

# Managing crown rot on upper Eyre Peninsula - a joint learning experience

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## Location

Buckleboo - Matthew Vandeleur AIR EP and Buckleboo Farm Improvement Group

## Rainfall

Av. Annual: 297 mm  
Av. GSR: 195 mm  
2023 Total: 280 mm  
2023 GSR: 160 mm

## Yield

Potential: potential yield calculator - 2.53 t/ha (good finish); 1.26 t/ha (poor finish)  
Actual: 1.08 - 2.14 t/ha (W); 1.76 - 2.18 t/ha (B)

## Paddock history

2023: Wheat  
2022: Barley  
2021: Barley  
2020: Lentils

## Soil type

Sandy loam

## Soil test

PREDICTA<sup>®</sup> B analysis showed inoculum of the following stem-base/root diseases was present at the site: high risk - crown rot; low risk - take-all, rhizoctonia, *Pratylenchus neglectus* and pythium.

## Plot size

12 m x 2 m

## Trial design

Variety - blocked split-plot x 4 reps.  
Inoculum carryover - paired plots x 8 reps.

## Yield limiting factors

Moisture stress during flowering/ grain filling. Mouse damage during flowering and grain filling.

## Location

Mitchellville - Ty Kaden AIR EP and Franklin Harbour Agricultural Bureau

## Rainfall

Av. Annual: 282 mm  
Av. GSR: 190 mm  
2023 Total: 309 mm  
2023 GSR: 160 mm

## Yield

Potential: potential yield calculator - 2.40 t/ha (good finish); 1.20 t/ha (poor finish)  
Actual: 1.14 - 2.16 t/ha (W); 1.37 - 2.33 t/ha (B)

## Key messages

- Positive average yield responses to VICTRATO<sup>®</sup> were seen in bread wheat (1%-11%) and barley (7%-12%) in 2022 and 2023, despite limited crown rot expression. These minor responses are consistent with lower-end responses seen at medium and high rainfall sites in South Australia (SA).
- Consider the economics using t/ha responses. For example, with a 10% yield improvement for Scepter at Buckleboo the yield response would be 0.39 t/ha in 2022, untreated yield 3.91 t/ha, but would only be 0.15 t/ha in 2023 where untreated yield was much lower at 1.56 t/ha.
- Analysis of 2022 data indicates that varietal responses to VICTRATO<sup>®</sup> will be similar, regardless of varietal maturity and resistance ratings.
- These findings make VICTRATO<sup>®</sup> a useful addition to the strategies currently available for crown rot management. It is clear VICTRATO<sup>®</sup> should not be used as a stand-alone option, but will best be pyramided with other management options where there is a known risk of yield loss from crown rot.
- At Mitchellville in 2023, a combination of season, soil and site conditions disadvantaged the barley yield response (22% yield decrease) to VICTRATO<sup>®</sup> due to good early growth promoted by VICTRATO<sup>®</sup> in

the presence of crown rot. This result was unexpected and is unlikely to occur often, nor is it as likely to occur in bread wheat varieties due to their different tillering habits.

- VICTRATO<sup>®</sup> slightly reduces severity but not visual incidence of crown rot on main stem bases. To better understand the effects of VICTRATO<sup>®</sup> on inoculum carryover, dedicated trials were established in 2023 and crown rot risk levels will be assessed in 2024.
- Once all data are available for 2023 and statistical analyses are complete (including meta-analysis), more extensive interpretation of project findings will be publicised.

## Why do the trial?

The key deliverables of the project are to A) Assess effects of varietal resistance and maturity on crown rot expression; and to B) Quantify the efficacy of a fungicide seed treatment (VICTRATO<sup>®</sup>) for managing crown rot in the low rainfall environments of upper Eyre Peninsula (UEP).

Following discussions with the Buckleboo Farm Improvement Group and Franklin Harbour Agricultural Bureau farmer groups, additional research measures were included in field trials. These included:

- sowing depth effects on crown rot expression and efficacy of VICTRATO<sup>®</sup>; and
- the effects of VICTRATO<sup>®</sup> on inoculum carryover.

**Paddock history**

2023: Wheat  
 2022: Medic pasture  
 2021: Barley  
 2020: Wheat

**Soil type**

Sandy loam

**Soil test**

PREDICTA® B analysis showed inoculum of the following stem-base/root diseases was present at the site: medium risk - crown rot; low risk - common root rot, *Pratylenchus neglectus* and pythium.

**Plot size**

12 m x 2 m

**Trial design**

Variety - blocked split-plot x 4 reps. Inoculum carryover - paired plots x 8 reps. Sowing depth - blocked split-plot x 8 reps

**Yield limiting factors**

Moisture stress during flowering/ grain filling.

VICTRATO® (with Tymirium® chemistry) is a Syngenta seed applied fungicide. VICTRATO® is in the process of being registered for assisting in reducing yield losses in cereals due to crown rot, and should be commercially available in Australia in 2024. VICTRATO® has demonstrated improved cereal

yields in medium and high rainfall areas in the presence of crown rot, but no information is available for low rainfall environments. This project will quantify the effects of VICTRATO® in low rainfall situations.

The decision to target UEP, specifically locations near Cowell and Kimba, was based on the results of a survey undertaken by Agricultural Innovation and Research Eyre Peninsula (AIR EP) in 2021. AIR EP facilitated the project management and extension activities for the delivery of this project in consultation with Buckleboo Farm Improvement Group and Franklin Harbour Agricultural Bureau in planning and implementing trials, to ensure the research remained relevant to UEP farming systems.

**How was it done?**

Field trials were established in 2022 and 2023 in paddocks with a medium to high risk of yield loss

due to crown rot at Buckleboo and Mitchellville on UEP. An additional field trial (funded by Elders) was established at Booleroo Centre in 2022 with the same treatments and risk profile as the main trial on UEP.

Trials relied on natural crown rot inoculum (Table 1) to ensure treatments were undertaken in a situation that reflected commercial paddock situations. Other soil-borne cereal stem and root pathogens were quantified for each site (Table 1). At all sites, nematodes and Rhizoctonia root rot were either at low risk levels or below detection at all sites, so these pathogens are unlikely to be influencing VICTRATO® effects (Tymirium® chemistry has some activity against these pathogens). Pythium root rot was present at medium risk levels at Booleroo Centre in 2022 and might have influenced VICTRATO® effects at that site (Tymirium® chemistry has some activity against this pathogen).

**Table 1. Soil inoculum concentrations and risk levels for yield loss due to soil-borne diseases that might interact with crown rot (PREDICTA B® analysis of soil samples taken pre-sowing).**

	2022			2023	
	Booleroo	Buckleboo	Mitchellville	Buckleboo	Mitchellville
Crown rot	4898	6542	23017	2135	172
Cereal cyst nematode	0	0	0	0	0
<i>Pratylenchus thornei</i>	3	0	0	0	0
<i>P. neglectus</i>	5	1	3	10	1
Rhizoctonia root rot	13	4	12	5	2
Take-all	13	16	15	6	1
Common root rot	81	11	4	0	12
Pythium root rot	51	15	3	12	11

Risk categories	
Validated	Provisional
Below detection	
Low risk	
Medium risk	
High risk	

Disease

**Table 2. Preliminary information on yield changes (%) due to VICTRATO® in bread wheat and barley varieties with different maturities<sup>1</sup> and varietal resistance ratings<sup>2</sup>. Sites on the Upper Eyre Peninsula (2022, 2023) and in the Mid North (2022) had naturally occurring, medium to high risk levels of crown rot inoculum.**

Ratings	Maturity	Varieties	2022			2023	
			Booleroo	Buckleboo	Mitchellville	Buckleboo	Mitchellville
MSS	VQ-Q	Emu Rock	6	0	6	4	-1
S	Q	Vixen	-1	8	10	8	2
MSS	Q-M	Anvil	6	5	7	4	7
S	Q-M	Razor	1	1	10	3	8
U	Q-M	Calibre	9	11	6	3	8
S	M	Scepter	4	4	2	10	8
MS	M-L	Trojan	na	na	na	10	3
-	Q-M	Commodus	0	12	7	7	-22
<b>Untreated Scepter yield t/ha</b>			<b>2.28</b>	<b>3.91</b>	<b>2.82</b>	<b>1.56</b>	<b>1.60</b>

<sup>1</sup> U=unknown; S=susceptible; MS= Moderately susceptible; MSS=moderately susceptible to susceptible.

<sup>2</sup> Q=quick maturing; M=mid maturing; M-L mdi to late maturing; VQ=very quick maturing.

Six (2022) or seven (2023) bread wheat varieties and one barley variety, all suited to UEP, were sown at all sites with and without seed applied VICTRATO® fungicide. Barley was included as it may “escape” yield losses due to crown rot due to grain filling before moisture stress occurs. Bread wheat entries (see Table 2 for details) included varieties with a range of maturities (which can influence responses to crown rot) and different crown rot resistance ratings.

The same seed sources were used for all trials and VICTRATO® fungicide was supplied by Syngenta Australia and applied to seed by Lyndon May. Total solution rate was 600 mL/100 kg of seed.

Statistical advice and trial designs will be provided by Sharon Nielsen (SN Stats). Sharon has commenced analysis of 2022 data and will complete more comprehensive statistical analyses once data from 2023 are available. When data sets are complete for both seasons and statistical analyses (including meta-analysis) have been undertaken, the findings will be publicised.

### What happened?

In 2022, very mild conditions during flowering and grain filling meant white heads, due to crown rot, did not express but (limited) stem browning symptoms, due to crown rot, developed at all sites. The good season on UEP also meant yields were higher than average at both Buckleboo and Mitchellville. At Booleroo Centre in 2022, the trial was late-sown due to timing of opening rains which reduced plant growth and yields.

2023 was more challenging for the UEP. Good seasonal conditions were present until around flowering, when rainfall abruptly ceased and moisture stress resulted in more crown rot expression (white heads and basal stem browning) than 2022.

At Buckleboo, there was significant mouse damage during flowering and early grain filling. Plots were scored for damage and that will be taken into account during data analysis. Neither 2022 nor 2023 trials were adversely affected by weeds, leaf diseases, insect pests or frosts.

### Varietal maturity and crown rot resistance and fungicide seed dressing effects.

Average yields of untreated Scepter (Table 2) and other varieties (data not presented) reflect seasonal conditions at the sites. Yields were lower in 2023 than in 2022, and in 2022 were lowest at Booleroo Centre and highest at Buckleboo (Table 2).

As expected for years with low crown rot expression, percentage yield changes were small but consistent with the lower end of responses where crown rot expression was significant at medium and high rainfall sites in South Australia in previous years.

The yield decrease for Commodus in 2023 at Mitchellville (Table 2) was unexpected, as other responses of this entry on UEP have been positive (7%-12%). This anomaly was possibly due to exceptional early growth in treated plots which meant grain filling could not be supported as moisture ran out. Barley has the potential to produce many tillers on a single plant if early season conditions are good but tiller numbers per plant are much lower in bread wheat, which makes it unlikely there would be a similar response in bread wheat varieties.

Replicate	Buckleboo		Mitchellville	
	%	t/ha	%	t/ha
1	-1	-0.02	19	0.40
2	31	0.41	17	0.36
3	31	0.34	0	0.01
4	12	0.15	12	0.25
5	29	0.42	5	0.12
6	29	0.38	1	0.03
7	2	0.04	4	0.10
8	4	0.07	5	0.11
Untreated Calibre yield		1.44		2.25

**Table 3. Preliminary information on variability in the magnitude of yield changes (%) due to VICTRATO® seed treatment in paired plots of Calibre wheat on upper Eyre Peninsula in 2023.**

	Mitchellville		Buckleboo	
	Untreated	Treated	Untreated	Treated
Calibre	2.00	1.22	1.82	1.33
Emu Rock	2.00	1.50	1.87	1.48
Scepter	2.09	1.62	1.86	1.38
Anvil	2.16	1.48	1.81	1.64
Vixen	2.27	1.64	2.07	1.48
Razor	2.31	1.50	2.08	1.73
Commodus	2.50	2.11	2.54	2.30

Treated = VICTRATO® fungicide seed dressing applied pre-sowing

0	No crown rot incidence
>0-1.5	Low risk of yield loss
>1.5-2.5	Some risk of yield loss
>2.5-3.5	Medium risk of yield loss
>3.5-5	High risk of yield loss

**Table 4. Preliminary information on main stem basal browning expression and risk categories for bread wheat and barley varieties with different maturities<sup>1</sup> and varietal resistance ratings<sup>2</sup> when treated with VICTRATO® on upper Eyre Peninsula in 2022.**

There was no obvious visual influence of varietal resistance or maturity on bread wheat yield responses to VICTRATO® treatment in either season (Table 2). Analysis of 2022 data supports this, as there was no significant difference in yield responses amongst the varieties assessed.

There has been a lot of variability amongst replicates in response to VICTRATO® (e.g. Table 3) in all trials, with % yield changes in the negative not being uncommon. Despite this, average yield changes were not usually negative. Crown rot expression was low in 2022 and 2023, so this variability in yield responses may have been brought about by spatial changes in crown rot inoculum and soil characteristics having a lot of influence on yield.

For ease of comparison across seasons and sites, % yield changes (not t/ha changes) due to VICTRATO® are presented (e.g. Table 3). It is extremely important to remember that the same % yield change means different t/ha yield increases for crops with different yield potentials/absolute yields, as demonstrated in Table 3 where untreated Calibre yield was lower at Buckleboo than at Mitchellville. A 31% yield improvement at Buckleboo resulted in a 0.34 or a 0.41 t/ha yield increase, but a much smaller (17% and 19%) % yield improvement at Mitchellville resulted in similar yield increases - 0.36 and 0.40 t/ha, respectively (Table 3).

#### **VICTRATO® effects on carryover of crown rot inoculum**

Incidence of main stems with basal browning (data not presented) was similar for Treated and Untreated plots. Basal stem browning severity was slightly lower in VICTRATO® Treated plots than Untreated plots, occasionally resulting in the Treated plots being placed in a lower risk category than the Untreated plot (Table 4). The “low risk of yield loss” category was only seen in Treated plots.

The small differences in crown rot incidence and severity due to treatment with VICTRATO® mean it is unclear whether VICTRATO® will influence inoculum carryover. The trials in Table 3 were established in 2023 to assess crown rot inoculum carryover at the start of 2024. Soil samples were taken in mid-January 2024 for PREDICTA® B analysis and when data are available the findings will be publicised.



## What does this mean?

Mild seasonal conditions and good moisture availability during grain filling meant crown rot pressure on yield was limited and this led to small responses to VICTRATO®. Responses were consistent with the lower end of responses seen in replicated trials in medium rainfall areas of SA in 2020 and 2021, where crown rot pressure was much higher.

VICTRATO® is a useful addition to other management options for crown rot. However, it is not a “silver bullet” as it is likely to result in average yield improvements ranging from 0% to around 15% on UEP in seasons with no moisture stress during flowering/grain filling. VICTRATO® is recommended for use in paddocks with a known risk of yield loss due to crown rot. It should be combined with other best-practice management options e.g. rotation to reduce crown rot inoculum, inter-row sowing etc. Better performing paddocks/areas (usually produce higher yields) are more likely to provide an economic yield response to VICTRATO®, so it is important to consider gross margins prior to using VICTRATO®.

The unexpected negative yield response of Commodus barley at Mitchellville in 2023 highlights the effects that season/site combinations might have on barley responses to VICTRATO®. Overall, the likelihood of such a negative average yield response to VICTRATO® is not high for barley - only 1 of 4 trials on UEP had such a response and none of the 3 trials in the mid-North had an average negative yield response.

Apart from an occasional -1% or 0% yield change, all bread wheat variety yield responses to VICTRATO® have been positive in 2020, 2021, 2022 and 2023. Given these results and the different growth habits of barley (large number of tillers per plant) and bread wheat (low numbers of tillers per plant), it seems unlikely that bread wheat will exhibit any magnitude of negative average yield response to VICTRATO®.

Findings from trials established in 2023 to assess effects of VICTRATO® on crown rot inoculum carryover into 2024 will be publicised once data from analysis of soil samples are available. If inoculum carryover is reduced, this will influence when and how VICTRATO® is used to manage crown rot on UEP and in other low rainfall environments.

## Acknowledgements

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VICTRATO® fungicide (with Tymirium® chemistry, proposed release in Australia in 2024) - registered trademark of Syngenta Crop Protection Pty Ltd.

