



IPNI
INTERNATIONAL
PLANT NUTRITION
INSTITUTE



GRDC™
UPDATES

Nutrition issues – 2017

Variable conditions from 2016 – implications
Where to now with N
Next year for P?

Rob Norton, IPNI Regional Director  @IPNIANZ

Cummins, South Australia, Friday August 11, 2017

With thanks to Bill Long, Mark Stanley, Andy Bates, Mick Faulkner

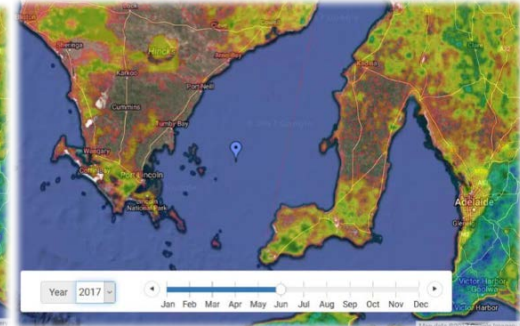
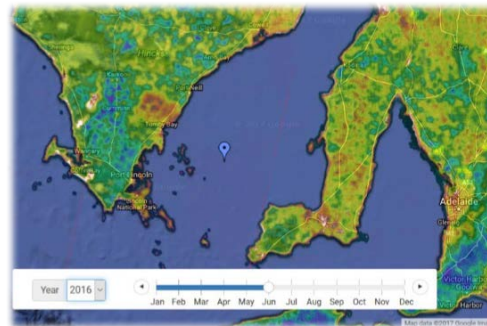
Better Crops, Better Environment ... through Science

Take homes for 2016

- Where yields were good, off-takes of all nutrients were low
 - at least balance P offtake in 2017
- Probably little N in the profile at harvest
 - Summer rains kicked pre-crop mineralisation along
 - Heavy stubbles & likely immobilization of some N
 - N status likely low but test – **more N at seeding?**
- P off-takes significant
 - **replacement if soil tests at or near critical.**
- **2017 is a new year**
 - with a new set of challenges.
 - Remember what happened
 - but don't expect the same.



Zack Zweck @Zweck17 Jul 29



The season...Cummins

- Season = Start and then nothing – then rain to make us feel OK



Q How is the season progressing?

For **Rainfall (mm)**

Starting in **January 2017**

and lasting for **9 months**

A **Below Average**

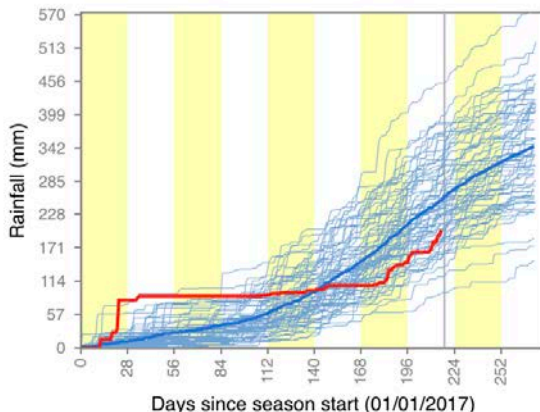


Departure from average on 05 August (for January to September 2017 season) is, **-51mm from Average (-0.7sd)**

Scroll down to view more...



Accumulated rainfall for the January to September 2017 season compared to historical events



Soil Water

71% full (122mm)

A **Chance is "low"**

Probability is 33.7%

This has occurred approximately 3 out of every 10 years during similar ENSO patterns.

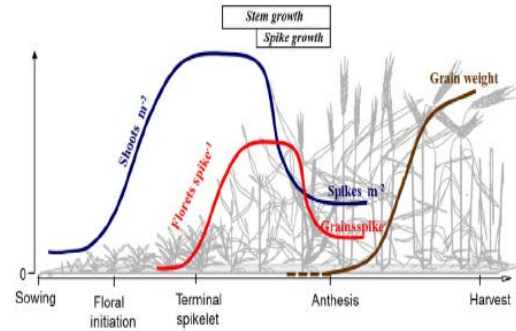


Past skill is "Medium"

Historically, predictions for this season have been "consistent" 61% of the time and "inconsistent" 39% of the time. (LEPS 7%)



Where we are now...late emergence/sown



Establishment
Q1

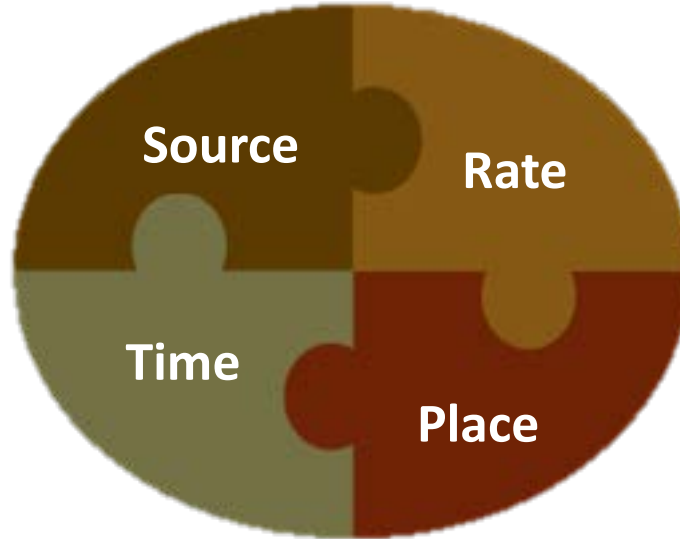
Construction
Q2 & Q3

Grain Fill
Q4

N decisions - *again* – dwell on us.



- 4R nutrient stewardship – select the RIGHT source, apply it at the RIGHT rate, at the RIGHT time and in the RIGHT place.

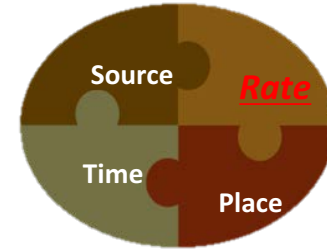


- Every year the RIGHT's change – tactical N management



What to know to get an N rate?

- Known Knowns - *maybe*
 - What N is there & is it accessible
 - Soil test / Soil guess (root depth).
 - Rough yield estimate.
- Known Unknowns
 - Soil mineralisation in-crop.
 - Losses of soil & applied N.
 - How much supplied ends up in the grain.
 - Improved yield estimate as season unfolds.
- Unknowns
 - Frost, bugs, late heat.



What do you know?

Cut for hay - loose 140 kg N; Harvest for grain – 100 kg N

Residue from a 5 t crop

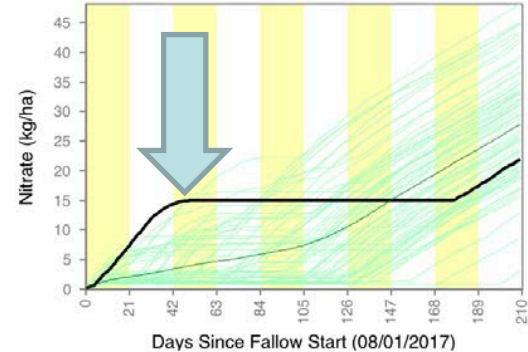
- Burn - Loose 30 kg N/ha
- Bale - Loose 40 kg N/ha
- Mulch - Loose 30 kg N/ha (immobilisation)

• Known Knowns – should be known

– What N is there & is it accessible

- Soil test / Soil guess (root depth).
- 10-15 kg N @seeding
- N from legume residues to the next cereal crop: 25-35%
- N from cereal residues to the next cereal crop:

Relative fallow nitrate-N accumulation from January to August 2017 (up until 3 days ago)



Location	Treatment	N in Stubb (kg N/ha)	(% stubble N)
Karoonda	Surface	12	2.1
	Incorp		3.1
Temora	Surface	55	8.7
	Incorp		15.4
Horsham	Surface	32	4.4
	Incorp		5.0

Gupta, McBeath, Richardson, Kirkegaard, Sanderman (CSIRO unpublished)

– Frost, bugs, late heat.

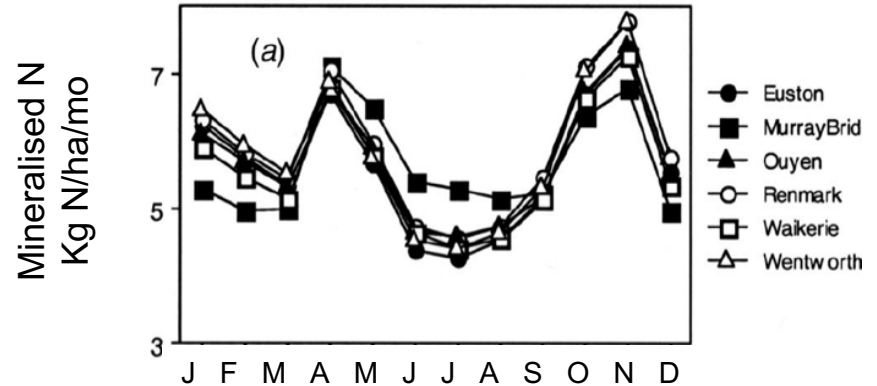


Sources of N

- In-crop mineralisation
 - At seeding – 15 kg N/ha
 - To date ~ 10 kg N
 - Maybe 25 kg N to come
 - Spring dependent
 - OC% dependent

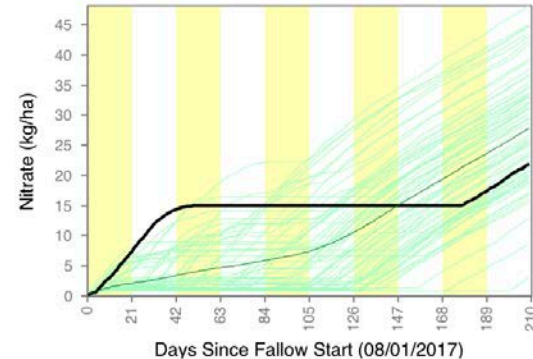
- Overall "native" N supply
 - 50 kg N/ha
 - **Enough for 1.3 t/ha wheat, 0.6 t/ha canola**
- Loss processes operating?
 - Leaching & denitrification & immobilization

Total N ~ 60 kg N/ha
 Winter ~ 0.1 kg N/ha/d
 Autumn/Spring ~ 0.2 kg N/ha/d



Sadras & Baldock, 2003 AJAR 54, 353-361

Relative fallow nitrate-N accumulation from January to August 2017 (up until 3 days ago)

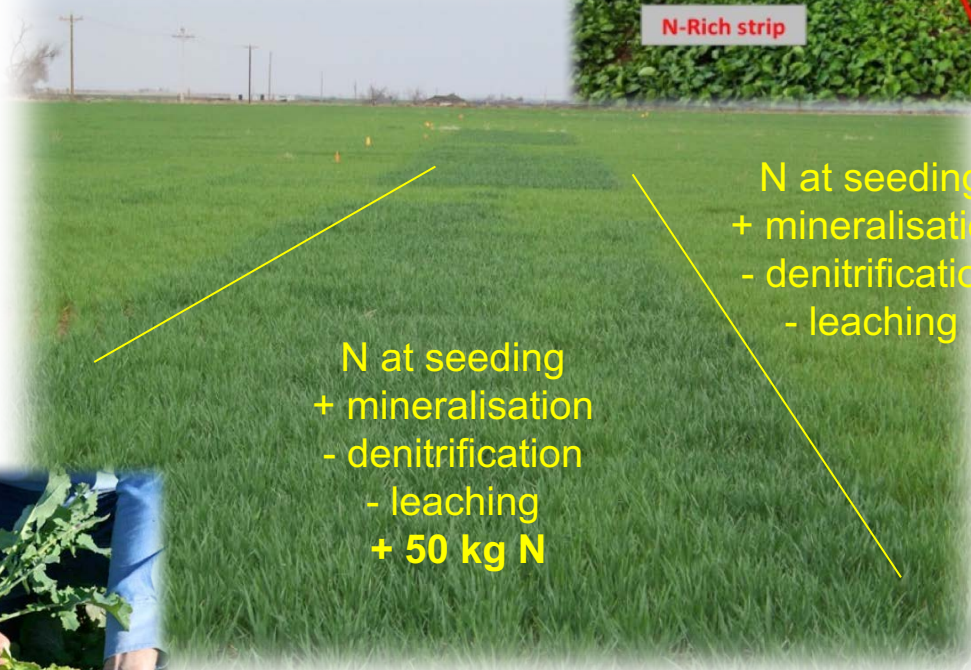


N-Rich strips



“The strips give me the confidence ‘Not to apply N’ when the crop is N sufficient. This has saved me a lot of \$\$\$ over the years.”

– Mark Branson, grain grower, South Australia.



- Potential response to 50 kg N extra
- May not want to *realise* this potential.

What do you know?

- Known Knowns – should be known
 - Mineral N supply 50 kg N/ha
 - Yield Potential = demand



Yield prophet, WUE, paddock history, bunions

Wheat N demand =

Yield * 20 / **Efficiency**

3 * 20 / 0.50

= 120 kg N/ha

Reasonable water under the crop,

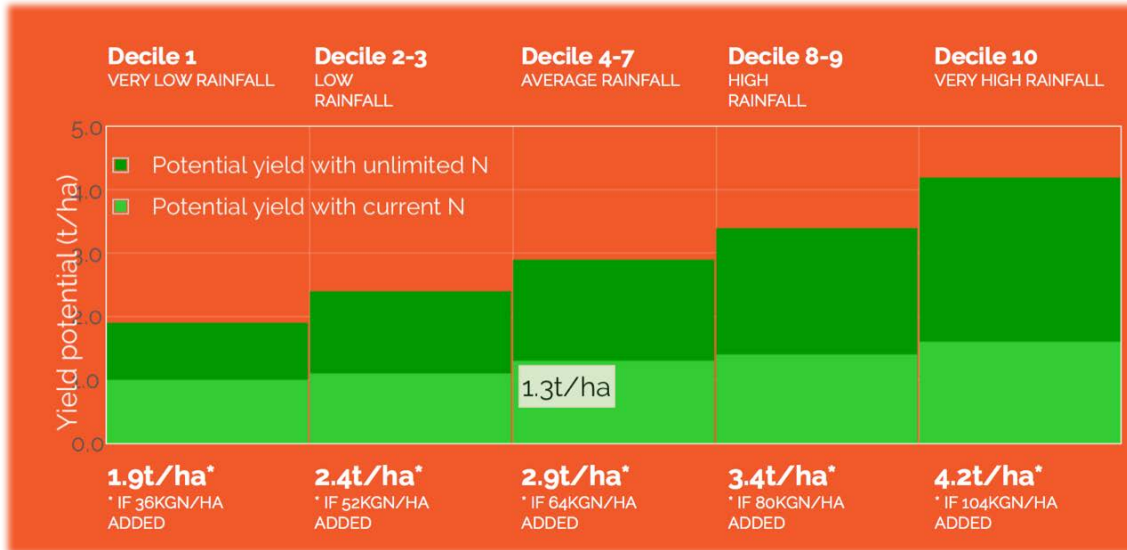
A Chance is "low"

Probability is 33.7%
This has occurred approximately 3 out of every 10 years during similar ENSO patterns.



Past skill is "Medium"

Historically, predictions for this season have been "consistent" 61% of the time and "inconsistent" 39% of the time. (LEPS 7%)



15 kg N ; 30 mm ASW ; 1% OC



So – do you really need any additional N?



A realistic yield estimate is critical to the path forward



N decisions - *again* – dwell on us.

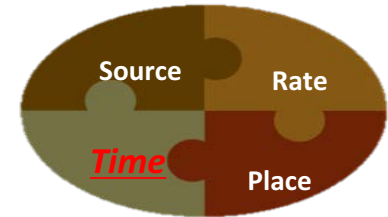
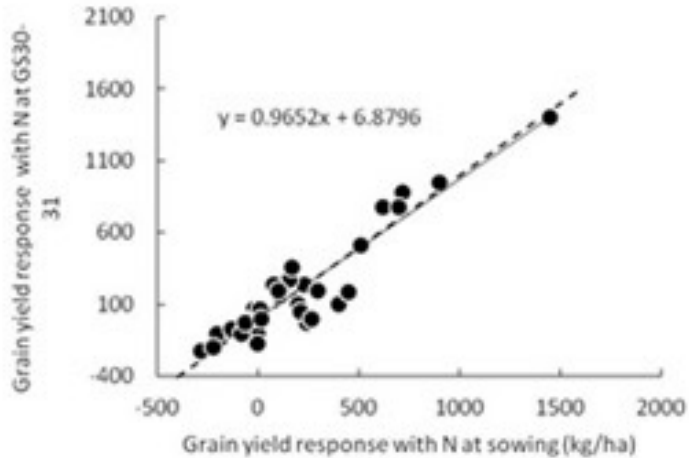


- 4R nutrient stewardship – select the RIGHT source, apply it at the RIGHT rate, at the RIGHT time and in the RIGHT place.



- **How late is too late? Crop + Weather + Budget**

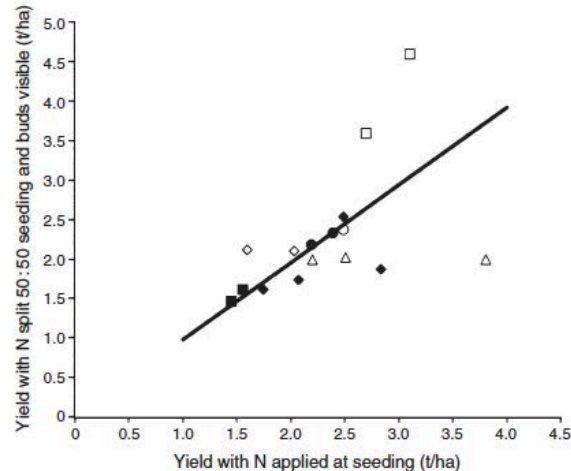
Penalty to delaying N?



Loss processes operating
Leaching
Denitrification

Late rains

Opportunities



How wide is the application “window”



ACKLEG CONTROL

6TH LEAF

Method & timing of N application	No. of trials	% increase v's control		% fert N recovery in grain
		yield	Protein	
mid row banded at sowing	12	13.3	5.5	29.9
Broadcast & incorporated by sowing	7	12.8	3.8	26.8
Topdress at 5-leaf stage	4	18.8	6.2	45.5
Topdress at fully tillered stage	7	18.5	7.2	44.4
Topdress at boot stage	12	14.6	10.8	47.2
Topdress at mid flowering	12	5.5	12.4	34.1

*sites include: Dookie 2000 - 2002, Gnarwarre 2000 - 2002, Naracoorte 2000, Clare 2000 - 2001, Woorndoo 2000, Glenthompson 2001, Lake Bolac 2002.

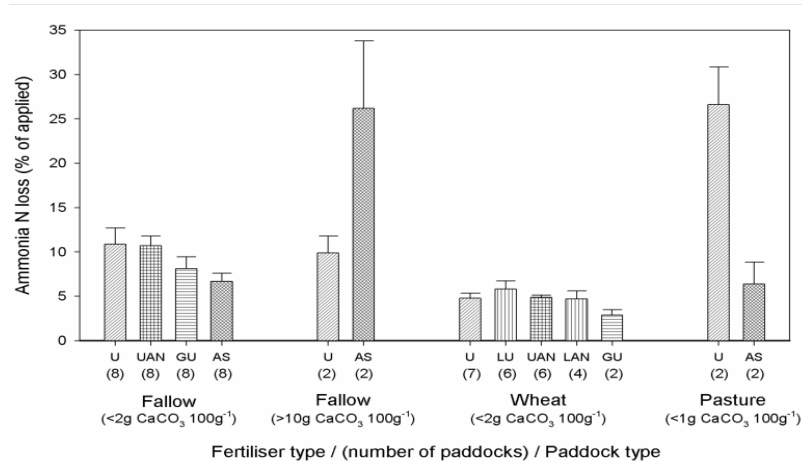
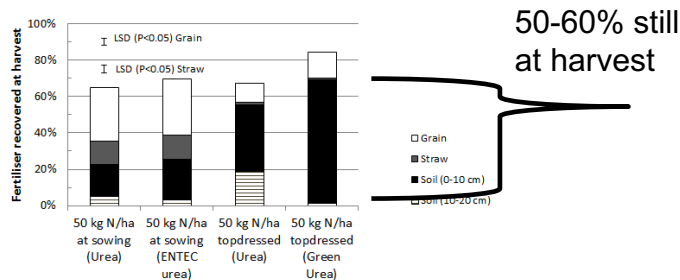
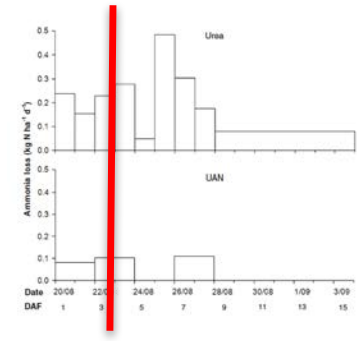
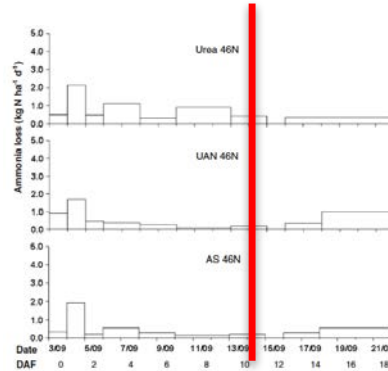


EARLY FLOWER

Timing relative to rain & situation

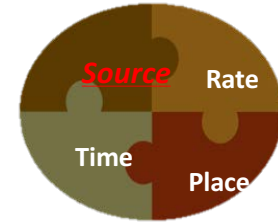
Turner et al. 2012 (Nutrient Cycling in Agroecosystems, 93, 113-126)

- Wimmera
 - Rain 9 DAF
 - 23% N loss from urea
 - 12% N loss from UAN
 - 12% N loss from AS
- Mallee
 - Rain 2 DAF
 - 6% N loss from urea
 - 3% N loss from UAN



Ash Wallace & Roger Armstrong; Horsham, 2014 – a dry year – 1.5 – 2.2 t/ha

N source – foliar, soil or what??



- N is taken up through the leaves
- Limited by either urea toxicity, salt burn or leaf area.

Treatment	Plant N 4 DAA (kg/ha)	Plant N 10 DAA (kg/ha)	Total Plant N at Anthesis (kg/ha)	Yield (t/ha)	Protein (%)
UAN streaming nozzles	23	30	30	1.54	9.6
Urea top dressed	19	26	30	1.69	8.5
UAN inter-row only	19	25	27	1.50	8.7
UAN standard nozzles	22	25	24	1.51	8.6
Liquid Urea	20	31	17	1.26	8.9
<i>LSD (P=0.05)</i>	<i>NS</i>	<i>NS</i>	<i>8.4</i>	<i>NS</i>	<i>0.11</i>

- The amount taken up through leaves is probably 10-15 kg N/ha
- Timing is important
- Worst effect if flag leaf is damaged
- Rest is taken up through roots.

Selection of source maybe more on logistics than just efficiency.

- Ease of handling ; Quantities applied ; Product quality ; Application ; Storage

N is – *again* – the big ticket item.



- 4R nutrient stewardship – select the RIGHT source, apply it at the RIGHT rate, at the RIGHT time and in the RIGHT place.

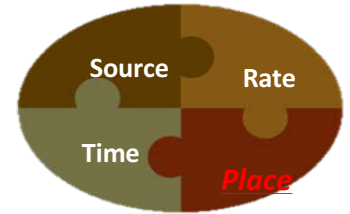
- **Foliar & soil – interaction with source.**
 - **In-crop mid-row banding**



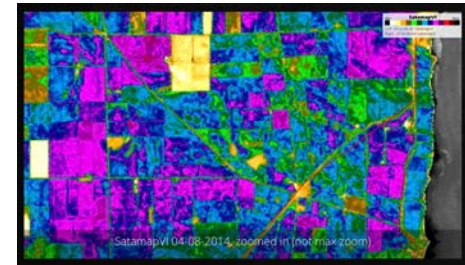
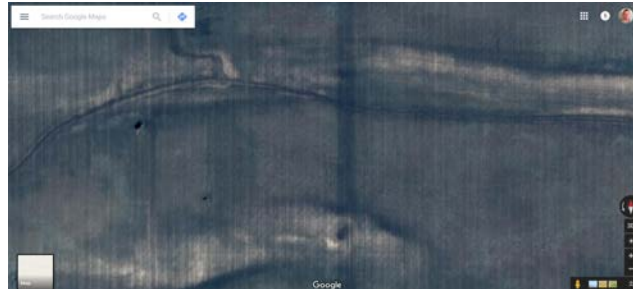


Split germinations and emergence

<http://anz.ipni.net/article/ANZ-3301>



- Rule #1 What is the realistic yield potential
- The need for fertilizer N depends on the yield potential – and a 1.5 t/ha wheat crop only requires around 60 kg N/ha.
- May be opportunity to spread on patches – but #1 still applies.
- Protect that yield potential and timing of herbicide application also becomes difficult. Deal with N nutrition first though – as N deficient weeds are harder to kill.
- Time herbicide applications to the most common stage, and slightly earlier is probably better than too late. Grass weed escapes, residual herbicides, and #1.



Application



Mixing compatibility
with fluids



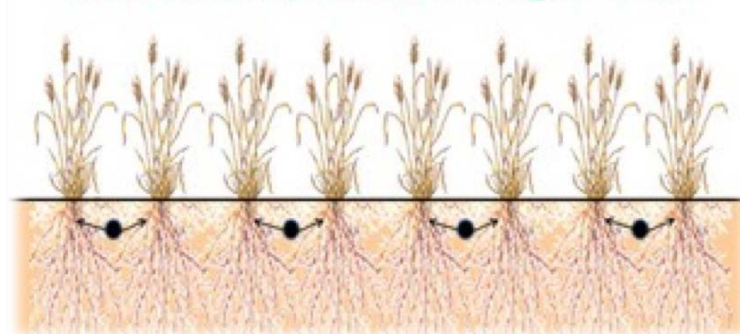
Mid-row banding urea in-season 2016



Ash Wallace, DEDJTR, Hsm

- Comparing:
 - Banding above and below surface
 - Streaming nozzles
 - Conventional nozzles
 - Topdressed granular

Mid-row skip-row banding of Urea

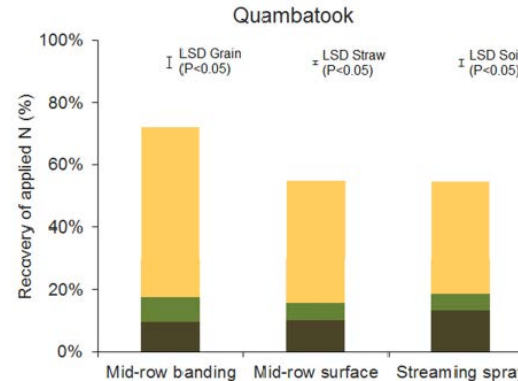


Mid-row banding urea in-season 2016

- Protein response to MRB at Quambatook
- Yield (+0.5 t/ha) response at Longerenong
- Responses varied with site, time of application and follow-up conditions.
 - 'Why?' is the key
- Higher plant uptake from mid-row banding (15N studies)
 - 60-75% of fertiliser 'taken up' vs. 40-65%
- Already commercial in Canada (corn) and some local growers

Quambatook
(50 kg N/ha only)

Application method	Yield (t/ha)	Protein (%)
Mid-row banded	4.08	7.8 ^a
Mid-row surface	3.75	7.5 ^{ab}
Broadcast granular	3.68	7.7 ^a
Streaming spray	3.84	7.3 ^b



N Decisions

Yes / No / Wait
Sorry?

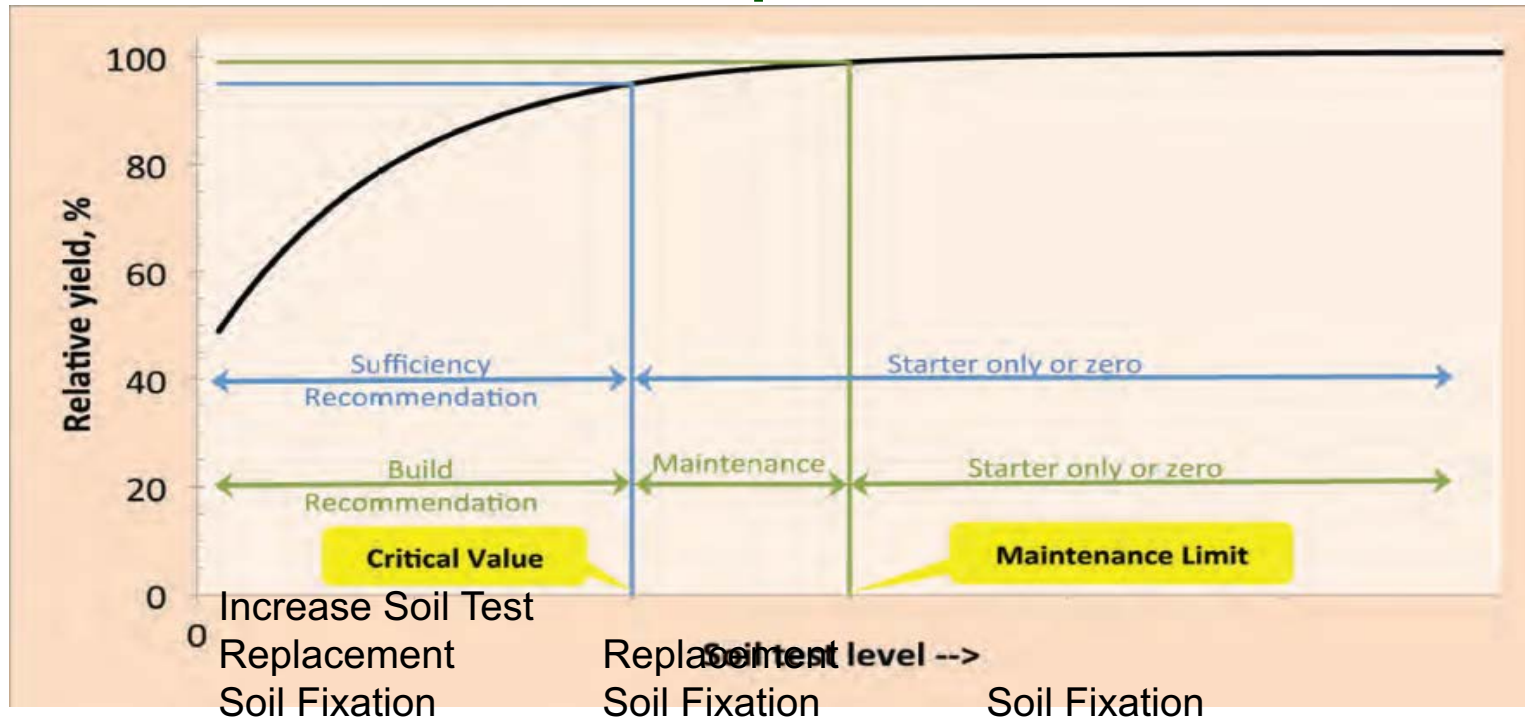


Criteria for making N decisions

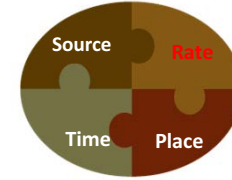
- Is N short?
- Can you get it / afford it?
- Timing – crop
- Timing – weather
- Seasonal forecast.

P Management for 2018

.....in response to soil test value.



Supplying enough P



- How much is replacement?
 - measure or estimate = Yield * Concentration
- How much is the fixation?
 - PBI gives an estimate
 - <150 probably only a kg P or so
- How much does it take to build the soil test?
 - Colwell rises by 0.1 to 0.4 units for each kg P in excess of removal

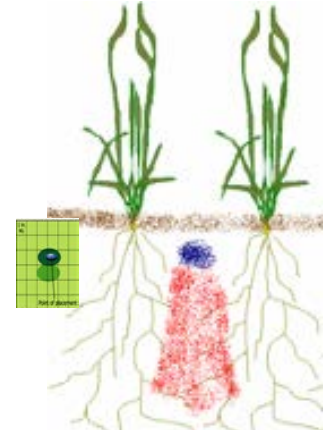
Crop	kg P/t
Wheat	3.5
Canola	5.1
Chickpea	3.2
Oat Hay	1.6

Why put any on after if soil test values > critical?


- Importance of “fresh P”
 - positional effect of having P adjacent to developing plants.

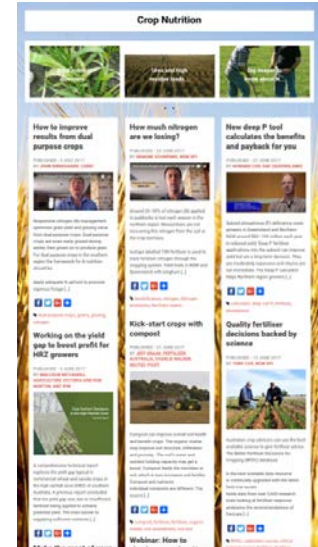
P Applied in 2006	P Applied in 2007			
	0	5	10	20
0	2.25	-	-	2.72
10	2.42	2.77	2.67	-
20	2.74	-	2.78	2.88
<i>LSD (p<0.05) = 0.25</i>				

- Even with high soil test values
 - +0.15 to +0.25 t/ha over all soil test values
- Minimum of 3-5 kg P/ha
 - to supply 2 kg P/ha @ 25 cm rows
 - granules 8-12 cm apart



Summary points

- Set N supply to meet **yield potential** – make water and radiation the limiting factor – not nutrition.
- Silk purses cannot be made from sow's ears.
- Rate is more important than timing and source.
 - Even application is as important as rate
- If you are on-par at halftime - keep an eye on S, Cu and Zn. Tissue tests good and problem areas.
- Replacement P plus PBI
- Keep in contact – Twitter  @IPNIANZ
 - <http://extensionaus.com.au/crop-nutrition/>



Thanks for your attention.....

<http://anz.ipni.net>



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