Key timings for fungicide applications to manage Septoria tritici blotch (STB) in wheat in the medium and low rainfall zones 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.

Fungicides are proven to be effective in controlling STB in wheat. However, the long latent period of the pathogen causing delayed symptom visibility makes timing of the fungicide applications challenging. Hence, information on the relative economics of different fungicide application timings in different environments is required to assist growers to make informed decisions about fungicide strategies to manage STB. This article reports on three experiments conducted to identify optimal timing of fungicide applications in different regions of Vic and SA during 2023 for better STB control.

Aim:

To observe the effect of fungicide application timing in controlling Septoria tritici blotch in wheat in the MRZ and LRZ of the Southern Australia.

Methods

Three experiments were conducted to determine the optimal fungicide timing for STB control during 2023. One experiment each was conducted in MRZ and LRZ regions of Vic and MRZ region of SA. Six fungicide treatments were applied to the susceptible variety Scepter and consisted of either single or combinations of seed and foliar applied fungicide, minimum disease or an untreated control (UTC). Each treatment arranged in a completely randomized block design with six replicates. Plots were visually assessed for disease severity and analysed as described in the variety selection trial.

Trial details

Locations:

Location	Rainfall zone	Soil type	Growing season rainfall (mm)
Longerenong (VIC)	MRZ	Clay	331
Hart (SA)	MRZ	Clay loam	281
Kinnabulla (VIC)	LRZ	Clay	219

Treatments:

1. Seed treatment
2. Foliar applied fungicide at Z31
3. Foliar applied fungicide at Z31 + Z39
4. Foliar applied fungicide at Z39
5. Seed + Foliar applied fungicide at Z31 + Z39 - Minimum disease
6. Untreated control -No fungicide

Note: All treatments, except treatment 5 received 1 kg of STB infected wheat stubble post sowing.

Varieties: Scepter (S)
Trial design: Randomized complete block 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

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:

Treatments/Fungicide application timing*	Product	Fungicide active (gai/L)[#]	Rate
Seed treatment	Jockey Stayer®	Fluquinconazole 167g/L	300 mL/100kg seed
Foliar at Z31	Soprano® at Z31	Epoxiconazole 500g/L	125 mL/ha
Foliar at Z31 + Z39	Soprano® at Z31 and Elatus Ace® at Z39[a]	Epoxiconazole 500g/L and Benzovindiflupyr 40g/L + Propiconazole 250g/L	125 mL/ha + 500 mL/ha
Foliar at Z39	Elatus Ace® at Z39	Benzovindiflupyr 40g/L + Propiconazole 250g/L	500 mL/ha
Seed + Foliar at Z31 and Z39	Jockey Stayer® + Soprano® at Z31 and Elatus Ace® at Z39	Fluquinconazole 167g/L + Epoxiconazole 125g/L and Benzovindiflupyr 40g/L + Propiconazole 250g/L	300 mL/100 kg seed + 125 mL/ha and 500 mL/ha
Untreated control	No disease control with STB infected wheat stubble and nil fungicide in season		

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

Results

Application of fungicides significantly reduced STB severity in all the three experiments conducted during 2023. Effective suppression was achieved when two foliar applications with or without seed treatment were applied. This improved grain yield by up to 10 to 14% in Victoria (Tables 1 & 2). At Kinnabulla (LRZ), single foliar application at stem elongation (Z31) was also equally effective as the dual applications at Z31 and flag leaf emergence (Z39) suggesting that one application may be sufficient to avoid yield loss in shorter environments.

At Hart (MRZ), South Australia, no yield benefit was measured due to fungicide application despite achieving significant STB control (Table 3). As found in variety yield loss experiments, this is likely due to the low grain yield potential exhibited by varieties in this environment. In such low yielding situations, fungicide applications are likely to result in economic losses and adds evidence to the rule of thumb that in-crop STB control is not warranted when yield potential is less than 3 t/ha.

At Longerenong (MRZ), despite two foliar applications suppressing STB for longer periods, complete control was not achieved at grain ripening stage (Z71-Z75) indicating a possible reduction in the efficacy of the fungicides applied (due to decreasing levels of sensitivity to fungicides in the STB population) or the need for a more intensive fungicide strategy. Fungicide resistance testing of samples at Centre for Crop and Disease Management (CCDM), Perth, WA demonstrated reduced sensitivity of *Z. tritici* populations to DMIs (Group 3) confirming the reduced efficacy of the fungicides applied. This suggested that continuous monitoring for fungicide sensitivity and resistance in the *Z. tritici* populations is required to allow industry use effective fungicides and avoid ineffective actives,

should resistance develop. This highlights the importance of STB management not being solely reliant on fungicides.

Limited improvement in grain quality from fungicide applications were measured at Kinnabulla but not at other sites (data not shown).

Table 1. Septoria tritici blotch severity (%) and associated yield loss in the wheat variety Scepter (S) in response to different fungicide treatments at Longerenong, VIC, 2023

Treatments	Disease severity[A] (% leaf area affected)		Grain yield (t/ha)[A]	Yield gain %[B]
	26-July Z34	11-Sep Z59		
Untreated control	35^{c}	58^{d}	4.78^{a}	-
Seed	34^{bc}	55^{d}	5.08^{ab}	-
Foliar at Z31	30^{a}	33^{b}	5.16^{ab}	-
Foliar at Z39	35^{c}	46^{c}	4.93^{a}	-
Foliar at Z31 + Z39	32^{ab}	30^{ab}	5.45^{b}	14
Seed + Foliar at Z31 + Z39	32^{ab}	26^{a}	5.55^{b}	16
P	0.002	<0.001	0.016	
LSD(0.05)	2.6	7.2	0.47	

[A]Within a column, means with one letter in common are not significantly different at 0.05. 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. [B]Yield gain % for each treatment was presented as percentage yield increase vs the untreated control.

Table 2. Septoria tritici blotch severity (%) and associated yield loss in the wheat variety Scepter (S) in response to different fungicide treatments at Kinnabulla, VIC, 2023

Treatments	Disease severity[A] (% leaf area affected)		Grain yield (t/ha)[A]	Yield gain %[B]
	10-Aug Z37	8-Sep Z59		
Untreated control	23^{b}	31^{c}	4.98^{a}	-
Seed	23^{b}	31^{c}	5.02^{ab}	-
Foliar at Z31	13^{a}	19^{b}	5.36^{cd}	7
Foliar at Z39	22^{b}	18^{b}	5.22^{bc}	-
Foliar at Z31 + Z39	13^{a}	9^{a}	5.49^{d}	10
Seed + Foliar at Z31 + Z39	12^{a}	9^{a}	5.49^{d}	10
P	<0.001	<0.001	<0.001	
LSD(0.05)	1.7	2.2	0.22	

[A]Within a column, means with one letter in common are not significantly different at 0.05. 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. [B]Yield gain % for each treatment was presented as percentage yield increase vs the untreated control.

Table 3: Septoria tritici blotch severity (%) and grain yield of wheat variety Scepter (S) in response to different fungicide treatments at Hart, SA during 2023

Treatments	Disease severity (% leaf area affected)[A]		
	19 Sept	3 Oct	Grain yield (t/ha)
Untreated control	9[d]	34[b]	3.07
Seed	7[c]	30[b]	3.04
Foliar at Z31	3[b]	10[a]	3.33
Foliar at Z39	5[c]	24[b]	3.19
Foliar at Z31 + Z39	1[a]	6[a]	3.23
Seed + Foliar at Z31 + Z39	0[a]	4[a]	3.25
P	<0.001	<0.001	0.19
LSD (0.05)	1.8	10.8	*ns*

[A]Within a column, means with one letter in common are not significantly different at 0.05.

Conclusion

Fungicides have been shown to be partially effectively suppress STB infection, but their applications can usually be avoided in seasons with below average rainfall or where grain yield potential is less than 3 t/ha, such as in SA during 2021 and 2023 where fungicide applications in either the MRZ or LRZ were not economical. When susceptible varieties are sown into seasons with wet seasons, then fungicides strategies should include applications at both growth stages 31 and 39 (Table 4). Two spray strategy at Z31 and Z39 protects yield contributing flag leaves and have shown ~10-16% yield increase compared to untreated control at Longerenong and Kinnabulla in 2023. It is also worth noting that STB populations have potential to develop resistance to fungicides and their unnecessary use should be avoided.

Table 4: Yield gain in wheat variety Scepter (S) at Wimmera and Mallee, Victoria during 2021-2023 in response to fungicide treatments for septoria tritici blotch infection

Fungicide applications	Wimmera (MRZ)			Mallee (LRZ)		
	Yield Gain (%)					
	2021	2022	2023	2021	2022[#]	2023
Seed	0	7	0	0	-	-
Foliar at Z31	0	14	0	0	-	7
Foliar at Z39	0	22	0	0	-	5
Foliar at Z31+39	0	37	14	0	-	10

Seed + Foliar at Z31+39	0	39	16	0	-	10

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

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