment[A]		Grain yield (t/ha)	
		19 Sept	3 Oct	Min.	Max.[C]
LRPB Lancer	MS	4[a]	6[a]	2.76	2.67[ns]
Hammer CL Plus	MSS	4[a]	12[ab]	2.87	2.84[ns]
Scepter	S	14[b]	30[cd]	3.20	2.94[ns]
Calibre	S	10[b]	21[bc]	3.22	3.04[ns]
Razor CL Plus	SVS	19[c]	43[e]	3.25	3.03[ns]
LRPB Impala	SVS	12[b]	34[de]	2.91	2.67[ns]
P		<0.001	<0.001		
LSD (0.05)		4.7	9.9		

*[A]Within column means with one letter in common are not significantly different. [B]Average of ten tillers per plot; [C]Max. = Maximum disease; Min. = Minimum disease; ** = statistically significant at 5% LSD; * = statistically significant at 1% LSD, [ns] = not significant at 5% LSD.*

Table 4: Septoria tritici blotch severity (% leaf area affected) and associated grain yield loss of six wheat varieties treated with low and high disease levels at Booleroo (LRZ), SA during 2023

Variety	Rating	Severity (% LAA) in Max. treatment[A]	Grain yield (t/ha)	
		16 Oct	Min.	Max.[C]
LRPB Lancer	MS	0[a]	1.77	1.63[ns]
Hammer CL Plus	MSS	0[a]	2.13	2.26[ns]
Scepter	S	1[abc]	2.12	2.32[ns]
Calibre	S	1[ab]	2.15	1.93[ns]
Razor CL Plus	SVS	1[c]	2.04	2.09[ns]
LRPB Impala	SVS	1[bc]	1.73	1.94[ns]
P		0.004	-	-
LSD (0.05)		0.6	-	-

*[A]Within column means with one letter in common are not significantly different. [B]Average of ten tillers per plot; [C]Max. = Maximum disease; Min. = Minimum disease; ** = statistically significant at 5% LSD; * = statistically significant at 1% LSD, [ns] = not significant at 5% LSD.*

Conclusion

STB has become a common foliar disease of wheat in the MRZ and LRZ of both Vic and SA supported by both the widespread cultivation of susceptible cultivars and stubble retention practices.

Consistent with the previous seasons, AgVic and SARDI trials demonstrated that susceptible varieties were the most affected due to STB during 2023. The susceptible to very susceptible variety Razor CL Plus was the hardest hit among all varieties with 28% yield loss at Longerenong (MRZ). However, in these experiments the disease development and yield losses were relatively low when susceptible varieties were avoided. Therefore, growing resistant cultivars can greatly reduce the potential impact of this disease even during a high-pressure season. The findings from the past three seasons indicated that to manage STB without fungicide intervention particularly in wet seasons, varieties with a rating of at least moderately susceptible (MS) or moderately susceptible to susceptible (MSS) should be considered in MRZ and LRZ, respectively (Table 5). Losses due to STB were also found dependent on grain yield potential of the variety, where potential is less than 3 t/ha, no losses were measured due to STB infection. As a result, growers are recommended to access yield (such as Yield Prophet®) and disease prediction tools to make informed decisions about in-crop STB management.

Table 5: Yield loss of six wheat varieties due to septoria tritici blotch infection in Wimmera and Mallee, Victoria during 2021-2023

Variety	Rating	Wimmera (MRZ)			Mallee (LRZ)		
		Yield loss (%)					
		2021	2022	2023	2021	2022[#]	2023
Sunlamb	MR	0	NA	NA	0	NA	NA
Orion	MRMS	0	NA	NA	0	NA	NA
LRPB Lancer	MS	0	17	0	0	-	0
Hammer CL Plus	MSS	0	21	16	0	-	5
Scepter	S	8	36	17	0	-	10
Calibre	S	NA	35	13	NA	-	13
Razor CL Plus	SVS	NA	43	28	NA	-	8
LRPB Impala	SVS	7	35	15	0	-	8

[#]2022 experiments at Mallee site, Nullawil were overrun by stripe rust infection, hence no data collected.

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