

Optimising Crop Yields in 2024: 2024 Season So Far...

Due to the delayed start to the season, crops across the Eyre Peninsula have mostly started emerging in early to mid-June. Generally, crops that establish in June don't have enough time to build up biomass before they enter the reproductive stage. This increases the likelihood of flowering during hotter conditions, which usually results in lower yield potential compared to crops that establish in early May.

However, tools like Yield Prophet® are forecasting that a wide range of potential yields are still possible across all Eyre Peninsula environments given the range of climatic conditions that may still eventuate. Examining the six focus paddocks being followed by the GRDC RiskWi\$e project, in some cases, sees shortfalls in the amount of nitrogen available in the soil, if potential yields are to be realised.

Table 1. Eyre Peninsula focus paddock summary information: paddock history, yield potential and nitrogen shortfall, June 2024.

Site	Ave GSR (mm)	PAW March (mm)	Soil N March (kg/ha N)	2023 Crop	2024 Crop	Yield prophet 75%		Yield prophet 50%		Yield prophet 25%	
						Yield (t/ha)	N gap (kg/ha N)	Yield (t/ha)	N gap (kg/ha N)	Yield (t/ha)	N gap (kg/ha N)
Cleve	288	62	32	Canola	Wheat	2.1	32	2.6	44	3.4	72
Lock	292	39	113	Canola	Wheat	2.4	0	2.9	0	4	0
Cootra	245	65	50	Lentil	Wheat	1.9	28	2.4	40	2.9	52
Minnipa	197	22	60	Lentil	Wheat	1.2	8	2	28	2.6	40
Pt Kenny	272	5	58	Medic Pasture	Wheat	2.1	24	2.8	44	3.8	72
Cockaleechie	340	92	137	Canola	Wheat	3.6	0	4.6	16	5.6	32

This poses questions like how much N should be applied, where and when? The following article aims to provide a framework that might be a useful guide to work through the decision.

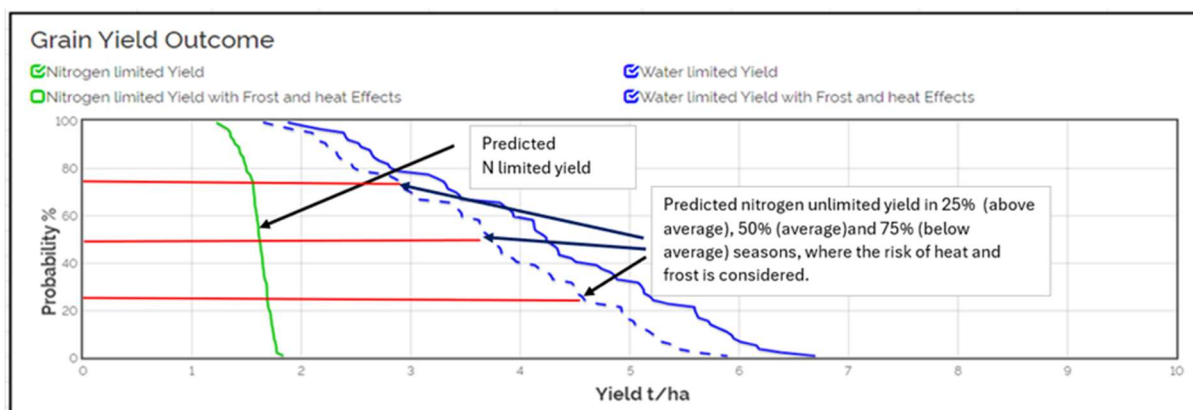
What is Yield Prophet?

[Yield Prophet®](#) is a crop modelling tool that simulates crop yields based on local climate data and soil conditions. It predicts potential yield outcomes across various seasonal conditions, ranging from the wettest to the driest years. These outcomes are often expressed in deciles: Decile 1 represents the lowest 10% of years, and Decile 10 represents the highest 10%.

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The platform generates graphs that illustrate potential grain yield outcomes. A solid blue line shows yield based on rainfall alone, while a dotted blue line accounts for the negative effects of frost and heat. The green line indicates current yield potential, considering initial nitrogen levels and modelled nitrogen availability through mineralization. These graphs help farmers understand crop yield potential and make informed decisions about inputs and economics.

Decision-Making with Yield Prophet

Making economic decisions about nitrogen application is most effective when considering multiple seasonal outcomes. Farmers aim to either profit from the yield response or minimize losses when there's no response. However, oversimplifying these decisions can lead to unexpected results.

The RiskWi\$e Project

Funded by GRDC, the RiskWi\$e project aims to help farmers with decision-making in complex or complicated situations. Using focus paddocks across different environments on Eyre Peninsula, we examine yield potential, yield gaps, and decision-making processes to reduce risk and uncertainty.

Example Scenario: Eyre Peninsula Wheat Crop

Consider a wheat crop with a 2.5-tonne yield potential in an average year. If a grower has enough nitrogen for a 2-tonne crop, what should they consider when deciding on additional nitrogen application? Here's a breakdown:

- Urea cost: \$730/tonne (including freight)
- Spreading 40 kg/ha of Urea: \$37/ha
- Total cost for 1,500ha: \$55,500
- Profit from a 0.5 t/ha yield increase: \$285,000 (1,500ha at \$380/tonne)

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- Yield increase needed to cover input costs: 0.1 t/ha

Based on this information, the potential outcomes could be:

- In 3 out of 10 years, no yield response (loss of \$55,500)
- In 4 out of 10 years, full yield response (profit of \$285,000)
- In 3 out of 10 years, partial yield response (breakeven)

On average, spreading Urea could yield a profit of \$103,000 per year. Conversely, not spreading could cost the grower \$103,000 annually.

Key Questions for Decision-Making

To make a well-informed decision, consider the following:

- Can my business handle a \$55,500 outlay if it's not recouped? How many years can I sustain this without financial risk?
- Will unused nitrogen remain in the system for future use?
- Is my paddock responsive to nitrogen? Do I understand soil nitrogen levels well enough?
- Can I expect a response across all soil types? If not, how can I address this?
- Do I need more information, and where can I find it?

Conclusion

Having a structured decision-making process can be really valuable when making decisions that are complex or have high levels of uncertainty. While no single method is perfect, a thoughtful approach helps manage the complexities of farming decisions. Below are the yield potentials and nitrogen-limited yields for six focus paddocks, providing valuable insights. More detailed Yield Prophet reports are available on the project [webpage](#).

Note that sowing dates are relative to establishment, many sites were sown earlier but the dry start to the season has resulted in delayed establishment dates.

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Cleve focus site, prepared 14 June 2024

Table 2. Cleve focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture (to 60 cm)	2022 Stubble	Initial N (to 60 cm)	N applied
Wheat	1 June	8 Nov	Sandy clay loam	62 mm	Canola	33 kg/ha	20 kg/ha

The focus paddock at Cleve is a reliable paddock with a soil type that has a relatively large bucket size. This is particularly evident in the section of the paddock where yield predictions are formulated.

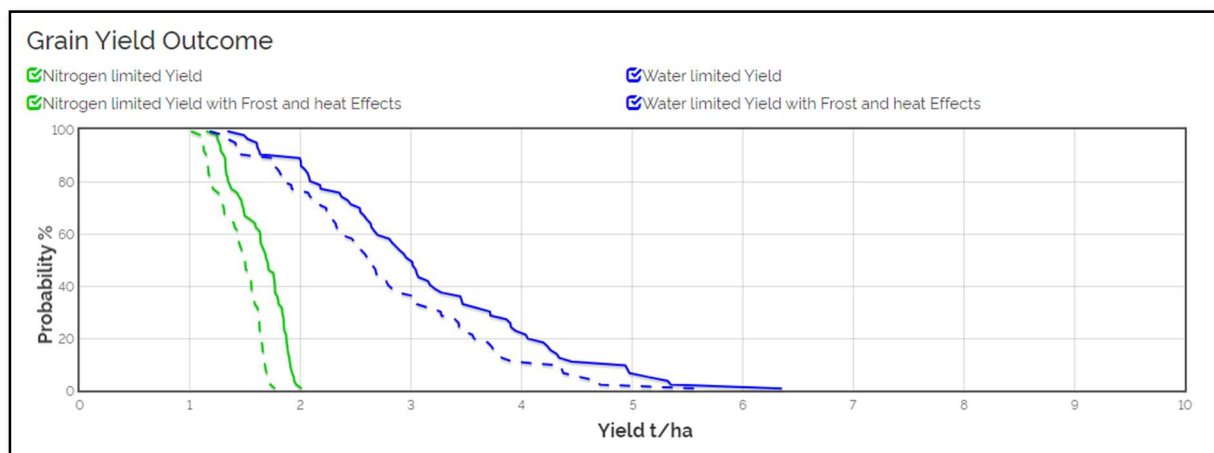


Figure 1: Yield Prophet graph from Cleve, generated on 14 June 2024. *Green line indicates the predicted nitrogen limited yield and blue line indicates the water limited yield. The dotted blue line represents water limited yield potential with frost and heat effects. The dotted green line represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).*

What does the Cleve graph tell us?

1. Yield potential ranges from 1.2-5 t/ha.
2. The nitrogen gap is large due to low starting N. It becomes larger as water limited yield potential increases.
3. This paddock is currently highly N responsive.
4. Heat and frost, while they have an effect in this environment (0.5-1 t/ha), are not as important as N.

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Cockaleeche focus site, prepared 14 June 2024

Table 3. Cockaleeche focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture (0-60cm)	Stubble	Initial N (0-60cm)	N applied
Wheat	1 June	5 Dec	Medium clay loam	92 mm	Canola	137 kg/ha	20 kg/ha

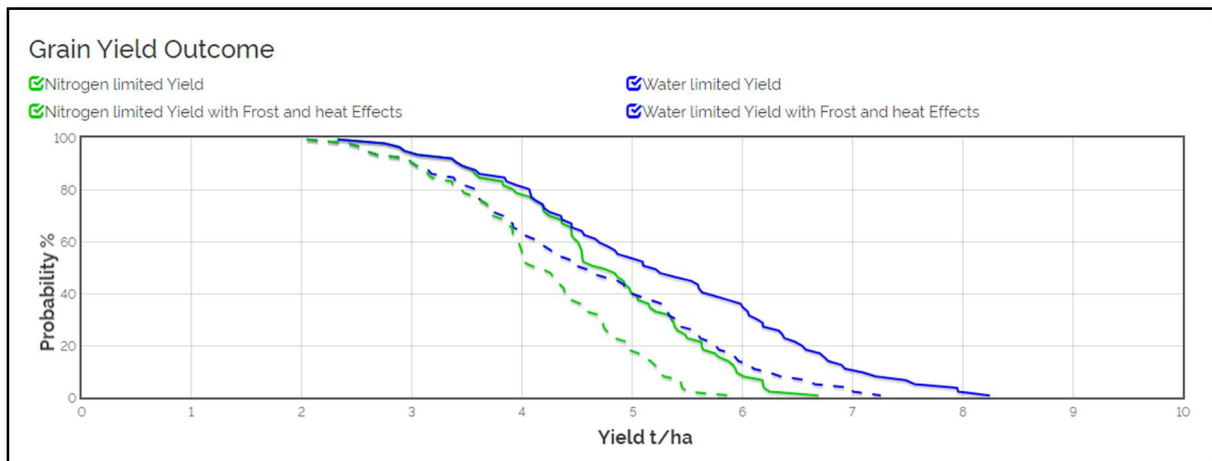


Figure 2: Yield Prophet graph from Cockaleeche, generated on 14 June 2024. *Green line indicates the predicted nitrogen limited yield and blue line indicates the water limited yield. The dotted blue line represents water limited yield potential with frost and heat effects. The dotted green line represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).*

What does the above tell us?

1. Yield potential ranges from 2-7 t/ha.
2. The nitrogen gap is low due to high starting N. This has decreased since April due to later establishment decreasing yield potential.
3. Heat and frost, have some effect, with later sowing placing the crop into a later, warmer flowering window.

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Cootra focus site, prepared 20 June 2024

Table 4. Cootra focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture (0-60cm)	Stubble	Initial N (0-60cm)	N applied
Wheat	1 June	25Nov	Sandy clay loam	65 mm	Lentil	50 kg/ha	46 kg/ha

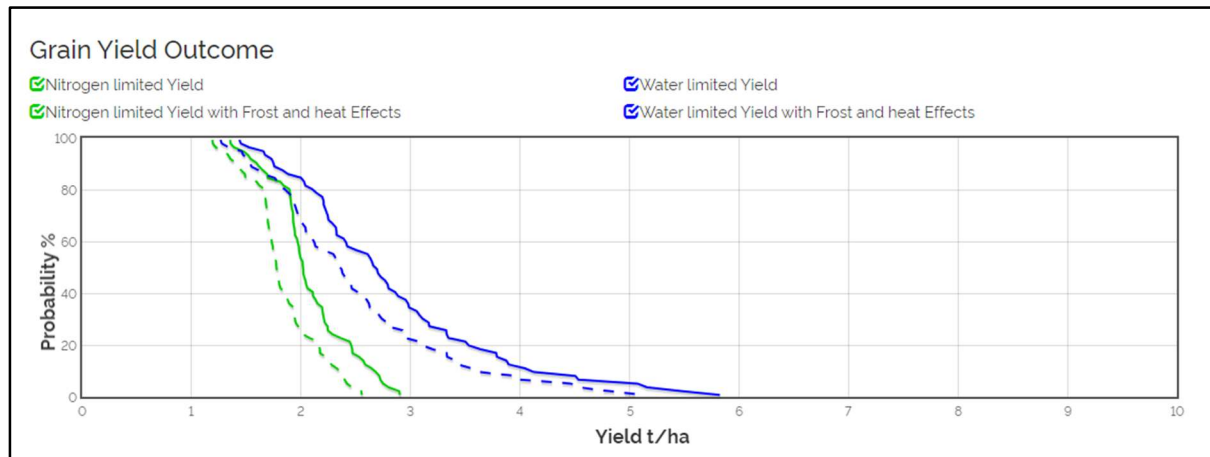


Figure 3: Yield Prophet graph from Cootra, generated on 20 June 2024. **Green line** indicates the predicted nitrogen limited yield and **blue line** indicates the water limited yield. The **dotted blue line** represents water limited yield potential with frost and heat effects. The **dotted green line** represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).

What does the above tell us?

1. Yield potential ranges from 1.2-5 t/ha
2. The nitrogen gap has decreased since April predictions. The cause of this is lower yield potential due to a relatively late break.
3. Heat and frost, while they have an effect in this environment, are not as important as N.
4. Despite a late break, the addition of N in this paddock will still be required to reach yield potential in the vast majority of seasons.

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Lock focus site, prepared 14 June 2024

Table 5. Lock focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture (0-60cm)	Stubble	Initial N (0-60cm)	N applied
Wheat	1 June	26Nov	Sandy clay loam, calcareous at depth	39 mm	Canola	113 kg/ha	57 kg/ha

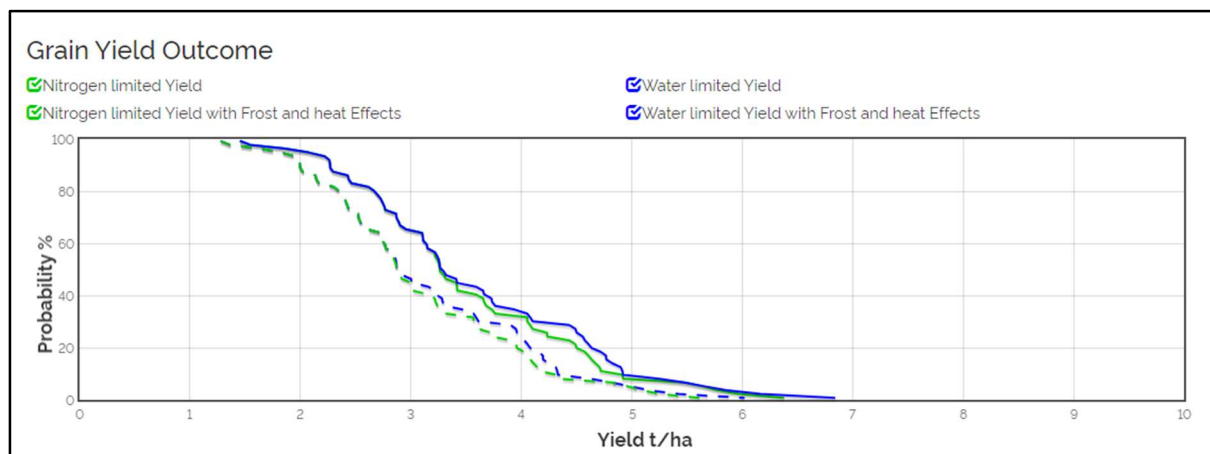


Figure 4: Yield Prophet graph from Lock, generated on 14 June 2024. *Green line indicates the predicted nitrogen limited yield and blue line indicates the water limited yield. The dotted blue line represents water limited yield potential with frost and heat effects. The dotted green line represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).*

What does the above tell us?

1. Yield potential ranges from 1.5-5.5 t/ha.
2. The gap between water limited and nitrogen limited yield is almost nil. This is due to high starting N and a reasonable amount of added N in season.
3. Heat and frost, have some effect in this instance.

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Minnipa focus site, prepared 14 June 2024

Table 6. Minnipa focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture	Stubble	Initial N (0-60cm)	N applied
Wheat	1 June	24 Nov	Sandy loam, some clay	22 mm	Lentil	60 kg/ha	20 kg/ha

The focus paddock at Minnipa generally performs well for the area. However, it has some areas that are severely constrained and will yield approximately half of what the better areas do. The area where yield predictions are based on would yield approximately 80% of the best and represent approximately 60% of the paddock. This knowledge assists in decision making.

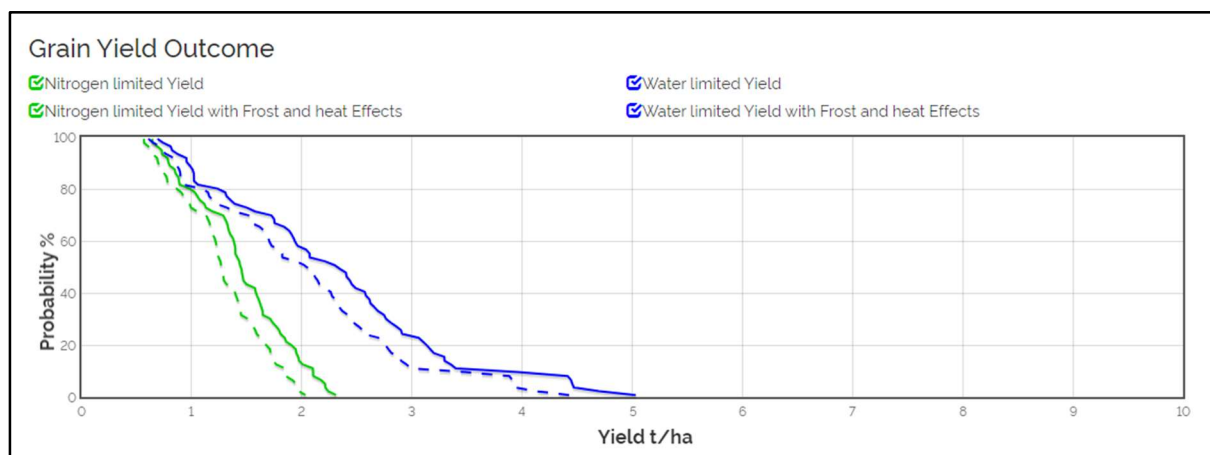


Figure 5: Yield Prophet graph from Minnipa, generated on 14 June 2024. *Green line indicates the predicted nitrogen limited yield and blue line indicates the water limited yield. The dotted blue line represents water limited yield potential with frost and heat effects. The dotted green line represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).*

What does the above tell us?

1. Yield potential ranges from 0.8 to 4.5 t/ha.
2. The nitrogen gap is moderate due to moderate starting N and low modelled mineralisation. It becomes larger as water limited yield potential increases.
3. Heat and frost, while they have an effect in this environment (0.5 t/ha), are not as important as N.

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Port Kenny focus site, prepared 14 June 2024

Table 7. Port Kenny focus paddock information.

Crop	Sowing	Maturity	Soil type	Stored moisture (0-60cm)	Stubble	Initial N (0-60cm)	N applied
Wheat	1 June	24 Nov	Grey calcareous sandy loam	8 mm	Medic	58 kg/ha	20 kg/ha

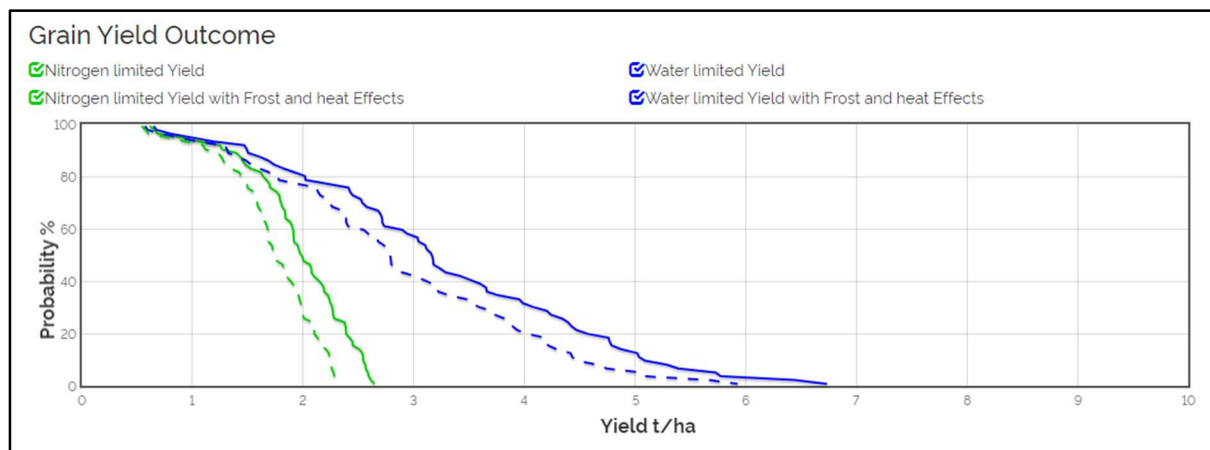


Figure 6: Yield Prophet graph from Pt Kenny, generated on 14 June 2024. *Green line indicates the predicted nitrogen limited yield and blue line indicates the water limited yield. The dotted blue line represents water limited yield potential with frost and heat effects. The dotted green line represents nitrogen limited yield potential with frost and heat events. This is based on the assumption that yield is only limited by these factors and no others (ie pests, weeds, diseases).*

What does the above tell us?

1. Water limited yield potential with heat and frost ranges from 1 to 5.5 t/ha.
2. The nitrogen gap is large due to moderate starting N. It becomes larger as water limited yield potential increases.
3. Heat and frost, while they have an effect in this environment (0.5 t/ha), are not as important as N.

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