IPNI
INTERNATIONAL
PLANT NUTRITION
INSTITUTE

GRDC
UPDATES

Nutrition issues – 2017

Variable conditions from 2016 – implications
Split germinations & uncertain yield potentials
N decisions from here on in.

Rob Norton, IPNI Regional Director @IPNIANZ

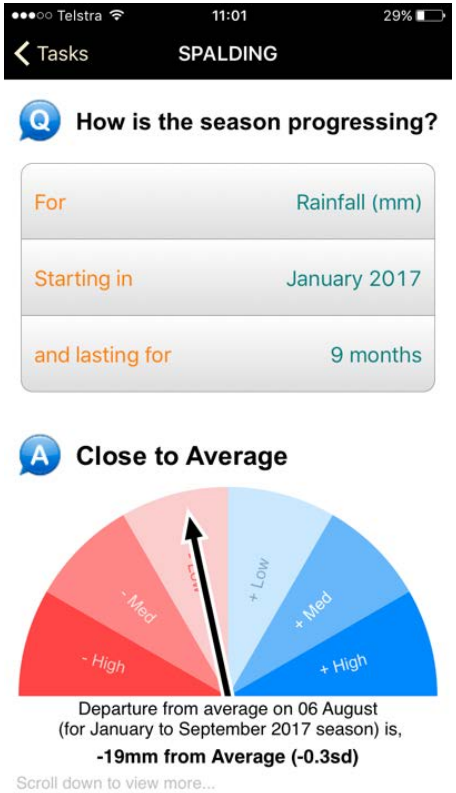
Spalding, South Australia, Wednesday August 09, 2017

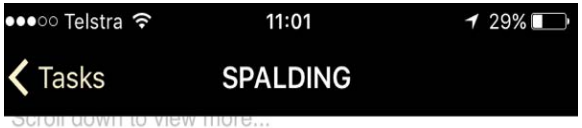
With thanks to Damien Sommerville

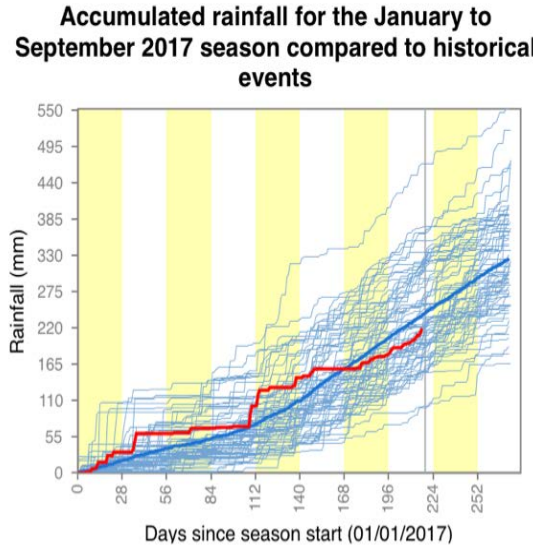
Better Crops, Better Environment … through Science

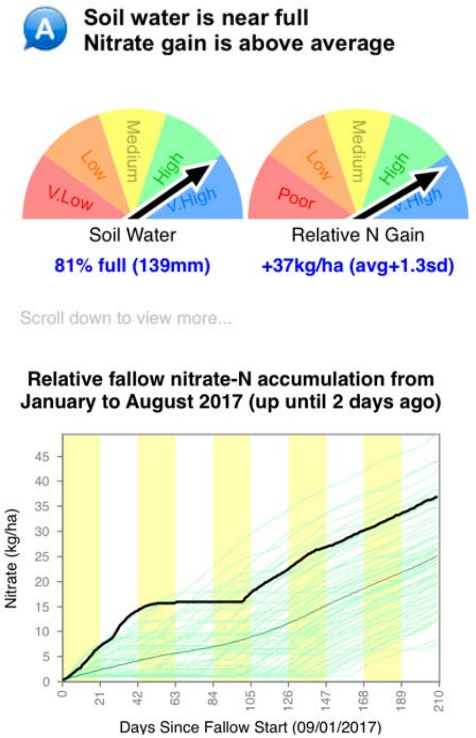
The season….Spalding

- Season = slower start but making up ground – N variable.





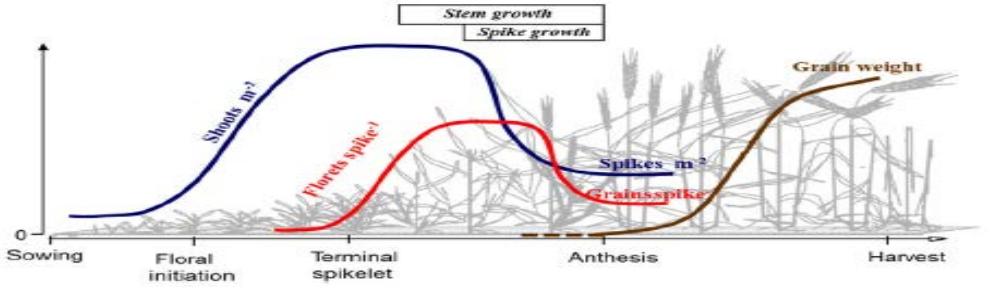


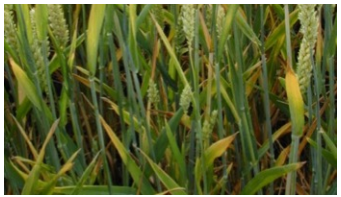


Where we are now…

& what to worry about

- N, P, K, S, Ca, Mg, B, *Zn*, Mn, Cu, Mo
  X x x x * * * *
- Mobile nutrients – N, S, B profile distribution
- Immobile nutrients – offtake and soil test

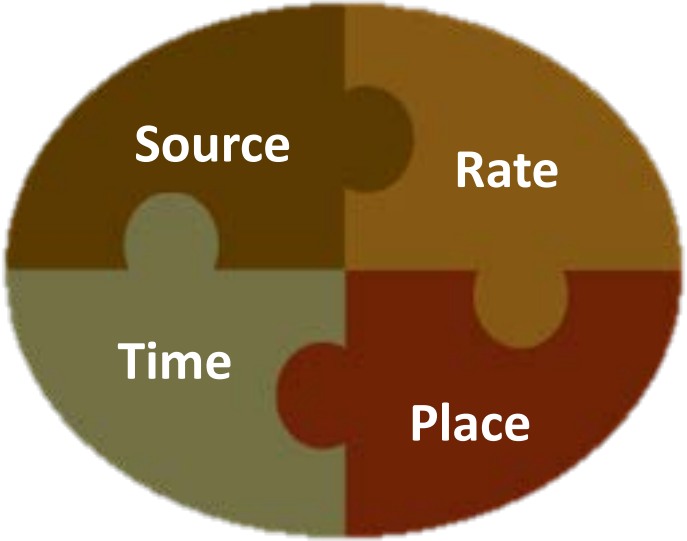




Establishment	Construction	Grain Fill
Q1	Q2 & Q3	Q4

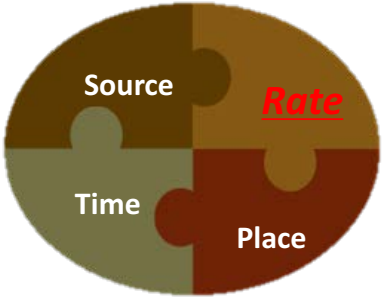
N is – *again* – the big ticket item.

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



- 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.

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What do you know?

- Known Knowns – should be known
  - What N is there & is it accessible
    - Soil test / Soil guess (root depth).

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)

- N from legume residues to the next cereal crop: 25-35%
- N from cereal residues to the next cereal crop:

Location	Treatment	N in Stubble (kg N/ha)	N in next crop (% 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)

Hart Field Site – 50 kg N/ha

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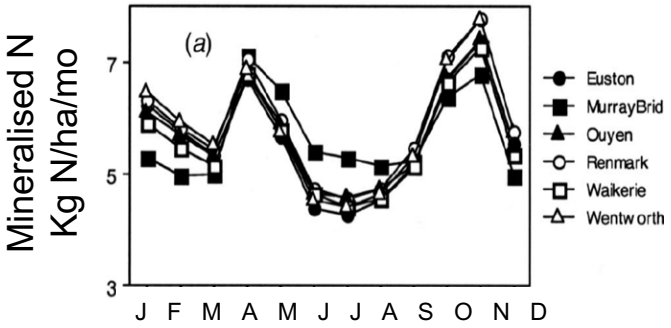
Sources of N

- In-crop mineralisation
  - Now (nil) 37 kg N to date
  - Maybe 25 kg N to come
    - Spring dependent
    - OC% dependent
- Overall ”native” N supply
  - 50 kg N/ha
  - Enough for 1.2 t/ha wheat, 0.6 t/ha canola
- To reach 4.5 t/ha
  - **Meet the deficit of 110 kg N/ha**
  - *Losses along the way?*

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

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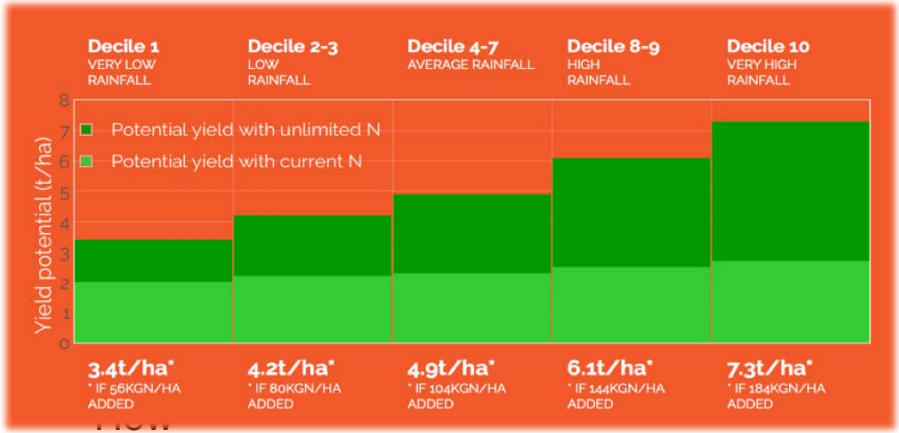
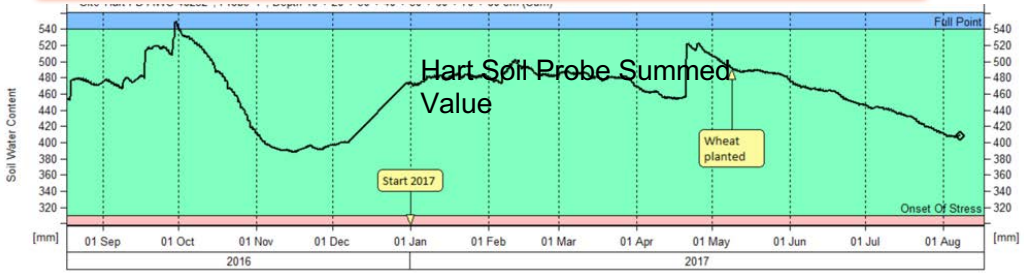
What do you know?

- Known Knowns – should be known
  - Yield estimate (YPL – 4.5 t/ha)





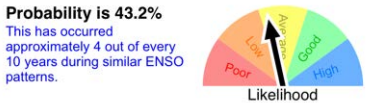
Yield prophet, WUE, paddock history, bunions

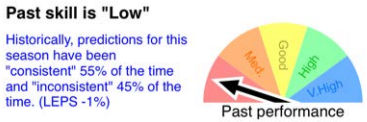
Wheat N demand =
Yield * 20 / ***Efficiency***

4.5 * 20 / 0.50

= 180 kg N/ha

Reasonable water under the crop,





50 kg N
30 mm ASW
1% OC

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."

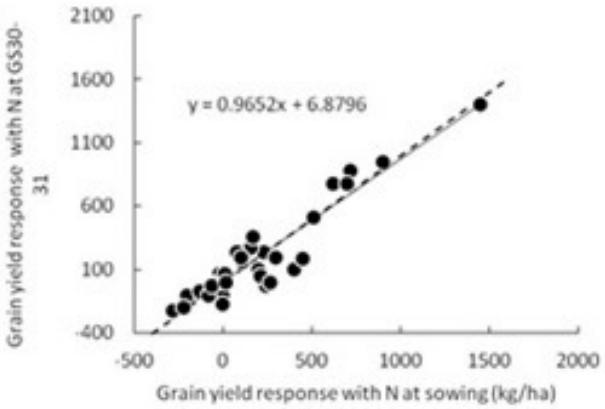
– Mark Branson, grain grower, South Australia.

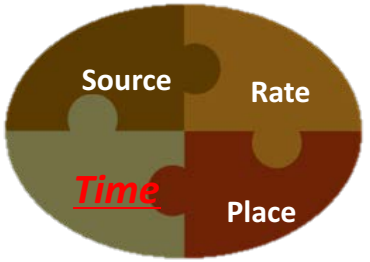
N at seeding
+ mineralisation
- denitrification
- leaching
+ 50 kg N

N at seeding
+ mineralisation
- denitrification
- leaching

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

Penalty to delaying N?

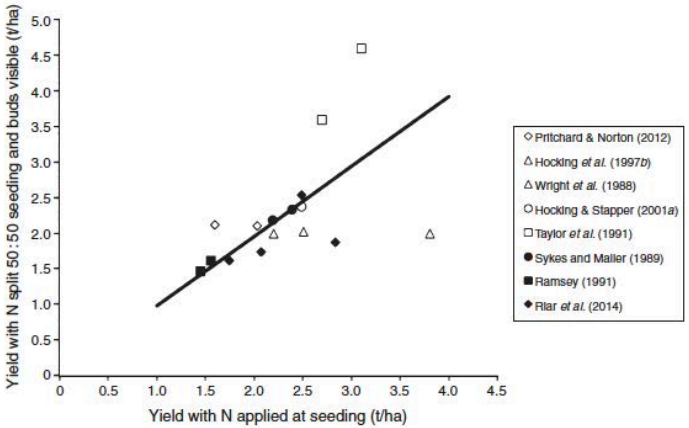




Loss processes operating
- Leaching
- Denitrification

Late rains

Opportunities



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Timing relative to growth stage

……Recovery of 50 kg N in grain & protein

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 N = Yield – window is from DC32 to DC39

Late N = Protein – window is DC55 but before DC70

Incitec Pivot Ltd, University of Melbourne, GRDC

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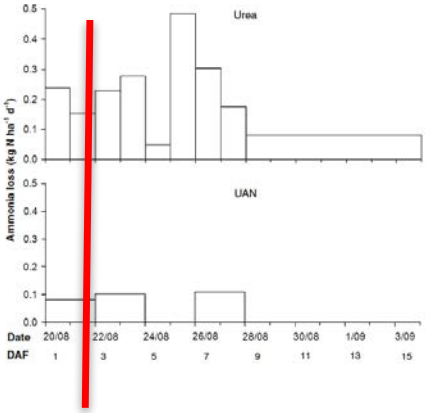
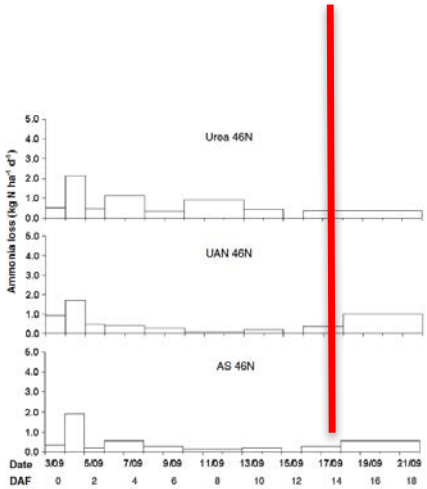
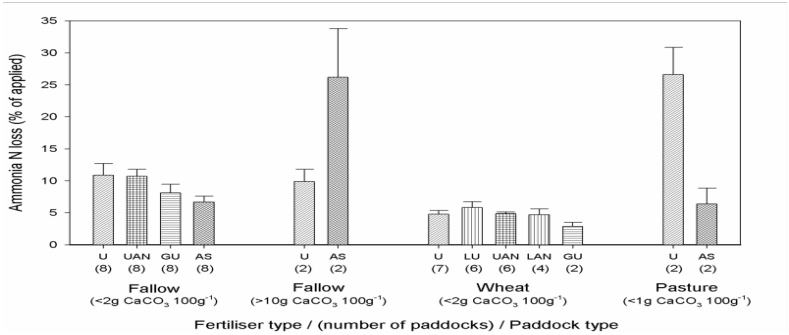
Timing relative to rain & situation

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

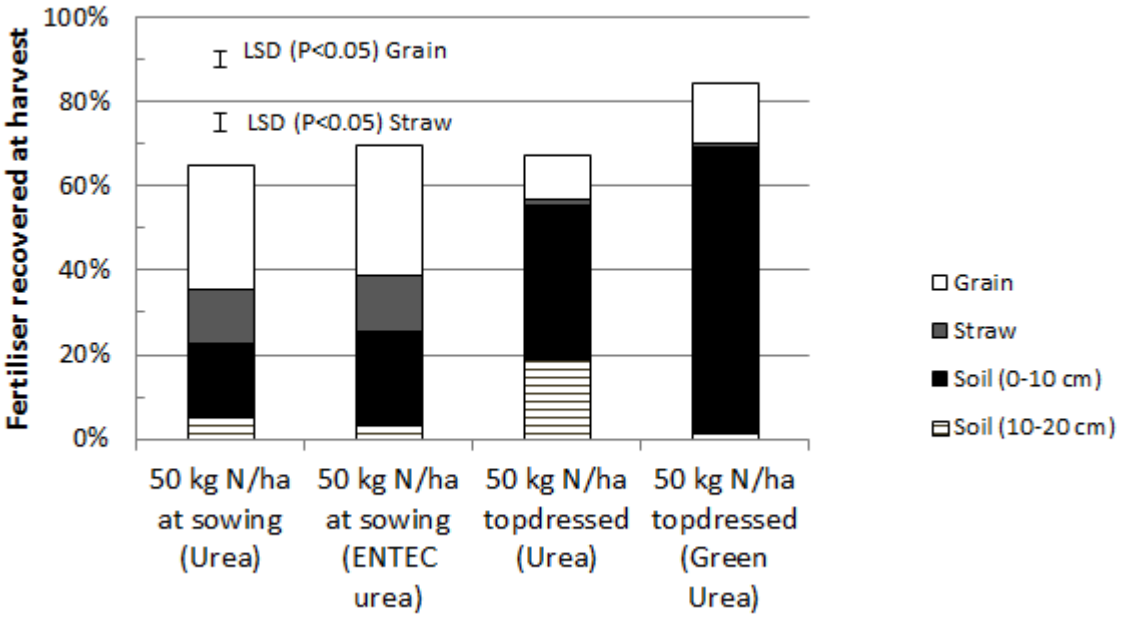
- Wimmera
  - *Rain 9 DAF*
  - 23% N loss from urea
  - 12% N loss from UAN
  - 12% N loss from AS
  - *Rain 1 DAF*
  - 13% N loss from urea
  - 3% N loss from AS







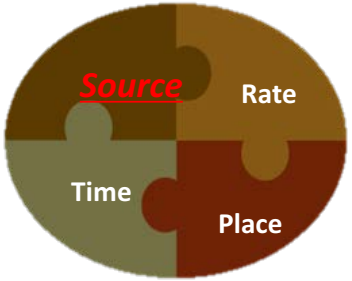
What happens to the N if it does not rain?



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

Losses in wetter years?

N source – foliar, soil or what??



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

- 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.

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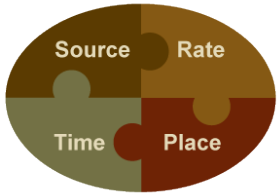
Source Comparisons



- Little agronomic difference between fluid/granular

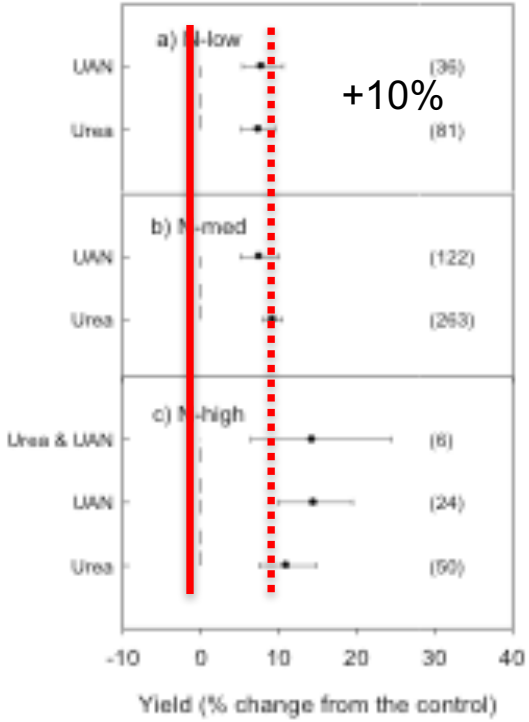
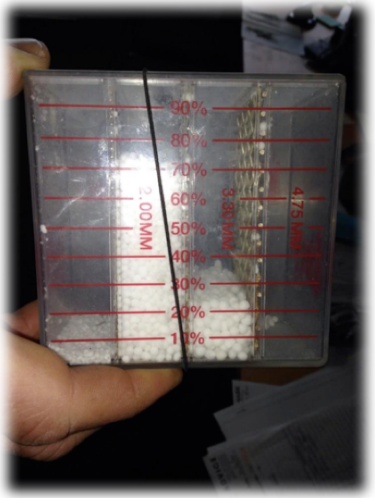


Fig. 1: The effect of different N sources (urea or UAN) on grain yield (a) and N uptake (b).

Selection of source maybe more on logistics than just efficiency.

- Ease of handling
- Quantities applied
- Product quality
- Application
- Carryover



S Cameron, Twitter

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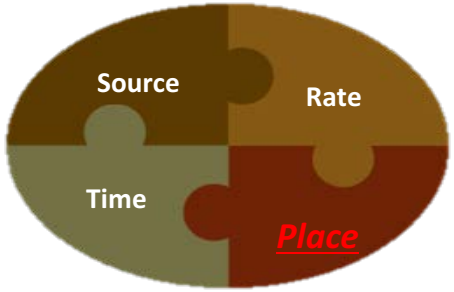
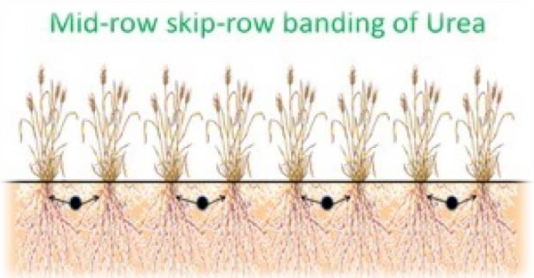
N is – *again* – the big ticket item.

- 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**

Mid-row banding urea in-season 2016





Ash Wallace, DEDJTR, Hsm

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

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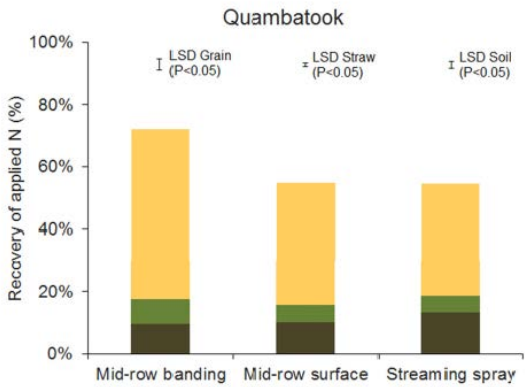
Mid-row banding urea in-season 2016

- 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]



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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.

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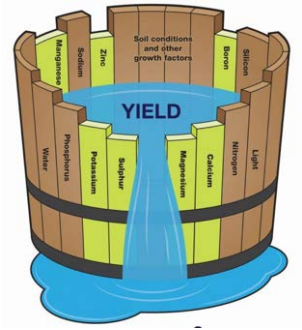
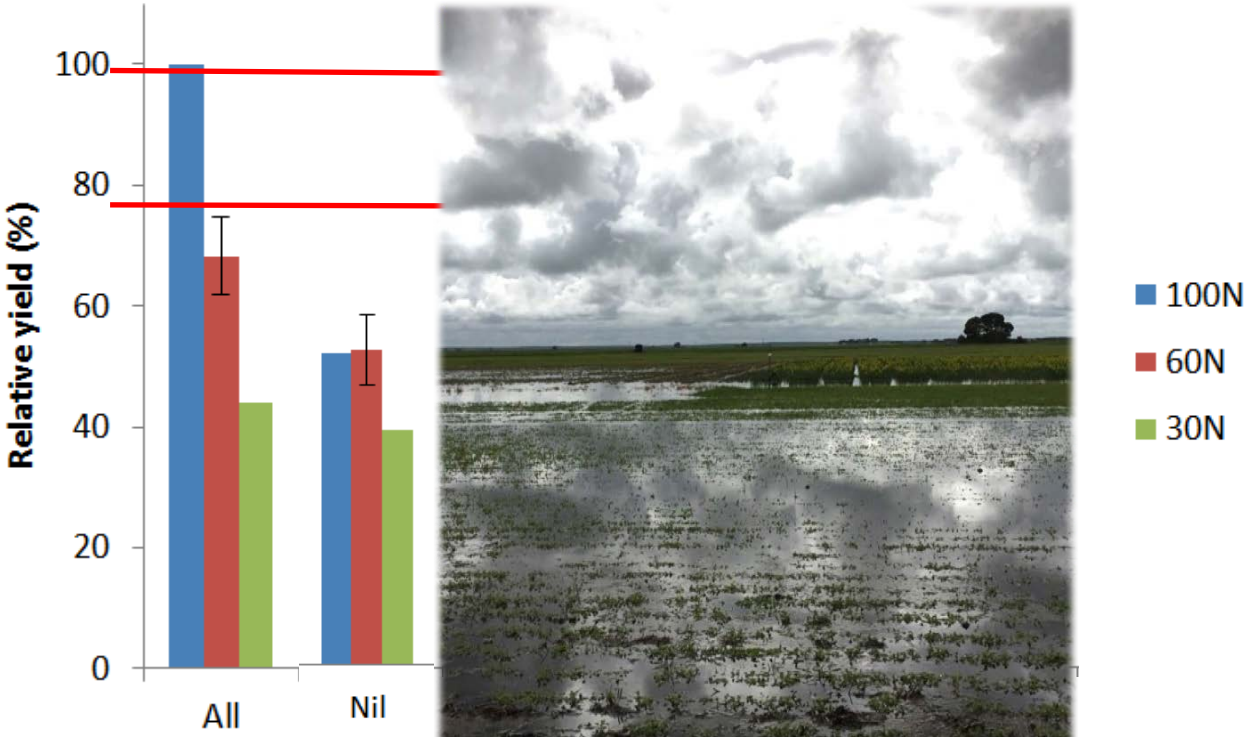
It’s not all about N … Balance Nutrition

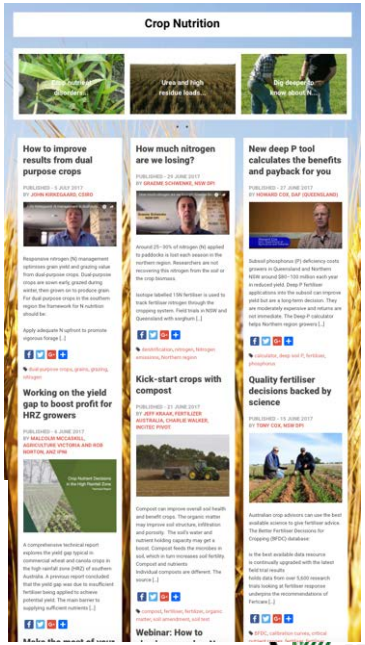
- Bool Lagoon
- Canola 2016
- 3.4 t/ha
- GRDC DAV00141
- Penny Riffkin, Amanda Pearce Malcom McCaskill





Summary points

- Silk purses cannot be made from sow's ears.
- N, S, B and maybe K may be deeper into the profile and access to these may be delayed or reduced.
- Set N supply to meet yield potential – make water and radiation the limiting factor – not nutrition
- Still a long way to go though so make N decisions in the light of that yield potential.
- Rate is more important than timing and source.
- It's not all about N – keep an eye on S, Cu and Zn. Tissue tests good and problem areas.
- Keep in contact – Twitter @IPNIANZ
  - http://extensionaus.com.au/crop-nutrition/



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Thanks for your attention……

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BHP Billiton
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International Raw Materials LTD
Kingenta Ecological Engineering Group Co., Ltd.
K+S KALI GmbH
The Mosaic Company
OCP S.A.
PhosAgro
PotashCorp
Shell Sulphur Solutions
Simplot
Sinofert Holdings Limited
Uralchem, JSC
Uralkali
Yara International ASA
Arab Fertilizer Association (AFA)
Associação Nacional para Difusão de Adubos (ANDA)
Fertiliser Association of India (FAI)
Fertilizer Canada
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International Fertilizer Association (IFA)
International Potash Institute (IPI)
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