Nitrogen Strategies for EP

Therese McBeath with

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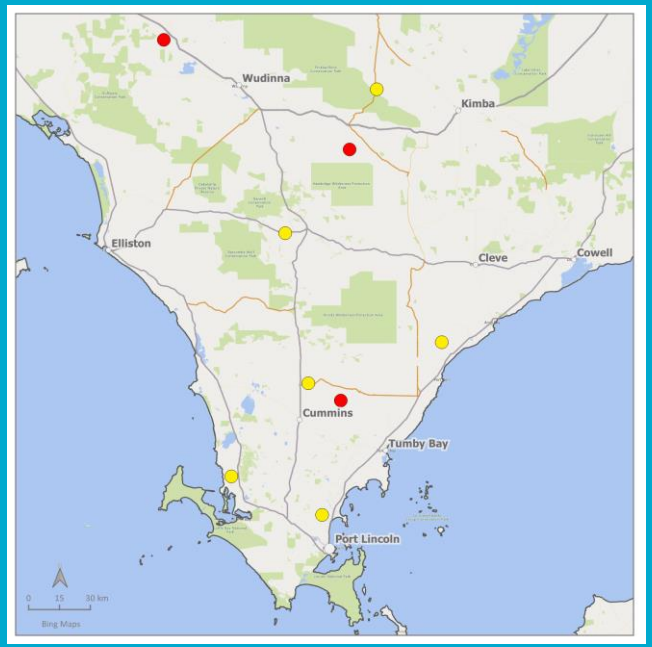

Resilient EP
For a profitable farming future

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Content

- LEP soils and climate.
- Gaps in our knowledge of N losses and mineralisation.
- Recent improvements in soil water and yield potential predictions.
- In-season N strategies.
- Approaches that combine legume and fertiliser management to better ‘bank’ nitrogen.
- Thinking about the year ahead

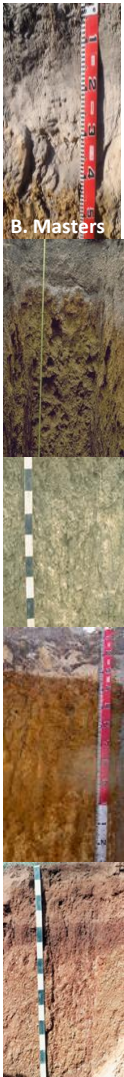
Soils

Losses/ demands

- Leaching (sands)
  1-3% of fertiliser N (WA)
- Waterlogging and denitrification (clay and texture contrast)
  3-10% of fertiliser N (Latta et al.)
- Lateral Flow (texture contrast)
  ?? Up to 10x variation in soil mineral N values in a paddock
- Volatilisation (alkaline soils worst)
  up to 12% of fertiliser N but dry soil problem

Delays

- Immobilisation (temporary)
  5 kg N/t stubble at sowing
- Waterlogging
  delays conversion of ammonia



Soils

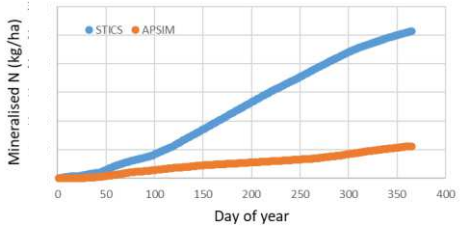
Gains/ Supply

- Fertiliser

  Fertiliser recovery varies (3-50% measured on EP).
- Legumes

  Varies by crop but ~20 kg N/t grain (Peoples et al.)
- Mineralisation- conversion of N from organic matter (soil and residues) to plant available forms

  Nitrogen supply potential (34-100 kg N/ha) in 2015/16



Unkovich et al. collaboration to test if we can use stable soil properties and climate data to better predict Nmin.

N fertiliser requirement= N demand-N supply

N demand is the amount required to produce a target yield

Assumption is that each tonne removes 20 kg N/ha

Target yield is a % of yield potential (% is usually a fudge factor based on experience, logistics, $$, attitude to risk)

Needs adjustment for fertiliser recovery/loss

Assumption is that recovery is 50% of N added

N supply is the amount that the soil can supply without fertiliser

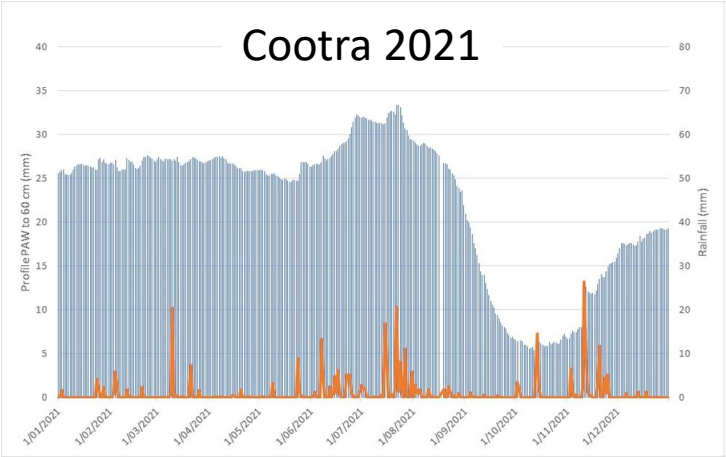
(Starting mineral N and mineralised N)

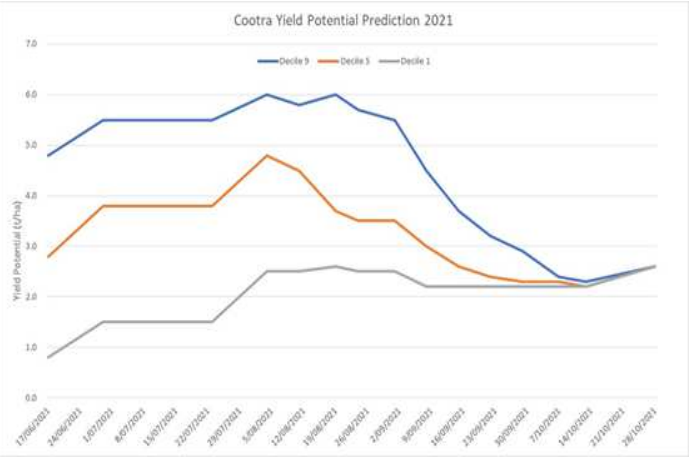
Mineralisation is often assumed to be 0.15 x organic carbon x growing season rainfall.

7 t/ha wheat at Cockaleechie is 280 kg N (6 x 40)- 105 kg starting Mineral N- 96 kg Mineralised N

=79 kg fertiliser N/ha= 171 kg Urea/ha

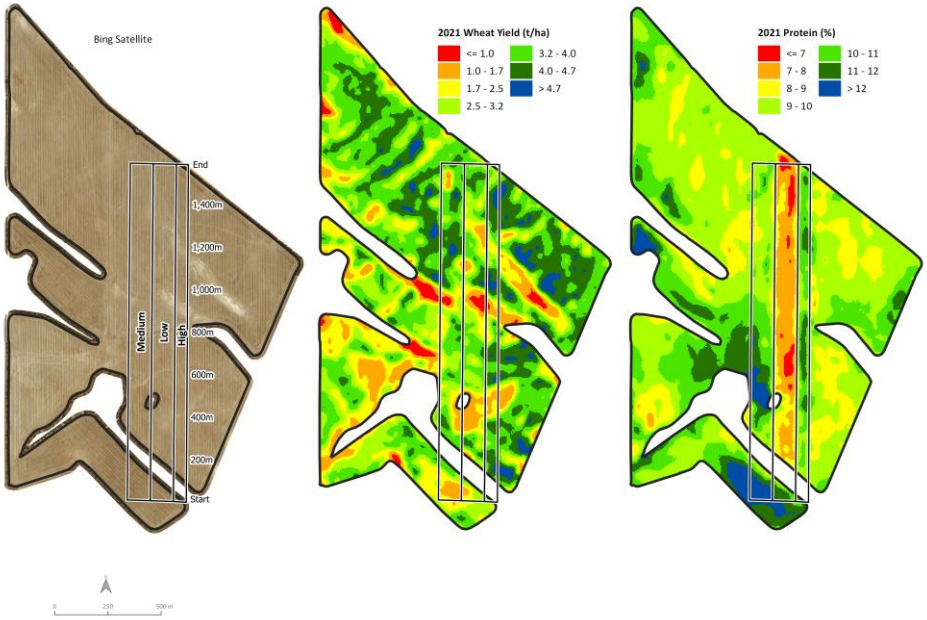
Cootra-Soil Water and Yield potential



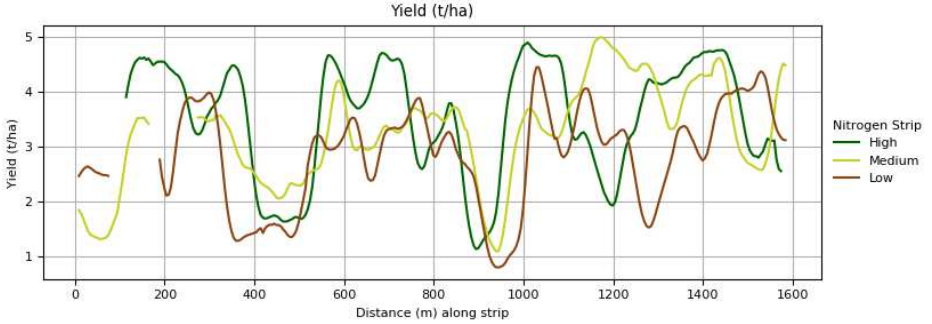


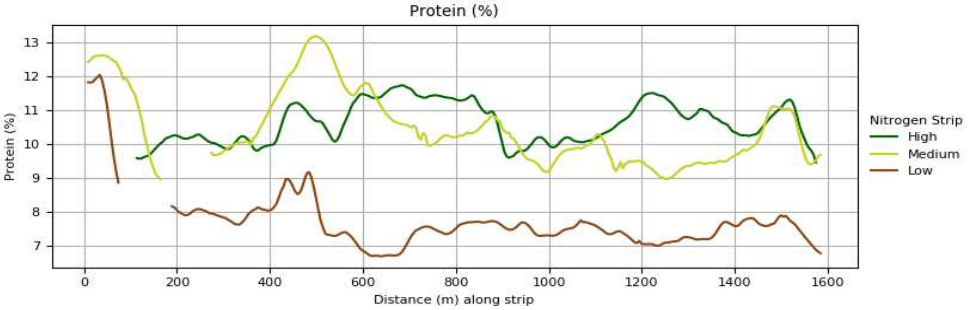
- Combination of soil water probe showing stored water and strong yield potential motivated N test strips.
- Reality is that there is a wide range of possible outcomes for the part of the season when decisions are made.
- Soil characterisation ongoing as yield prophet often underpredicts yield for this site.

Test Strips-Cootra



Test Strips-Cootra

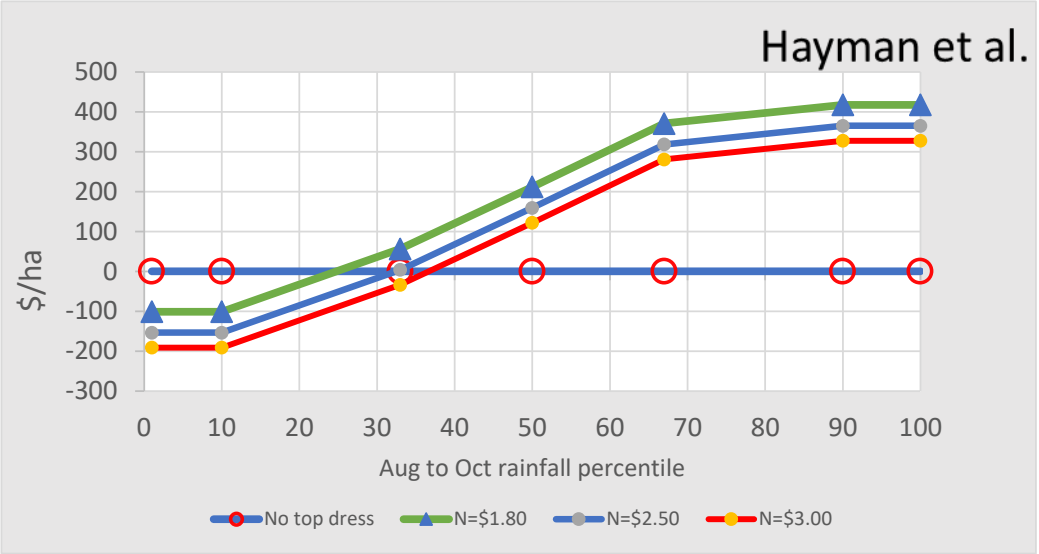




Of the 1130 m strip:

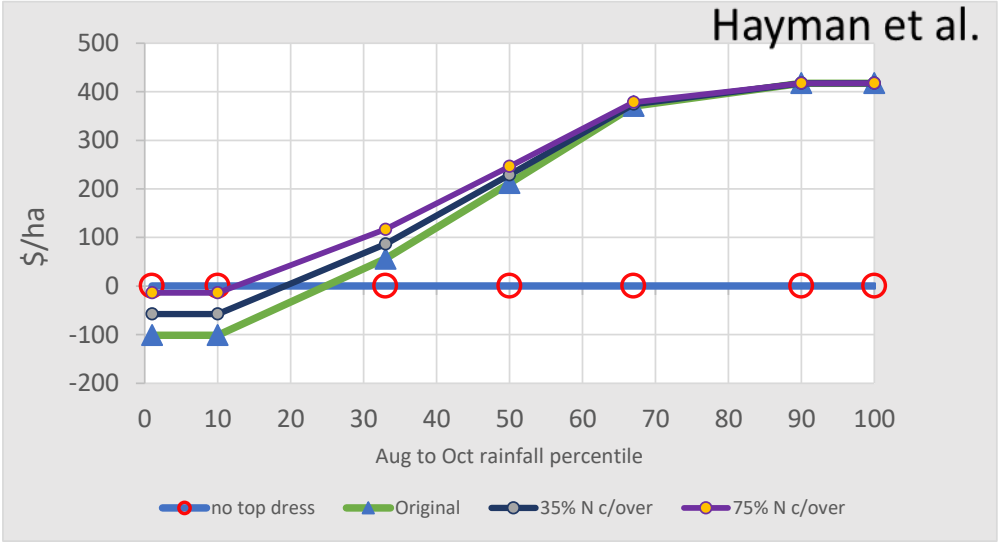
- 70% was responsive to N> low input.
- 61% had more grain yield with high N compared with medium N.

N budgeting- Cootra



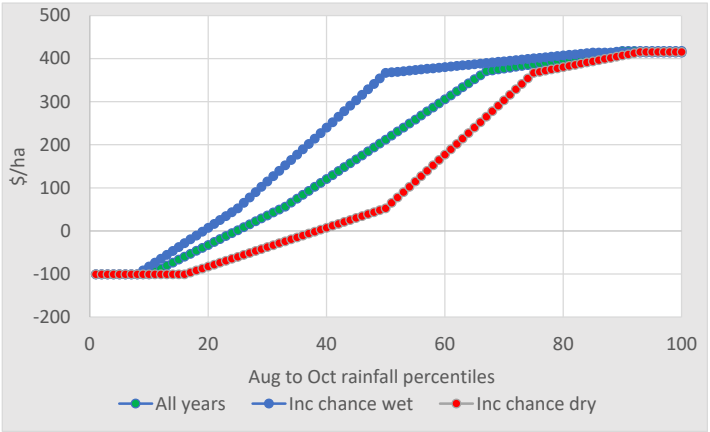
- A higher cost of N does not change the shape of the curve it just shifts the profit for all deciles south.
- Under these assumptions, it is still profitable to add 75 kg/ha topdressing even if urea has shifted from $828/t to $1380/t.

N budgeting- Cootra



- Assuming 35% of N is carrirf over leads to 10% increase long term average return on topdressing with 75 kg/ha.
- 70% carryover leads to 20% increase.
- The impact is on the lowest deciles shifting the decile 1 outcome from -$110 to -57 (35% carryover) and -$14 (70% carryover)

N budgeting- Cootra

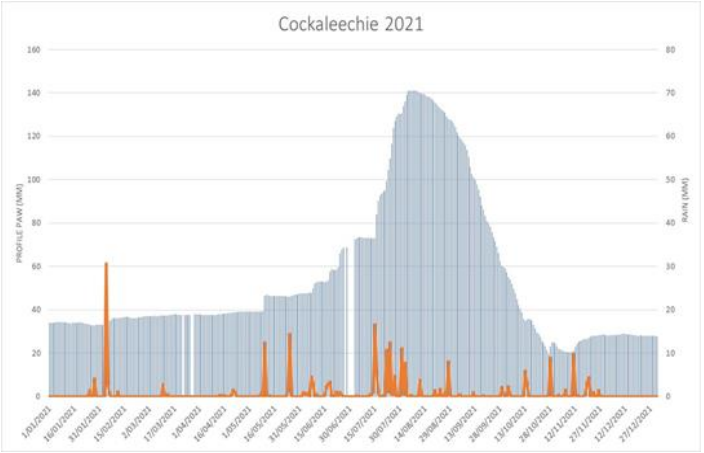


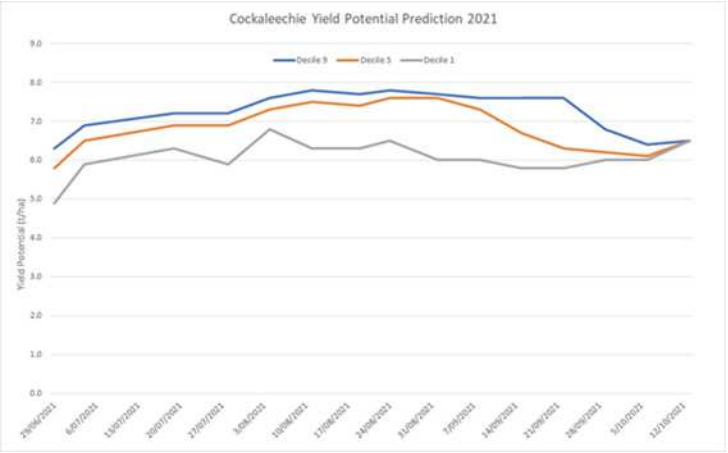


- Long term average return on topdressing +26% (increased chance of wet) and -32% (increased chance of dry).
- Under these assumptions – no change to the worst (decile 1) or best (decile 10 outcome).

Hayman et al.

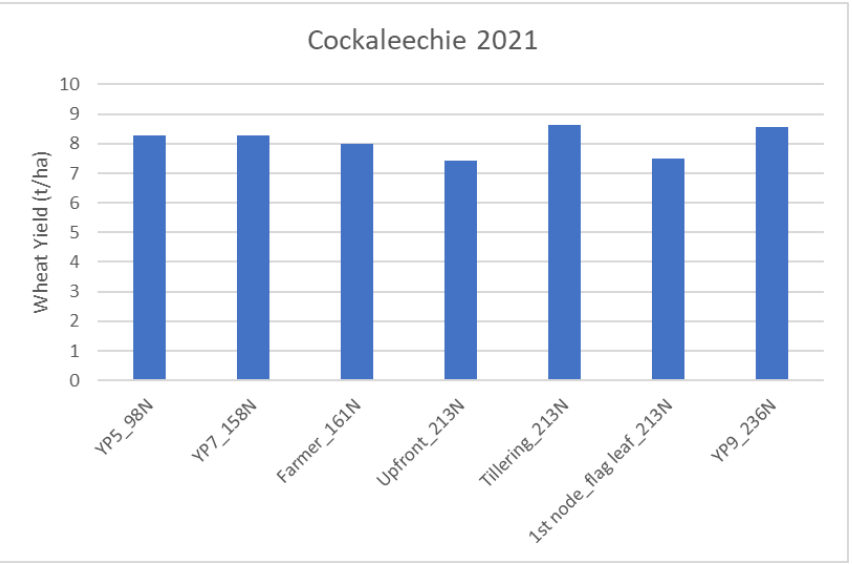
Cockaleechie-Soil Water and Yield potential





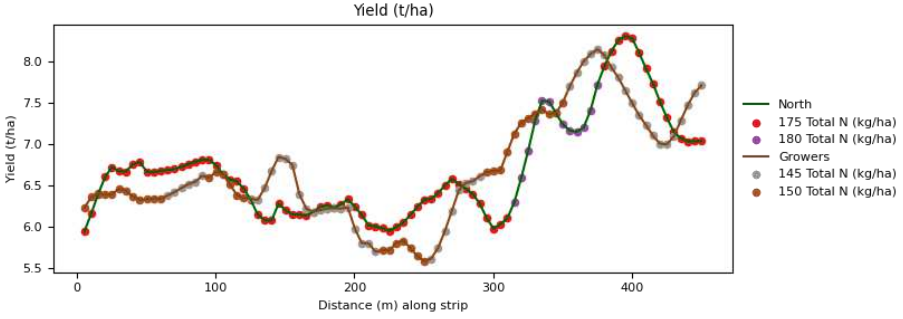
- With adjustment to ensure soils and phenology match local conditions yield prophet predictions are more trustworthy.
- Stored water information provides confidence with setting the % of potential to target.

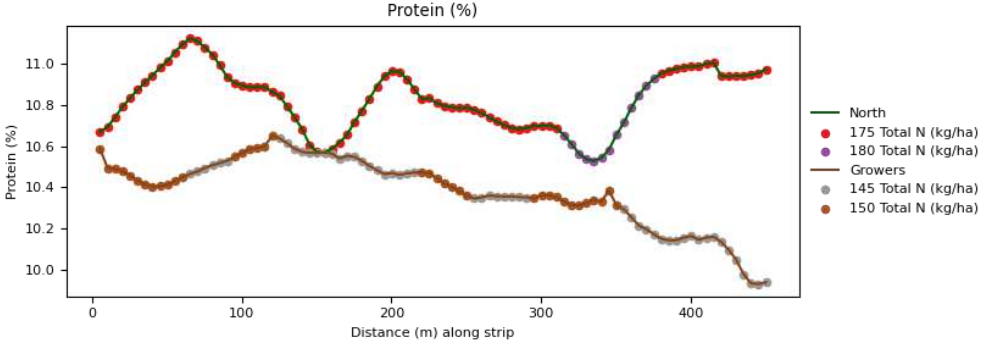
Test Strips/ Plots-Cockaleechie



- A range of strategies tested based on target yields set by yield prophet (YP) deciles and timing effects.
- Initial responses related to N dose but no sig. effects on grain yield.

Test Strips/ Plots-Cockaleechie





- Test strip of extra 37 kg N yielded > for 58% of the strip
- Protein differences more apparent with an important shift from ASW to APW

In-season Strategies

- Know your target yield (yield potential can be a guide).
- Make sure the crop is set up for the first phase of growth.
- Understand your soils in terms of losses, but also logistics of trying to manage with the potential for losses.
- Monitor how soil mineral N is responding in different soils/ situations (unpopular I know!).
- Utilise supporting tools/budgets to predict N requirement
- Test strips can be useful for integrating the soil and plant response to inputs.
- Reflect on end of season experiences to guide your intuition.

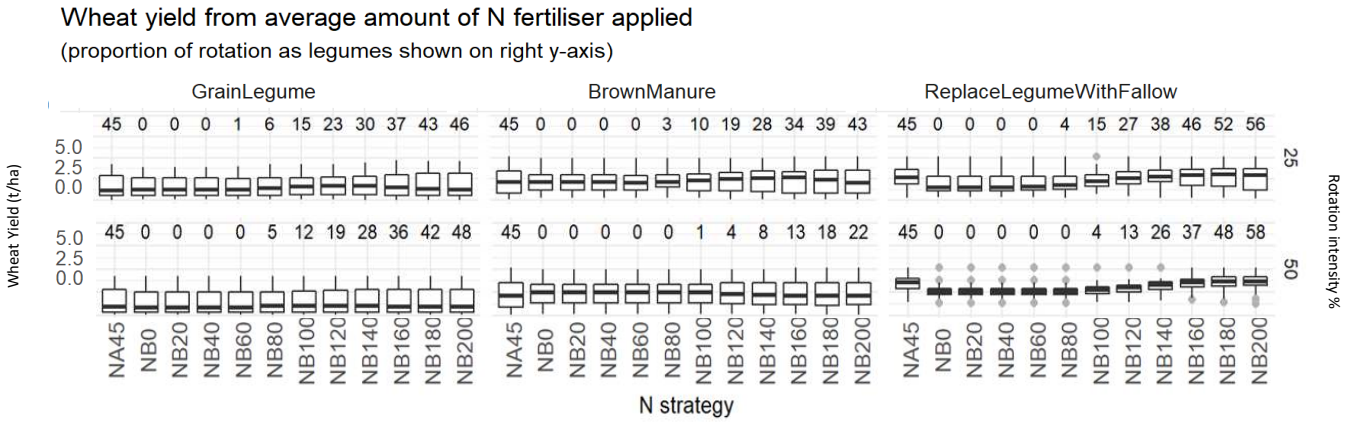
Using legumes and fertiliser N for N banking

Flohr, Meier, Hunt, McBeath, Llewellyn (in prep)

- An emerging approach to determining the amount of nitrogen to supply to crops has been coined the “N Bank” strategy (Smith et al., 2019; Meier et al. 2021)
- The approach aims to maintain a level of N in the soil that will not limit cereal production (Meier et al. 2021)
- Low rainfall environments will likely require a mix of legume and fertiliser to match N bank requirements (e.g. soil type, economics, risk)
- Based on data from our legumes project, we have modelled N contribution of grain and brown manure legumes to the farming system in different soil types and climates.

Loam

Flohr, Meier, Hunt, McBeath, Llewellyn (in prep)



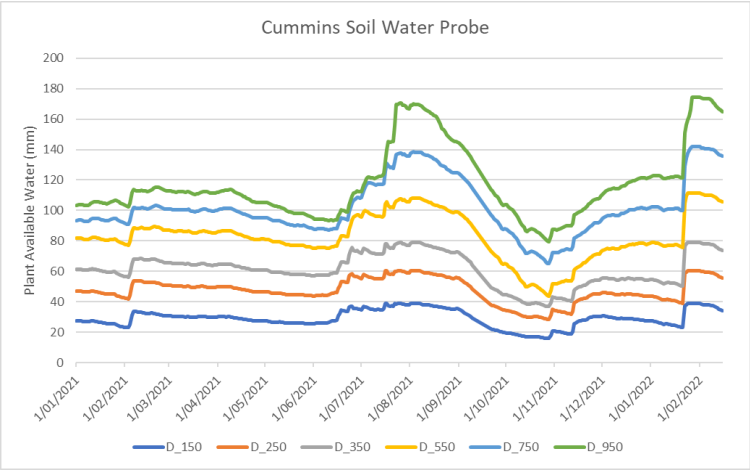
- GSR 234 mm
- 120 kg N/ha optimal for continuous cereal
- Lower N fert applied due to higher mineralisation compared to sand (not shown).
- Grain legumes contribute a mean of 11-18 N kg/ha per year to 120 NB
- Brown manure legume contribute 15-34 N kg/ha per year to 120 NB

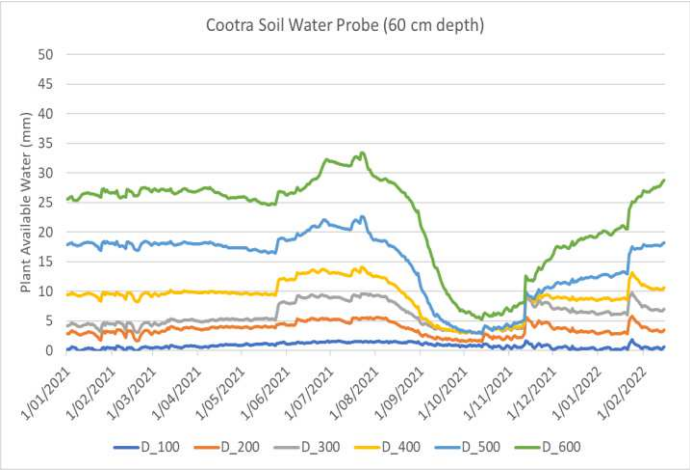
The Season Ahead

- Late Fallow Nitrogen 2021/ 2022

Location	2020 crop	March 21 Nitrogen (kg/ha)	2021 crop	2021 Yield (t/ha)	Feb 22 Nitrogen (kg/ha)
Yeelanna	Wheat	99	Lentil	4.0	76
Lock	Vetch	119	Canola	1.5	85
Minnipa	Wheat	186	Canola	1.1	176
Cootra	Wheat	71	Wheat	3.4	23
Pinkawillinie	Wheat	119	Barley	2.9	16
Wharminda					17

The Season Ahead





Take Home Messages

- LEP has a unique combination of soils and climate.
- Some gaps in our knowledge include our ability to predict N losses and mineralisation.
- Proof-of-concept model for mineralisation predictions for EP.
- Recent improvements in soil water and yield potential predictions.
- In-season N strategies need to be tailored to our knowledge of soils and yield potential.
- We are exploring approaches that combine legume and fertiliser management to better 'bank' nitrogen.
- While soil water is higher this year, starting nitrogen will depend on soil, history and rain events.

Thankyou

To our funders, collaborators in the project team, RIG and landholders

N budgeting-Cootra

	ASSUMPTIONS					OUTPUT						
	Wheat	N	Urea	Carry	Climate	LtAvg	Diff fro	Dec 1 G	Diff fro	BCR	BCR	
	$/t	$/kg	$/t	over		P Bdgt	standar	P Budg	standar	$/$	%>1	%>2
Original Jul-21	$300	$1.80	$828	0%		$ 192		-$ 101		$ 2.32	76%	58%
N=$2.50	$300	**$2.50**	**$1,150**	0%		$ 139	-27%	-$ 154	-$ 53	$ 1.71	68%	46%
N=$3.00	$300	**$3.00**	**$1,380**	0%		$ 102	-47%	-$ 191	-$ 90	$ 1.43	64%	38%
Carryover N 35%	$300	$1.80	$828	**35%**		$ 211	10%	-$ 57	$ 44	$ 2.45	81%	61%
Carryover N 70%	$300	$1.80	$828	**70%**		$ 230	20%	-$ 14	$ 87	$ 2.59	88%	64%
Incr odds wet	$300	$1.80	$828	0%		$ 241	26%	-$ 101	$-	$ 2.66	81%	68%
Incr odds dry	$300	$1.80	$828	0%		$ 130	-32%	-$ 101	$-	$ 1.89	62%	43%

Hayman et al.