# 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*), a stubble borne fungal disease of wheat, is widespread and damaging in the Victorian and South Australian HRZ where susceptible cultivars are grown. In recent years, it has also become widespread across Victoria's medium (MRZ) and low (LRZ) rainfall zones. During 2021, AgVic and BCG trials demonstrated less than 10% yield loss in the MRZ and no yield loss in the LRZ in susceptible cultivars.

Disease pressure was extreme during 2022 due to a combination of the amount and frequency of rainfall from August to November which provided ideal conditions for disease development. This resulted in a damaging outbreak of STB in all regions of Victoria and caused yield losses where control was insufficient.

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 2022 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 2022. One experiment each was conducted in MRZ and LRZ regions of Vic and MRZ region of SA. Five fungicide treatments were applied to the susceptible variety Scepter and consisted of either single or combinations of seed and foliar applied fungicide, which were compared to a minimum disease or an

untreated control (UTC). Each treatment was conducted in six replications and arranged in a completely randomized block design. 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 | 547 |
| Hart (SA) | MRZ | Clay loam | 417 |
| Nullawil (VIC) | LRZ | Clay | 427 |

**Treatments:**

1. Seed treatment
2. Foliar applied fungicide at Z31
3. Foliar applied fungicide at Z31 + Z39
4. Foliar applied fungicide at Z39
5. No stubble, Seed + Foliar applied fungicide at Z31 + Z39 – Minimum disease
6. Untreated control - No disease control with 1 Kg STB infected wheat stubble or inoculated with spore inoculum at a concentration of >10,000 spores/mL

**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 | 28th April 2022 | 150 | 17th December 2022 | 3.3 |
| Hart (SA) | MRZ | 5th May 2022 | 150 | 25th November 2022 | 3.4 |
| Nullawil (VIC) | LRZ | 4th May 2022 | 150 | 15th December 2022 | 2.9 |

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

**Chemical applications:**

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

*[#] gai = grams active ingredient*

**Tridermafon applied at 300ml/ha to all plots to selectively control stripe rust.*

**Results**

Fungicides provided variable control of STB in trials conducted in the medium rainfall zones of Vic and SA (Tables 1-3). In both locations, all fungicide treatments reduced STB severity compared to the untreated control (UTC). Early applications to seed or a single foliar application at Z31 were not as effective as the treatments that included a fungicide application at Z39. However, Z39 application did not provide substantial control of STB in this season which was longer than average. This indicated that there may be considerable advantage with an additional foliar fungicide application at mid flowering (Z55) to achieve further control of STB and yield benefit during high pressure seasons. Within these trials, the best economic control of STB was achieved by two foliar fungicide applications at Z31 and Z39 (with or without a seed treatment) increasing grain yield by 14 to 39%. A seed treatment and foliar fungicide application at Z31 protected the crop from primary infection while a follow up spray at Z39 limited the infection spread to upper canopy resulting in a yield increase. The two fungicide application strategy also improved grain quality of Scepter by reducing screening percentage (~5%) and increasing retention percentage (~17%) at Longerenong and improving test weight at Hart (~3%) (Tables 2 & 3). At Longerenong, protein percent in the grain significantly increased with more disease which reflected reduced green leaf area due to disease, thus forcing uptake and storage of additional resources in grain.

High stripe rust pressure during 2022 at Nullawil (LRZ) had a confounding effect on results (Appendix 1) and so results were not discussed here. However, the site recorded low levels of STB infection and did not warrant fungicide intervention. Hence, wheat varieties with moderate resistance which are likely to escape yield losses should be considered for cultivation in these conditions.

**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, 2022.**

| Treatments | Disease severity[A] (% leaf area affected) | | | Grain yield (t/ha)[A] | Yield gain %[B] |
|---|---|---|---|---|---|
| | 17-Aug Z37 | 5-Sep Z53 | 19-Oct Z77 | | |
| Untreated control | 15[d] | 39[e] | 95[de] | 3.26[a] | - |
| Seed | 11[c] | 34[d] | 97[e] | 3.49[ab] | 7 |
| Foliar at Z31 | 9[b] | 24[c] | 91[d] | 3.70[b] | 14 |
| Foliar at Z39 | 14[d] | 37[e] | 85[c] | 3.97[c] | 22 |
| Foliar at Z31 + Z39 | 9[b] | 22[b] | 80[b] | 4.48[d] | 37 |
| Seed + Foliar at Z31 + Z39 | 5[a] | 14[a] | 76[a] | 4.54[d] | 39 |
| P | <0.001 | <0.001 | <0.001 | <0.001 | |
| LSD(0.05) | 1.3 | 2.1 | 4.2 | 0.2 | |

*[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: Grain quality of wheat variety Scepter (S) infected with STB in response to different fungicide treatments at Longerenong, VIC, 2022.**

| Treatments | Protein (%)[A] | Screenings (%) | Retention (%) | 1000 gw |
|---|---|---|---|---|
| Seed | 12[cd] | 11.1[b] | 54.3[a] | 30.0 |
| Foliar at Z31 | 12[bc] | 10.7[b] | 57.5[a] | 27.8 |
| Foliar at Z31 + Z39 | 11[a] | 6.2[a] | 70.7[bc] | 31.8 |
| Foliar at Z39 | 12[ab] | 7.2[a] | 65.7[b] | 30.5 |
| Seed + Foliar at Z31 + Z39 | 11[a] | 5.8[a] | 73.3[c] | 34.1 |
| Untreated control | 13[d] | 11.5[b] | 53.6[a] | 29.0 |
| P | <0.001 | <0.001 | <0.001 | 0.3 |
| LSD (0.05) | 0.5 | 2.21 | 5.90 | *ns* |

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

**Table 3: Septoria tritici blotch severity (%), grain yield and quality of wheat variety Scepter (S) in response to different fungicide treatments at Hart, SA during 2022.**

| Treatments | 19 Sept Z71[A] | Grain yield (t/ha) | Yield gain (%) | Protein % | Screenings (%) | Test weight (Kg/hL) |
|---|---|---|---|---|---|---|
| Seed | 18[b] | 3.69[a] | - | 10 | 3.5 | 81.6[a] |
| Untreated control | 23[b] | 3.71[a] | - | 10 | 3.2 | 80.6[a] |
| Foliar at Z31 | 8[a] | 4.02[ab] | 8 | 10 | 3.1 | 81.2[a] |
| Foliar at Z39 | 20[b] | 4.07[ab] | 9 | 10 | 2.8 | 83.5[b] |
| Foliar at Z31 + Z39 | 4[a] | 4.30[b] | 14 | 10 | 3.1 | 83.4[b] |
| Seed + Foliar at Z31 + Z39 | 2[a] | 4.33[b] | 14 | 10 | 2.8 | 83.3[b] |
| P | <0.001 | 0.04 | | 0.38 | 0.12 | <0.001 |
| LSD (0.05) | 7.8 | 0.501 | | *ns* | *ns* | 1.42 |

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

**Conclusion**

Fungicides have been shown to effectively supress STB infection, but their applications can usually be avoided in seasons with below average rainfall, such as in 2021 when their application in either the MRZ or LRZ was not economical. However, if susceptible varieties are grown during seasons with wet conditions like 2022, then fungicides strategies are most effective when applications are at both growth stages Z31 and Z39. This can result in up to 37% grain yield increase compared to untreated control. It is also worth noting that the STB fungal population has the potential to develop resistance to fungicides and unnecessary use of them should be avoided.

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# Appendix 1:

## Summary tables showing yield and quality loss to stripe rust infection in fungicide timing trial at Nullawil, Vic, 2022

**Table A1:** Stripe rust severity (% leaf area infected) and associated yield loss in wheat variety Scepter (MSS) in response to different fungicide treatments at Nullawil (BCG), Victoria during 2022

| Treatments | Stripe rust severity (% leaf area infected)[#] | | Head infection (%) | Grain yield (t/ha) | Yield gain (%)[B] |
|---|---|---|---|---|---|
| | 14-Sep Z62[A] | 29-Sep Z69 | 27-Oct Z77 | | |
| Untreated control | 47$^{c}$ | 82$^{c}$ | 22$^{b}$ | 2.28$^{a}$ | - |
| Seed | 42$^{c}$ | 80$^{c}$ | 21$^{b}$ | 2.33$^{a}$ | 2 |
| Foliar at Z31 | 19$^{b}$ | 42$^{b}$ | 19$^{b}$ | 2.53$^{ab}$ | 11 |
| Foliar at Z31 + Z39 | 5$^{a}$ | 9$^{a}$ | 6$^{a}$ | 3.37$^{c}$ | 48 |
| Foliar at Z39 | 37$^{c}$ | 41$^{b}$ | 7$^{a}$ | 3.03$^{bc}$ | 33 |
| Seed + Foliar at Z31 + Z39 | 3$^{a}$ | 6$^{a}$ | 6$^{a}$ | 3.44$^{c}$ | 51 |
| P | <0.001 | <0.001 | <0.001 | <0.001 | |
| LSD (0.05) | 12.8 | 9.5 | 3.9 | 0.5 | |
| CV% | 42.7 | 18.7 | 25.0 | 16.3 | |

*[#]Within column, means with one letter in common are not significant. [A]Date of assessment made and Zadoks growth stages Z51, Ear emergence; Z60, Anthesis; Z75, Milk development according to Zadoks et al. (1974). [B]Yield gain % for each variety was presented as percentage yield increase vs the minimum disease treatment.*

**Table A2:** Grain quality of wheat variety Scepter (MSS) infected with stripe rust in response to different fungicide treatments at Nullawil (BCG), Victoria during 2022

| Treatments | Protein (%) | Screenings (%)[#] | Test weight (Kg/hL) |
|---|---|---|---|
| Untreated control | 12.78 | 2.72$^{bc}$ | 67.57$^{a}$ |
| Seed | 12.65 | 3.02$^{c}$ | 65.70$^{a}$ |
| Foliar at Z31 | 12.40 | 2.33$^{b}$ | 66.15$^{a}$ |
| Foliar at Z31 + Z39 | 12.05 | 1.32$^{a}$ | 73.39$^{b}$ |
| Foliar at Z39 | 11.98 | 1.63$^{a}$ | 72.76$^{b}$ |
| Seed + Foliar at Z31 + Z39 | 11.93 | 1.20$^{a}$ | 72.79$^{b}$ |
| P | 0.34 | <0.001 | <0.001 |
| LSD (0.05) | *ns* | 0.5 | 4.4 |
| CV% | - | 21.7 | 5.4 |

*[#]Within column, means with one letter in common are not significant.*