Epidemiology of septoria tritici blotch in medium rainfall zones

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Key findings

- Conditions at Hart in 2022 were conducive for moderate infection levels of septoria tritici blotch (STB) due to high volumes of regular spring rainfall.
- Wheat varieties rated MSS or above performed best at reducing disease severity at Hart in 2022. Variety resistance did not affect grain yield with a trial average of 3.51 t/ha.
- Septoria tritici blotch infection decreased test weight (kg/hL) and increased screenings (%) in the variety resistance trial. Test weight was also reduced in the fungicide timing trial where a GS 39 foliar fungicide was not applied.
- In the fungicide timing trial, treatments with foliar fungicides at both GS 31 and GS 39 increased grain yield by 0.57 t/ha when compared to no fungicide or seed treatment only.
- Fungicide treatments applied as foliar spray at GS 31, foliar spray at GS 31 + GS 39 and seed treatment + Foliar spray at GS 31 + GS 39, reduced disease infection levels to 2-8% in the fungicide timing trial. Foliar spray at GS 39 did not reduce disease (20%) when compared to the nil (23%).

Introduction

Septoria tritici blotch (STB) is a foliar fungal disease (*Zymoseptoria tritici*) in wheat that is a common occurrence for growers in high rainfall areas. In recent seasons, septoria tritici blotch has become more prevalent in medium and low rainfall zones across the southern region.

Septoria tritici blotch survives on wheat stubble over summer, causing infection in following crops through windborne spores. The spread of STB in-season is assisted by rainfall and infection can be more severe when regular rainfall events occur. In seasons suitable for STB development, yield losses of around 40% have been experienced in susceptible varieties (GRDC 2022b).

Growing varieties with increased genetic resistance to STB is a major tool for minimising the impact of the disease on grain production. Avoiding highly susceptible varieties allows fungicides to control STB more effectively (GRDC 2022b). Fungicide timing can be critical in maximising STB control and reducing yield loss by protecting emerging leaves. Rotating fungicide groups is also crucial to limit development of resistance in STB populations. Fungicide resistance is already developing in southern Australia, with reduced sensitivity to Group 3 DMI fungicides.

Another strategy for reducing the impact of STB is avoiding wheat on wheat to decrease inoculum levels. This strategy decreases the risk of severe infections in surrounding wheat crops. A combination of these strategies is required to minimise the impact of STB in Australian farming systems (GRDC 2022b).

The trial aims to create an integrated disease management strategy for STB in the medium rainfall zone. Two trials were hosted at Hart in 2022, assessing the (1) impact of variety selection, and (2) fungicide timing and management strategies (Tables 1 and 2).

Methodology

Plot size	1.75 m x 10.0 m	**Fertiliser**	Seeding: DAP (18:20) Zn 1% @ 80 kg/ha
Seeding date	May 5, 2022		July 22: Easy N (42.5:0) @ 70 L/ha
Location	Hart, SA		August 17: Easy N (42.5:0) @ 60 L/ha
Harvest date	November 25, 2022		
2021 crop	Mulgara Oaten Hay		

Trials were managed with the application of pesticides to ensure a weed and insect free canopy. All plots were assessed for grain yield (t/ha), protein (%), test weight (kg/hL), screenings (%) and disease severity (%).

The trials were inoculated with STB on July 5 using infected stubble from 2021 trial sites at Hart and Waite. The stubble was spread evenly to all + disease plots in the variety resistance trial and all plots in the fungicide timing trial.

The variety resistance trial was a randomised split plot design with six replicates, six wheat varieties and two treatment blocks of +/- disease. To reduce the spread of disease across treatments, barley buffer plots were sown between the treatment blocks. The – disease plot was sprayed with fungicides at GS 31 and GS 39 to control disease. Data was analysed using a split-plot ANOVA model in Genstat 22nd edition.

Table 1. Varieties sown at Hart in 2022 in the STB variety resistance trial with maturity and septoria tritici blotch resistance rating (GRDC 2022a).

Variety	Maturity	Resistance rating to STB
LRPB Impala	Mid	SVS
Razor CL Plus	Quick-mid	SVS
Scepter	Quick-mid	S
Calibre	Quick-mid	S
Hammer CL Plus	Quick-mid	MSS
LRPB Lancer	Mid-slow	MS

VS = Very susceptible, SVS = Susceptible – very susceptible, S = Susceptible, MSS = Moderately susceptible – susceptible, MS = Moderately susceptible, MRMS= Moderately resistant – moderately susceptible

The fungicide timing and yield loss trial was a randomised block design with six replicates and six fungicide treatments that were applied on Scepter wheat, a susceptible variety to STB. Barley buffer plots were sown between each plot to reduce the potential drift of fungicide at application. Data was analysed using a randomised complete block ANOVA model in Genstat 22nd edition.

Table 2. Fungicide treatments trialed at Hart in 2022 in the fungicide timing and yield loss trial.

Treatment timing	Fungicide actives	Fungicide groups
Nil	-	-
Seed treatment	Fluquinconazole	3
Foliar spray @ GS 31	Benzovindiflupyr + propiconazole	7 + 3
Foliar spray @ GS 39	Epoxiconazole	3
Foliar spray @ GS 31 + GS 39	Benzovindiflupyr + propiconazole @ GS 31 + Epoxiconazole @ GS 39	7 + 3 3
Seed treatment + foliar spray @ GS 31 + GS 39	Fluquinconazole + Benzovindiflupyr + propiconazole @ GS 31 + Epoxiconazole @ GS 39	3 7+3 3

Results and discussion

2022 season at Hart

Trial emergence was delayed due to late opening rains with 26 mm recorded on May 30. This caused crops to establish late into cool conditions, resulting in low crop vigour and slow crop growth.

Hart received above average growing season rainfall, characterised by a dry start followed by a wet spring. Disease pressure and crop potential were greatly influenced by the 2022 growing season conditions.

The late emergence of crops caused a delay in STB infection. There was average rainfall for May and June, followed by a dry July (Figure 1). This period was also colder than normal, resulting in very slow crop growth.

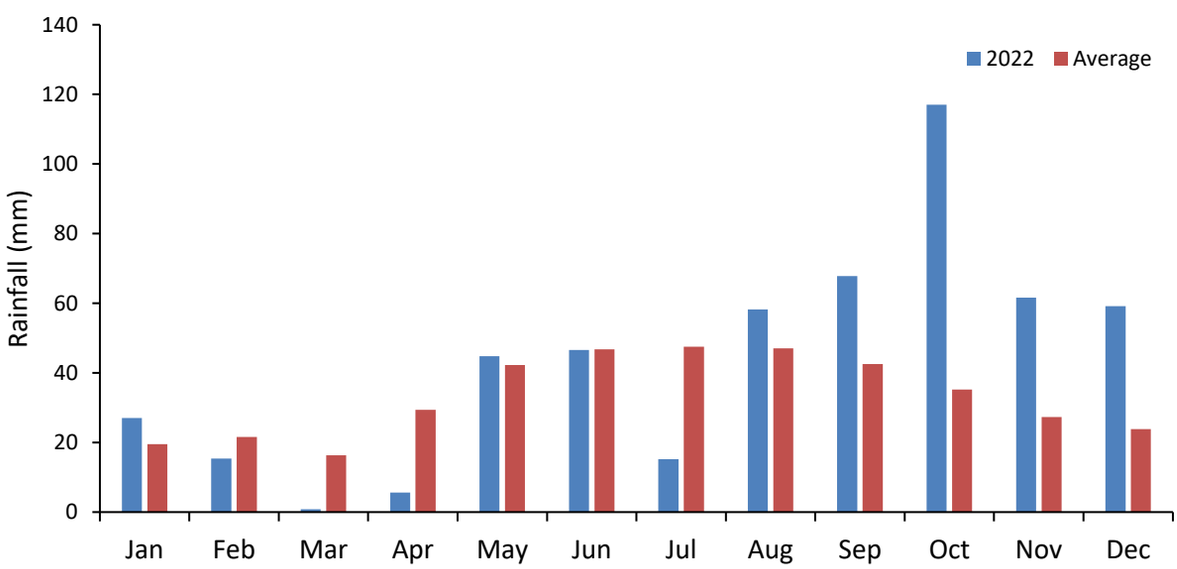

Figure 1. Monthly rainfall for Hart in 2022 as recorded on the Hart Mesonet station. Annual rainfall in 2022 was 520 mm, growing season rainfall was 355 mm. Hart's average annual rainfall is 400 mm and average GSR is 290 mm.

Trials were inoculated with STB infected stubble on July 5. Conditions were not ideal for disease spread and development as dry July conditions persisted. A conducive environment for STB development presented in early August and remained until harvest. This resulted in increased development and spread of STB in all trials.

Variety resistance

Disease levels were moderately high in 2022 with susceptible varieties Scepter and Razor CL Plus recording 30% and 26 % disease severity (% total leaf area infected) respectively (Figure 2). Calibre (S) and Impala (SVS) also had moderately high levels of disease, with 20.3% and 19.5% of the total leaf area affected by STB. Increased volume and regularity of September and October rainfall contributed to the increased disease development when compared to 2021 where Impala recorded the highest disease level of 11% (Anderson et al 2021). A combined 36 mm was recorded in September and October in 2021, compared to 185 mm in 2022 across the same time period, reflecting the amount of disease. A minimum variety resistance rating of MSS was required to maximise disease control at Hart in 2022.

The Mid-North pathotypes for STB caused higher infection in Scepter than in the SVS variety Impala. As Scepter is widely grown, the local strains of STB have become better suited to infecting that variety. A similar trend was observed at Booleroo Centre in 2022, although Impala still experienced significant yield loss (Figure 6). Impala still poses a high risk of yield loss in regions with STB present.

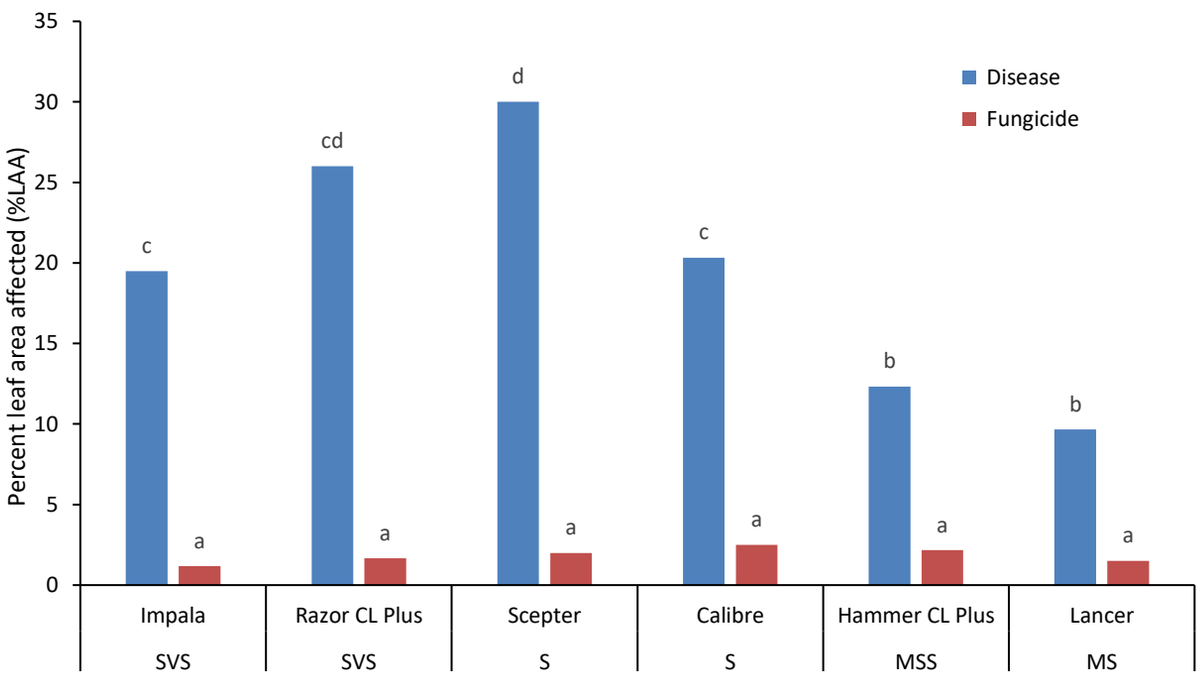

Figure 2. Average disease severity (%) of wheat varieties trialed at Hart in 2022. Varieties are ordered in increasing resistance to STB. Varieties with the same letter are not significantly different.

Despite the moderately high infection severity recorded in disease plots there was no yield loss between diseased and treated in any variety (Figure 3). Yield loss due to foliar disease can be attributed to the infection levels on the top 3 leaves. Whilst the disease severity of the whole plant was as high as 30% in this trial much of the infection was on the lower leaves and could contribute to the lack of yield losses. In addition, variety resistance to STB did not influence yield loss at Hart in 2022 (Figure 3). The variety resistance trial recorded an average grain yield of 3.51 t/ha.

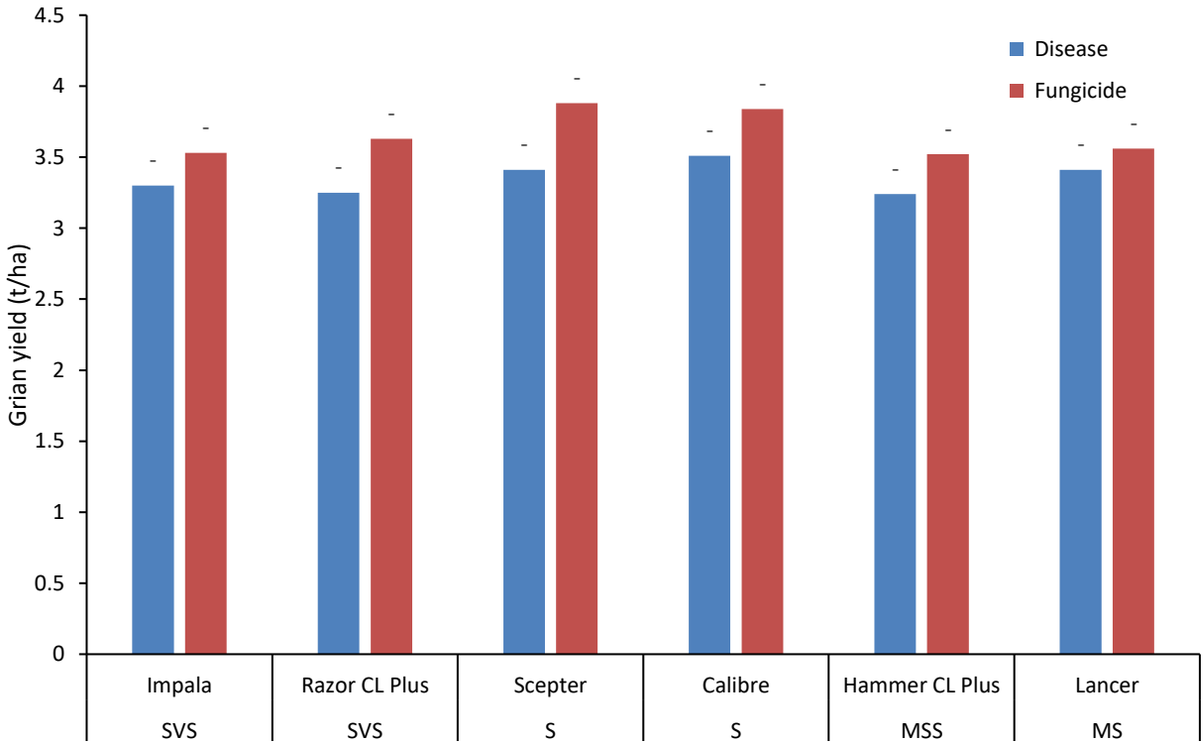

Figure 3. Grain yield of wheat varieties trialed at Hart in 2022. Varieties are ordered in increasing resistance to STB. Data is not significant.

The fungicide control block recorded higher yields than the disease block, with a 0.31 t/ha increase in grain yields. This highlights the impact fungicides can possess in moderate infection situations. Application of fungicides improved grain quality with increased test weight (82.5 kg/hL) and decreased screenings (2.6%) (Table 3). Protein was unaffected by the disease or fungicide treatment.

Table 3. Summary of grain yield and quality of disease and fungicide treatments at Hart in 2022. Values shaded blue indicate best performing treatments.

Treatment	**Grain Yield** (t/ha)	**Protein** (%)	**Test weight** (kg/hL)	**Screenings** (%)
Disease	3.35[a]	9.2	81.9[a]	2.9[b]
Fungicide	3.66[b]	9.1	82.5[b]	2.6[a]
LSD (P≤0.05)	**0.16**	**NS**	**0.36**	**0.2**

Fungicide timing

Septoria tritici blotch disease severity in Scepter was highest in the untreated control (23%), seed treatment (18%) and the foliar spray at GS 39 (20%) treatments. These treatments were significantly different from the disease severity in the foliar spray at GS 31, foliar spray at GS 31 + GS 39 and Seed + Foliar spray at GS 31 + GS 39 which ranged from 2-8% leaf area infected (Table 4).

Application of two foliar fungicides increased grain yield at Hart in 2022 (Figure 4). Foliar sprays at both GS 31 and GS 39 resulted in a 0.57 t/ha increase in grain yield. Use of a seed treatment or foliar sprays at a single timing did not improve grain yield when compared to the untreated plots. Higher disease pressure would explain the reduced effectiveness of single foliar sprays.

Table 4. Disease severity expressed as % total leaf area infected and % leaf infection on the top 3 leaves for each treatment in the fungicide timing trial. Varieties with the same letter are not significantly different. Values shaded blue indicate best performing treatments.

Treatment	STB Disease severity (% total leaf area infected)
Untreated control	23^{C}
Seed treatment	18^{bc}
Foliar spray at GS 31	8^{ab}
Foliar spray at GS 39	20^{c}
Foliar spray at GS 31 + GS 39	4^{a}
Seed treatment + Foliar at GS 31 + GS 39	2^{a}

Grain quality was largely unaffected by fungicide applications with protein (%) and screenings (%) averaging 9.7 % and 3.1 %, respectively, across all treatments. Test weight (kg/hL) was higher where a GS 39 spray was included in the fungicide treatment, averaging 83.4 kg/hL (data not shown). The remaining treatments recorded an average test weight of 81.1 kg/hL which would not result in a downgrade in receival standards.

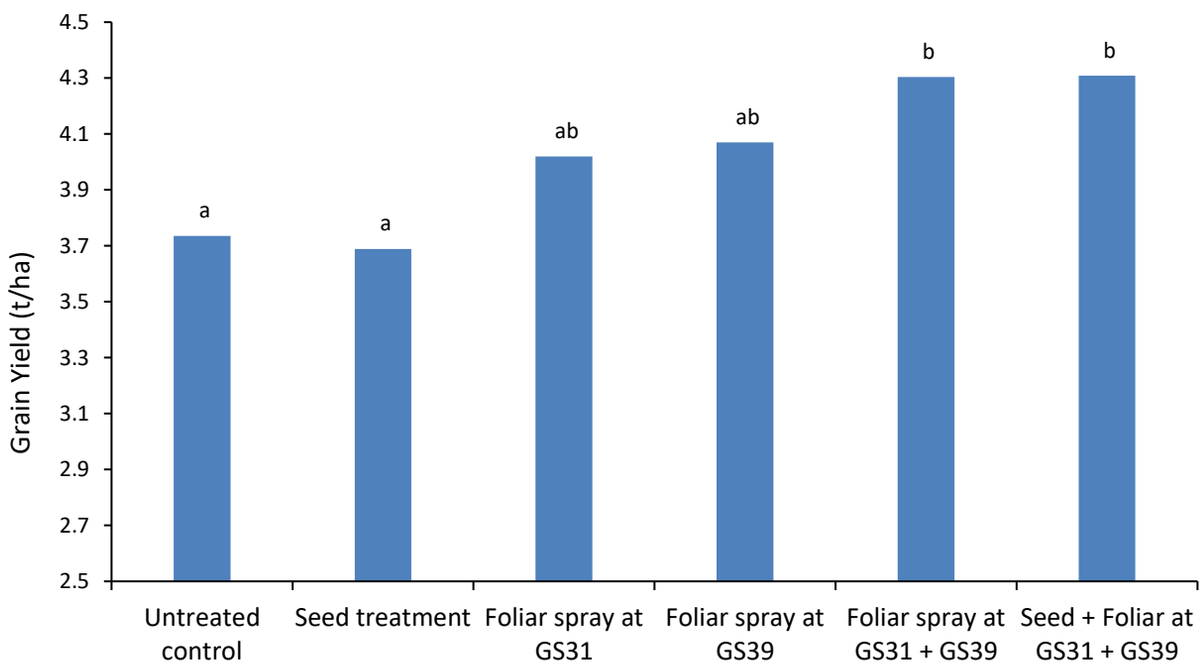

Figure 4. Summary of grain yields for the fungicide timing trial at Hart in 2022. Values with the same letter are not significantly different.

Model development and climate modelling

Disease development was tracked over the course of the 2022 growing season at Hart (MRZ) and Waite (HRZ) by assessing STB disease severity every 2 weeks. Figure 5 shows the percentage of leaf area infected was low (less than 10%) at both sites until GS 55. Both sites had reached this stage by mid-late August and disease development began to increase as they moved into flowering (GS 61-69). Disease severity levels differed in the grain development stage with Hart reaching 43% total leaf area infected and Waite reaching 94% leaf area infected by the end of the season. This provides an example of maximum infection levels with no disease management strategies across the two rainfall zones. At Hart, the disease development data can also be compared with the variety resistance trial's disease severity and yield values, where the same variety Razor CL Plus had no significant yield loss and had reached 26% disease severity by GS 71. This disease level was comparable to both Waite and Hart sites at GS 71 and spring rainfall and humidity is likely to drive late season STB development.

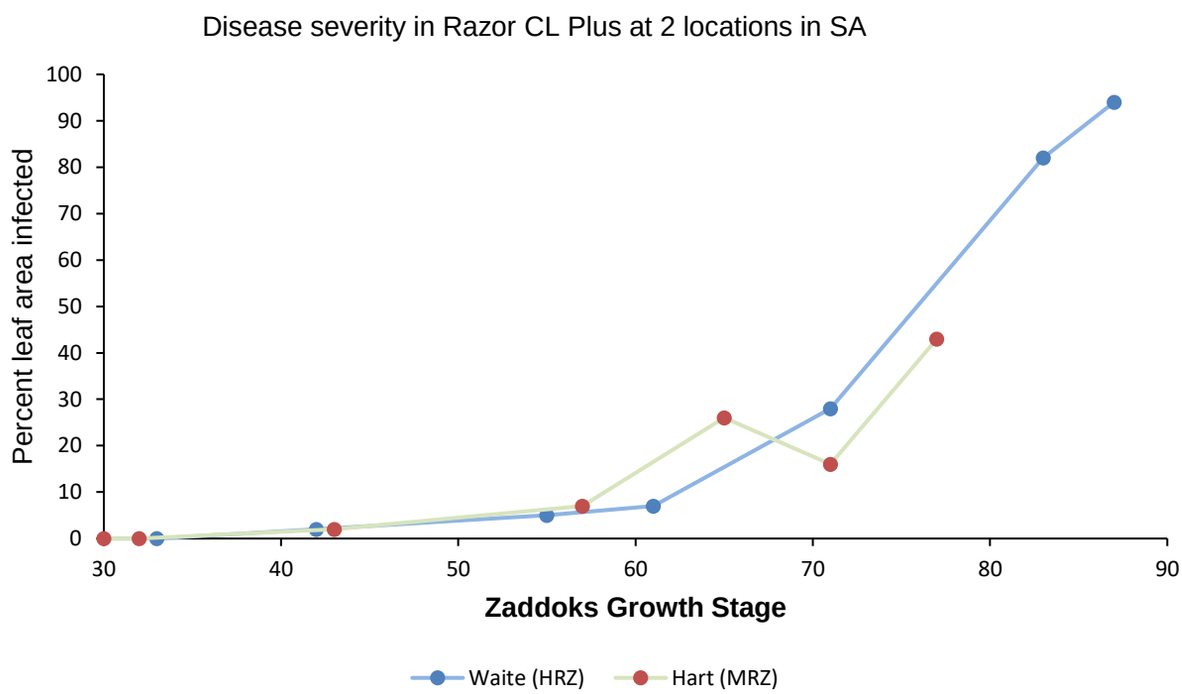

Figure 5. Disease development over the course of the 2022 growing season in an SVS variety in the MRZ and HRZ in SA.

Low rainfall zone – Booleroo Centre

A variety resistance trial was also conducted at Booleroo Centre, to represent STB under low rainfall conditions. The trial site contained high levels of disease in susceptible varieties with Scepter, Calibre and Razor CL Plus recording 72%, 74% and 83% disease severity, respectively (Figure 6) (Garrard 2023).

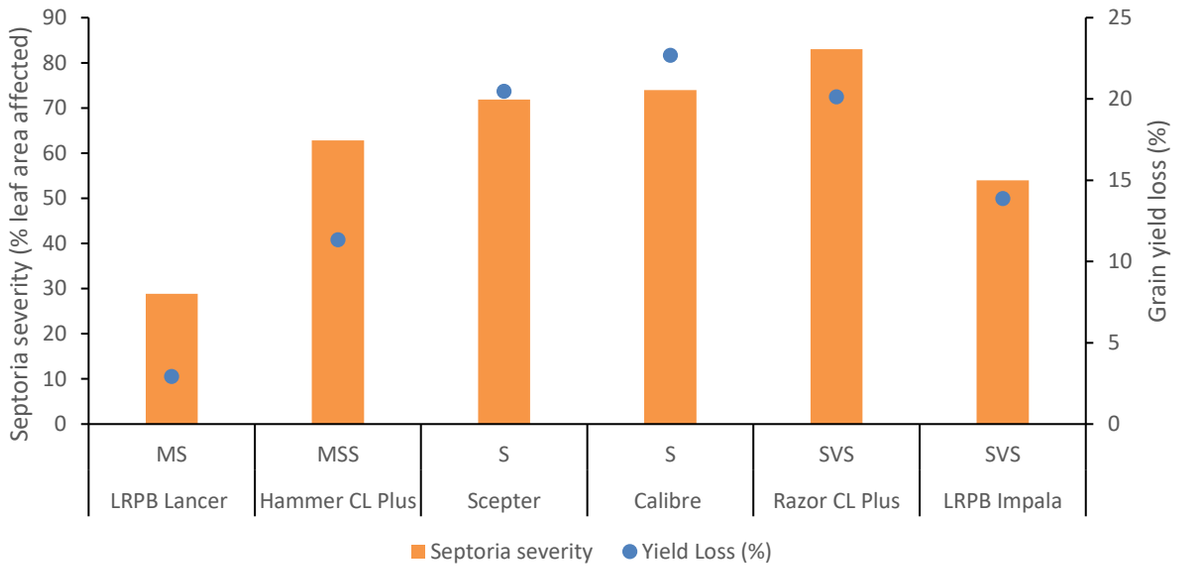

Figure 6. Grain yield losses and STB disease severity at Booleroo Centre STB Variety trial in 2022. All varieties, excluding LRPB Lancer, recorded significant yield loss (Garrard 2023).

The average grain yield of the trial was 5.7 t/ha with yield losses of 13.9 - 22.77% for all varieties present, excluding LRPB Lancer (Garrard 2023). High disease levels and yield loss can be contributed to large and consistent volumes of rainfall in late winter and spring creating optimal conditions for STB.

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