Timing of septoria tritici blotch infection in wheat

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Key findings

- At Waite in 2021, drier spring conditions reduced the overall spread and infection (%) of septoria tritici blotch (STB), with wheat varieties yielding similarly, ranging between 4.33 – 5.16 t/ha.
- The selection of resistant varieties can significantly reduce STB infection, even in low disease pressure years.
- Early infection timings of STB within a growing season significantly increase disease infection (%) of wheat.

Why do the trial?

Septoria tritici blotch (STB) is a foliar disease in wheat that is often associated within high rainfall cropping environments, however, it is becoming increasingly common across the low and medium rainfall regions. Septoria tritici blotch is known for causing yield loss in crops with losses of up to 60% (GRDC 2020).

Recent spore trapping data completed across recent seasons has shown that there may be multiple infection events during a given growing season, particularly when significant rainfall events occur.

The aim of this trial is to evaluate the implications of infection timing (through inoculation) in wheat and determine if variety selection can reduce disease severity and impact on grain yield.

How was it done?

Plot size	0.5 m x 2.0 m	**Inoculation timings**	June 18 – GS14 (seedling) inoculation
Seeding date	May 14, 2021		July 28 – GS30 (stem elongation) inoculation
Location	Urrbrae, SA		September 1 – GS45 (mid-booting) inoculation
Harvest date	December 3, 2021		

The trial was a randomised split plot design with three replicates, six wheat varieties and four infection timings. All plots were assessed for grain yield (t/ha), crop establishment (plants/m^2) and disease infection (%).

Plots were sown by hand, and varieties were grouped for spray inoculation treatments. Each of the six wheat varieties trialed had different resistance ratings to STB (Table 1).

Three inoculation timings were selected based on results collected through spore trapping data from Port Germein in SA, indicating the key timings that infection events may be occurring within a growing season. The first inoculation timing was applied at four-leaf crop stage (GS14) to demonstrate impacts of early infection. Some plots were also inoculated at stem elongation (GS30) and mid-booting (GS45). Inoculation is the process of applying septoria spores as a spray solution.

Septoria tritici blotch was applied as a spore solution with a backpack sprayer.

Septoria tritici blotch prefers continual wet conditions for development and spread, which occurred from late May to early August (GRDC 2020) at Waite in 2021. From August onwards, rainfall conditions were below average which limited disease development for the remainder of the season.

Harvest cuts were conducted by hand (1 m x 2 rows) with scythes to measure wheat grain yield (t/ha). The heads were thrashed in a laboratory thresher and the grain sample was cleaned using a dockage tester. Disease assessments were also conducted on three plants per plot with STB infection (%) measured across leaf area, from flag leaf and every other leaf that had not senesced.

Table 1. Varieties trialed at Waite in 2021, showing maturity and resistance ratings for STB.

Variety	Maturity	STB Resistance Rating
Impala	Mid Spring	Very susceptible
Razor CL Plus	Quick-Mid Spring	Susceptible – Very susceptible
Scout	Mid Spring	Susceptible
Illabo	Quick Winter	Moderately susceptible – Susceptible
Denison	Slow Spring	Moderately susceptible
Orion	Mid-Slow Spring	Moderately resistant – Moderately susceptible

Results and discussion

Infection levels

Variety selection was shown to influence infection levels across the trial at Waite in 2021.

Impala and Razor CL Plus, two varieties that have poor genetic resistance to septoria tritici blotch, had the highest level of disease infection, as expected (Table 2). Illabo, Denison and Orion have improved genetic resistance to STB and this was demonstrated through the low levels of infected leaf area, ranging from only 6 – 13.2%. This enforces the fact that varieties selected with an increased resistance to disease will have significantly lower infection levels, reducing levels of STB inoculum in following years.

At Waite in 2021, varieties with disease resistance ratings of moderately susceptible - susceptible (MSS) were effective in controlling STB infection (< 10.6%).

Table 2. Average leaf area infection (LAI%) for each variety at Waite. Disease assessments were completed October 7, 2021.

Variety	Average infected leaf area (%)
Impala	40.5^{d}
Razor CL Plus	38.7^{d}
Scout	19.6^{c}
Illabo	6.0^{a}
Denison	13.2^{bc}
Orion	10.6^{ab}
LSD (P≤0.05)	**6.63**

The use of variety selection to reduce disease levels in a wheat crop is highlighted in Figure 1. The nil treatment also displayed higher LAI% than expected (Table 3). This was likely due to the trial having smaller plots that were close proximity, resulting in the spread of STB from treated plots.

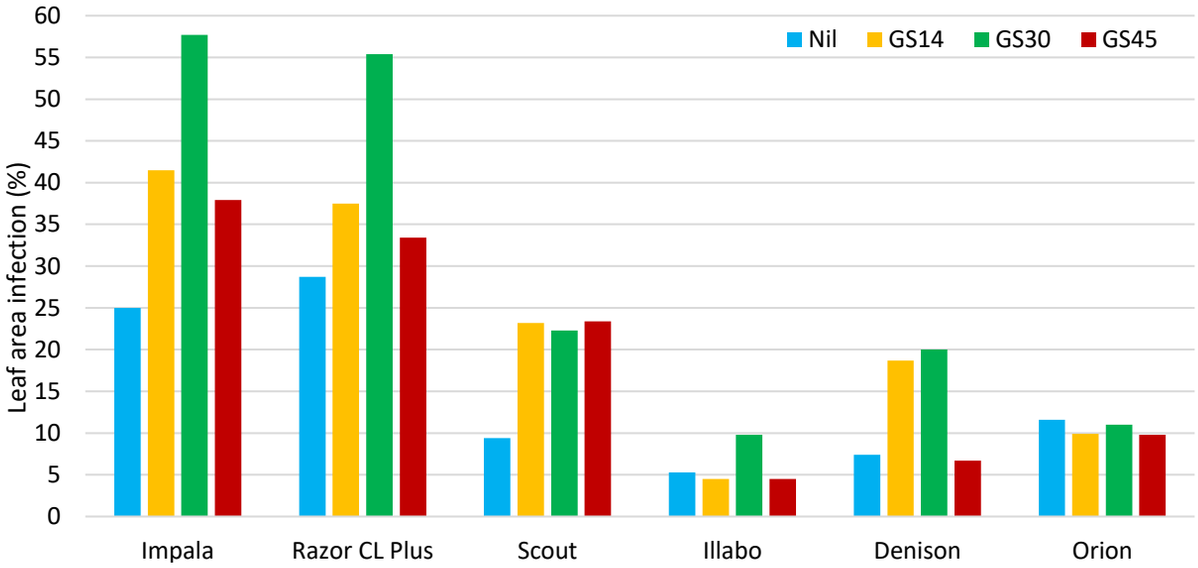

Figure 1. Leaf area infection (%) of varieties for each inoculation timing, assessed on October 7, 2021. Varieties are ordered from least to most resistant. Relationship between variety and infection timing is not significant.

The timing of STB inoculation influenced infection levels within the trial (Table 3). The seedling (GS14) and stem elongation (GS30) application timings showed the highest infected leaf area across all treatments. The early application at GS14 shows that STB had time to develop and spread during the season, increasing infection levels to 22.5%. While applications of inoculum at GS30 did not have the same amount of time to develop, there was more leaf area present to intercept the inoculation spray, providing a larger area for initial crop infection (29.4%).

The mid-booting (GS45) application had similar levels of STB to the nil treatment, which was not anticipated, due to low levels of infection expected.

At mid-booting, there was an abundance of leaf area to intercept the inoculation spray, however, penetration through the canopy to infect lower leaves is difficult due to canopy closure. At this timing, inoculant was intercepted by the upper canopy, resulting in high infection, but this was not observed lower down on the plant.

Table 3. Average leaf area infection (%) for each infection timing at Waite. Disease assessments conducted October 7, 2021.

Infection timing	Average infected leaf area (%)
Nil	14.6[a]
Seedling (GS14)	22.5[ab]
Stem Elongation (GS30)	29.4[b]
Mid-booting (GS45)	19.3[a]
LSD (P≤0.05)	**9.85**

Figure 2. (L-R) Flag leaf of Orion (MRMS) and Impala (VS) 36 days after GS45 application at Waite.

Yield loss

No differences were observed for wheat grain yields across all treatments trialed. Varieties yielded similarly ranging between 4.33 – 5.16 t/ha.

Although leaf area infection varied significantly across varieties and infection timings, grain yield was not affected. This is likely a result of negligible upper canopy infection in most treatments due to the lack of rainfall events occurring after mid-August, which would normally spread spores across the plant to the flag leaf.

The upper leaves of a cereal plant canopy are the most important when it comes to achieving grain yield. The flag leaf alone provides approximately 45% of the grain yield in wheat (Poole 2005). When the flag leaf and upper canopy are unaffected by disease, large yield losses would not be expected to occur.

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References

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