Victrato® – When is it worth it?

Mitch Buster, Matt Gardner and Skye Traill, AMPS Research

Key words

Victrato®, fusarium crown rot, FCR, seed treatment, disease management

Take home messages

- Victrato® seed treatment resulted in regular yield benefit over Vibrance® alone in both wet and dry seasons
- The higher rate of Vibrance® is only consistently worthwhile in durum wheat and not in bread wheat or barley
- Although Victrato® has demonstrated effectiveness in FCR suppression, seed treatments should be used as an additional tactic within existing integrated disease management strategies for Fusarium crown rot (FCR).

Background

Fusarium crown rot (FCR) caused by *Fusarium pseudograminearum* has long been a major constraint in Australian grain growing regions causing yield and quality downgrades. The stubble borne disease is responsible for over $400 million in losses annually (Hollaway *et al*. 2022). At present there is no in-crop treatment for the disease and hence growers' ability to mitigate the consequences of FCR is limited to prior to sowing. Integrated management of FCR involves varietal selection, crop rotations, inter-row sowing, early sowing, stubble management and seed treatments. Seed treatments have been an effective tool in minimising the yield and quality losses associated with FCR. Victrato® (cyclobutrifluram, anticipated for commercial release in 2024) from Syngenta is the newest of the seed treatments targeting the suppression of FCR in cereal crops. Results presented in this paper are a subset of 12 independent field trials across the last three seasons (2021–2023) assessing the effectiveness of Victrato in comparison to Vibrance® (difenoconazole, metalaxyl-m + sedaxane) in the suppression of FCR expression. Results presented are a comparison of yield and quality (primarily screenings) in both wet and dry seasons.

What we did

Small plot field trials (approx. 1.8 x 10 m plots with minimum 3 replicates) were conducted annually (season permitting) at Gurley, Armatree, Breeza and Tamworth. A site with a similar soil type/profile and rotation to the previous year was selected for comparability between seasons.

All trials included varying FCR inoculum simulating different rotations and FCR risk profiles (nil, 1 g/m, 2 g/m). The nil treatment had background inoculum present in the field which was minimal due to paddock selection and stubble management. The inoculated treatment of 1 g/m represented a moderate infection rate (approximately >50% plants infected), whilst the 2 g/m treatment corresponds to a high-risk environment of approximately >80% plants infection.

Three cereal species were included at each site (excluding Tamworth 2023): barley (Maximus CL ⓟ), bread wheat (LRPB Mustang ⓟ) and durum (Westcourt ⓟ) to determine any differentiation in the efficacy of the seed treatment by species. Seed treatments are outlined in Table 1.

Table 1. Seed treatments applied in 6 FCR replicated field experiments in 2022 and 2023. All treatments had Gaucho® (imidacloprid) applied at 120 mL/100 kg of seed.

Treatment	Description
Untreated	No fungicide applied
Vibrance	Vibrance at 180 mL/100 kg of seed
Vibrance + Victrato	Vibrance at 180 mL/100 kg of seed + Victrato at 200 mL/100 kg of seed
Victrato 200	Victrato at 200 mL/100 kg of seed
Vibrance 360 + Victrato 200	Vibrance at 360 mL/100 kg of seed + Victrato at 200 mL/100 kg of seed
Vibrance 360 + Victrato 400	Vibrance at 360 mL/100 kg of seed + Victrato at 400 mL/100 kg of seed

Seasons summary

The results presented are from the 2022 and 2023 winter growing seasons where 2022 is characteristic of a wet growing season and 2023 a dry growing season. In-crop rainfall (May–Oct) during the 2022 season was: Armatree 420 mm, Gurley 488 mm and Tamworth 484 mm. Comparably the 2023 season Armatree received 61 mm, Gurley 67 mm and Breeza 113 mm. The average yield per species and site is given in Table 2.

Table 2. Average variety site yield (t/ha) in six FCR replicated field experiments (2022–2023).

Species	Average site yield (t/ha)					
	2022			2023		
	Armatree	Gurley	Tamworth	Armatree	Breeza	Gurley
Barley (Maximus CL♭)	7.7	6.7		3.8	5.0	3.6
Bread wheat (Mustang♭)	6.6	7.1	6.0	3.3	4.8	3.4
Durum (Westcourt♭)	6.7	6.9	6.1	2.7	4.6	1.8

Wet season observations (2022)

The use of Victrato with Vibrance significantly reduced yield losses compared to Vibrance alone in Maximus CL ♭ at Gurley in both the 1 g/m and 2 g/m rates by 5 and 8%, respectively (Table 3). No significant benefit was observed at Armatree by the addition of Victrato.

Similarly, the combination of Victrato and Vibrance significantly reduced yield losses compared to Vibrance alone in Mustang♭ at Gurley in both the 1 g/m (9%) and 2 g/m (4%) rates. Only the 1 g/m rate was significantly different to the Vibrance alone at Armatree with 5% additional yield. At Tamworth, the use of Vibrance + Victrato significantly increased yield compared to Vibrance alone by 8% only at the 2 g/m FCR rate.

The most consistent benefit of Victrato was observed in Westcourt♭ durum where yield was significantly improved at all three sites in both the moderate and high inoculum rates (Table 3). The use of Vibrance + Victrato compared to Vibrance alone resulted in significant yield increase at Armatree of 8% in the 1 g/m and 6% in the 2 g/m treatment. Similar results were observed at Gurley and Tamworth, in particular Tamworth in the 1 g/m rate recorded a 15% yield increase compared to Vibrance® alone. With the exception of the Tamworth site there was no significant yield increase observed from increasing the Vibrance rate to 360 mL/100kg and Victrato to 400mL/100kg.

Table 3. Relative yield gain/loss (t/ha) compared to Vibrance (180 mL/100 kg seed) treatment at three sites in 2022. Induced FCR inoculum levels as indicated by; Nil, 1 g/m and 2 g/m.

		Yield gain/loss compared to Vibrance treatment (t/ha)								
		Armatree 2022			Gurley 2022			Tamworth 2022		
Variety	Treatment	Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m
Maximus Ⓑ	Untreated	-0.43*	-0.41*	-0.20	-0.24*	-0.75*	-1.17*			
	Vibrance + Victrato	-0.10	-0.08	0.02	0.02	0.34*	0.53*			
Mustang Ⓑ	Untreated	-0.40*	-0.09	-0.20	0.04	-0.03	-0.01	-0.31*	-0.82*	-0.33*
	Vibrance + Victrato	-0.02	0.35*	0.17	-0.05	0.70*	0.31*	0.02	0.08	0.50*
Westcourt Ⓑ	Untreated	0.09	-0.29*	-0.49*	-0.05	0.17	-0.11	0.08	-0.28*	-0.46*
	Vibrance + Victrato	0.08	0.57*	0.42*	-0.08	0.36*	0.25*	-0.02	0.96*	0.70*
	Victrato 200			0.44*			0.03			0.60*
	Vibrance 360 + Victrato 200			0.64*			0.17			0.41*
	Vibrance 360 + Victrato 400			0.48*			0.25*			1.02**
	LSD (*P*<0.05)	0.26			0.22			0.20		

* Denotes where yield response (t/ha) was significantly different to Vibrance (180 mL/100 kg) treatment (*P*<0.05).

** Denotes where yield response (t/ha) was significantly increased compared to Vibrance (180 mL/100 kg) + Victrato (200 mL/100 kg) treatment (*P*<0.05).

Dry season observations (2023 season)

The addition of Victrato at 200 mL/100 kg significantly reduced yield losses compared to Vibrance alone in Maximus Ⓑ at all three sites in both the 1 g/m and 2 g/m FCR rates as well as the nil FCR treatment at both Armatree and Gurley. Relative to Vibrance alone, at Armatree, Victrato + Vibrance resulted in a yield increase of 5% in the nil, 14% in the 1 g/m and 17% in the 2 g/m FCR (Table 4). At Breeza yield increase was 16% in the 1 g/m and 12% in the 2 g/m, whilst at Gurley there was a 5% yield increase in the nil, 14% in the 1 g/m and 15% in the 2 g/m. There was no significant difference between the 200 mL and 400 mL/100 kg seed rates of Victrato in Maximus Ⓑ at all three sites.

Similar observations were made in Mustang Ⓑ where the addition of Victrato at 200 mL/100 kg significantly reduced yield losses compared to Vibrance alone at all sites and FCR inoculum rates except for at Gurley in the 1 g/m rate (Table 4). Relative to Vibrance alone at Armatree, Victrato + Vibrance resulted in a yield increase of 18% in the 1 g/m and 21% in the 2 g/m FCR. At Breeza yield increase was 14% in the 1 g/m and 11% in the 2 g/m, whilst at Gurley there was no difference in the 1 g/m and 7% yield increases in the 2 g/m. Like Maximus Ⓑ there was no significant difference between the 200 mL and 400 mL/100 kg seed rates of Victrato in Mustang Ⓑ at all three sites.

Like 2022 the most consistent benefit of Victrato was observed in Westcourt Ⓑ where yield was significantly improved at all three sites in all three FCR inoculum rates. The addition of Victrato at 200 mL/100 kg resulted in significant yield increases at Armatree, 40% at 1.19 t/ha in the 1 g/m FCR and

42% at 0.16 t/ha in the 2 g/m treatment. Similar results were observed at Gurley with a yield increase of 34% across both the 1 g/m and the 2 g/m treatments, and at Breeza 9% and 14 % respectively.

There was a significant benefit from increasing the rate of Victrato from 200 mL to 400 mL/100kg at Armatree across all three inoculum loads and in the 1 g/m at Breeza. There was no significant benefit observed at Gurley. However, increasing the Vibrance rate to 360 mL/100 kg again returned significant yield benefits over the low rate at all three sites.

Table 4. Relative yield gain/loss (t/ha) compared to Vibrance (180 mL/100 kg) treatment at three sites in 2023. Induced FCR inoculum levels as indicated by; Nil, 1 g/m and 2 g/m.

		Yield gain/loss compared to Vibrance treatment (t/ha)								
		Armatree 2023			**Breeza 2023**			**Gurley 2023**		
Variety	**Treatment**	**Nil**	**1 g/m**	**2 g/m**	**Nil**	**1 g/m**	**2 g/m**	**Nil**	**1 g/m**	**2 g/m**
Maximus ⓑ	Vibrance + Victrato 200	0.20*	0.53*	0.64*	0.01	0.84*	0.57*	0.20*	0.56*	0.57*
	Vibrance + Victrato 400	0.15*	0.58*	0.82*	0.02	0.90*	0.90*	0.16*	0.46*	0.48*
Mustang ⓑ	Vibrance + Victrato 200	-0.04	0.63*	0.67*	0.02	0.72*	0.49*	0.15*	0.00	0.22*
	Vibrance + Victrato 400	0.04	0.71*	0.81*	0.30*	0.85*	1.10*	0.07	0.01	0.32*
Westcourt ⓑ	Untreated			-0.36*			-0.59*			-0.30*
	Vibrance + Victrato 200	0.67*	1.19*	1.16*	0.30*	0.45*	0.66*	0.29*	0.68*	0.72*
	Vibrance + Victrato 400	0.74**	1.37**	1.32**	0.35*	0.70**	0.72*	0.38*	0.69*	0.72*
	Vibrance 360 + Victrato 200			1.23**			0.87**			0.76*
	Vibrance 360 + Victrato 400			1.36**			1.15**			0.98**
	LSD (*P*<0.05)	0.15			0.18			0.14		

* Denotes where yield response (t/ha) was significantly different to Vibrance (180 mL/100 kg) treatment (*P*<0.05).
** Denotes where yield response (t/ha) was significantly increased compared to Vibrance (180 mL/100 kg) + Victrato (200 mL/100 kg) treatment (*P*<0.05).

Observations on grain quality

Grain quality has previously been reported to be downgraded by FCR due to the vascular disruption imposed by the fungus inside the xylem tissue. Although it has been reported to affect protein accumulation, the most common observation is an increase in screenings due to poor water availability at grain fill. In these experiments grain protein or test weight was not significantly different based on seed treatment across all sites and years (*P*>0.05). However, screenings fluctuated between years and sites in the durum wheat, but not the bread wheat or barley.

In the high-risk situation, there was no significant difference between the untreated and Vibrance treatments in Westcourt ⓑ at both Armatree and Breeza (Figures 1 & 2). The addition of Victrato

significantly decreased screenings compared to Vibrance at Armatree only for the Vibrance 360 + Victrato 400 treatment. However, screening % was significantly reduced in all Victrato treatments at Breeza compared to Vibrance alone. Typically, as the FCR inoculum rate increased the screenings increased (Figures 1 & 2).

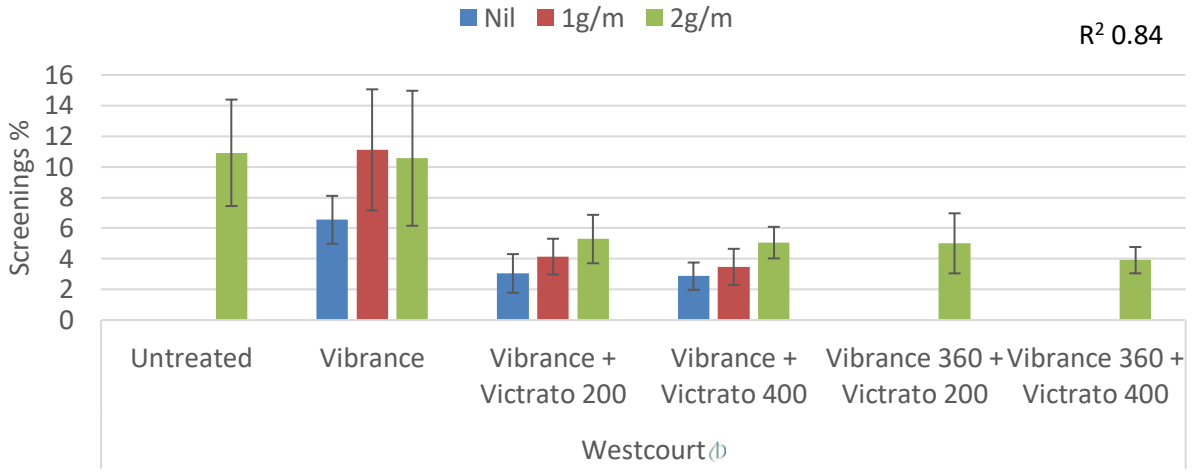

Figure 1. Screenings (%) of Westcourt ⁽ᵇ durum at Armatree 2023. Induced FCR inoculum levels as indicated by; Nil, 1 g/m and 2 g/m. Error bars indicate 95% confidence.

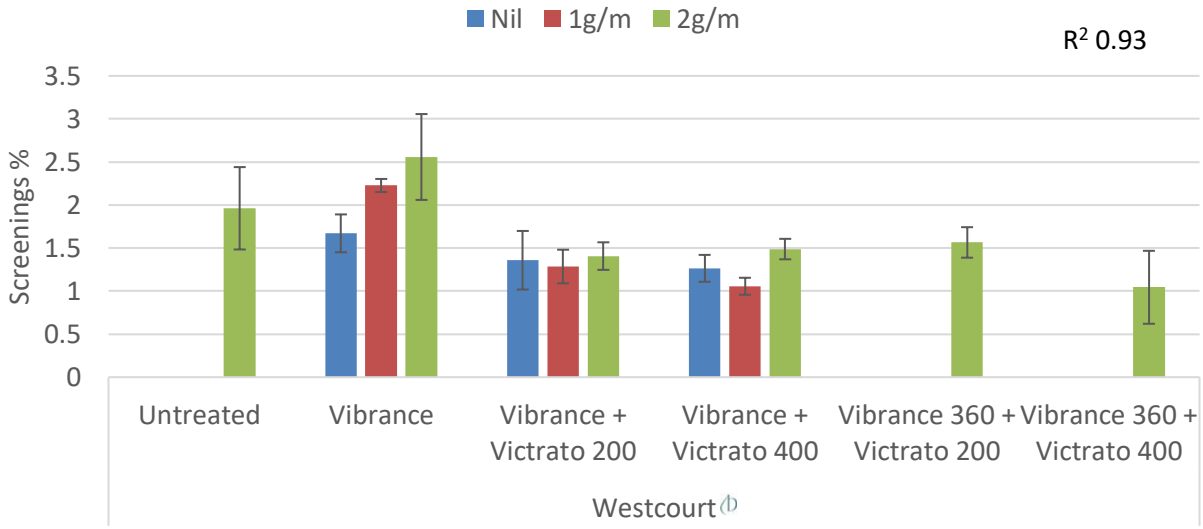

Figure 2. Screenings (%) of Westcourt ⁽ᵇ durum at Breeza 2023. Induced FCR inoculum levels as indicated by; Nil, 1 g/m and 2 g/m. Error bars indicate 95% confidence.

Financial analysis

Table 5 presents projected net returns based upon yields presented in tables 3 and 4. Assumptions of these projections are as follows: barley $380/t, wheat $400/t, durum $450/t, Vibrance $68/L, Victrato $75/L, growing costs are consistent between sites, years and varieties.

Table 5. Relative net return ($/ha) gain/loss compared to Vibrance (180 mL/100 kg) treatment at three sites in 2022. Induced FCR inoculum levels as indicated by; Nil, 1 g/m and 2 g/m. Assumptions: barley $380/t, wheat $400/t, durum $450/t, Vibrance $68/L, Victrato $75/L, growing costs are consistent between sites and varieties.

Variety	Treatment	Relative net return gain/loss compared to Vibrance treatment ($/ha)								
		Armatree 2022			Gurley 2022			Tamworth 2022		
		Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m
Maximus (b)	Untreated	-157*	-148*	-69	-84*	-278*	-438*			
	Vibrance + Victrato	-58	-50	-13	-13	108*	182*			
Mustang (b)	Untreated	-153*	-31	-75	21	-6	4	-116*	-323*	-125*
	Vibrance + Victrato	-31	121*	47	-40	259*	103*	-11	11	179*
Westcourt (b)	Untreated	47	-125*	-216*	-19	84	-42	40	-118*	-200*
	Vibrance + Victrato	15	234*	169*	-57	140*	89*	-28	410*	292*
	Victrato 200			201*			-1			253*
	Vibrance 360 +Victrato 200			171*			48			155*
	Vibrance 360 +Victrato 400			245*			70*			416**

* Denotes where relative net return ($/ha) was significantly different to Vibrance (180 mL/100 kg) treatment (*P*<0.05).

** Denotes where relative net return ($/ha) was significantly increased compared to Vibrance (180 mL/kg) + Victrato (200 mL/100 kg) treatment (*P*<0.05).

Table 6. Relative net return ($/ha) gain/loss compared to Vibrance (180 mL/100 kg) treatment at three sites in 2023. Induced FCR inoculum levels as indicated by; Nil, 1g/m and 2g/m. Assumptions: barley $380/t, wheat $400/t, durum $450/t, Vibrance $68/L, Victrato $75/L, growing costs are consistent between sites and varieties.

		Relative net return gain/loss compared to Vibrance treatment ($/ha)								
		Armatree 2023			Breeza 2023			Gurley 2023		
Variety	Treatment	Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m	Nil	1 g/m	2 g/m
Maximus ◊	Vibrance + Victrato 200	55*	182*	224*	-19	297*	194*	55*	192*	196*
	Vibrance + Victrato 400	22*	184*	274*	-27	307*	307*	26*	140*	147*
Mustang ◊	Vibrance + Victrato 200	-36	231*	247*	-12	268*	176*	38*	-21	67*
	Vibrance + Victrato 400	-22	247*	286*	82*	302*	406*	-8	-31	92*
Westcourt ◊	Untreated			-154*			-258*			-129*
	Vibrance + Victrato 200	280*	515*	500*	114*	180*	277*	108*	286*	302*
	Vibrance + Victrato 400	299**	580**	558**	123*	280*	289*	135*	272*	287*
	Vibrance 360 + Victrato 200			526**			364**			313*
	Vibrance 360 + Victrato 400			572*			474**			398**

* Denotes where relative net return ($/ha) was significantly different to Vibrance (180mL/100kg) treatment (P<0.05).
** Denotes where relative net return ($/ha) was significantly increased compared to Vibrance (180 mL/kg) + Victrato (200 mL/100 kg) treatment (P<0.05).

Summary

Victrato seed treatment can suppress the expression FCR in cereal production, resulting in significant yield benefits. When there is a moderate to high FCR risk it appears that the recommended 200 mL/100 kg seed delivers a regular benefit compared to Vibrance alone. In these experiments the treatment (Victrato) regularly recovers its cost in high rainfall seasons in durum and bread wheat production, whilst intermittently in barley. In Mustang◊, across all three sites in 2022 there was an average net return of $130/ha in the moderate FCR risk (1 g/m) and $109/ha in the high risk (2 g/m). Whilst in the durum variety Westcourt ◊, across all three sites in 2022 there was an average return of $261/ha in the moderate FCR risk (1 g/m) and $183/ha in the high risk (2 g/m).

However, when considering drier seasons the return on investment significantly increases again. In Maximus◊ barley, across all three sites in 2023, there was an average return of $224/ha in the moderate FCR risk (1 g/m) and $204/ha in the high risk (2 g/m). In Mustang ◊ bread wheat, across all three sites in 2023, there was an average return of $159/ha in the moderate risk (1 g/m) and $163/ha in the high risk

(2 g/m). Whilst in Westcourt ♁, across all three sites in 2023 there was an average return of $327/ha in the moderate risk (1 g/m) and $360/ha in the high risk (2 g/m).

It was only in the durum that there was a consistent yield advantage with the high rate of Victrato. In the 400 mL/100kg treatment across all three sites in 2023 there was an average return of $377/ha in the moderate FCR risk (1 g/m) and $378/ha in the high risk (2 g/m). Furthermore, the high Vibrance rate combination with Victrato® delivered very competitive returns compared to the low rate of Vibrance in the durum. These treatments were only conducted on the durum cultivar and not the barley and bread wheat so cannot be confirmed if similar results would have been observed, however, it does warrant further investigation to confirm.

Victrato as a seed treatment is an effective tool for FCR suppression, however, it needs to be used wisely within existing integrated disease management strategies for FCR suppression.

References

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Contact details

Mitch Buster
AMPS Research
690 Waverley Rd, Caroona, NSW 2343
Ph: 0428 306 914
Email: mitch.buster@ampsagribusiness.com.au

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