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Are you wasting money on fungicides?
The economics of canola disease control revealed.

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Key Messages:

- **Fungicide treatments significantly improved canola yields at high-disease-risk sites** – Kojonup and Dandaragan showed the most consistent yield benefits, with all three fungicides providing statistically significant increases.
- **Revystar® and Miravis® Star delivered the highest average yield gains** – Across all five sites, Revystar® and Miravis® Star increased yield by 0.18 t/ha, while Aviator® Xpro® provided a 0.16 t/ha increase, all with strong statistical significance ($p \leq 0.002$)**.**
- **Economic returns by product** – Aviator® Xpro® and Revystar® delivered the highest average economic returns of $90/ha, with Aviator® Xpro® showing more consistent performance across locations. Miravis® Star averaged $82/ha but had a higher return than Aviator® Xpro® and Revystar® at two sites, highlighting the variability in fungicide response across different environments.
- **What should you use?**
    - Yield potential <1.5 t/ha consider a generic prothicoconazole and tebuconazole spray.
    - Yield potential 1.5-2.5 t/ha use Aviator® Xpro®.
    - Yield potential >2.5 t/ha use Miravis® Star.
    - While Revystar® demonstrated strong grain yields in these trials, additional research is needed to determine its economic viability and competitive advantage compared to other premium fungicides in the market.

Background

2023 Trials: Evaluating Prosaro® and Aviator® Xpro® in Canola

In 2023, Laconik, in partnership with a local grower west of Munglinup, WA, conducted Laconik Combine® trials to assess the grain yield and economic returns from applying Prosaro® (prothioconazole and tebuconazole) and Aviator® Xpro® (bixafen and prothioconazole) applied at 50% flowering in canola. The results demonstrated that both fungicides increased grain yield and delivered a positive return on investment. Prosaro® resulted in a 0.07 t/ha increase in grain yield compared to the Untreated Control, leading to a profit increase of $33/ha. Aviator® Xpro® provided an even greater yield response, delivering a 0.2 t/ha increase in grain yield over the Untreated Control, translating to a profit increase of $117/ha.

2024 Trials: Expanding the Evaluation of Premium Fungicides

Following feedback from growers and agronomists seeking further insights into the value of premium-priced fungicides in canola, Laconik has expanded its research efforts in 2024. Five Laconik Combine® trials were established across the high rainfall zone of Western Australia to evaluate the performance of three premium fungicides: Miravis® Star (fludioxonil and pydiflumetofen), Revystar® (mefentrifluconazole and fluxapyroxad), and Aviator® Xpro® (bixafen and prothioconazole). Each trial also includes an Untreated Control (UTC) for baseline comparison.

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These trials aim to provide growers and agronomists with robust, farm-scale data to understand better grain yield and economics returns from premium fungicides in canola. The results offer insights into how these fungicides contribute to improved yield and profitability in the high rainfall zones of Western Australia.

Method

All trials followed the Laconik Combine™ design, with plots measuring 60 m long and 36 m wide (Figure 1). This design is particularly effective for fungicide trials as it captures the spatial variability of disease pressure across paddocks, which is critical for accurately assessing fungicide performance. Unlike small plot trials that confine treatments to artificially uniform areas, Laconik Combine™ trials cover entire paddocks, exposing treatments to natural disease pressure variability caused by differences in soil type, moisture, and microclimate.

To apply each treatment, the grower uploaded a trial prescription generate by Laconik into the boomspray rate controller, drove across the paddock, and applied the first treatment. After completing the application, they returned to the tank, cleaned out the boomspray, and refilled it with the next treatment. This process was repeated until all treatments had been applied. All treatments were applied at a 750 mL/ha rate using 100 L/ha of water to ensure consistent coverage. All treatments were applied when the crop was between 40-60% flower.

Figure 1: An example of a Laconik Combine® trial layout. Each colour represents a different fungicide treatment. Non-coloured plots had no fungicide applied.

Laconik purchased 20 litres of each fungicide treatment from a local retailer. The prices paid were $42 per litre for Aviator® Xpro®, $65 per litre for Revystar®, and $75 per litre for Miravis® Star. These prices were used to calculate the economic outcomes, along with a canola grain price of $800 per tonne and an application cost of $6 per hectare.

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Grain yield data was first examined using boxplot analysis to identify potential outliers in the yield values. Outliers were defined as data points falling beyond 1.5 times the interquartile range from the first and third quartiles. These outliers were removed from the dataset to ensure a robust analysis. Following this step, the cleaned dataset was analysed using linear mixed models (LMMs) to account for variability across replicates and locations. This approach allowed the inclusion of both fixed and random effects. The fixed effects represented the treatment factor, which included UTC, Aviator® Xpro®, Miravis® Star, and Revystar®. The random effects accounted for block-level variability within each location by incorporating replicate as a random predictor. The number of replicates per trial ranged from six at Kojonup to 13 at Dandaragan.

Over five trials, grain yield data was analysed from 50 replicates. In contrast, if this work had been done using traditional small plot trials with only four replicates per site, it would have yielded just 20 replicates. By using Laconik Combine™, 2.5 times more data was collected, resulting in a far more robust and statistically powerful dataset. This increased dataset improves confidence in the results, better captures paddock variability, and gives growers and agronomists more reliable, real-world insights to guide fungicide decisions.

The LMM was structured with yield (t/ha) as the response variable. Treatment was included as a fixed predictor, with the UTC treatment as the intercept. Replicates within each location were treated as a random predictor to appropriately model variability due to experimental design.

The models were implemented using the stats models Python library. Estimated coefficients were calculated to represent the mean differences between each treatment and the UTC intercept. Statistical significance was assessed by deriving p-values from Wald z-tests, with a significance threshold set at $\alpha = 0.05$.

Results

Individual Site Results

The yield response of canola to fungicide treatments varied across the five trial locations, with significant differences observed in some regions while others showed no response to fungicide applications (Table 1).

At Beverley, the UTC had an average yield of 2.05 t/ha. Revystar® was the only fungicide treatment that significantly increased yield compared to the UTC (2.15 t/ha, $p = 0.033$). Aviator® Xpro® (2.10 t/ha, $p = 0.302$) and Miravis® Star (2.08 t/ha, $p = 0.486$) did not result in statistically significant yield increases.

At Kojonup, the UTC yielded 3.13 t/ha, and all three fungicide treatments significantly increased yield. Aviator® Xpro® (3.31 t/ha, $p = 0.013$), Miravis® Star (3.36 t/ha, $p < 0.001$), and Revystar® (3.39 t/ha, $p < 0.001$) all showed statistically significant improvements over the UTC. Revystar® provided the highest numerical yield increase, followed closely by Miravis® Star, which had highly significant p-values ($p < 0.001$), suggesting a strong and consistent yield response.

At Condingup, the UTC yielded 1.16 t/ha, and none of the fungicide treatments resulted in a statistically significant increase. Aviator® Xpro® (1.19 t/ha, $p = 0.858$), Miravis® Star (1.26 t/ha, $p = 0.464$), and Revystar® (1.14 t/ha, $p = 0.829$) all had p-values above the threshold for significance, indicating no detectable yield benefit from fungicide application in this environment.

At Dandaragan, the UTC yielded 2.77 t/ha, and all fungicide treatments significantly increased yield. Aviator® Xpro® (3.13 t/ha, $p < 0.001$) and Miravis® Star (3.07 t/ha, $p < 0.001$) both showed highly significant yield

improvements. Revystar® also significantly increased (2.97 t/ha, p = 0.015), though to a lesser extent than the other two fungicides.

At Bremer Bay, the UTC yielded 1.55 t/ha, and two fungicides significantly increased yield. Miravis® Star (1.79 t/ha, p < 0.001) and Revystar® (1.91 t/ha, p < 0.001) both provided significant improvements. However, Aviator® Xpro® (1.73 t/ha, p = 0.133) did not result in a statistically significant increase.

Table 1: Canola grain yield responses to fungicide at five locations across Western Australia.

	Beverley		Kojonup		Condingup		Dandaragan		Bremer Bay	
Treatment	**t/ha**	**p-value**	**t/ha**	**p-value**	**t/ha**	**p-value**	**t/ha**	**p-value**	**t/ha**	**p-value**
UTC	2.05		3.13		1.16	0	2.77		1.55	
Aviator® Xpro®	2.10	0.302	3.31	0.013	1.19	0.858	3.13	<0.001	1.73	0.133
Miravis® Star	2.08	0.486	3.36	<0.001	1.26	0.464	3.07	<0.001	1.79	<0.001
Revystar®	2.15	0.033	3.39	<0.001	1.14	0.829	2.97	0.015	1.91	<0.001

These results indicate that the effectiveness of fungicide treatments varied by location, with Kojonup and Dandaragan showing the most consistent and significant yield improvements. In contrast, no yield benefit was observed at Condingup, suggesting potential environmental factors such as disease pressure or climate conditions may have influenced treatment efficacy.

Mean Yield Response Across Five Trial Sites

The mean yield response of canola to fungicide treatments across five trial locations showed significant improvements over the untreated control (Nil). The UTC yielded an average of 2.13 t/ha, while all three fungicide treatments yielded statistically significant yield increases.

Aviator® Xpro® yielded 2.29 t/ha, representing a 0.16 t/ha increase over the UTC (p = 0.002). Miravis® Star and Revystar® yielded 2.31 t/ha, showing a 0.18 t/ha improvement over the UTC, with highly significant p-values (p = 0.001 for both treatments).

Table 2: Canola grain yield response across five locations in Western Australia.

Treatment	**t/ha**	**p-value**	**Yield increase compared to UTC (t/ha)**
UTC	2.13		
Aviator® Xpro®	2.29	0.002	0.16
Miravis® Star	2.31	0.001	0.18
Revystar®	2.31	0.001	0.18

These results indicate that all three fungicide treatments significantly improved canola yield when averaged across all trial sites. Miravis® Star and Revystar® demonstrated the highest mean yield increase, while Aviator® Xpro® also provided a statistically significant benefit. The consistency of significant p-values suggests that fungicide application was an effective strategy for increasing canola yield under the conditions tested.

Economic Returns

The economic return of fungicide treatments varied across sites. At Kojonup, Dandaragan, and Bremer Bay, all fungicides provided positive returns, with Revystar® achieving the highest at $153/ha, $109/ha, and $233/ha, respectively. Aviator® Xpro® performed best at Dandaragan ($252/ha).

At Beverley and Condingup, returns were more variable. Revystar® provided a positive return at Beverley ($25/ha) but was negative at Condingup ($71/ha). Miravis® Star showed a small positive return at Condingup ($18/ha) but was negative at Beverly ($38/ha).

Across all sites, Aviator® Xpro® and Revystar® yielded the highest returns ($90/ha each), followed by Miravis® Star ($82/ha).

Table 3: Economics of fungicide application at each site.

Treatment	Beverly	Kojonup	Condingup	Dandaragan	Bremer Bay	Average
UTC						
Aviator® Xpro®	$2	$106	$(14)	$252	$106	$90
Miravis® Star	$(38)	$122	$18	$177	$130	$82
Revystar®	$25	$153	$(71)	$109	$233	$90

Discussion

The results from this study demonstrate that the yield and economic response of canola to fungicide application varied significantly across locations. While fungicide treatments provided clear yield and financial benefits at specific sites, others showed limited or no response. This highlights the importance of site-specific factors, including environmental conditions and disease pressure, in determining the effectiveness of fungicide applications.

Yield Response Across Sites

The yield data suggest that the impact of fungicide treatments was most pronounced at Kojonup and Dandaragan, where all three fungicides significantly increased yields compared to the UTC. This indicates that these site's disease pressure or environmental conditions were conducive to a fungicide response. In contrast, at Condingup, no significant yield increases were observed for any fungicide treatment. This suggests that disease pressure was either low or other environmental factors such as soil moisture, nutrition, or climatic conditions limited yield potential.

Revystar® produced the highest yield increases at four out of five locations, with responses at Kojonup, Dandaragan, and Bremer Bay. Miravis® Star also performed well, showing significant yield increases at the same sites. Aviator® Xpro® demonstrated significant yield benefits at Kojonup and Dandaragan but did not provide a statistically significant increase at Bremer Bay.

Mean Yield Response Across Sites

When averaged across all five locations, all three fungicides significantly increased canola yields compared to the UTC. Revystar® and Miravis® Star provided the highest mean yield increase of 0.18 t/ha, while Aviator® Xpro® resulted in a 0.16 t/ha increase. The strong statistical significance of these results (p-values ≤ 0.002) confirms that fungicide application was an effective strategy for improving canola productivity under the conditions tested.

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Economic Returns

Economic analysis revealed that the profitability of fungicide treatments varied by site. At Kojonup, Dandaragan, and Bremer Bay, all fungicides provided positive economic returns, with Revystar® delivering the highest financial gain. The economic response was most substantial at Dandaragan, where Aviator® Xpro® resulted in a $252/ha return, followed by Bremer Bay, where Revystar® returned $233/ha.

Conversely, Beverley and Condingup showed more variable economic responses. At Beverley, Revystar® was the only treatment that provided a positive return ($25/ha), while Miravis® Star resulted in a loss ($38/ha). At Condingup, none of the fungicide treatments provided a positive financial return, with Revystar® showing the largest negative result $71/ha. These findings suggest that fungicide applications may not always be economically viable in environments with low disease pressure or limited yield potential.

Implications for Growers

The results suggest that fungicide application can significantly improve canola yield and profitability, but the response is highly site dependent. Before investing in fungicide applications, growers should consider historical disease pressure, seasonal conditions, and economic risk. In areas with consistently high disease risk, fungicides are likely to provide a strong return on investment, whereas in lower-risk environments, economic returns may be less consistent. Furthermore, these findings highlight the importance of site-specific agronomic decision-making.

Conclusion

Overall, fungicide application effectively increased canola yields in moderate to high disease-pressure environments. Kojonup and Dandaragan exhibited the most consistent yield and economic benefits, while sites like Condingup showed no yield response, reinforcing the need for regionally tailored disease management strategies.

About Laconik

Laconik (www.laconik.com.au) is the new industry standard. We are pioneering farm-scale trials to generate real-world insights for better crop input decisions. Our patented Laconik Analytics Engine™ integrates advanced spatial analytics and machine learning to uncover how crops respond to nutrients across highly variable paddock conditions. We empower growers and agronomists to make more confident, data-driven decisions by delivering actionable recommendations and measurable financial returns.

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