Cropping systems – which are the best performing?

2026 Hart ‘Getting the Crop In’

Matthew Knowling, Adelaide University

Craig Davis, Crop Consulting Services

11 March 2026

Adelaide University

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

CROP CONSULTING SERVICES PTY LTD
Independent Agronomy Services

CELEBRATING 30 YEARS
GRAINS RESEARCH UPDATE

Farming Systems South (FSS)

- Deliver **new insights** into the **drivers of profitability and sustainability** in the southern region
- **Identify strategies** that improve a **range of performance metrics**
- Better understanding **how 'levers' influence metrics**

For more FSS, scan the QR

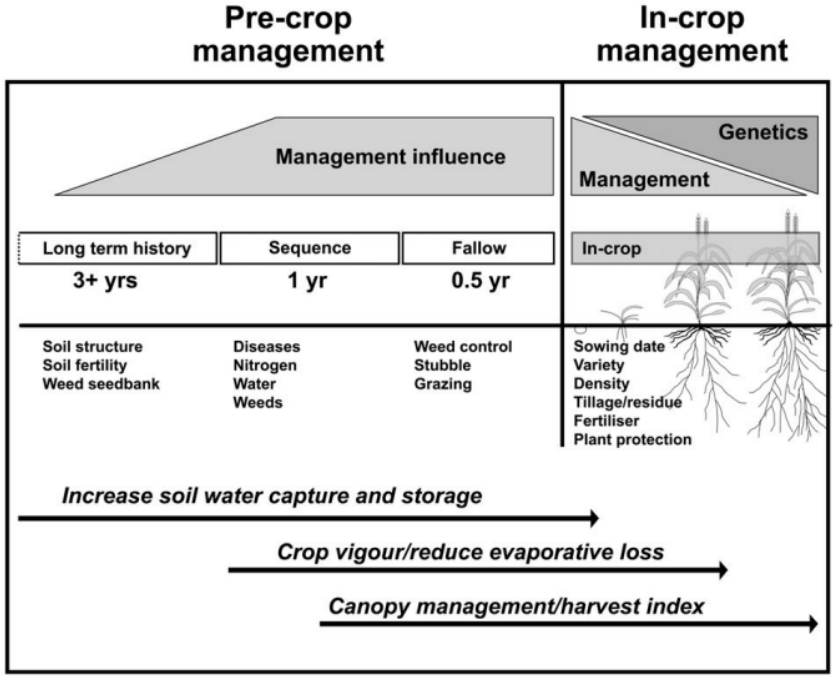
CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

Farming Systems South (FSS)

Differentiators:

1. A 'systems' view

While much attention on how to improve performance of individual crops within a season, FSS assesses how these innovations play out over the longer term as crops interact across a sequence



Kirkegaard and Hunt (2010)

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3. 'New' systems

Assess performance of new systems, which are of interest, yet growers feel they cannot adopt due to insufficient evidence base

CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

The FSS team

Project Funder

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

Project Lead

Adelaide University

Economics and engagement

Flinders University

Star ECONOMICS

Agronomy Advisers

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AGRICULTURAL CONSULTING & RESEARCH

S&D CONSULTING
ADVICE FOR AGRICULTURE

DAGRO

Farming Systems Groups

SFS
Southern Farming Systems

BCG
SHARED SOLUTIONS

HART

AIR EP
Ag Innovation & Research
Eyre Peninsula

Upper North Farming Systems

FSS is a collaboration of many people and organisations

Acknowledge the contributions of all!

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Economics and

In particular, acknowledge those who contributed to work presented here:

Glenn McDonald

Maryam Barati

Daniel Gregg

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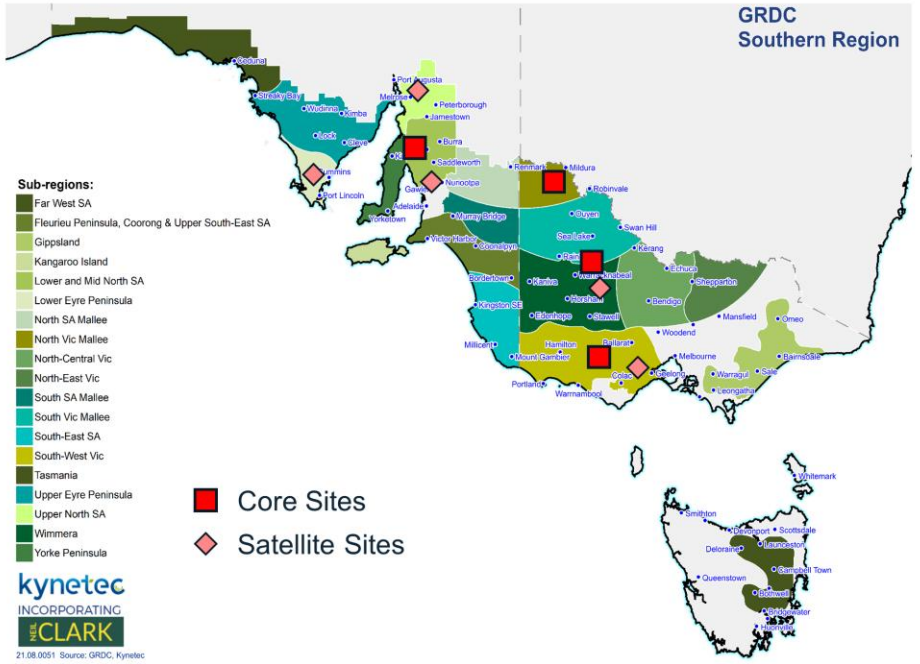
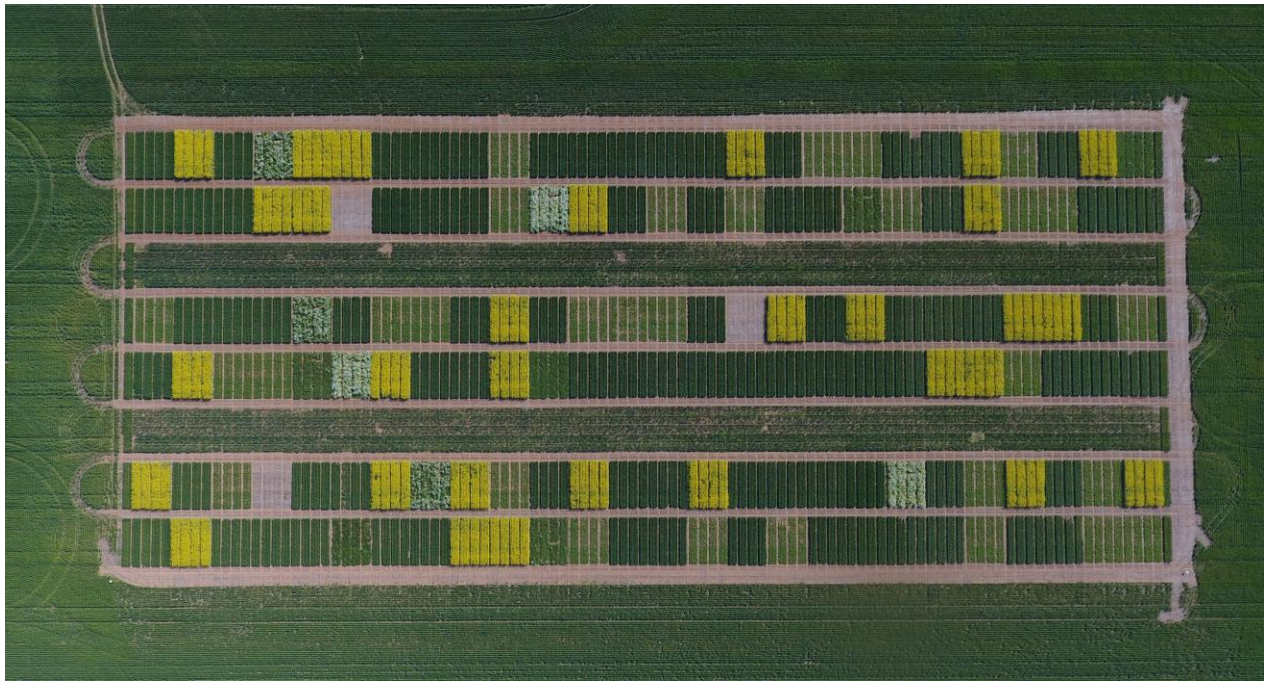
CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

Field trials

- Established in 2023
- 9 trial sites across SA and Vic
- Sites span a range of environments
  - low to high rainfall zones
  - varying seasonality
  - different soil types
- Following consultation with (5) farming systems groups, agronomists and growers
- Fully phased to avoid seasonal biases
- Randomised and replicated





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- Baseline system
  - Most common practice in the region

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GRAINS RESEARCH UPDATE

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    - E.g. Frequency of cereals, pulses and canola, sequencing, cropping/harvest intensity, N strategy, TOS strategy

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Double break	Lentil-Canola-Wheat-Barley
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  - Decisions made adaptively by local adviser based on available information

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Adviser-led	Wheat (long-season)-Barley (hay)

[1]Intercropping refers to a mix of two species that are both grown for grain; [2]N strategy treatments applied; [3]Time of sowing (TOS) treatments applied

Today's presentation

- Preliminary results
- Based on 2 years (2023 and 2024)
- With update from 2025 – results hot off the press…
- 'Early days' in FSR terms
- Focus on trial at Hart

GSR (Decile)	**Hart**
2023	236 (4)
2024	176 (1)
2025	223 (3)

CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

Early take-home messages

- Productivity correlates with GM, but with considerable variability.

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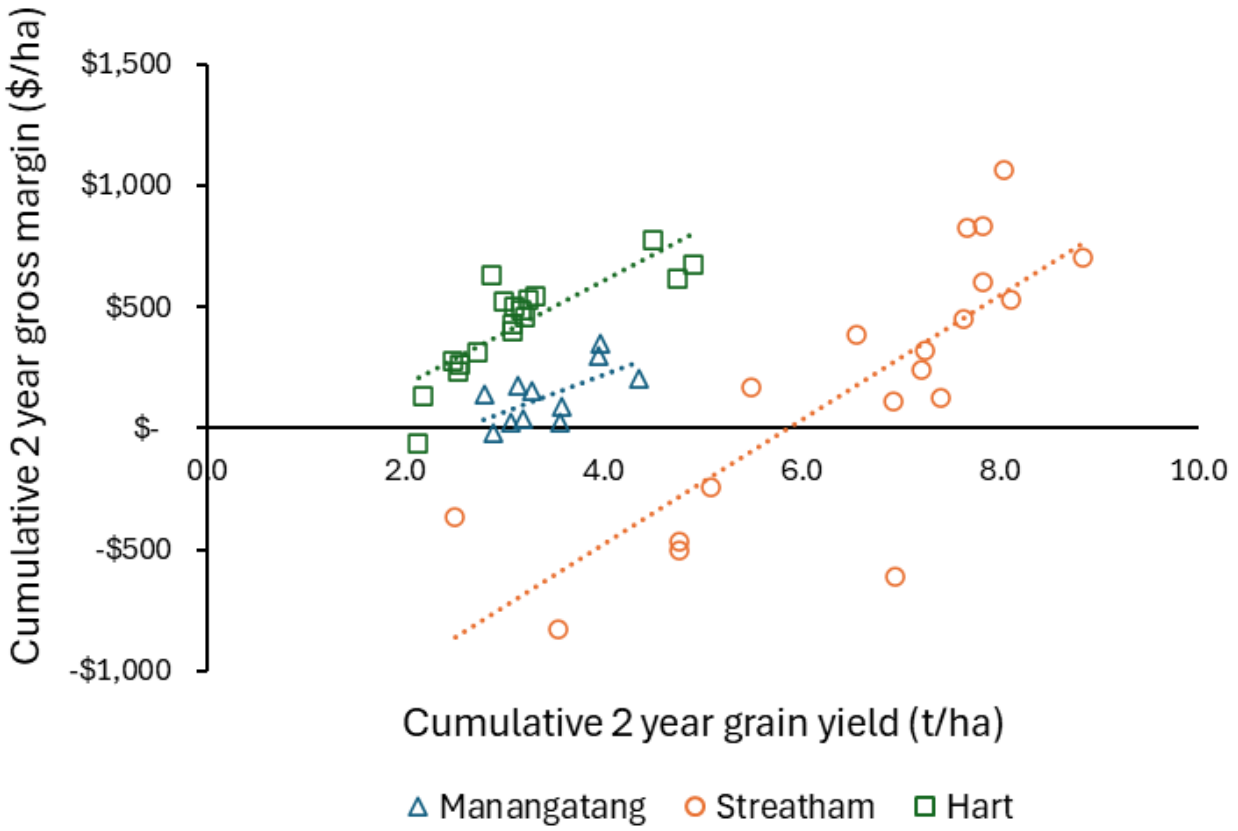

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GRAINS RESEARCH UPDATE

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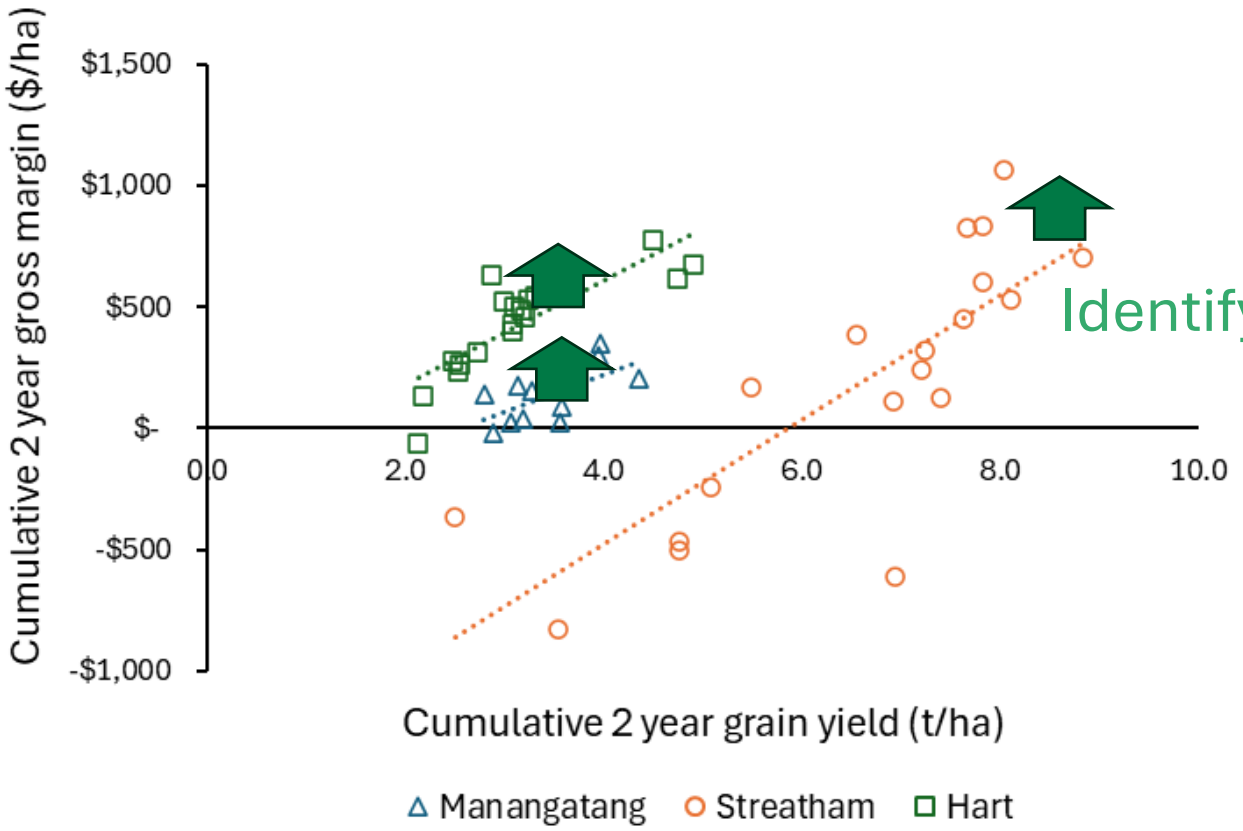

Identify where opportunities are

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- Identified opportunity for systems that achieve higher GMs that the Baseline, while also tending to be less variable.

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- Identified opportunity for systems that achieve higher GMs that the Baseline, while also tending to be less variable.
- Adaptive decision-making resulted in improved gross margins.
- Despite dry seasons, sequence legacy effects were apparent, with legumes typically leaving more residual soil water for subsequent crops.

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30
YEARS

Early results: Mid-North SA (Hart)

HART
SA's premier cropping field site

Kaidy Morgan

Bek Allen

Craig Davis

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GRAINS RESEARCH UPDATE

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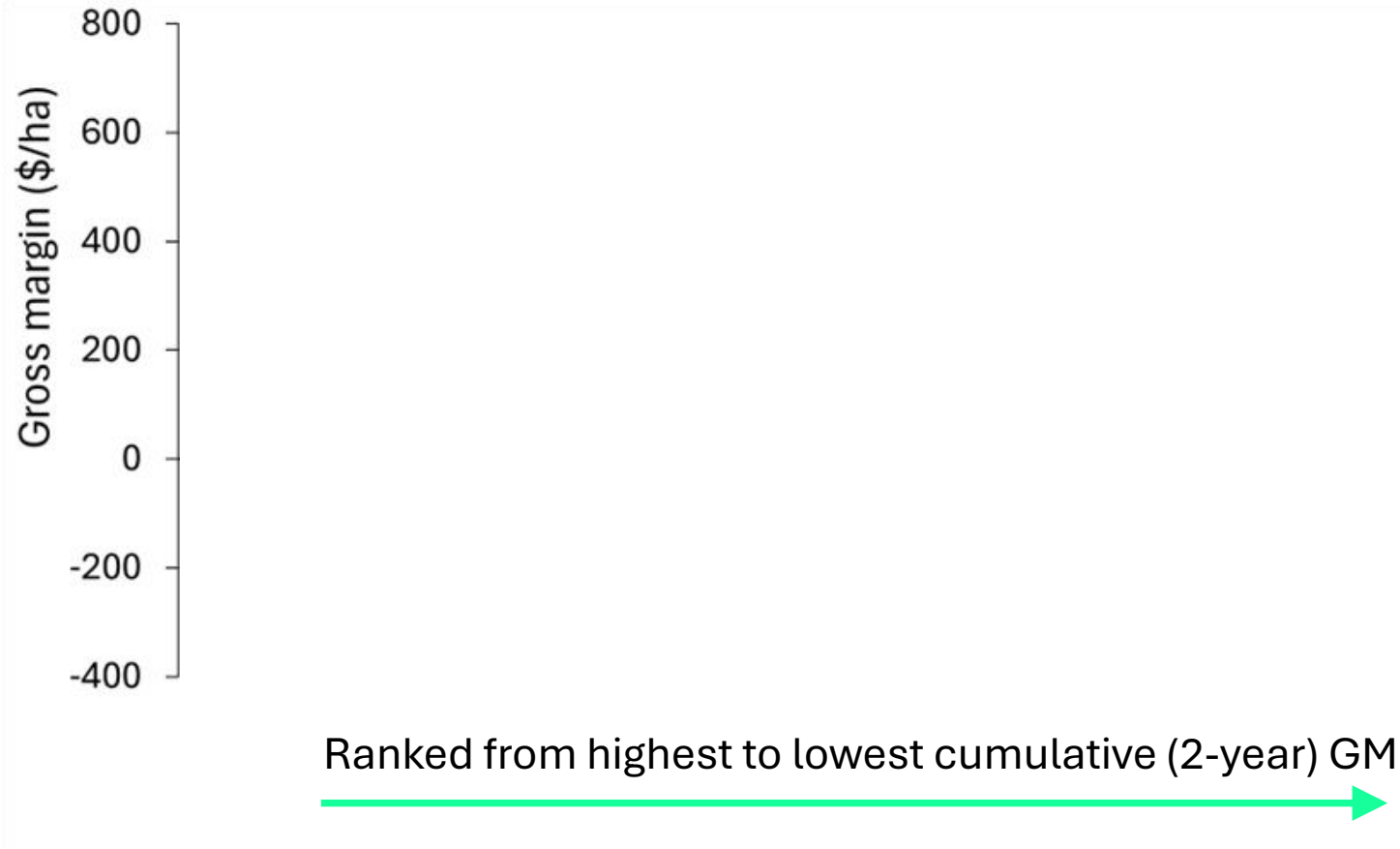

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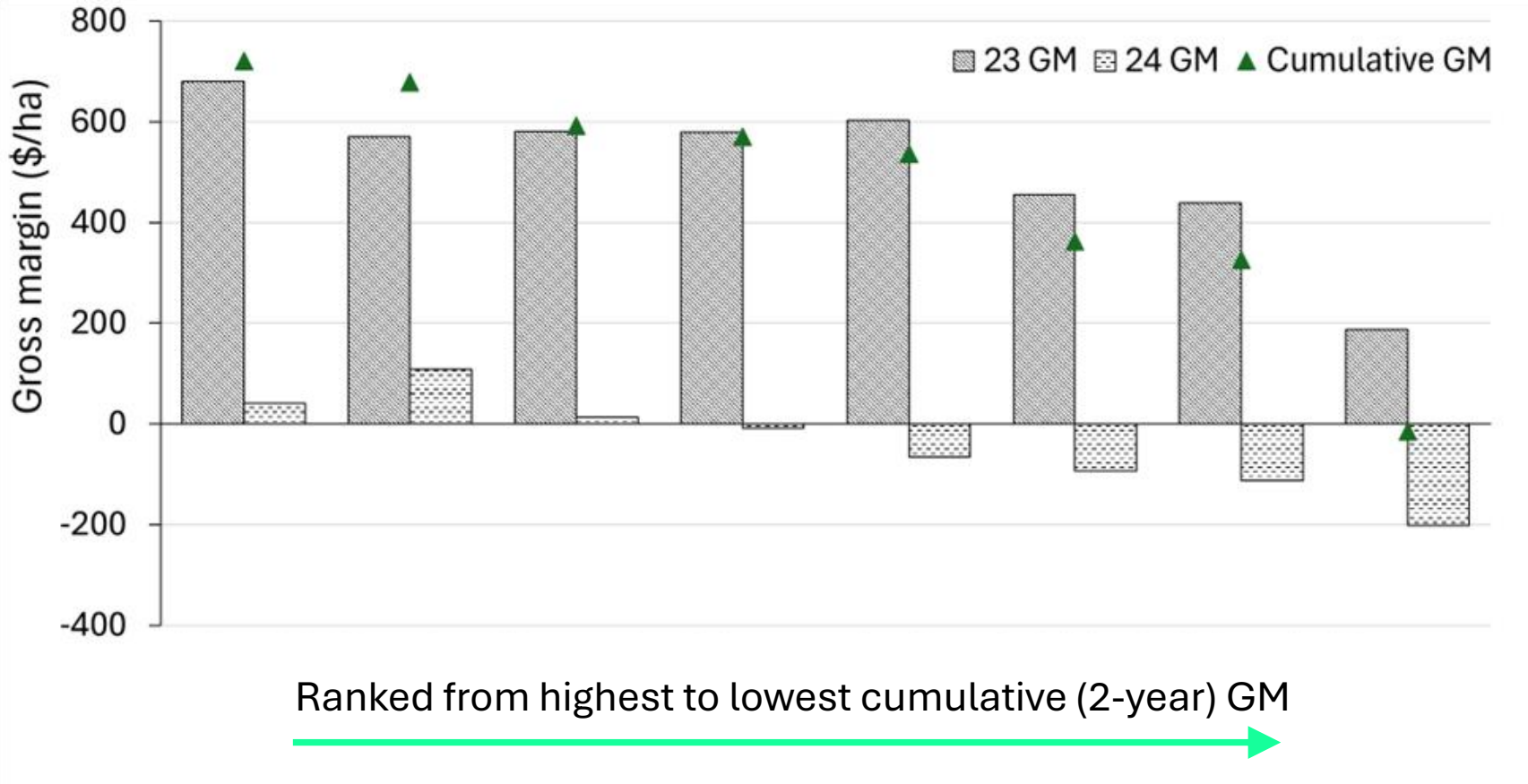

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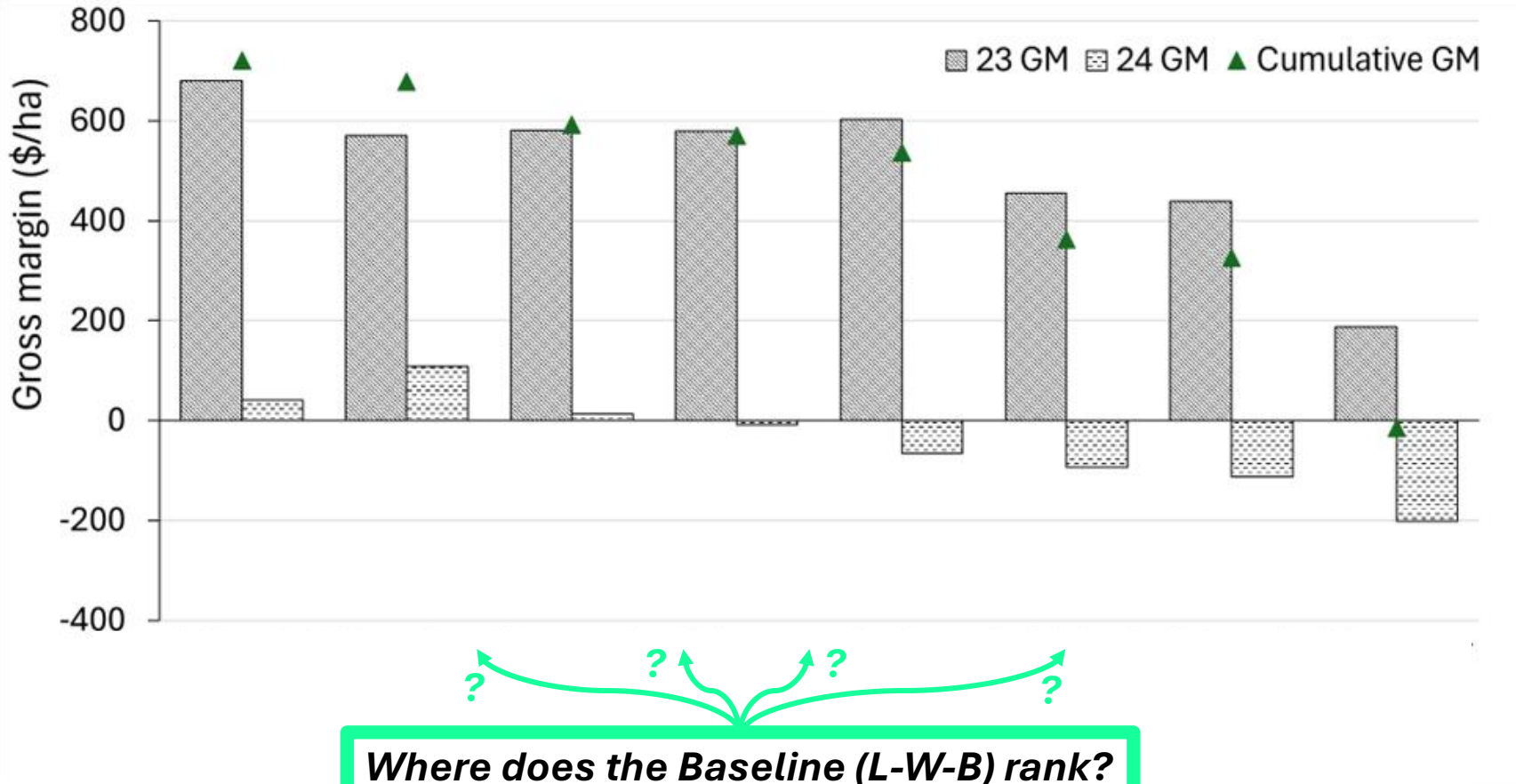

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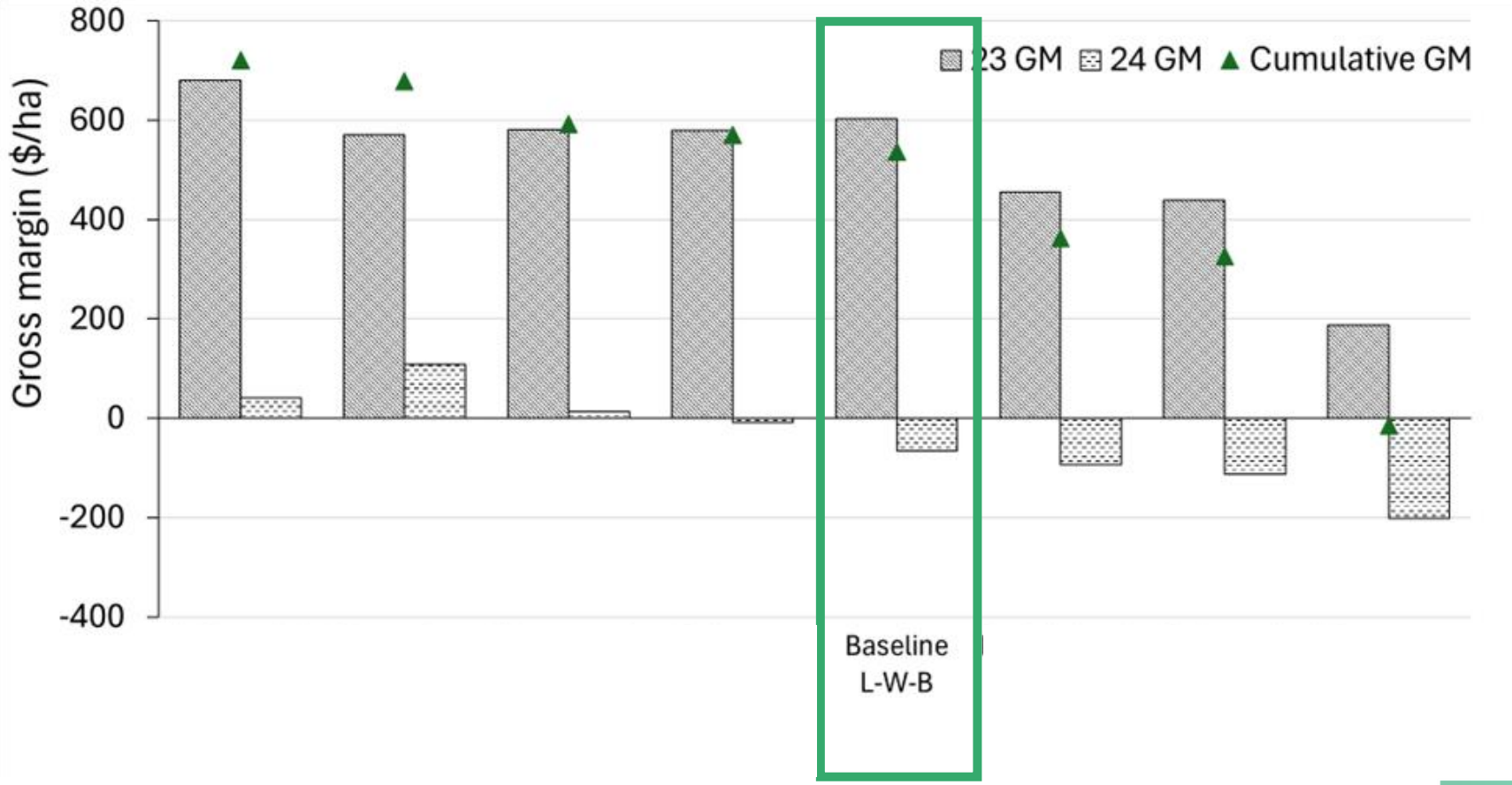

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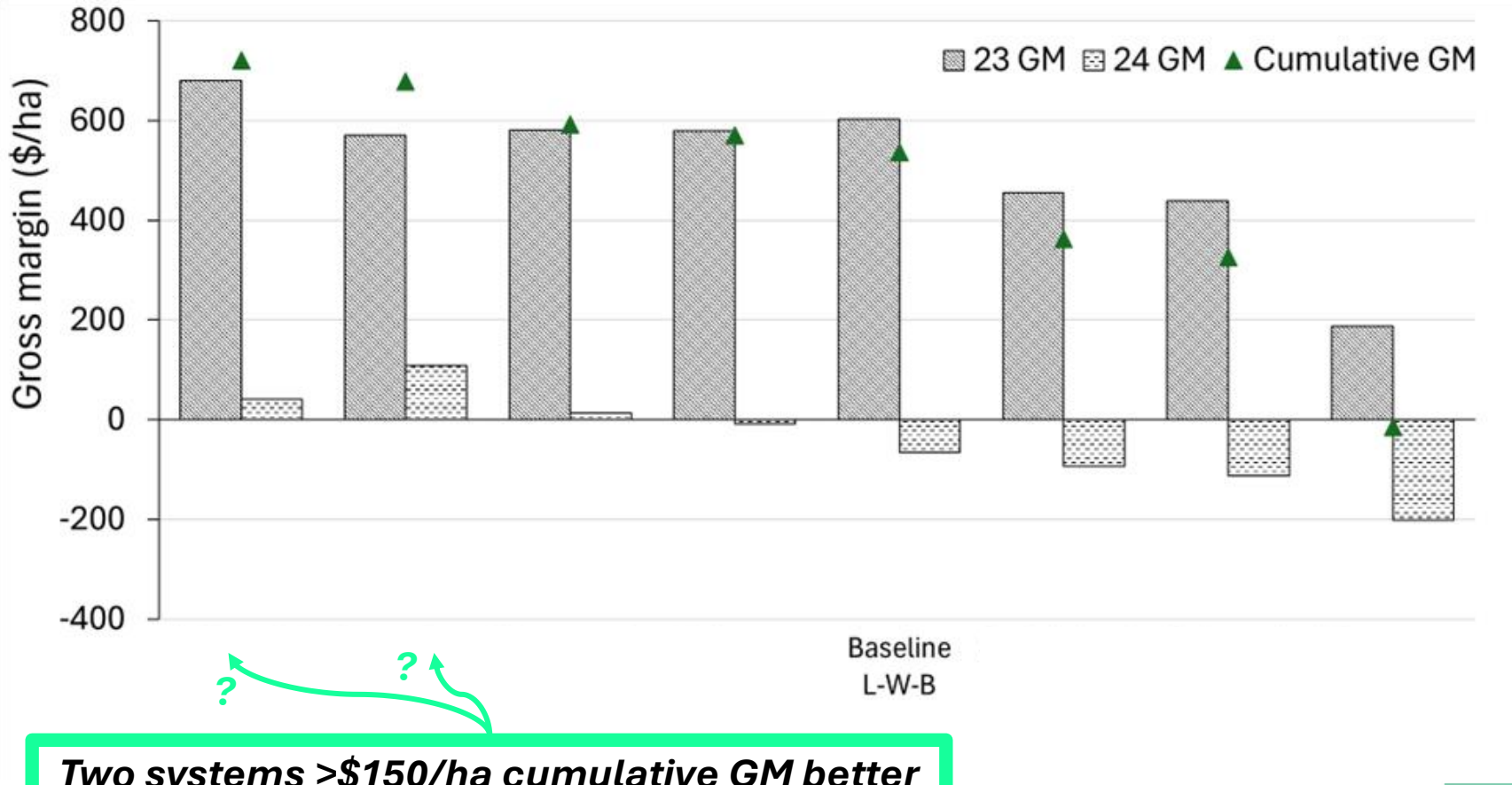

Two systems >$150/ha cumulative GM better – what are they?

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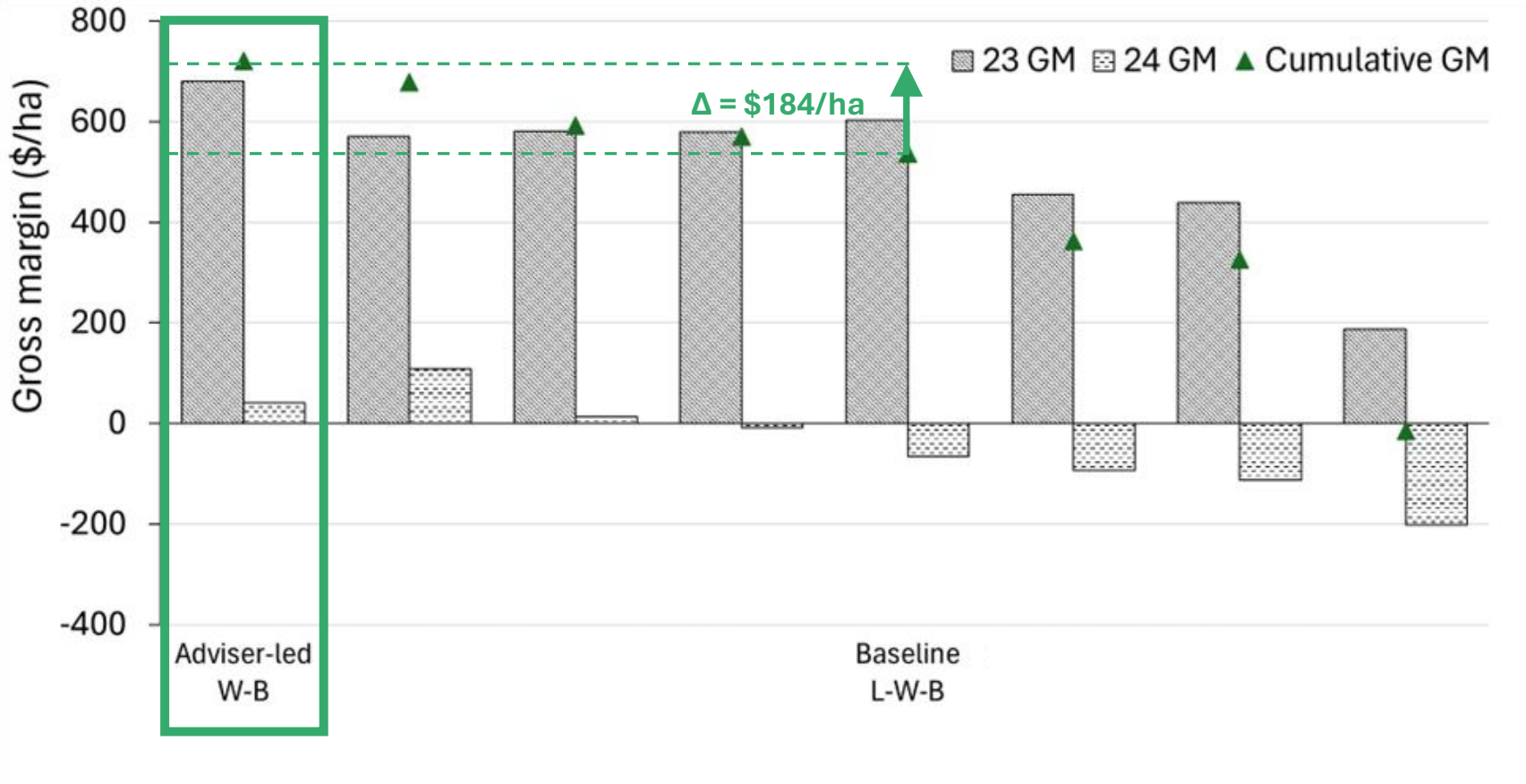

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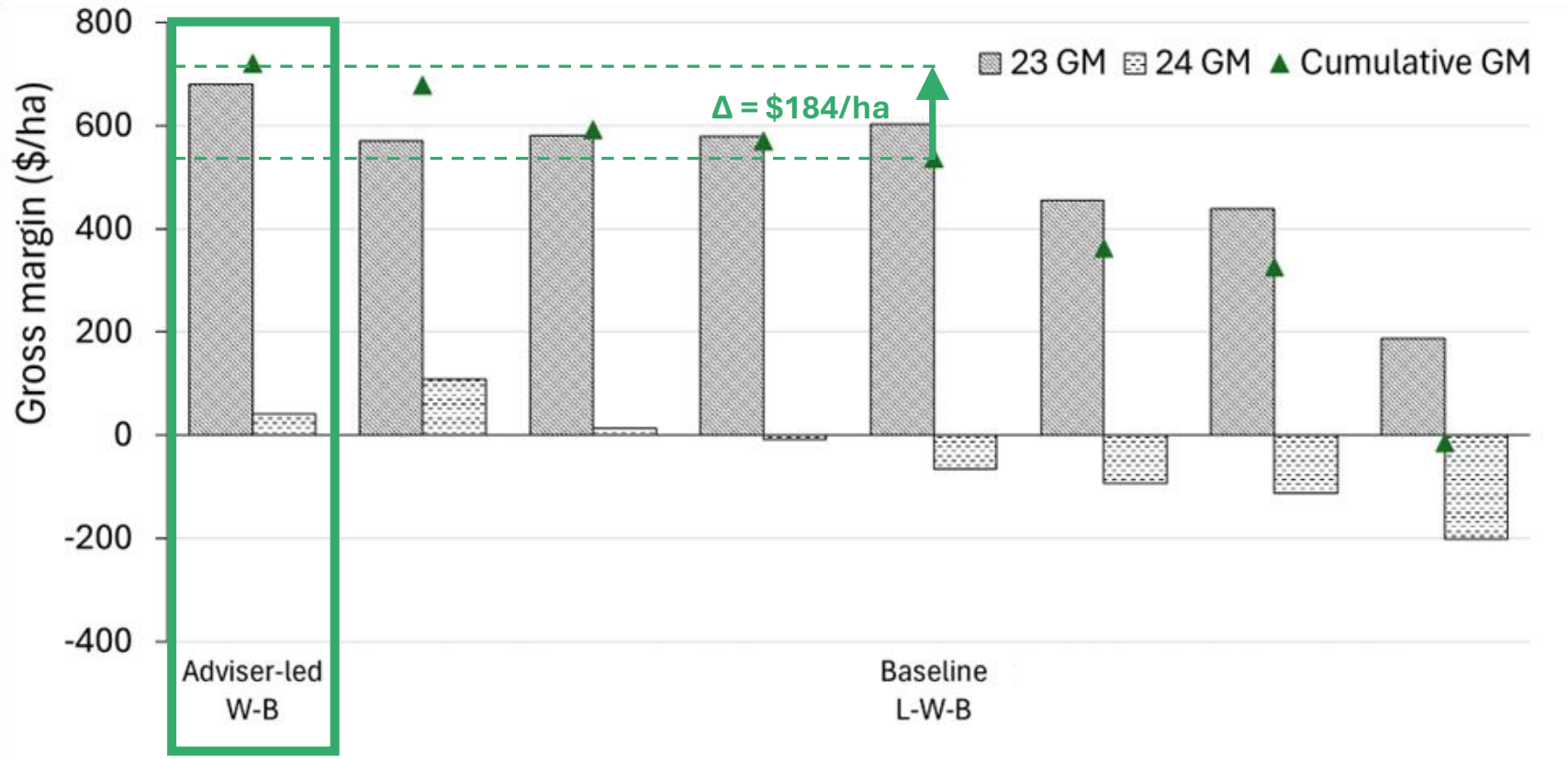

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2023: Decided to sow long-season spring wheat (Rockstar) following wet summer (125 mm TAW) → extra 0.8 t/ha (3.8 v 3.0 t/ha)
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GRAINS RESEARCH UPDATE

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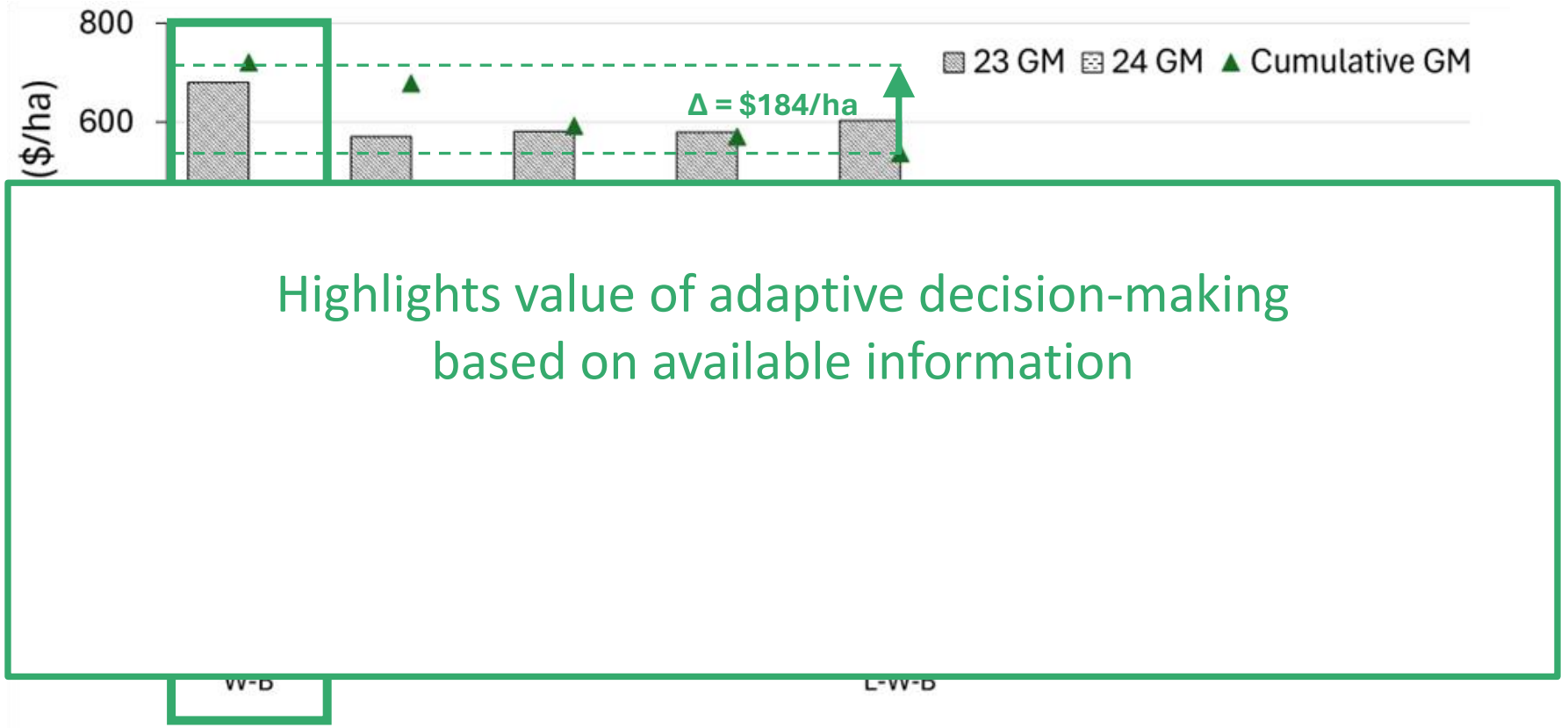

Highlights value of adaptive decision-making based on available information

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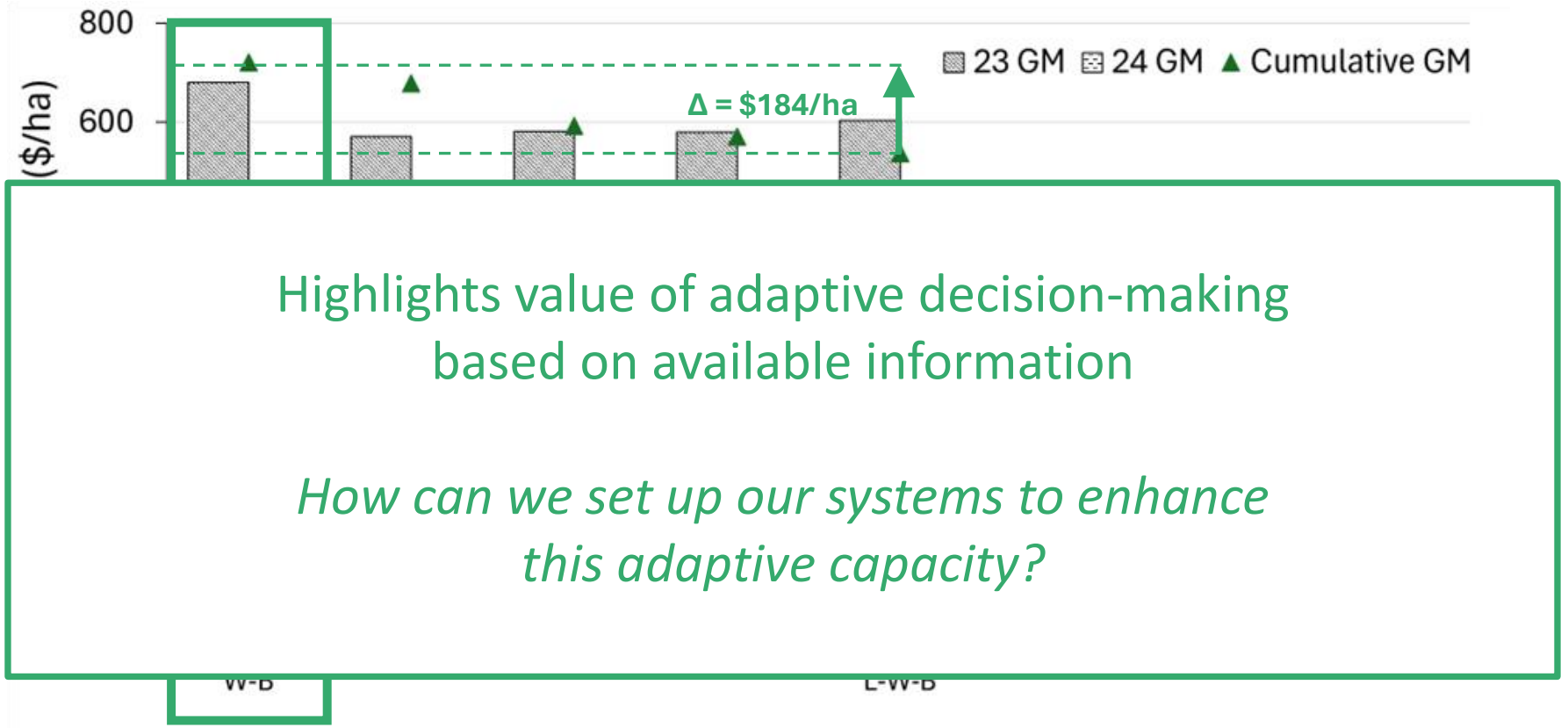

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How can we set up our systems to enhance this adaptive capacity?

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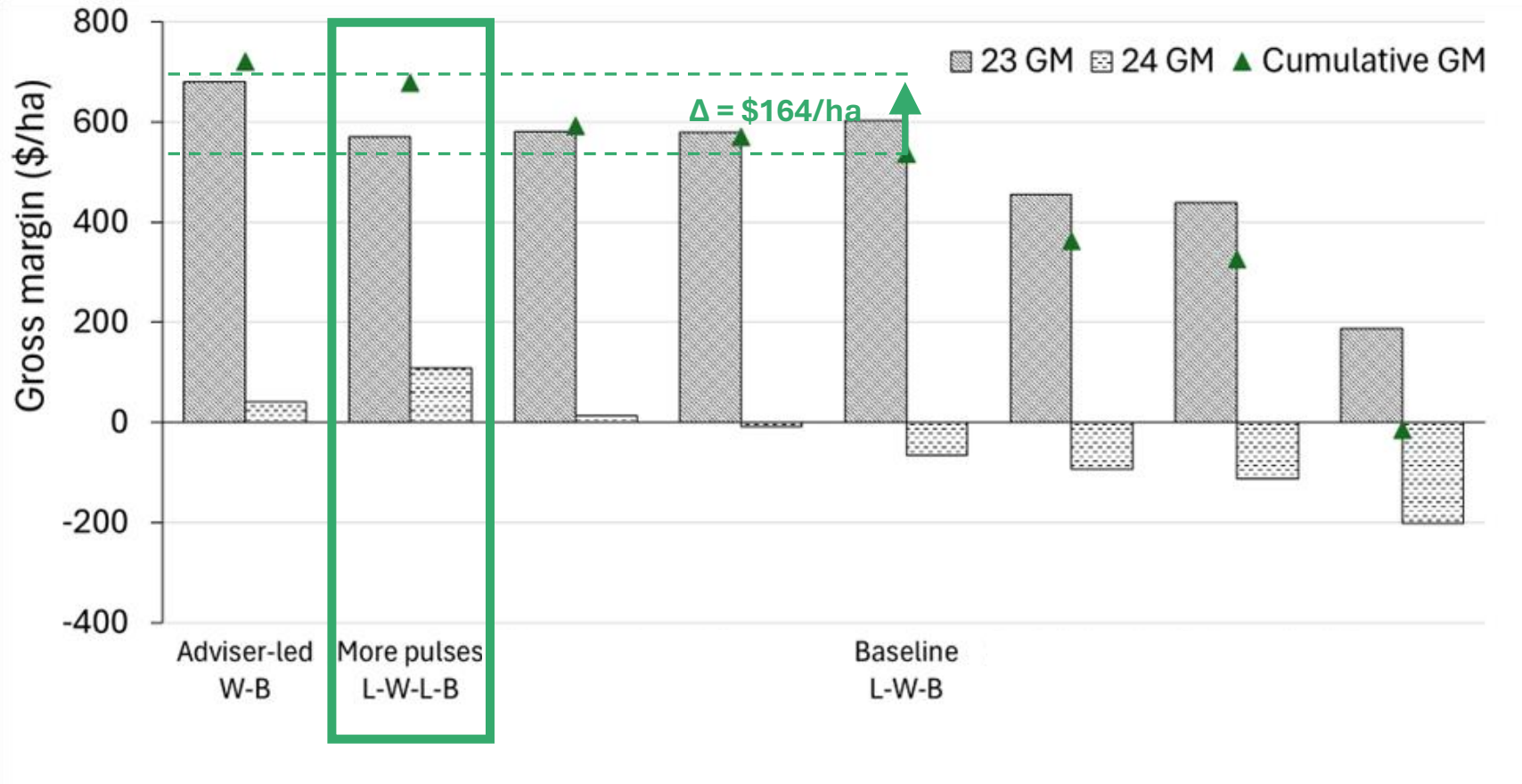

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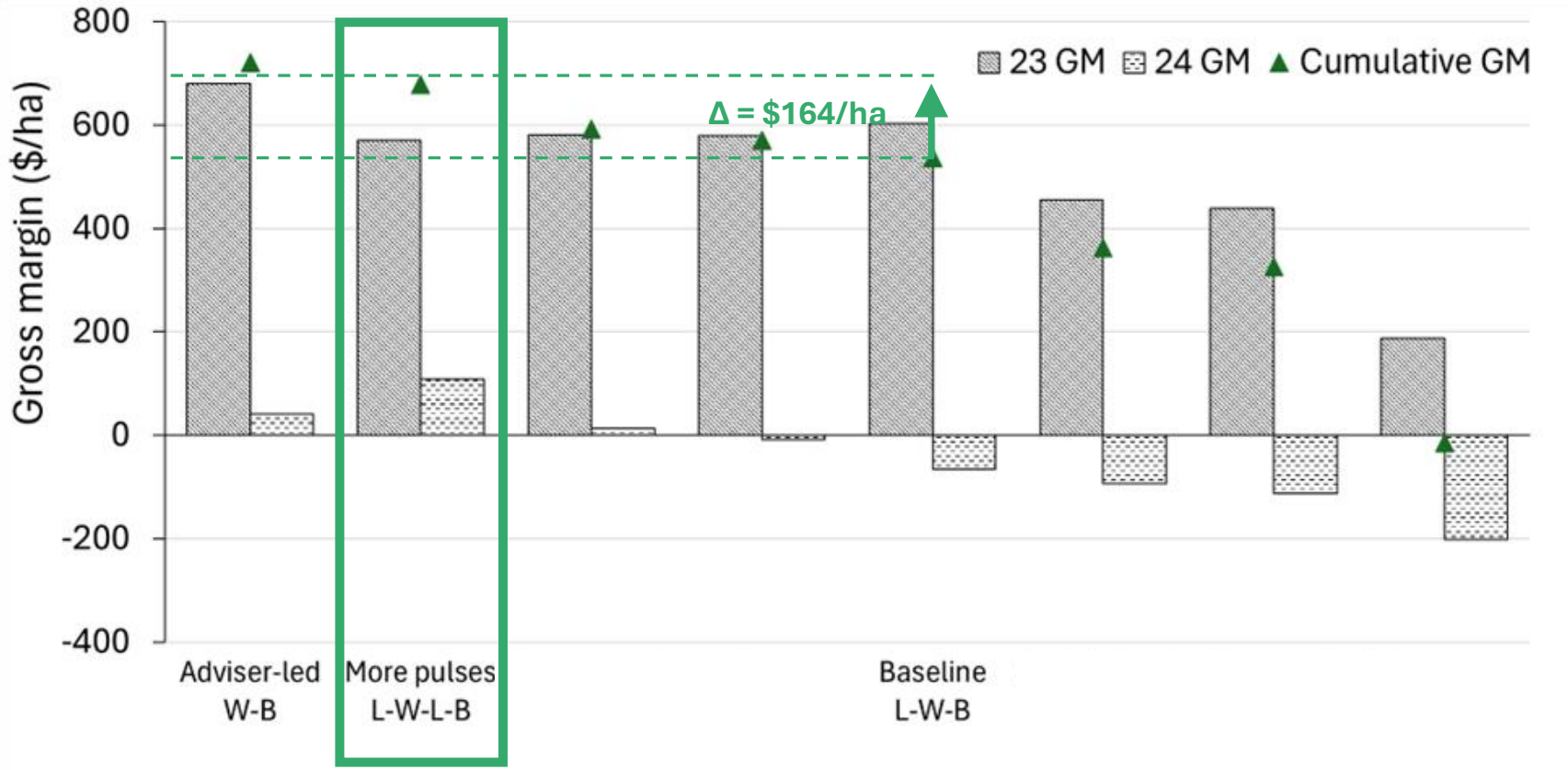
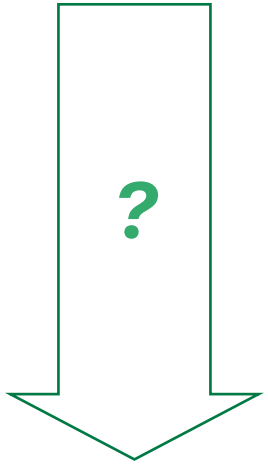


Why does increasing the frequency of lentils improve GM outcomes?

1. Higher proportion of lentils, a high value crop (5-year average)
2. Legacy benefits of lentils, increasing yield of subsequent crops

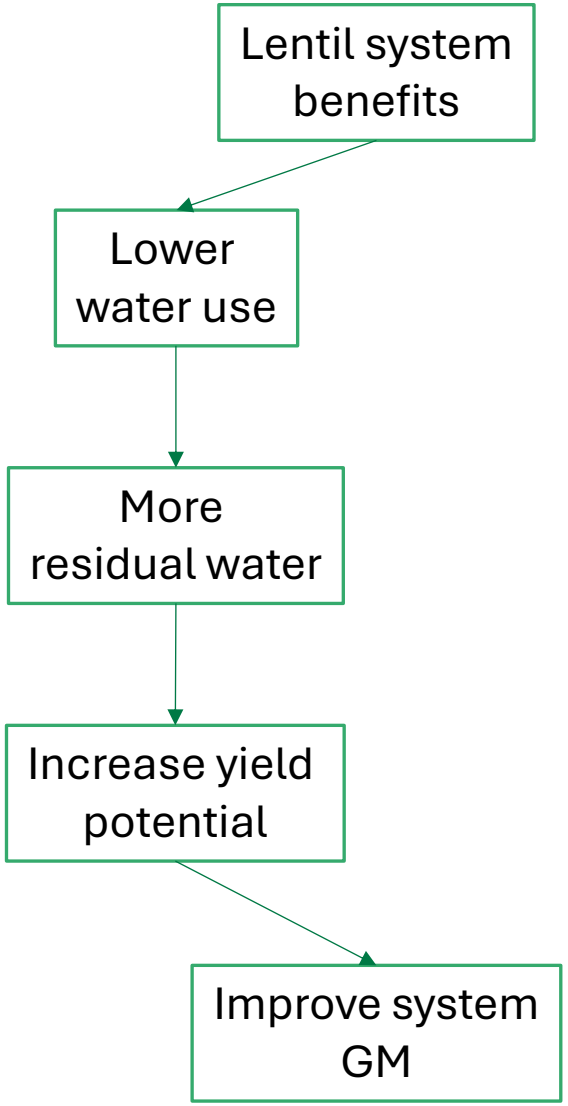
Early results: Mid-north SA (Hart)

Lentil system benefits



Improve system GM

Early results: Mid-north SA (Hart)



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GRAINS RESEARCH UPDATE

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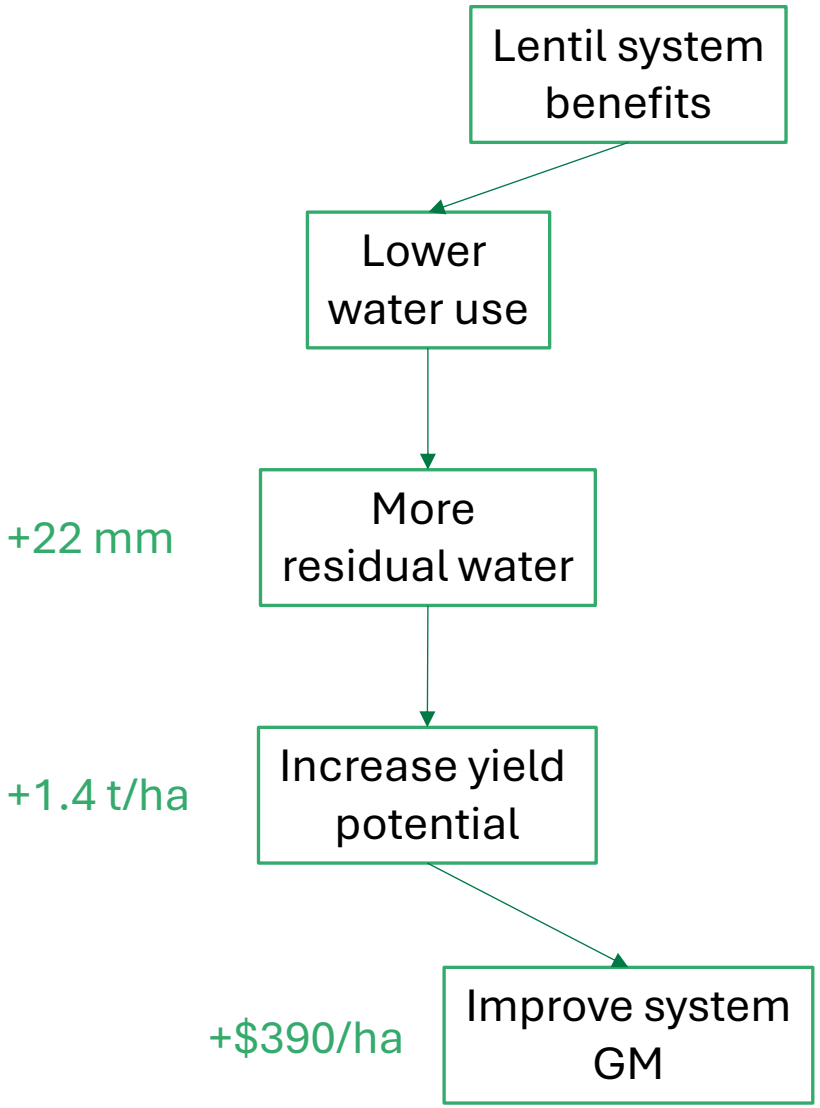

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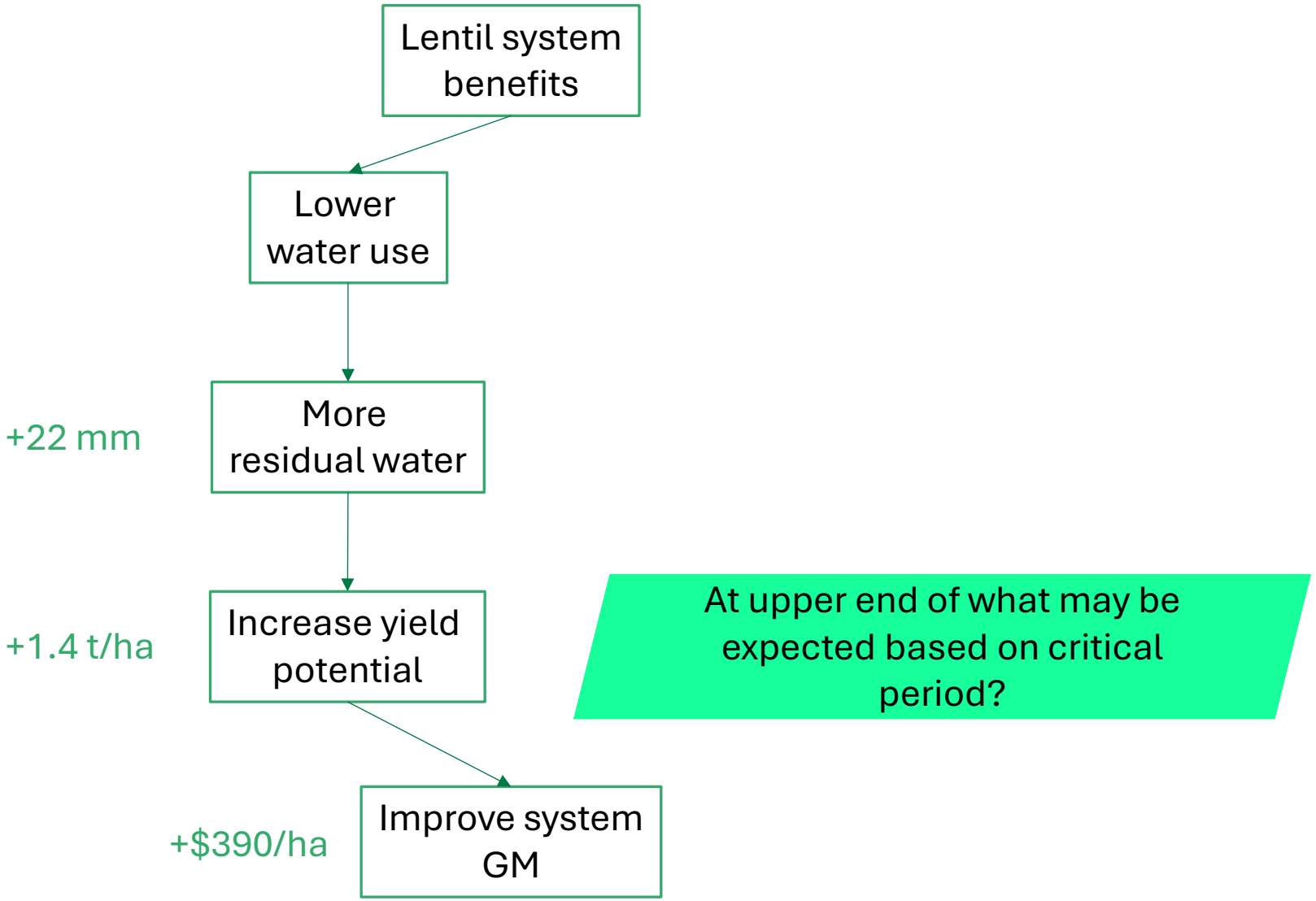

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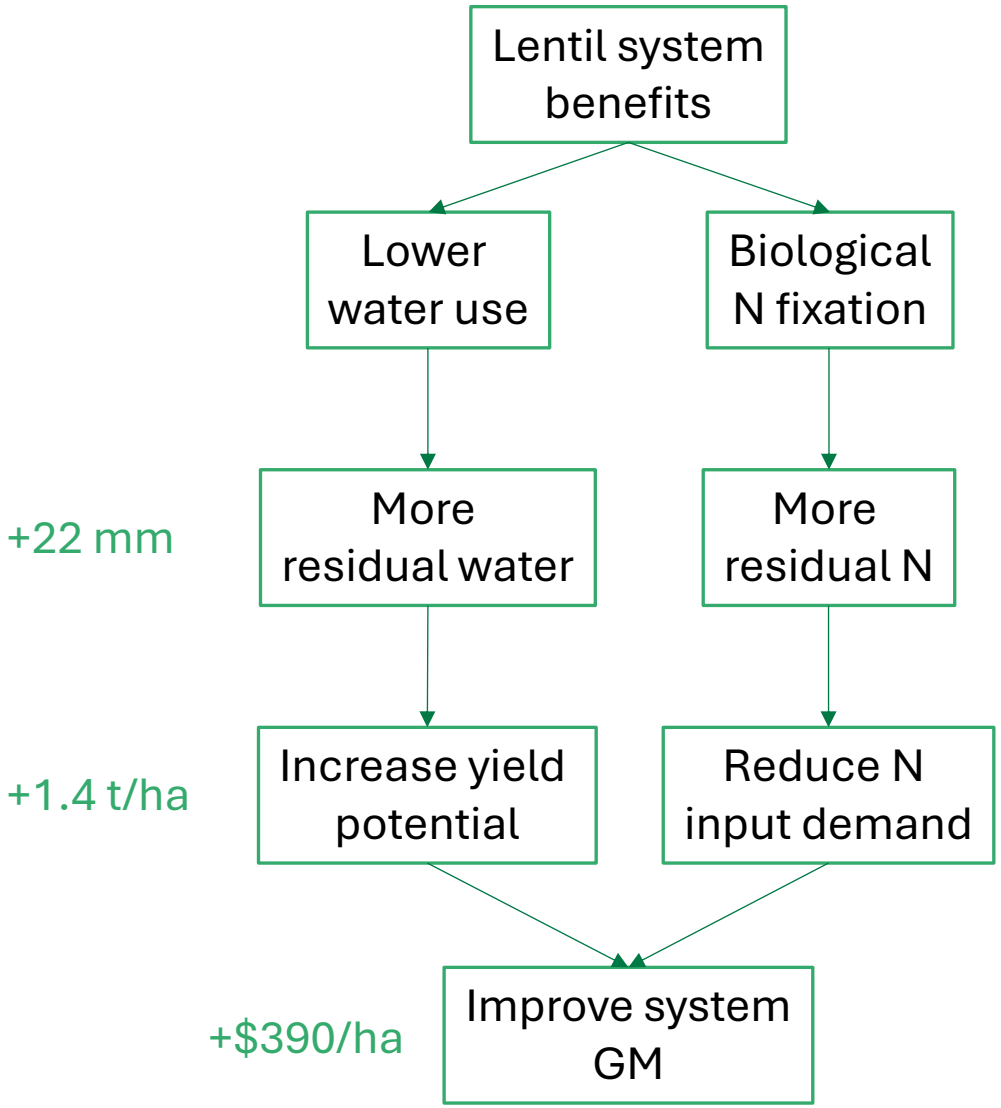

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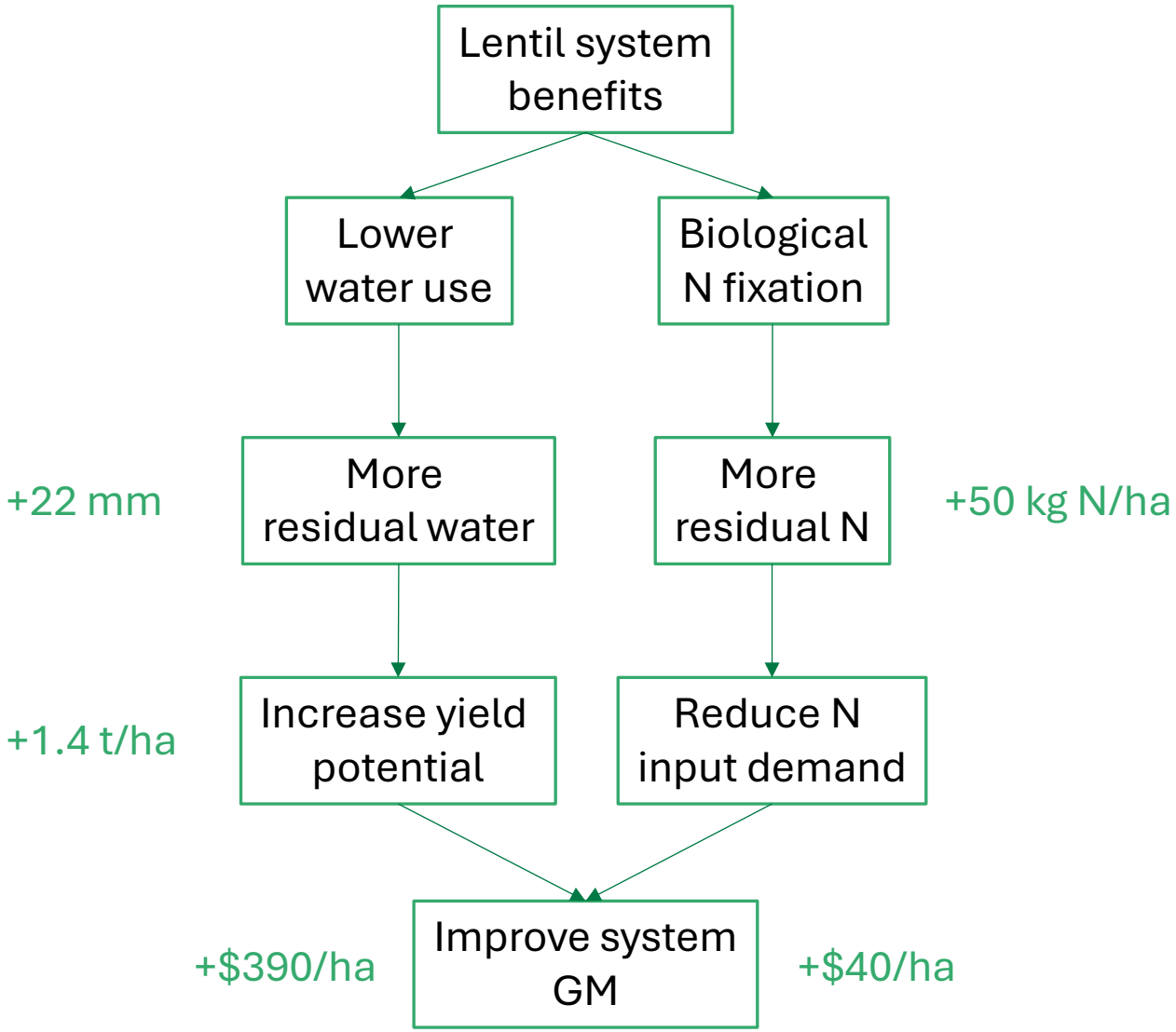

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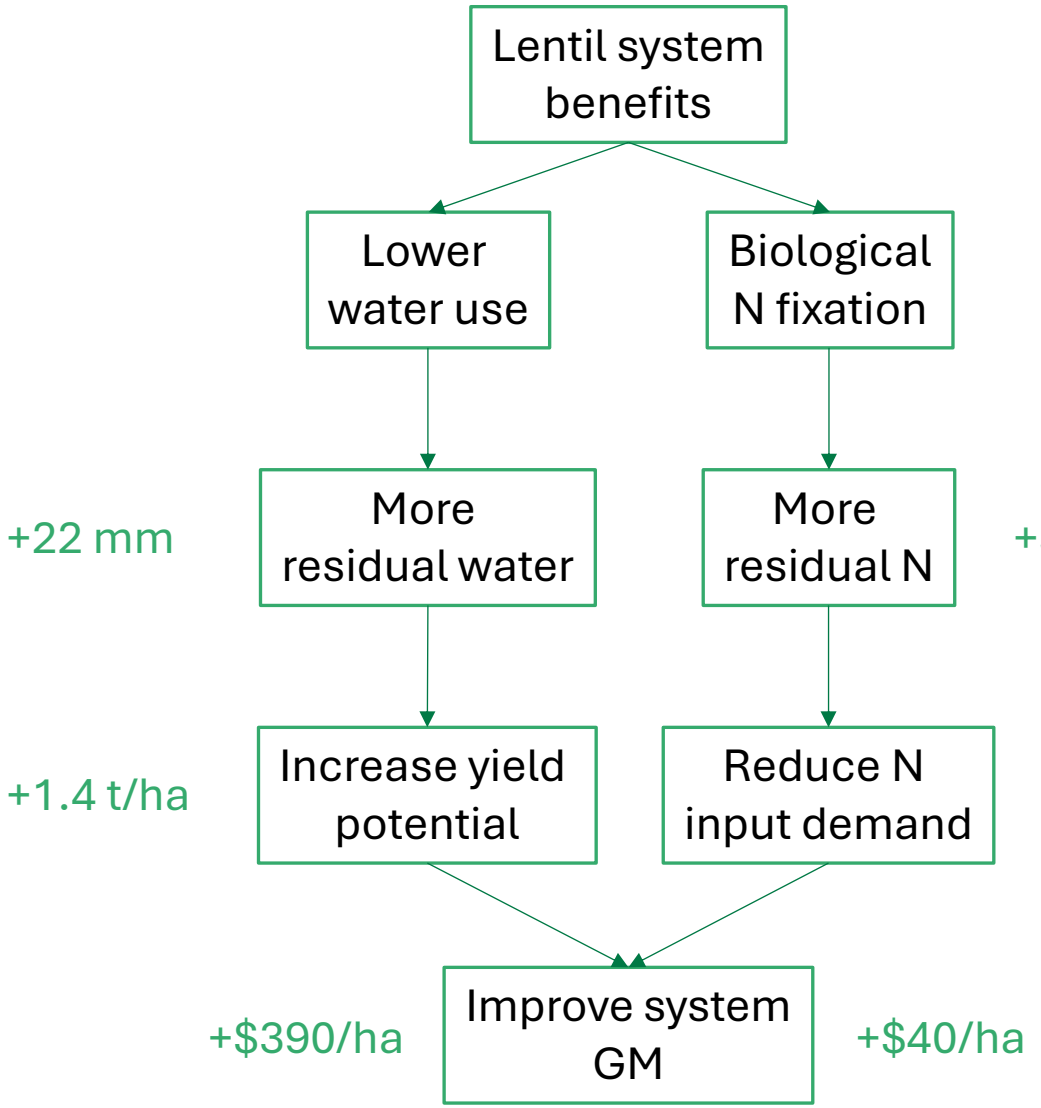

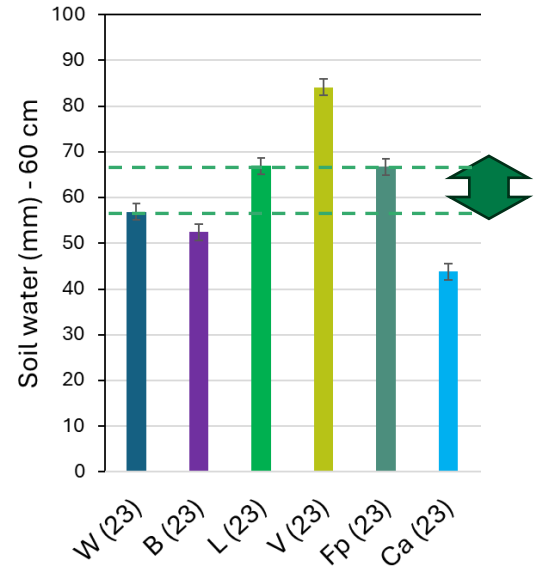

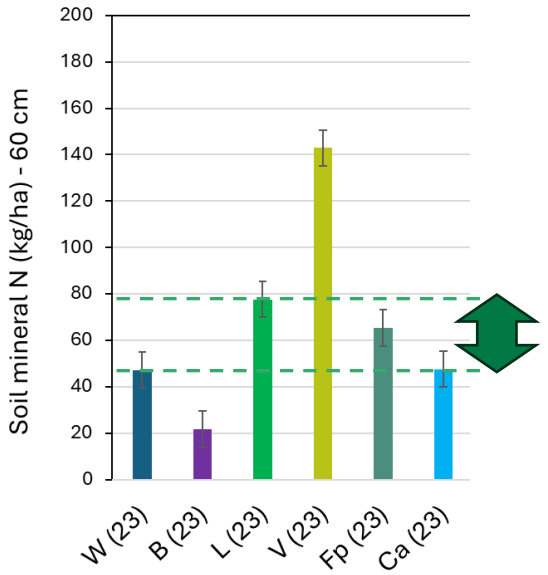

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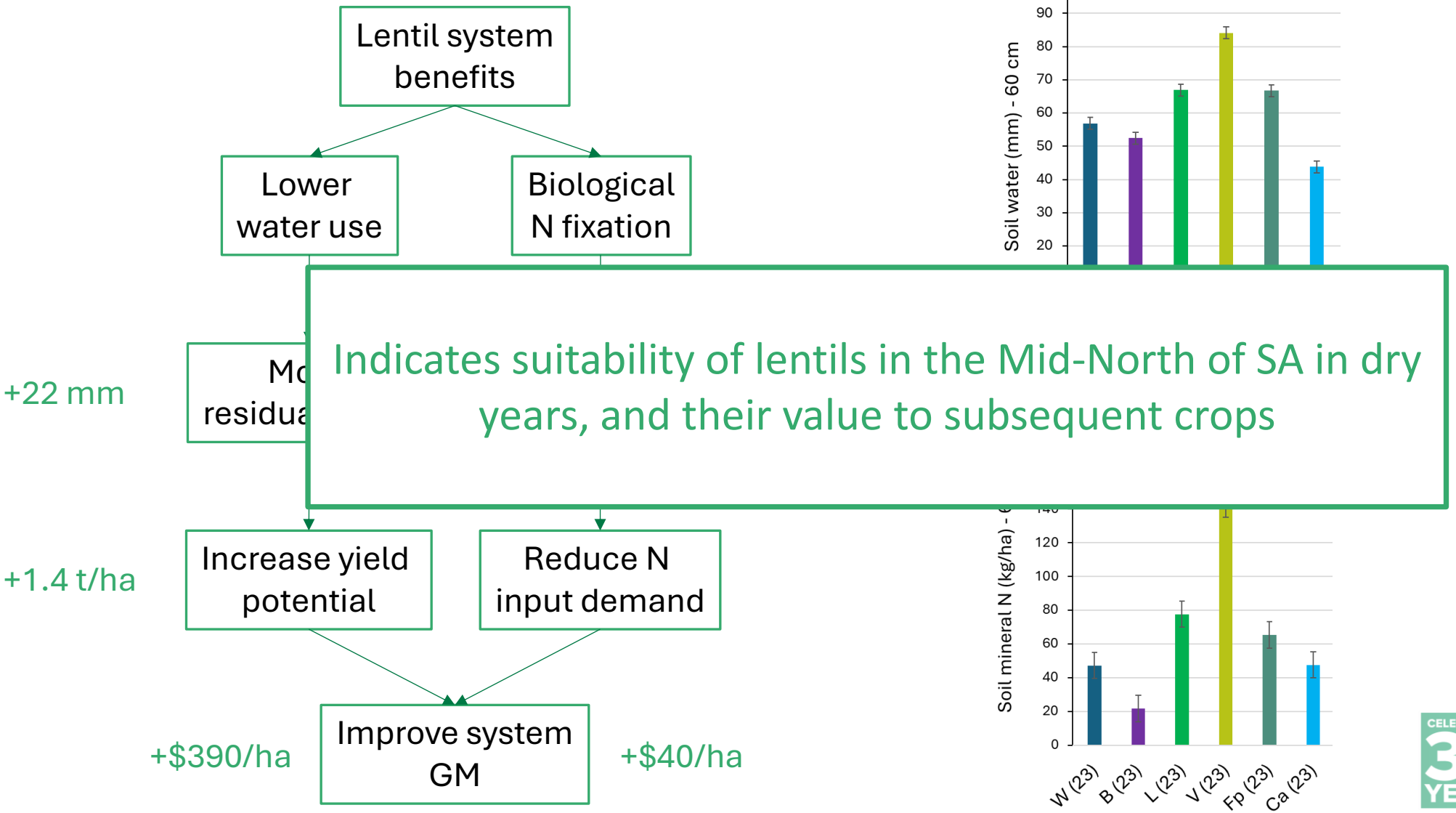


CELEBRATING 30 YEARS

GRAINS RESEARCH UPDATE

Early results: Mid-north SA (Hart)

Lentil system benefits

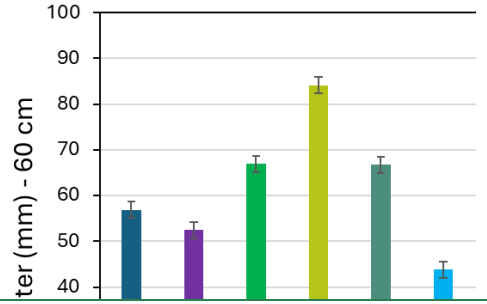
Lower

Biological

+22 mm

What do you see as the main advantages and potential risks of increasing lentil frequency (from 1/3 to 1/2?)? Weed control implications?

Particularly risky in dry years?



+1.4 t/ha

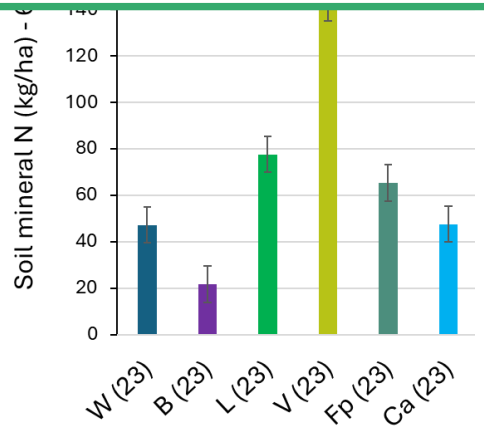
Increase yield potential

Reduce N input demand

+$390/ha

Improve system GM

+$40/ha



CELEBRATING 30 YEARS

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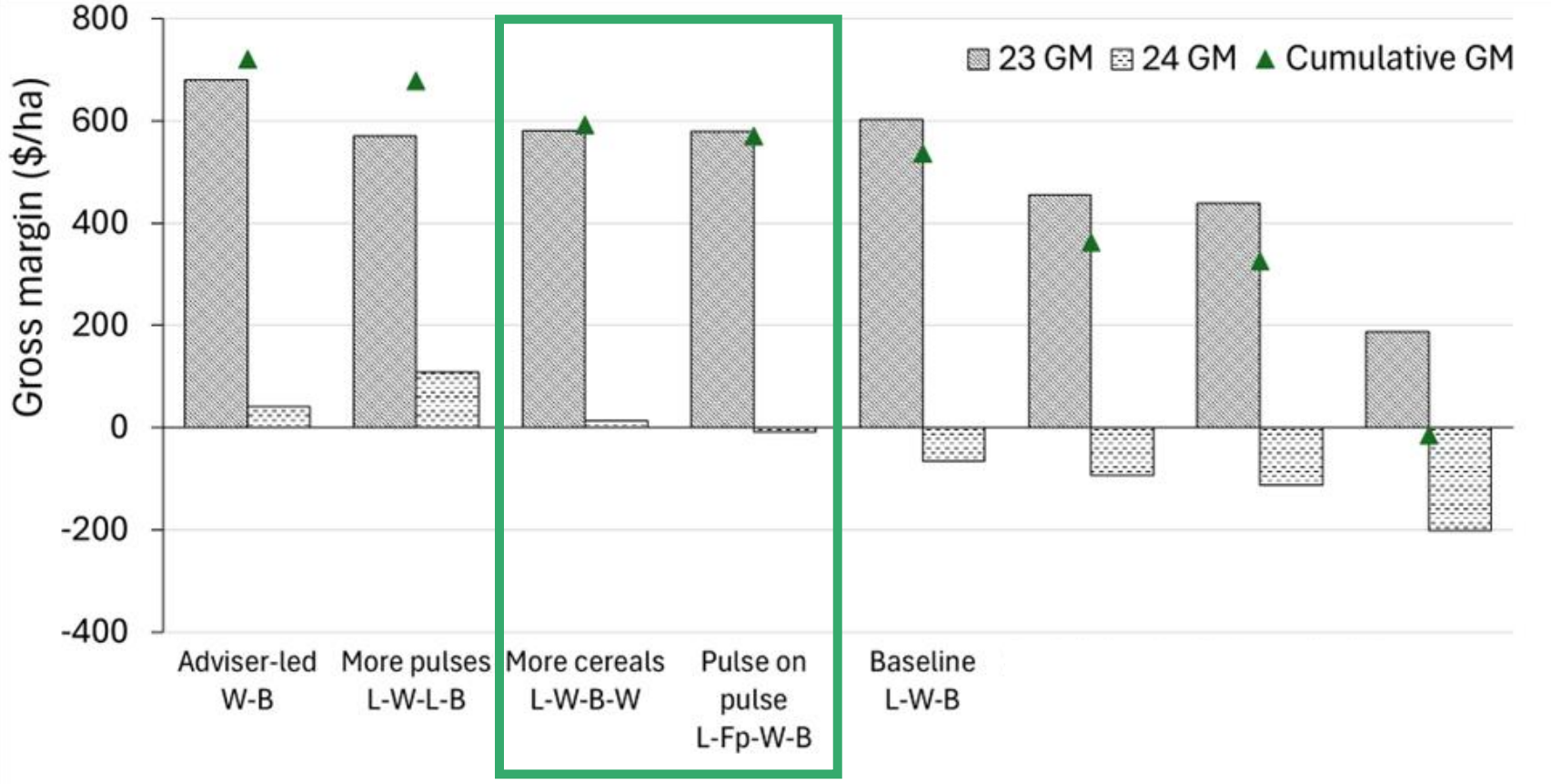
Similar GMs to Baseline achieved with systems with different legume frequencies



CELEBRATING 30 YEARS
GRAINS RESEARCH UPDATE

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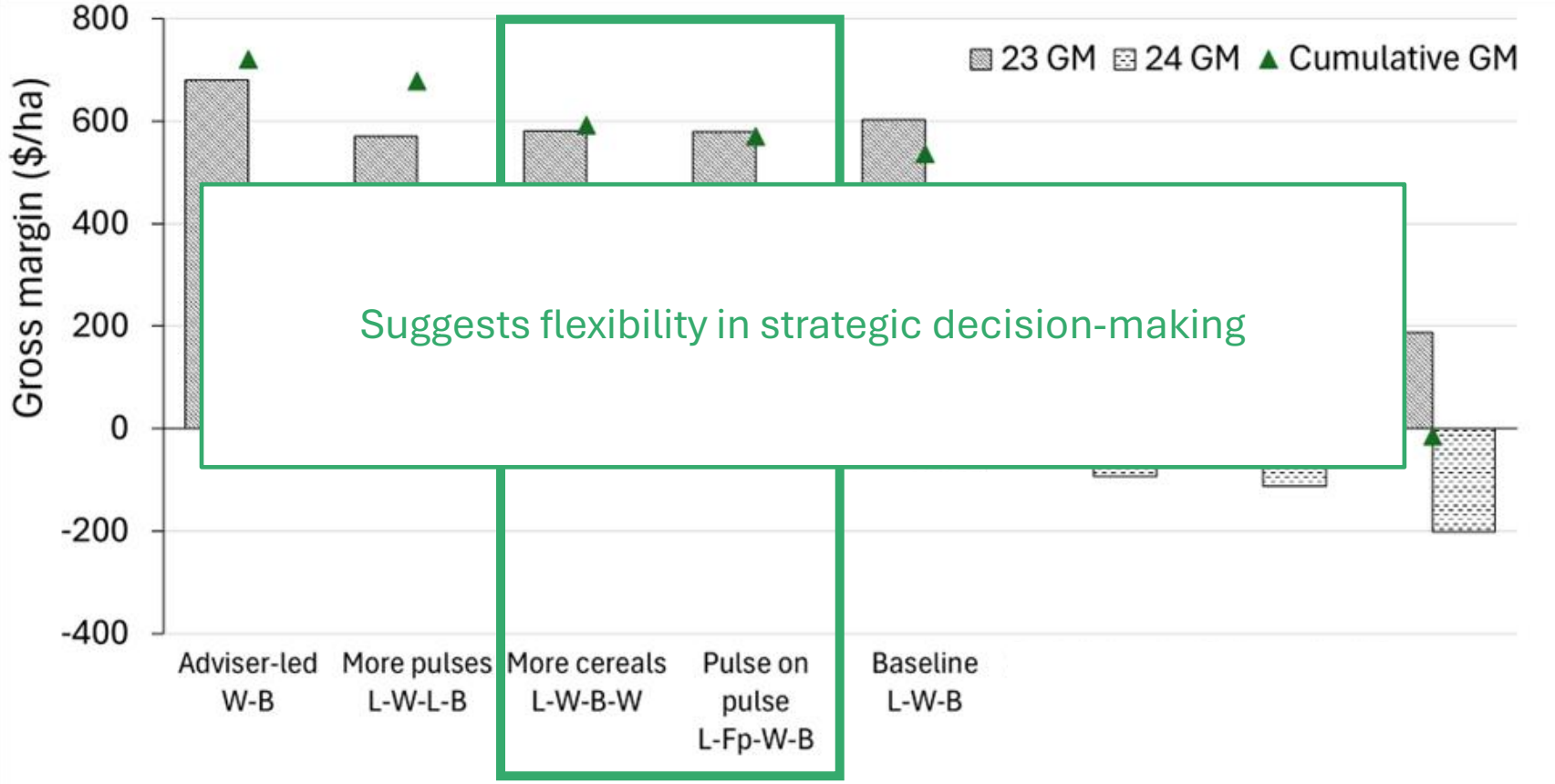
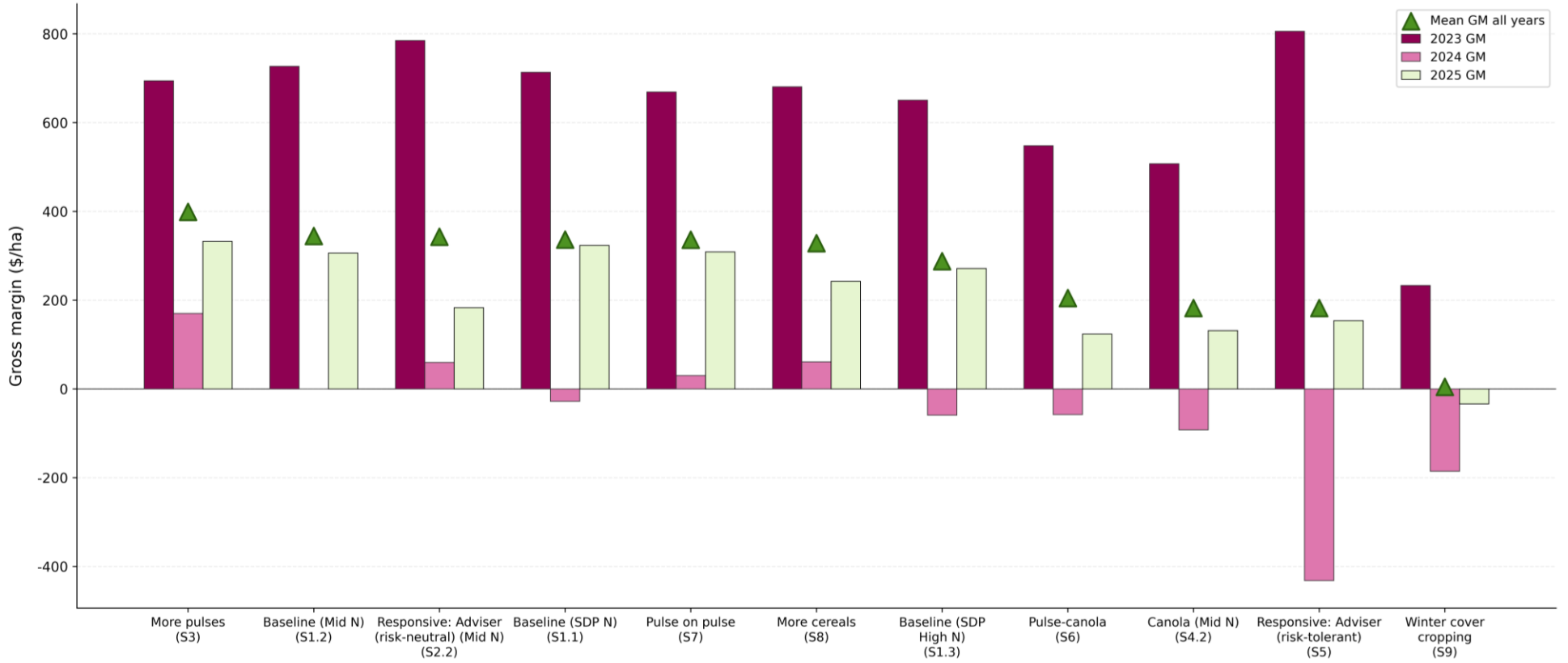


CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

Updates based on 2025 season



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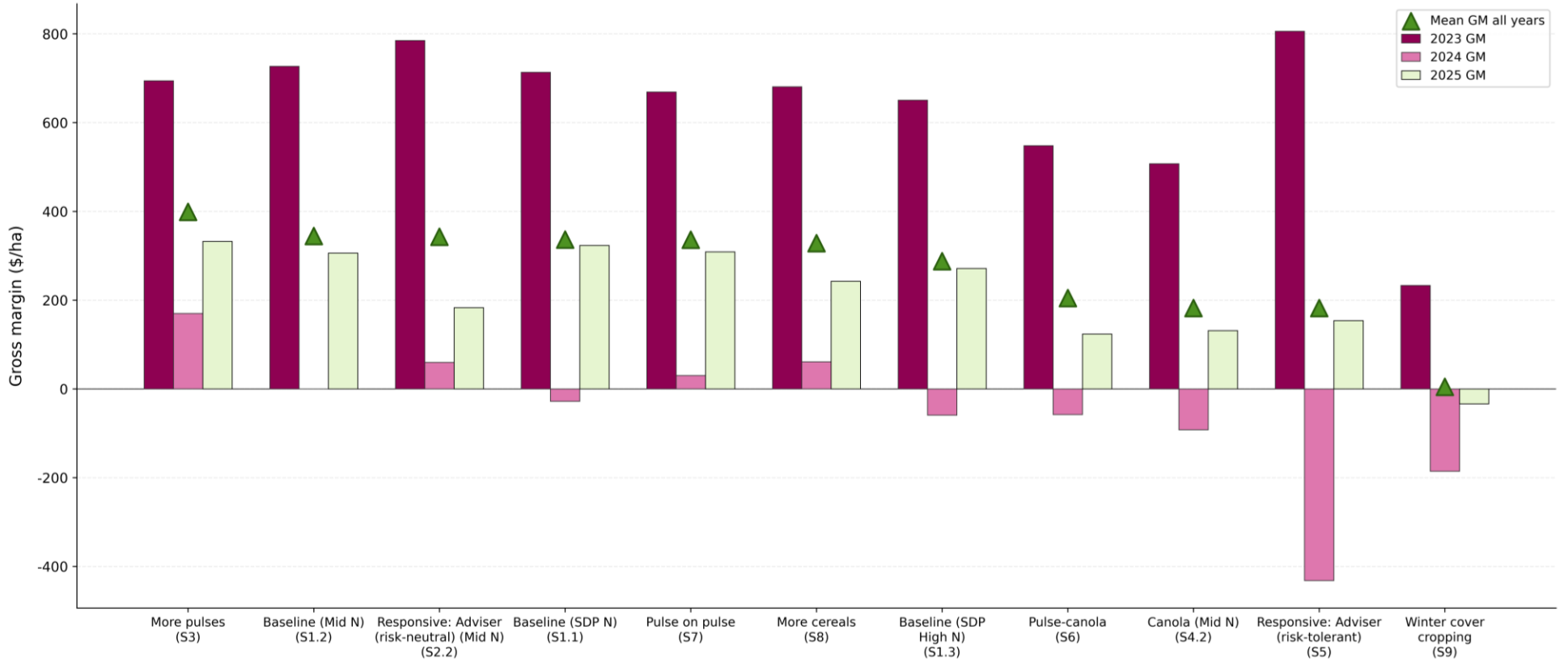

- High level of consistency – good news!
  - Higher lentil frequency
  - Flexibility about crop selection/sequence
  - Poor canola performance, even when setting up with vetch prior…

CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

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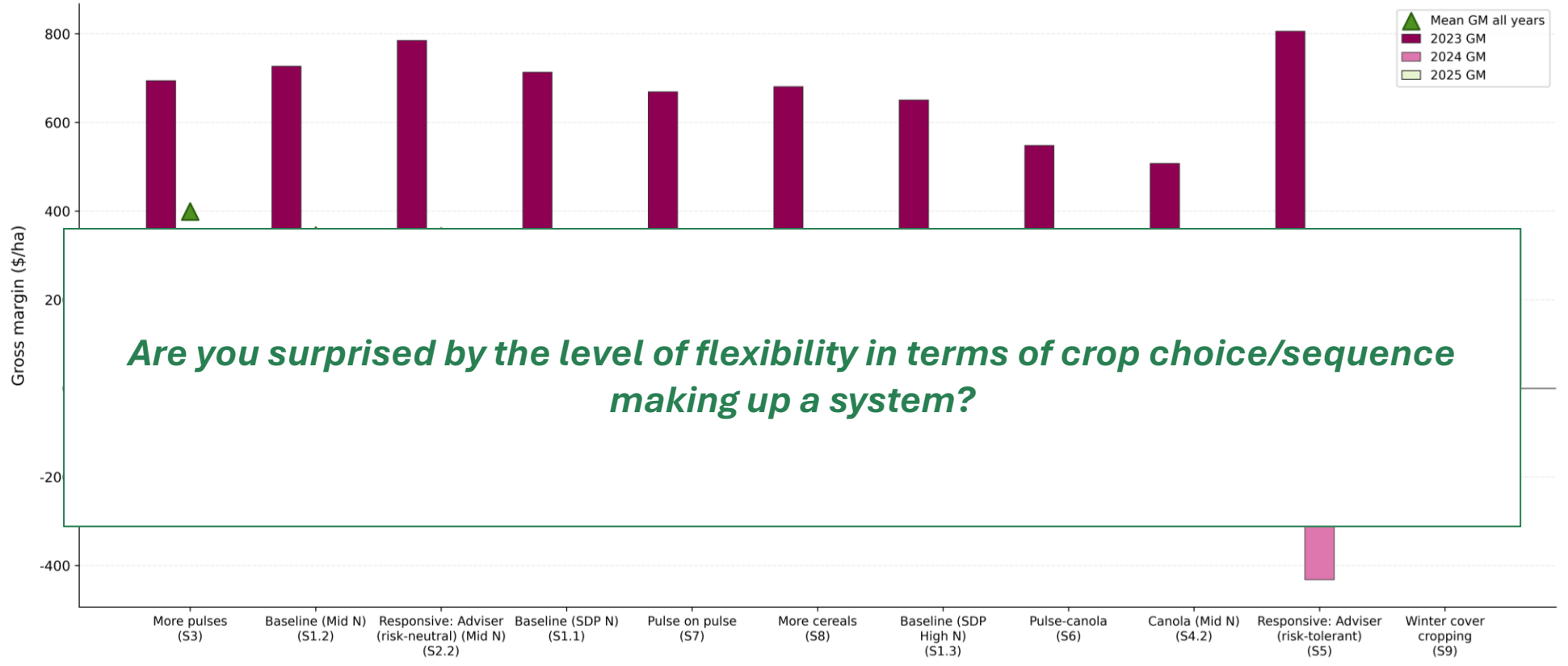

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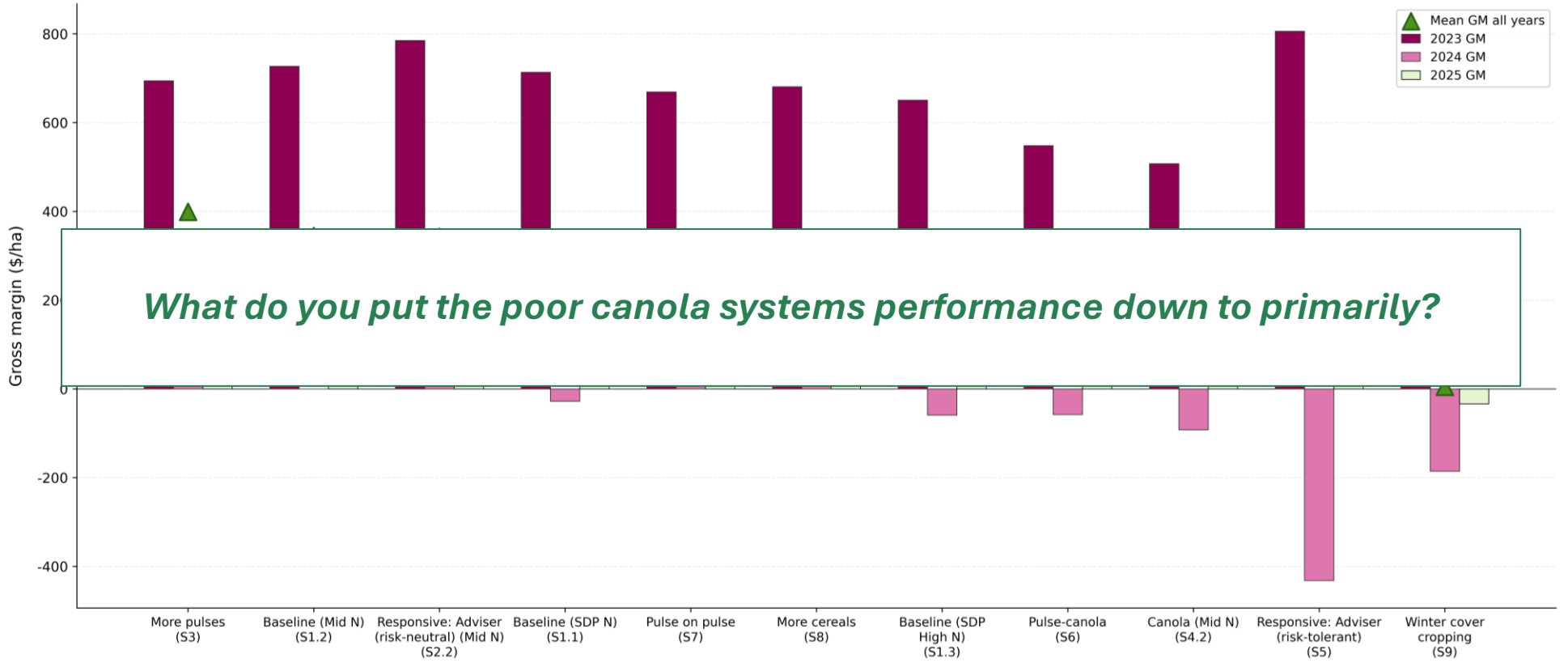

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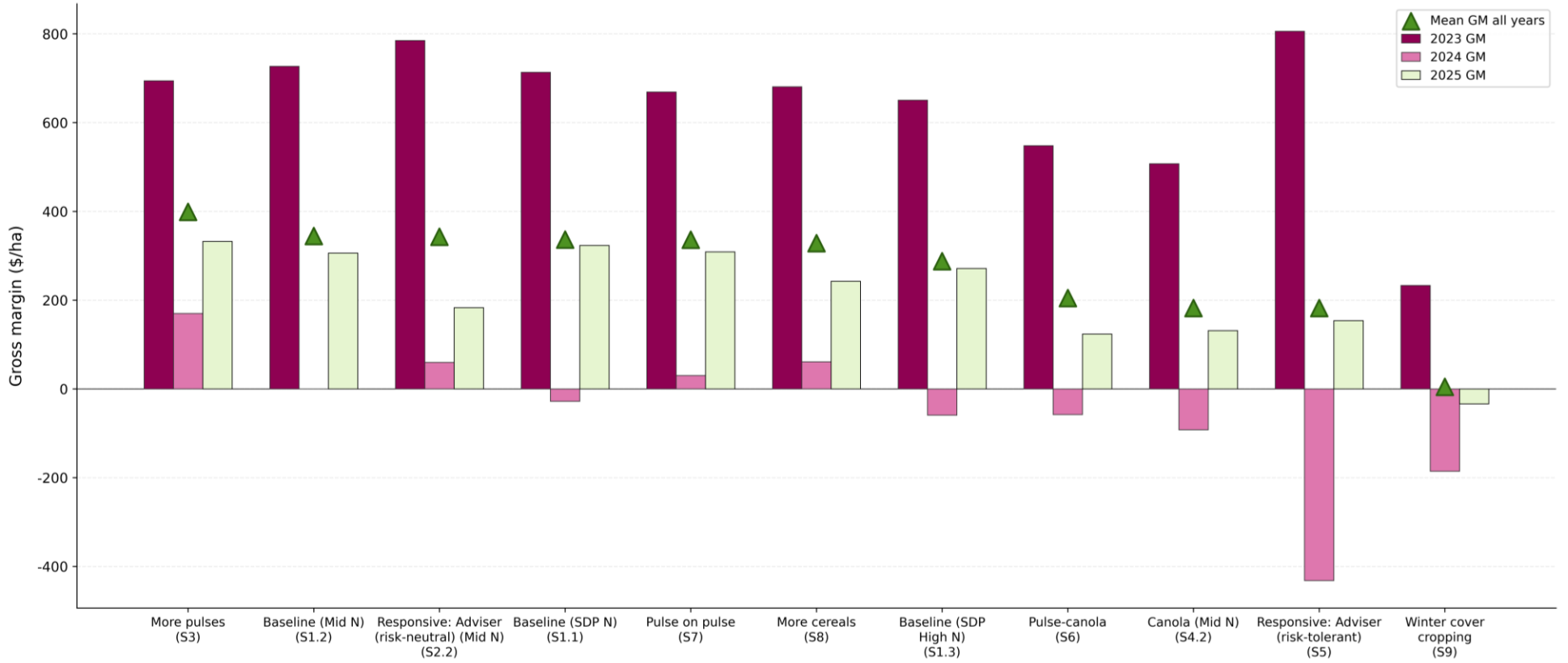

- Differences
  - Increased lentil frequency now outright lead – equal best in 2025, outright best in 2024. This is despite a relatively poor year for lentils.
  - Adviser-led system dropped back into the pack – again, relatively poor lentil year
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CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

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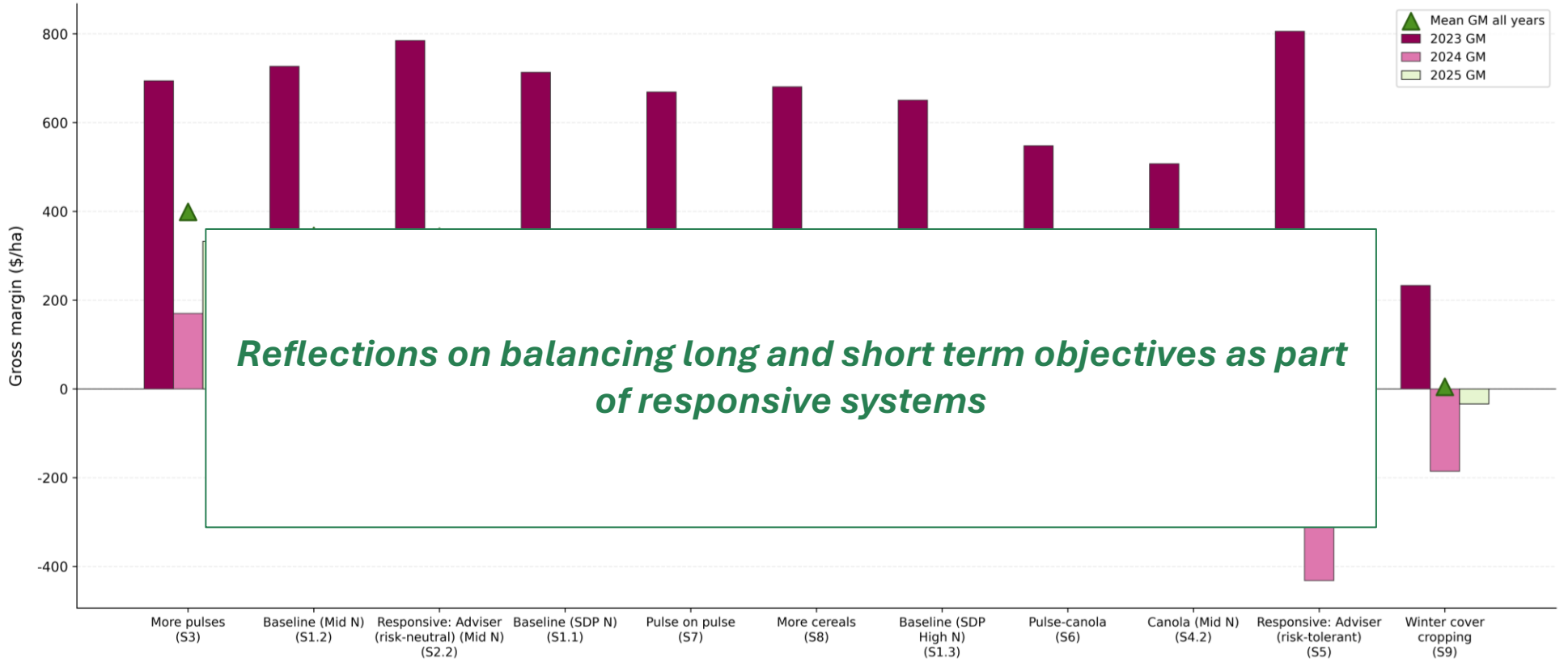

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CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

Benchmarking – yield potential

	Relative yields (Ya/Yw)	
	Wheat	**Lentil**
Hart 2023	70%	69%
Hart 2024	45%	44%
Hart 2025	73%	62% (-11%)

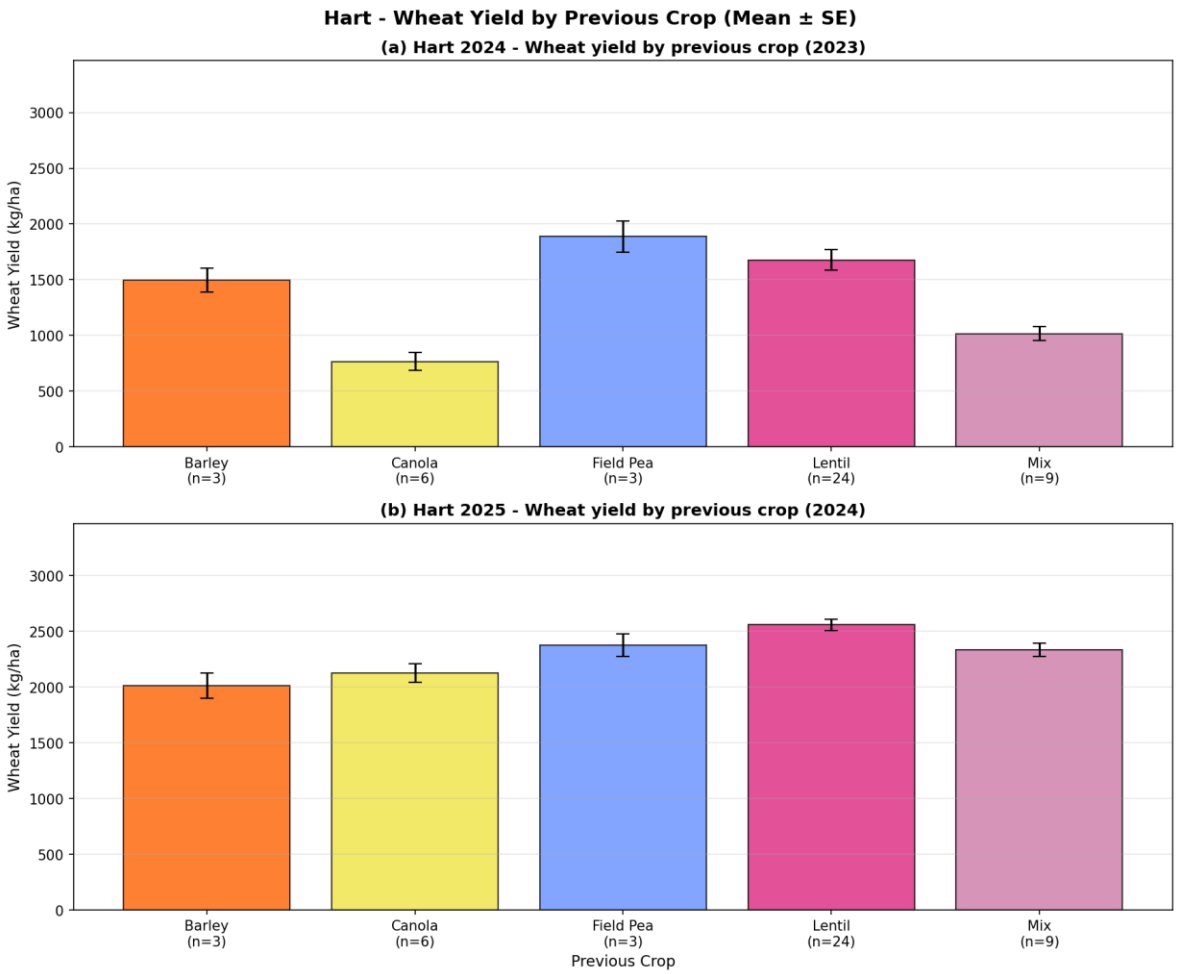
CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

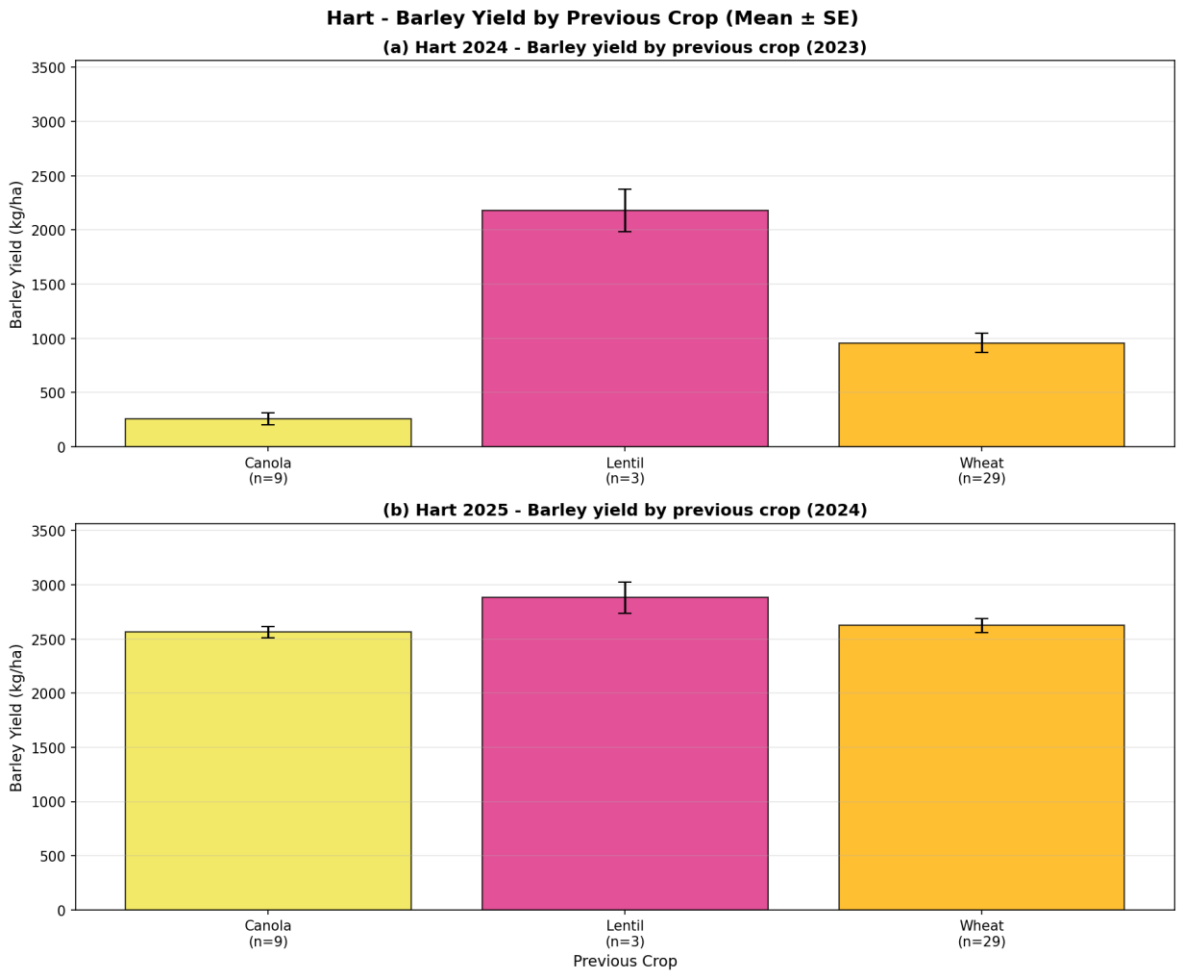
Benchmarking – yield potential

Why do you think it was a not-so-good year for lentils last year?

Hart 2023	70%	69%
Hart 2024	45%	44%
Hart 2025	73%	62% (-11%)

Data building … crop legacy effects





30 YEARS GRAINS RESEARCH UPDATE

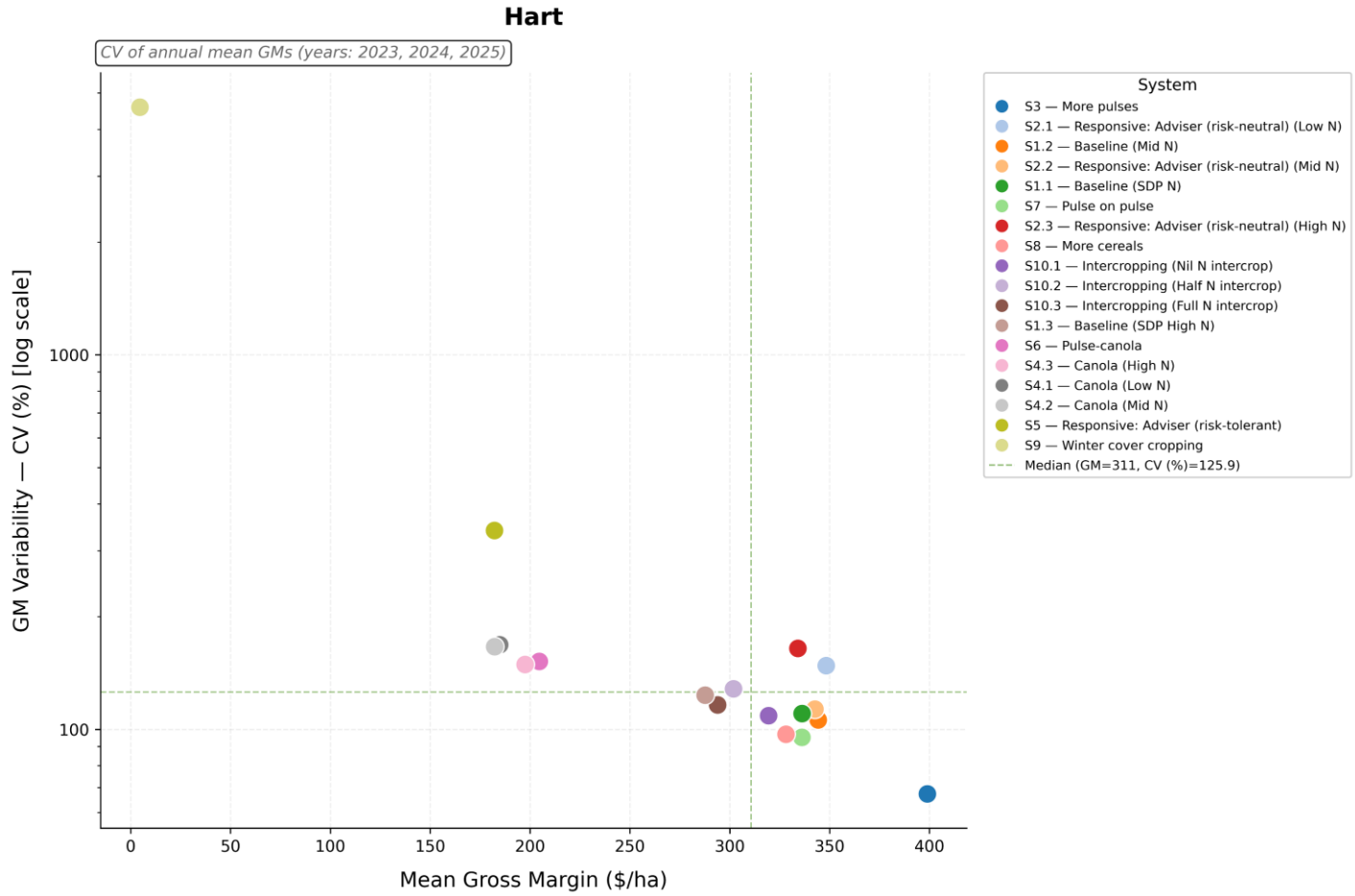
Other things to mention

- We are collecting other data streams too
  - Weed count
  - Disease (Predicta B and foliar)
  - Ground cover
  - Soil water
  - Soil N
  - ….

Additional comments Craig?

The bigger picture

The more profitable systems were also less variable in terms of GM



CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

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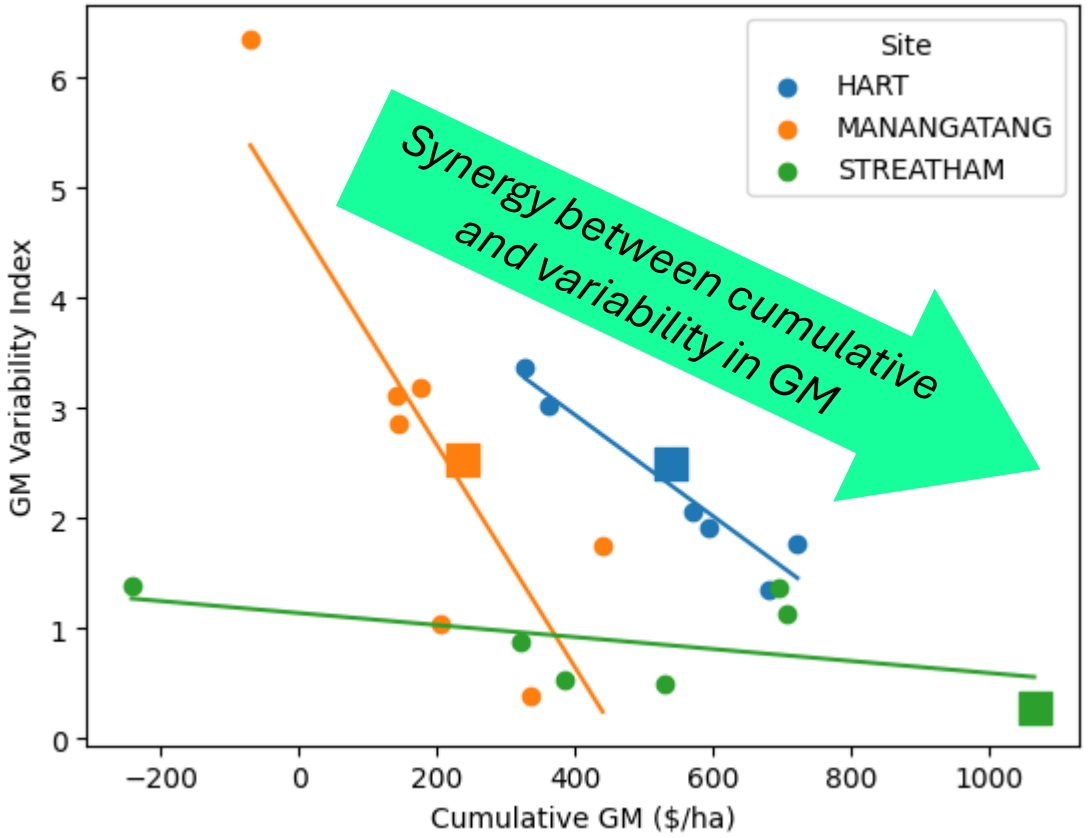

CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

The bi

- Identified
  profit and
  relative to
  - 30% i
  - 50% i

What about other trade-offs?

How at-odds are these objectives?
Satisfy both at the same time?

CELEBRATING
30
YEARS

Metrics for sustainability

- Some metrics related to sustainability
  - GHG emissions
  - Soil health
    - Soil microbiome
    - Soil OM
    - pH
    - …
  - Ground cover (erosion risk)
  - …

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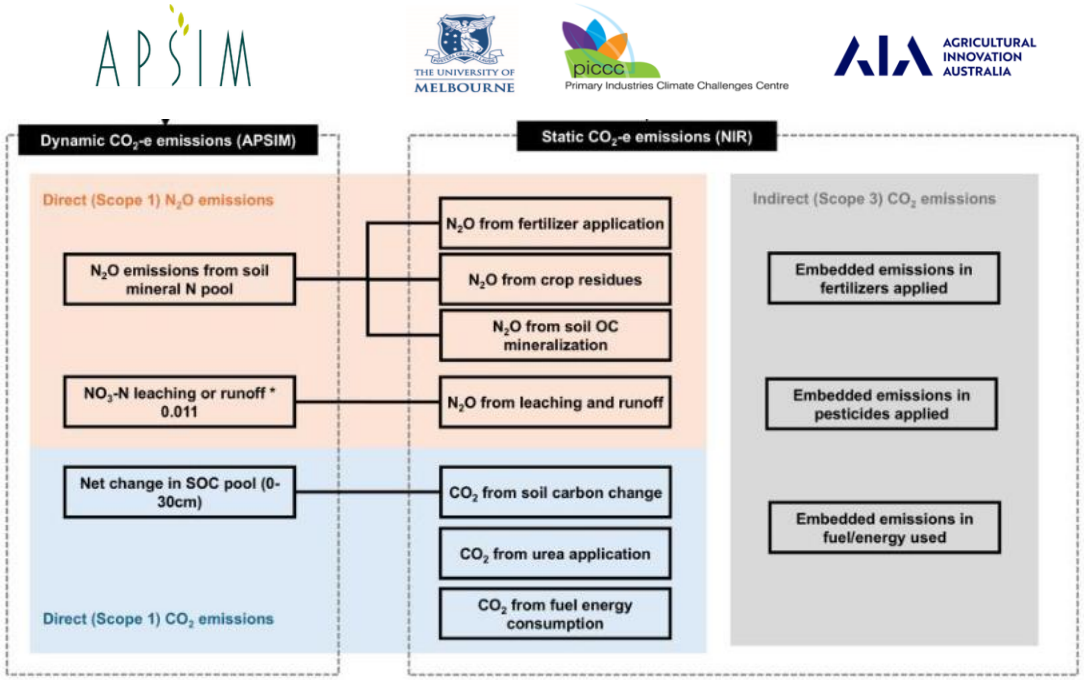
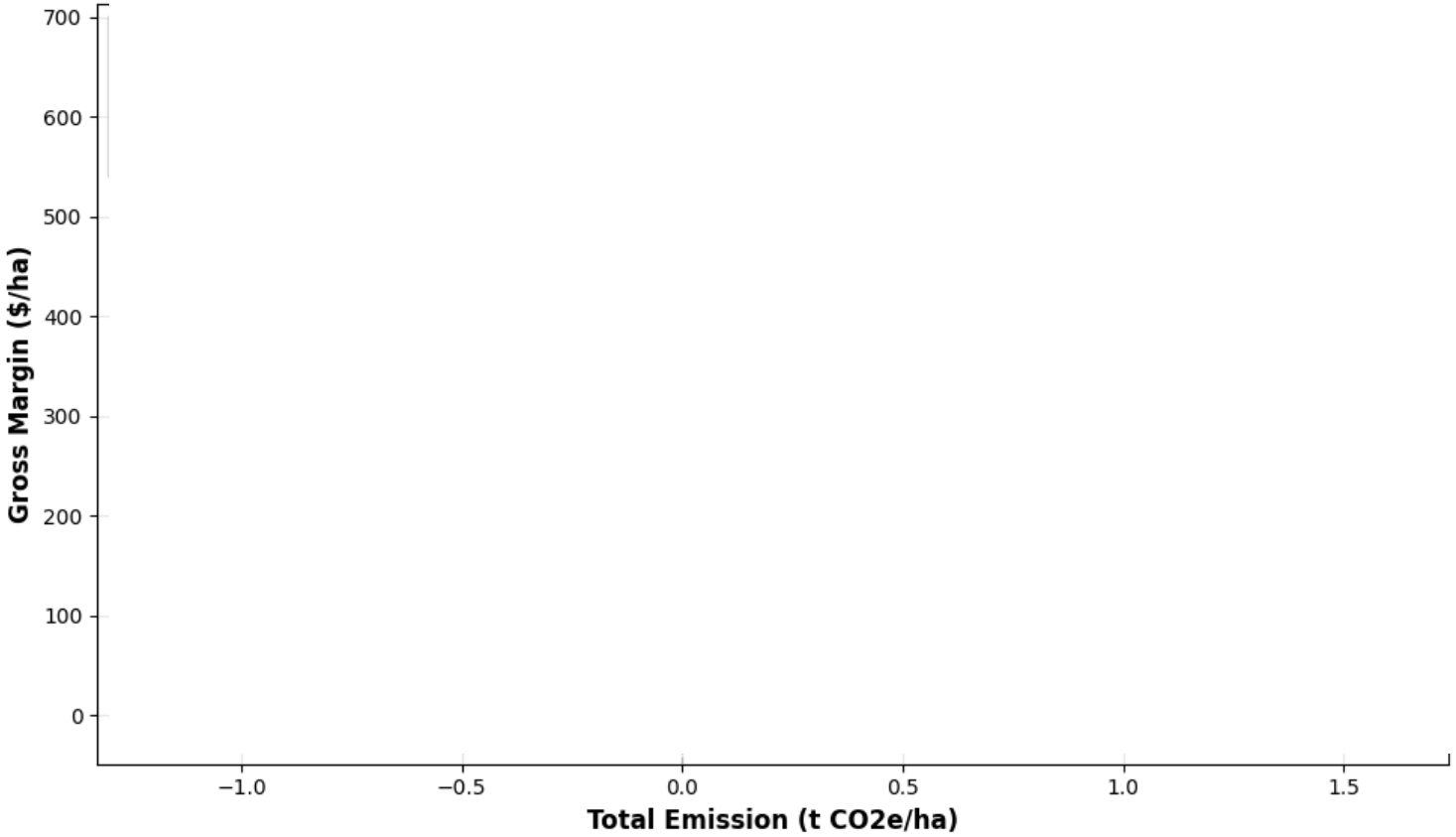


GHG emissions: Mid-north SA



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GRAINS RESEARCH UPDATE

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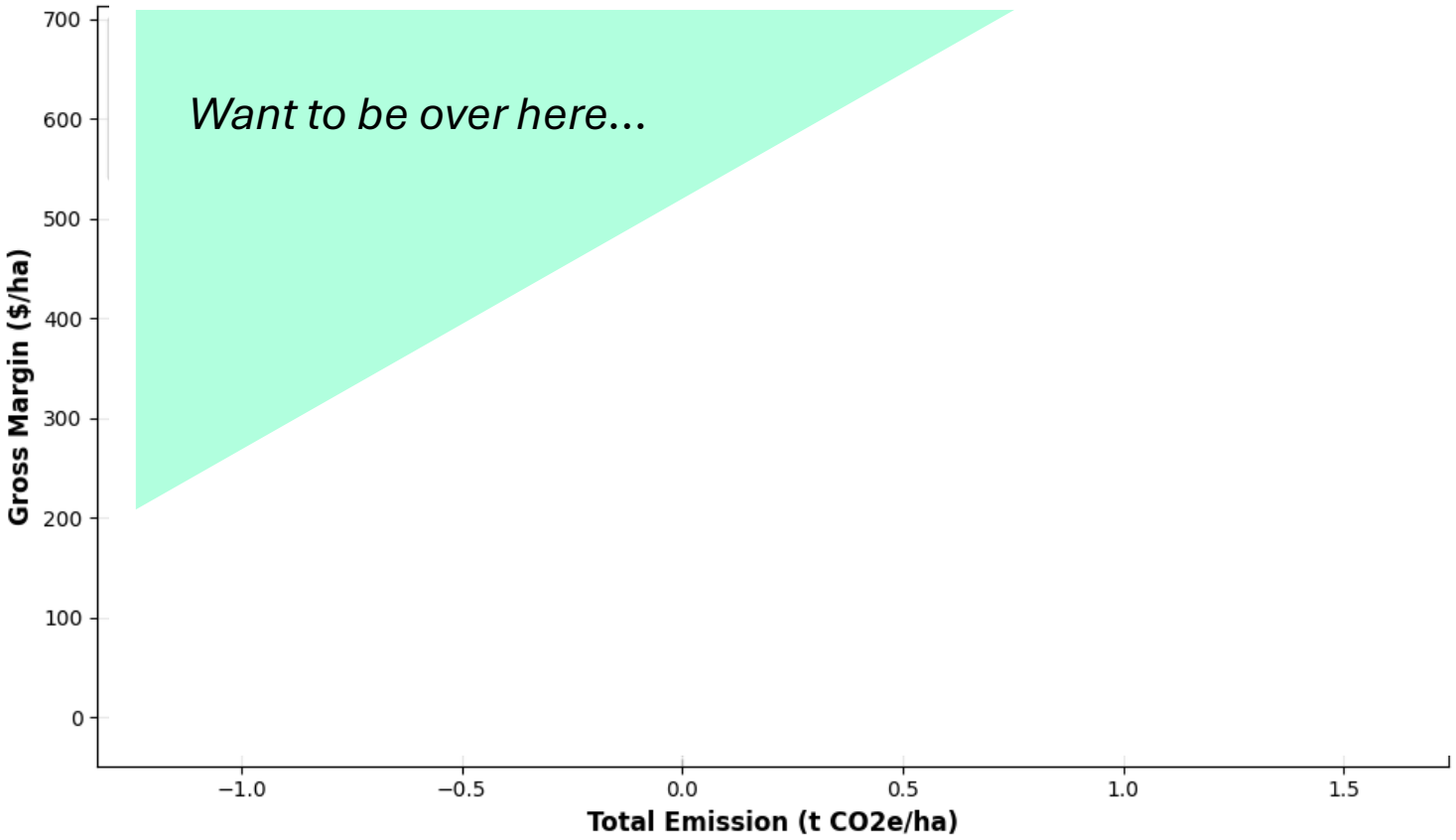

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GRAINS RESEARCH UPDATE

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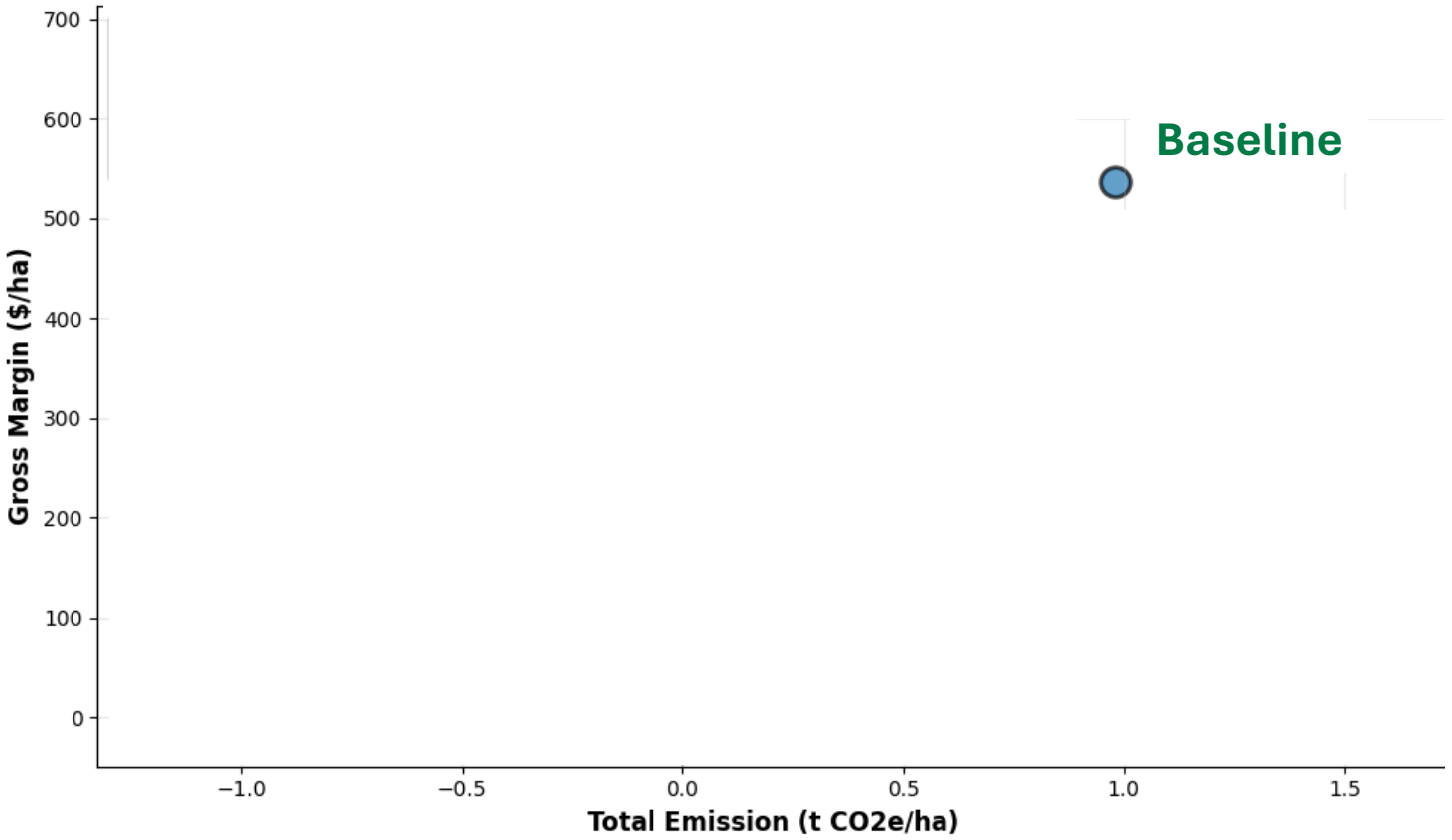

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GRAINS RESEARCH UPDATE

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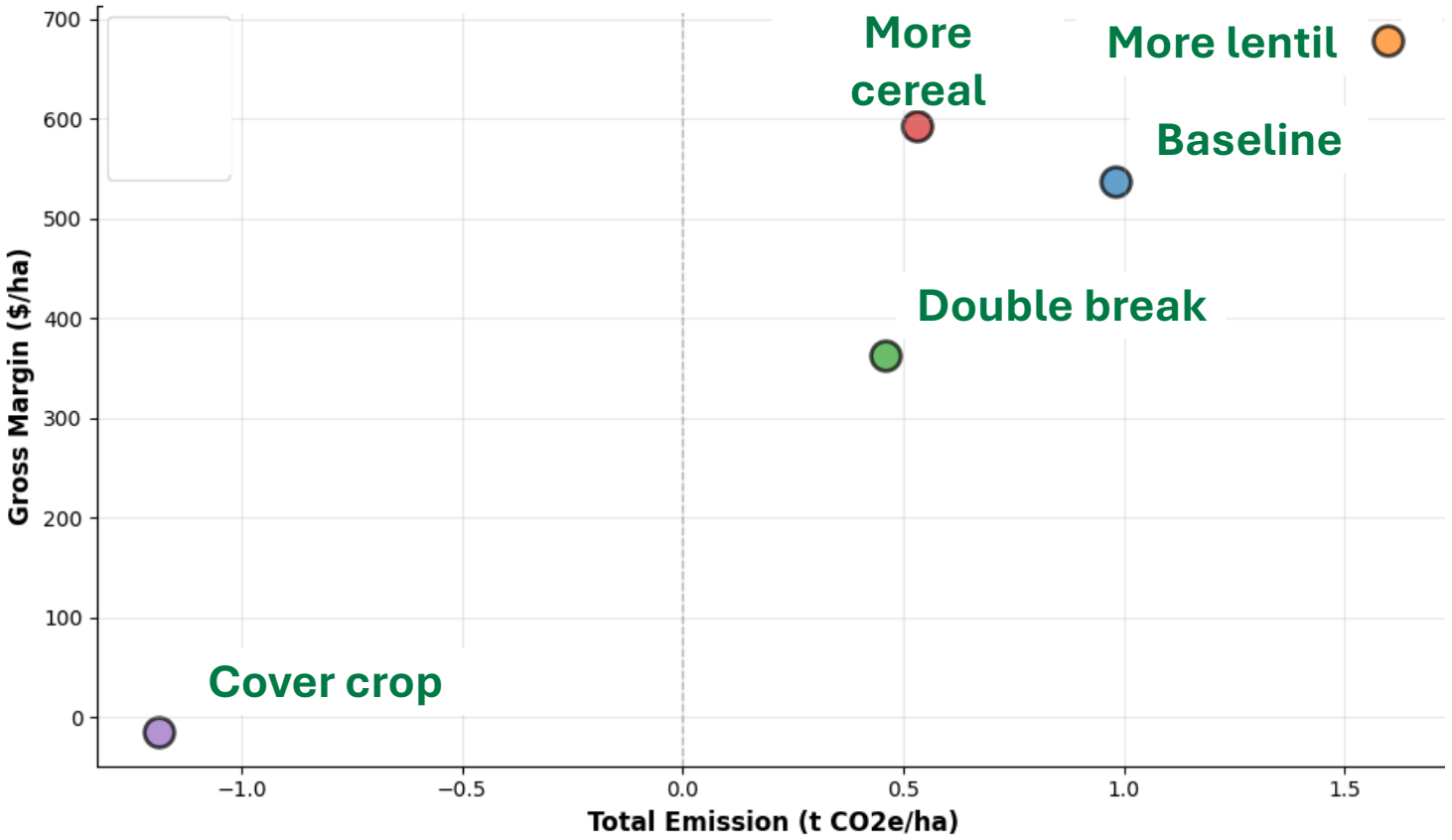

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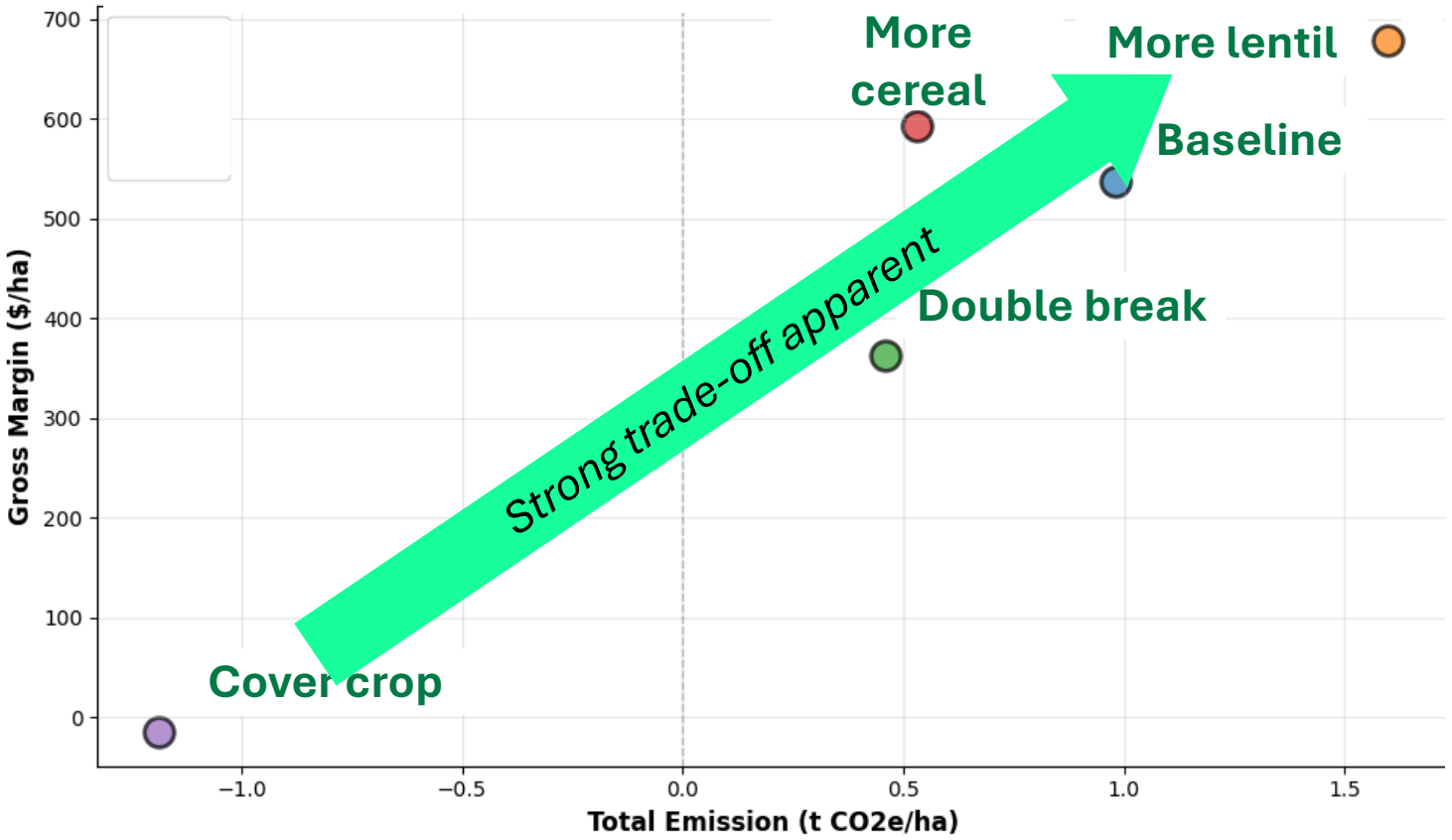

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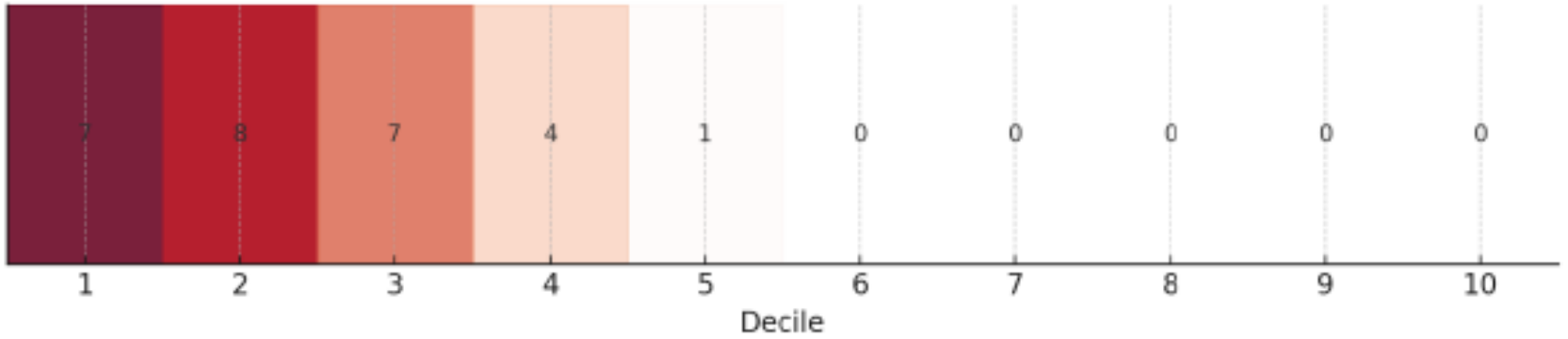
Towards a FSS Phase II

- In process of considering what a Phase II could look like
- ***Two primary reasons for a Phase II:***

1. To deliver **more robust insights**
    i. Experimental seasons represent only a small subset of climate variability (dry/very dry years)

    "To what extent will findings hold for more typical and favourable years?"

    "Are current findings biased?"



GRAINS RESEARCH UPDATE

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    "To what extent will findings hold for more typical and favourable years?"
    "Are current findings biased?"
    ii. Good farming systems research takes time
    e.g. biological pressures build over time, taking longer in dry conditions
    "To what extent are current findings masking important factors that would determine success on-farm?"

Towards a FSS Phase II

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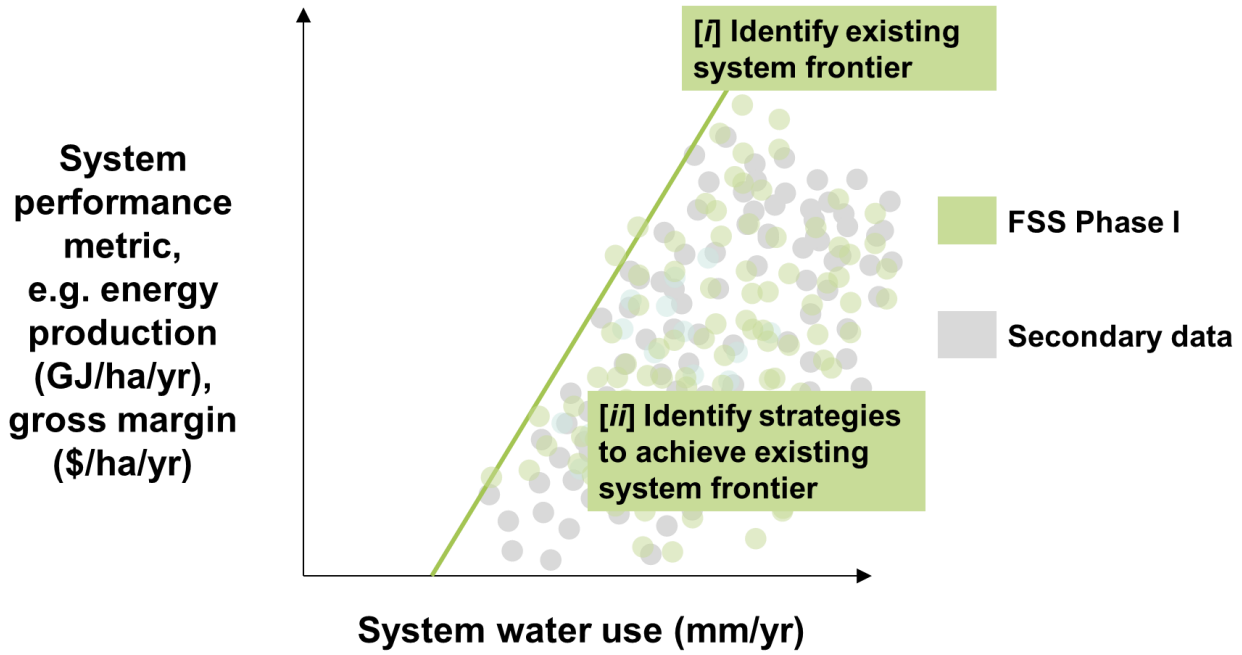
Harness existing potential



Towards a FSS Phase II

- In process of considering what a Phase II could look like
- ***Two primary reasons for a Phase II:***

2. To explore **'future' systems** and their ability to:
   i. To **reach new frontier(s)**
   ii. To **enhance capacity to adapt** to opportunities (e.g. new markets) and challenges (e.g. reduced weed control products)

- 'Future' systems will integrate multiple innovations

Towards a FSS Phase II

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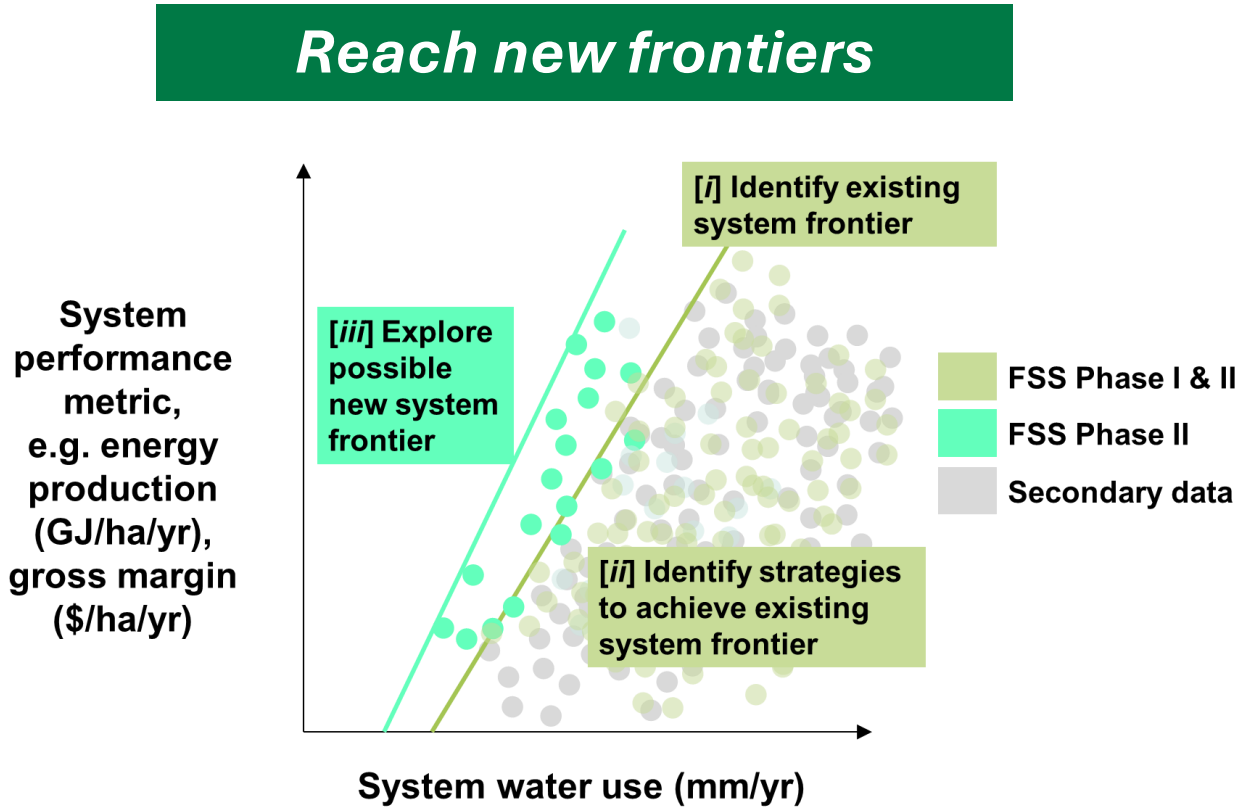

CELEBRATING 30 YEARS GRAINS RESEARCH UPDATE

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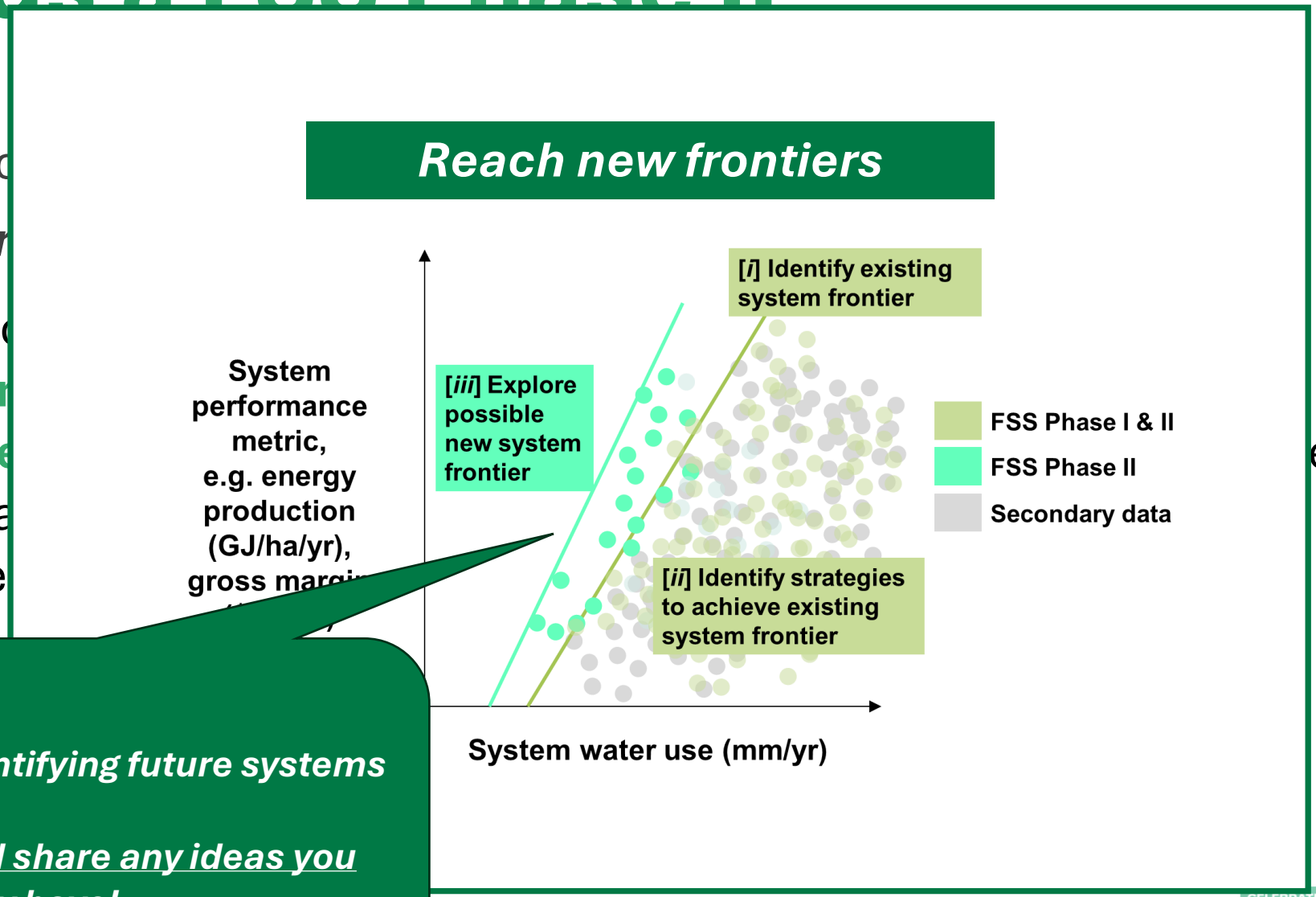

Early stages of identifying future systems

<u>Please come and share any ideas you may have!</u>

#GRDCUpdate

Matthew Knowling
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X: mjknowling_

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