Impact of inoculum loads on in crop disease risk from Septoria tritici blotch (STB) in wheat

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Background

Stubble is the primary source of STB inoculum, therefore, it is expected the physical amount of the stubble will determine the disease pressure in wheat crops. Large areas sown to susceptible varieties and the adoption of stubble retention systems in the medium and low rainfall zones of the southern region have raised STB inoculum levels, causing increased disease prevalence and severity. However, there is limited information on the amount of inoculum required to cause disease and its interaction with different environments to develop STB epidemics. This information where available is critical to improve integrated disease management strategies for STB control in this region. Therefore, the impact of increasing inoculum loads on disease severity and grain yield in the MRZ will be evaluated in this study.

Aim

To determine the impact of increasing inoculum loads of STB on wheat grain yield and quality

Methods

One field experiment was conducted in the MRZ at Longerenong, Victoria during 2022 to evaluate the impact of increasing inoculum levels on disease severity and grain yield. Six treatments including different levels of inoculum and a control with minimum disease were applied to a susceptible to very susceptible variety LRPB Impala (SVS). Each treatment consisted of six replications arranged in a randomised complete block design. Treatments were separated by double-buffers of a non-host (barley) to reduce inter-plot disease spread. Plots were visually assessed for disease severity and analysed as described in the variety selection trial below.

Trial details

Location:

Location	Rainfall zone	Soil type	Growing season rainfall (mm)
Longerenong (VIC)	MRZ	Clay	547

Treatments:

1. No stubble, seed + Foliar applied fungicide at Z31 + Z39 – Minimum disease

2. Zero stubble (0 Kg/plot)
3. Quarter kilogram stubble (0.25 Kg/plot)
4. Half kilogram stubble (0.5 kg/plot)
5. One Kilogram stubble (1 Kg/plot)
6. Two kilogram stubble (2 Kg/plot)

Variety: LRPB Impala (SVS)
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	3rd May 2022	150	17th December 2022	3.3

Trial inputs: UREA and MAP applied and managed as per best practice and kept weed and pest free.

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	Elatus Ace®	Benzovindiflupyr 40g/L + Propiconazole 250 g/L	500 mL/ha
Foliar at Z39	Soprano®	Epoxiconazole 500 g/L	125 mL/ha

 # gai = grams active ingredient

Results and discussion

In general, stubble application significantly increased STB severity and caused grain yield (~30 %) and quality losses in wheat variety LRPB Impala (Tables 1 & 2). Thus, demonstrating the importance of stubble management in wheat when no control was applied. However, increasing inoculum loads did not significantly vary disease severity or grain yield and quality in LRPB Impala. Significant yield losses (~33%) were also observed in the plots where stubble was not applied even though disease severity was significantly low compared to the plots with stubble early in the season. This can be related to inter-plot spread of the disease predominantly aided by pycnidiospores originating from infected plants in the other treatments. Pycnidiospores are usually considered as the main source of inoculum during the epidemic period and are dispersed by rain splash over short distances. The combination of both the amount and frequency of rainfall from August to November during 2022, provided ideal conditions for disease development, hence rapid increase in pycnidiospore movement late in the season and consequently higher disease severity and grain yield loss.

These results identify inoculum drift from adjacent paddocks as a significant risk where wheat is not sown into stubble. With the adoption of stubble retention systems and increased frequency of disease

conducive seasons, it is imperative to understand the spatio-temporal patterns of *Z. tritici* spore spread and determine disease risk.

Table 1: Septoria tritici blotch severity (% leaf area affected) and grain yield of wheat variety LRPB Impala (SVS) in response to variable loads of stubble inoculum at Longerenong, Victoria during 2022.

Stubble Treatments	Severity (% LAA)[#]			Grain yield (t/ha)	Yield loss %
	15-Jul	5-Sep	19-Oct		
	Z32	Z45	Z70		
Minimum disease	0[a]	5[a]	37[a]	4.01[a]	0
Quarter kilogram stubble (0.25 kg)	1[b]	20[c]	94[b]	2.90[b]	28
Half kilogram stubble (0.5 kg)	1[c]	23[cd]	91[b]	2.88[bc]	28
Two kilogram stubble (2 kg)	1[b]	23[cd]	93[b]	2.86[bc]	29
One kilogram stubble (1 kg)	1[b]	23[d]	94[b]	2.82[bc]	30
Zero Stubble	0[a]	11[b]	90[b]	2.69[c]	33
P	<0.001	<0.001	<0.001	<0.001	-
LSD(0.05)	0.3	3.4	9.2	0.2	-

[#]*Within column, means with one letter in common are not significantly different*

Table 2: Grain quality of wheat variety LRPB Impala (SVS) in response to variable loads of stubble inoculum at Longerenong, Victoria during 2022.

Treatments	Protein (%)[#]	Screenings (%)	Retention (%)	1000gw
Minimum disease	12	40.0[a]	19.0[a]	19.7[a]
Zero Stubble	13	70.7[c]	6.0[c]	14.9[b]
Quarter kilogram stubble (0.25 kg)	12	66.4[bc]	8.2[b]	15.8[b]
Half kilogram stubble (0.5 kg)	12	65.0[b]	7.5[bc]	14.9[b]
One kilogram stubble (1 kg)	13	66.2[bc]	7.3[bc]	16.2[b]
Two-kilogram stubble (2 kg)	13	65.1[b]	7.5[bc]	16.2[b]
P	0.18	<0.001	<0.001	<0.001
LSD (0.05)	*ns*	4.79	2.04	1.37

[#]*Within column, means with one letter in common are not significantly different*

Conclusion

The results reiterated that stubble is the primary source of inoculum and causes primary infection of STB in wheat. Therefore, demonstrating that managing stubble would alleviate the risk of STB in the early stages of crop. However, when susceptible cultivars are sown away from stubble, other control options should be considered to reduce the chances of infection due to wind borne spores from adjacent wheat paddocks.

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