Bigger bangs for fertiliser bucks:
future directions for crop nutrition research

GRDC UPDATES

GRDC's new investment into nutrition

A unique and unprecedented $14.5 million suite of soils and grain crop nutrition projects for Western Australia. Involving extensive collaboration between industry, government and universities, the new investments were initiated by the GRDC which is the major investor in the research, committing $8.3 million towards the three projects. Co-investments equivalent to $6.2 million have been committed by The University of WA (UWA), the Department of Primary Industry and Regional Development (DPIRD), Commonwealth scientific and research organisation (CSIRO), Murdoch University, CSBP, and Summit Fertilizers.

Projects:

Increasing profit from N, P and K fertiliser inputs into the evolving cropping sequences in the Western Region (Craig Scanlan) (UWA) (5-year project)

Improved sampling methods to better predict nutrient availability and supply for soils in the Western Region (Phil Ward) (CSIRO) (4-year project)

Nutrient re-distribution and availability in ameliorated and cultivated soils in the Western Region (Craig Scanlan) (DPIRD) (4-year project)

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Soil sampling investment

- Modern farming systems can change nutrient distributions
  - No-till, soil amelioration, on-row sowing
- Diverse methods for soil sampling
  - On/off row, depth, samples/paddock

- What is the best way to get value from soil sampling?
  - Consistent sampling methodology

Increasing profit from N, P and K fertiliser inputs into the evolving cropping sequences in the Western Region

Motivation

- ↓ Confidence in soil testing
- ↓ Legume area
- ↓ Confidence in soil N supply
- Earlier sowing
- Changing rainfall

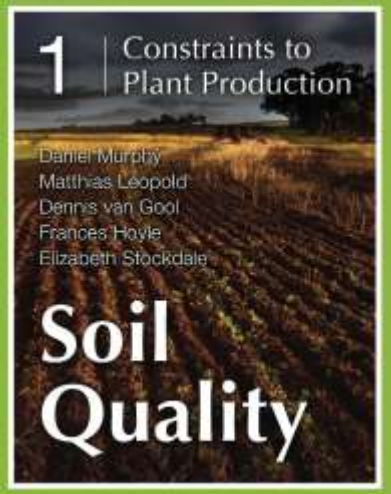
Research focus

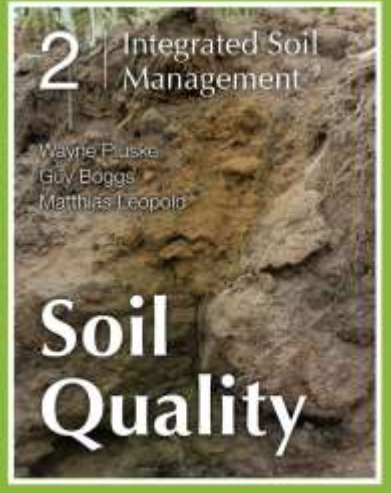
- Nitrogen
  - N mineralisation and immobilisation
  - Impact of changing rainfall on soil N supply to crop
- Phosphorus
  - Impact on yield of repeatedly applying low rates of P
  - Predicting soil P supply (incl. subsoils)
  - Starter P and early growth
- Potassium
  - Methods of soil analysis for K
  - K availability in fine-textured soils
  - Long-term fate of applied K
- Economic
  - Management decisions that have the greatest influence on profit from fertiliser

Outputs

- SYN 2.0
- Economic analysis
- Technical workshops with growers
- Decision support products

GRDC Grains Research & Development Corporation | The University of Western Australia | Department of Primary Industries and Regional Development | Murdoch University | CSBP | Summit Fertilizers | SouthernDirt | EQUII | The University of Adelaide | GRDC Updates





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"A great resource for farmers, agricultural professionals and students, with experts from their fields sharing current knowledge and best practice techniques in layers of information, allowing readers to choose the level of detail they require"

– SoilsWest Director and UWA's Frances Hoyle.

The Soil Quality series is an output of SoilsWest partners from The University of Western Australia, the Department of Primary Industries and Regional Development, Wheatbelt Natural Resource Management, with support from NRM WA and the Grains Research and Development Corporation.

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GRAINS RESEARCH & DEVELOPMENT CORPORATION

Nutrient re-distribution and availability in ameliorated and cultivated soils in the Western Region

Combining different scales of research…

Plot

Strategic tillage and:

- Soil nutrient redistribution
- Root growth
- Soil water

Field trial

- Changes in soil supply due amelioration
- Impact of soil amelioration on yield response to fertilisers

Paddock

- Utilise natural variation in yield response
- Impact of paddock-scale variation vs changes due to tillage on nutrient management

To deliver …

- Soil testing methodology for ameliorated soils
- Prediction of yield response to fertiliser application

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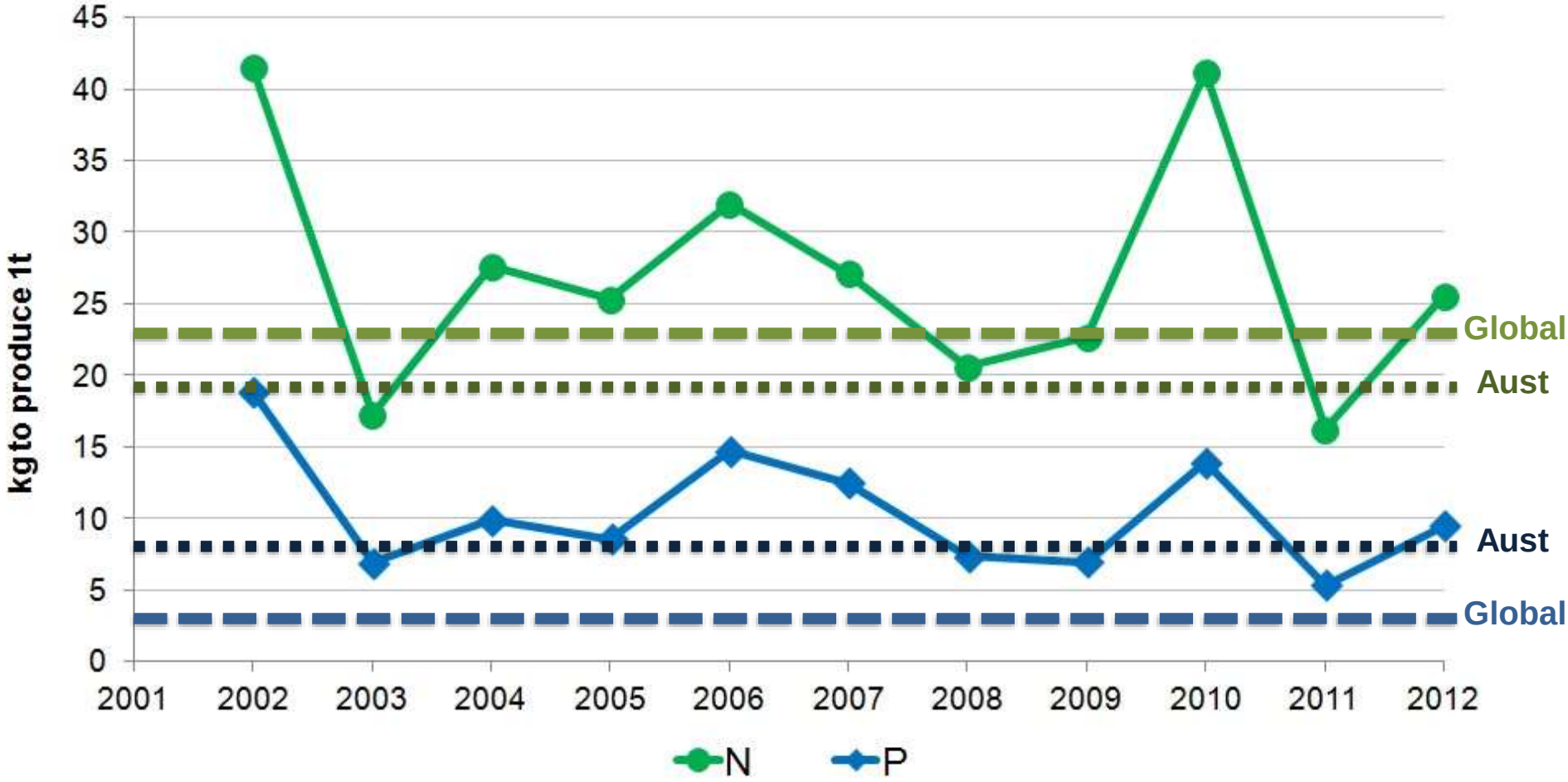
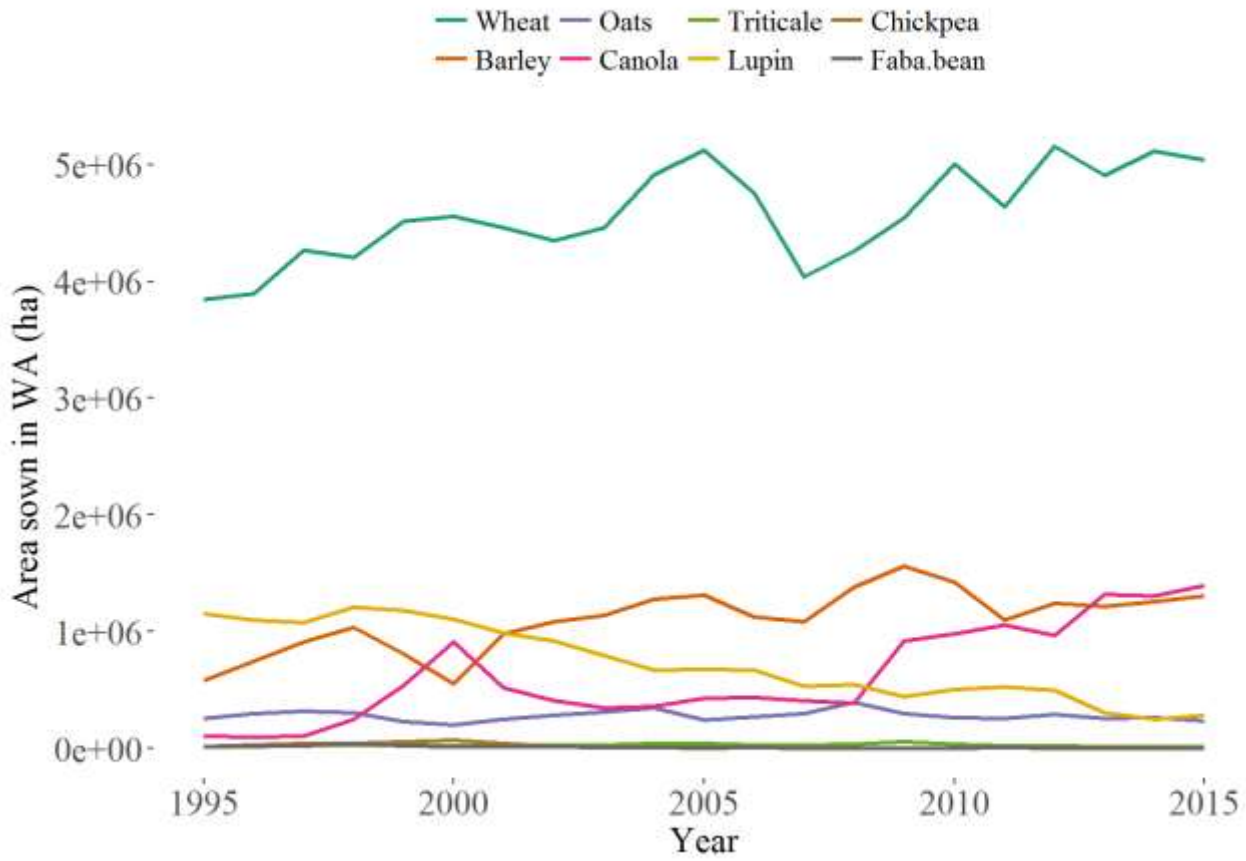
kg to produce 1 tonne



Barley and canola planted area has increased over the last 20 years and lupin has decreased.



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Today’s panel

- Craig Scanlan
- Sean Mason

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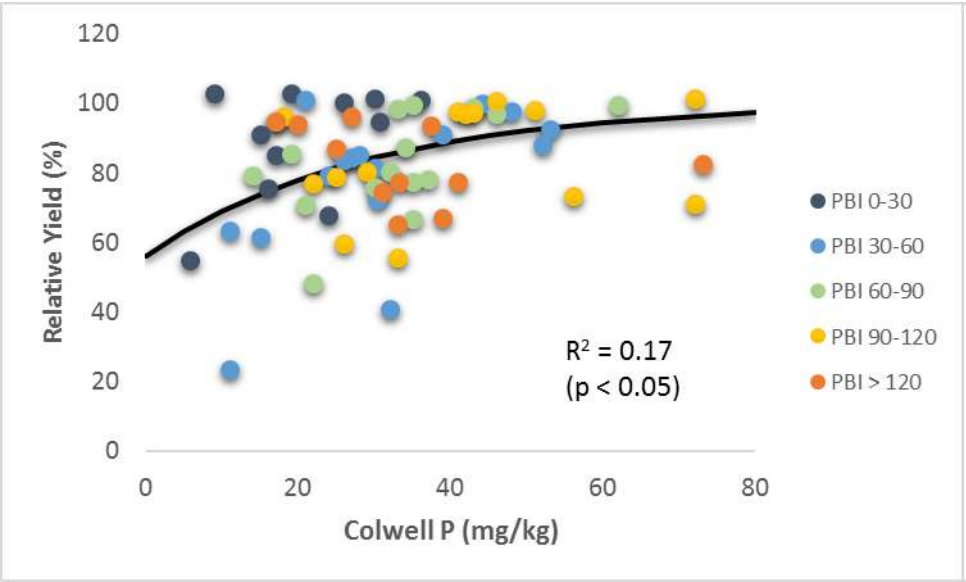
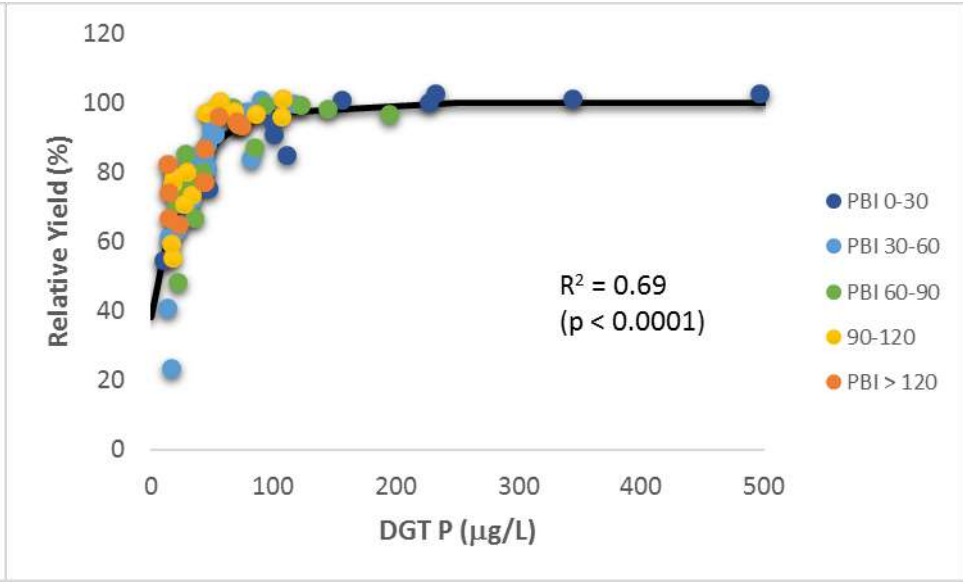
Analyte	Recommended core number	
pH	30 - 40	10 - 20 where site is uniform & lime never applied
K	30 - 40	50 - 60 where fertiliser recently applied
P	30 - 40	50 - 60 where fertiliser recently applied
OC	5 - 10	Higher where organic matter varies

From Soil Analysis: An Interpretation Manual, 1999
Edited by: KI Peverill, LA Sparrow, DJ Reuter

DGT vs Colwell P

> 75 replicated field trials assessing wheat response to applied P across WA, **SA, VIC**, NSW, QLD





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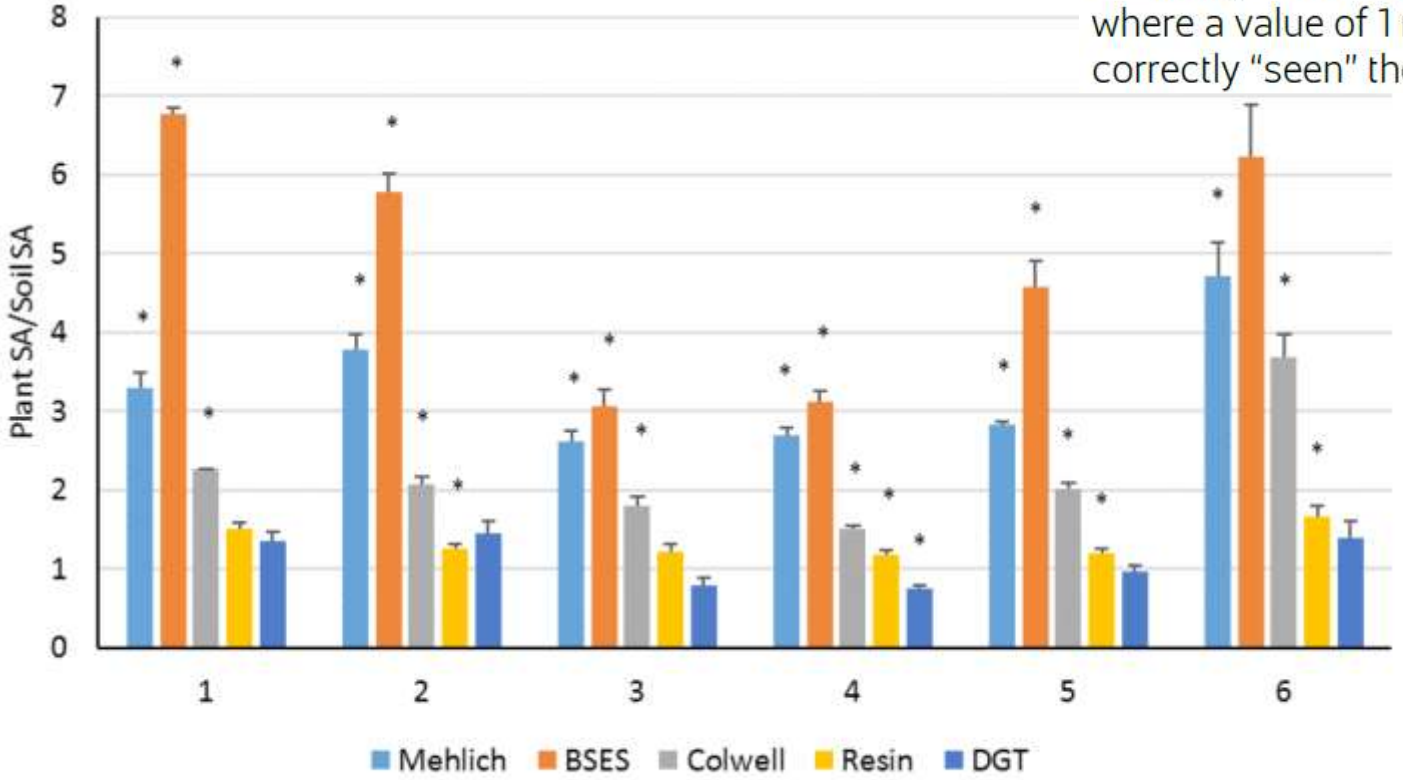
Isotopic dilution - WA

The ratio of plant SA : soil SA gauging the accuracy of the soil test methods where a value of 1 means the soil test has correctly "seen" the same P as plants.



Ratios significantly ($p \leq 0.05$) deviating from 1 are denoted by *

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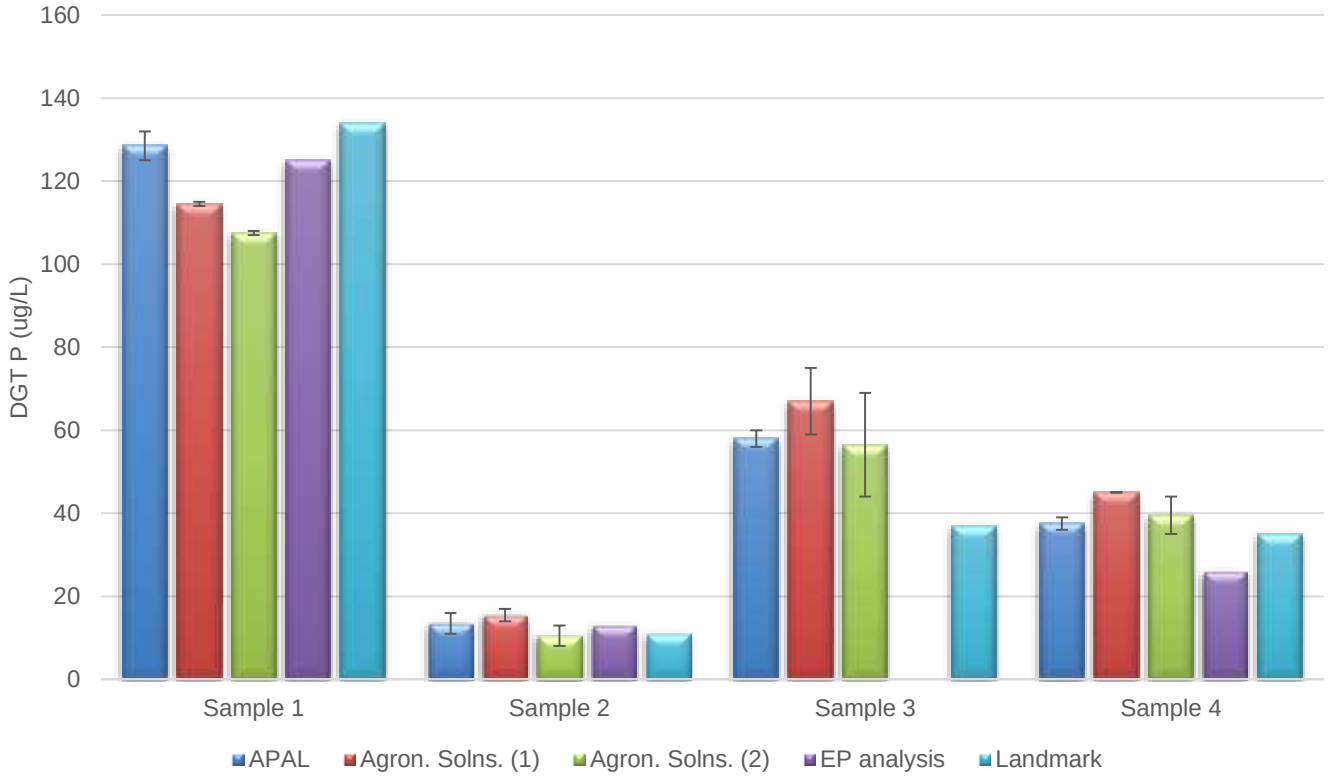
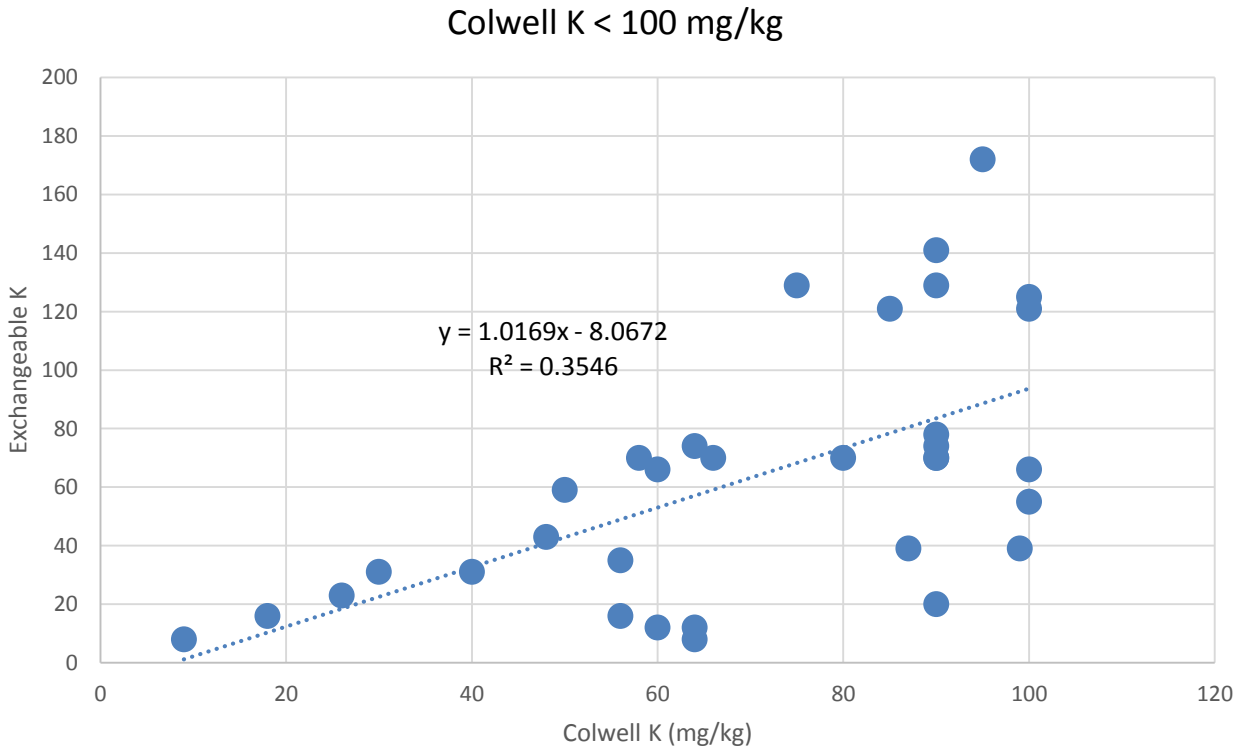
DGT-P lab accuracy

New test and therefore not in the ASPAC proficiency rounds



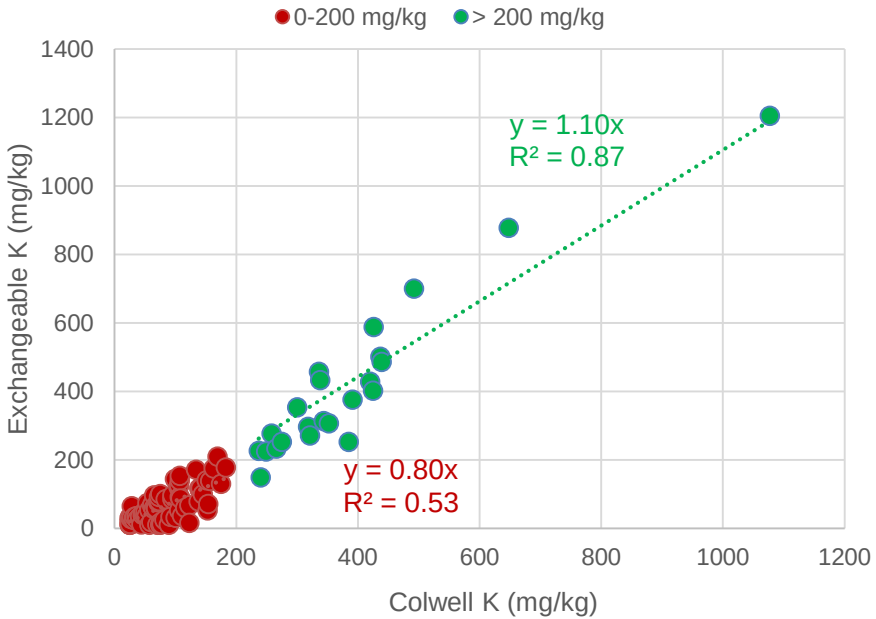
Is there a relationship between Colwell & Exchangeable K?

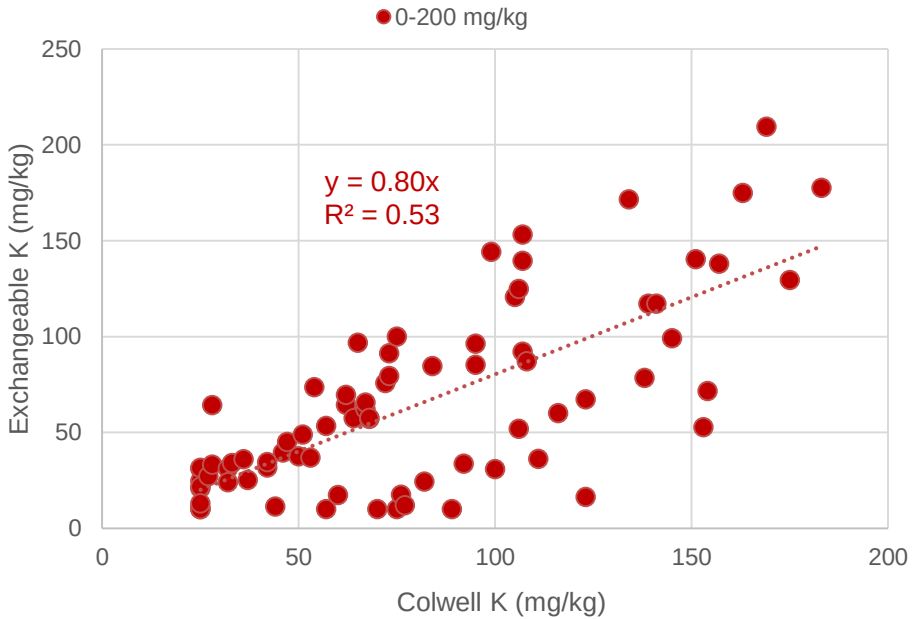
- BFDC data



Is there a relationship between Colwell & Exchangeable K?

- WA data





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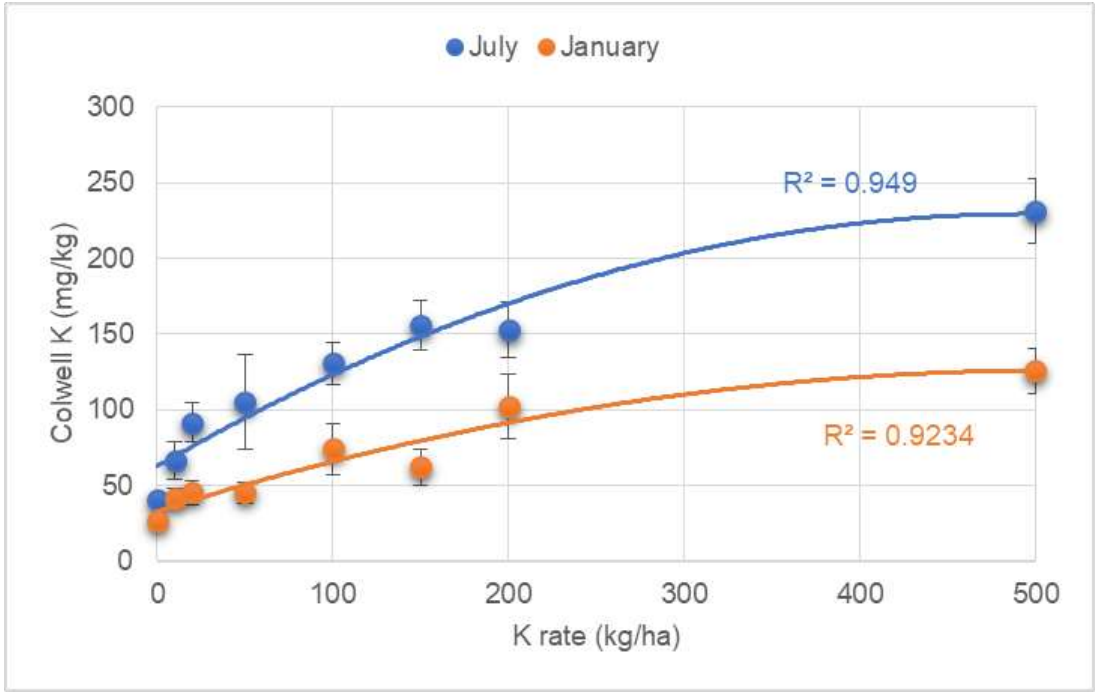
Investigation – Soil testing, January 18

0-10cm comparison

2 cores per plot, 6 treatment reps - every plot sampled and analysed in 10cm increments to 50cm

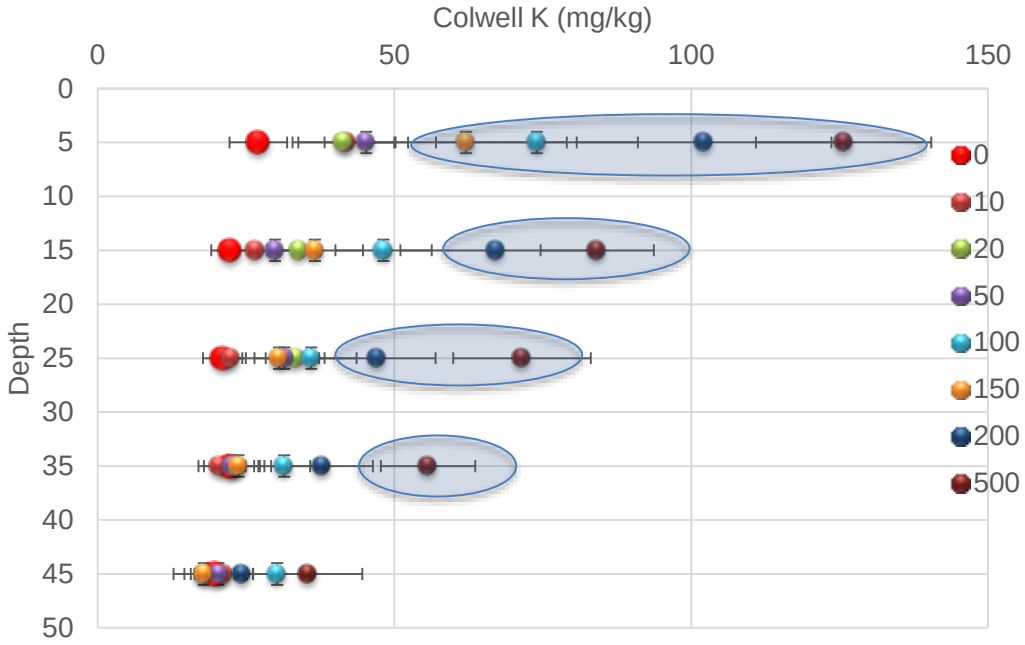


Investigation – Soil testing, January 18

2 cores per plot, 6 treatment reps, every plot sampled and analysed in 10 cm increments to 50cm

Sampling time Jan 18, 1040 K tests

Soil test value decrease from 220 to 125 from July sampling



P < 0.05 to control

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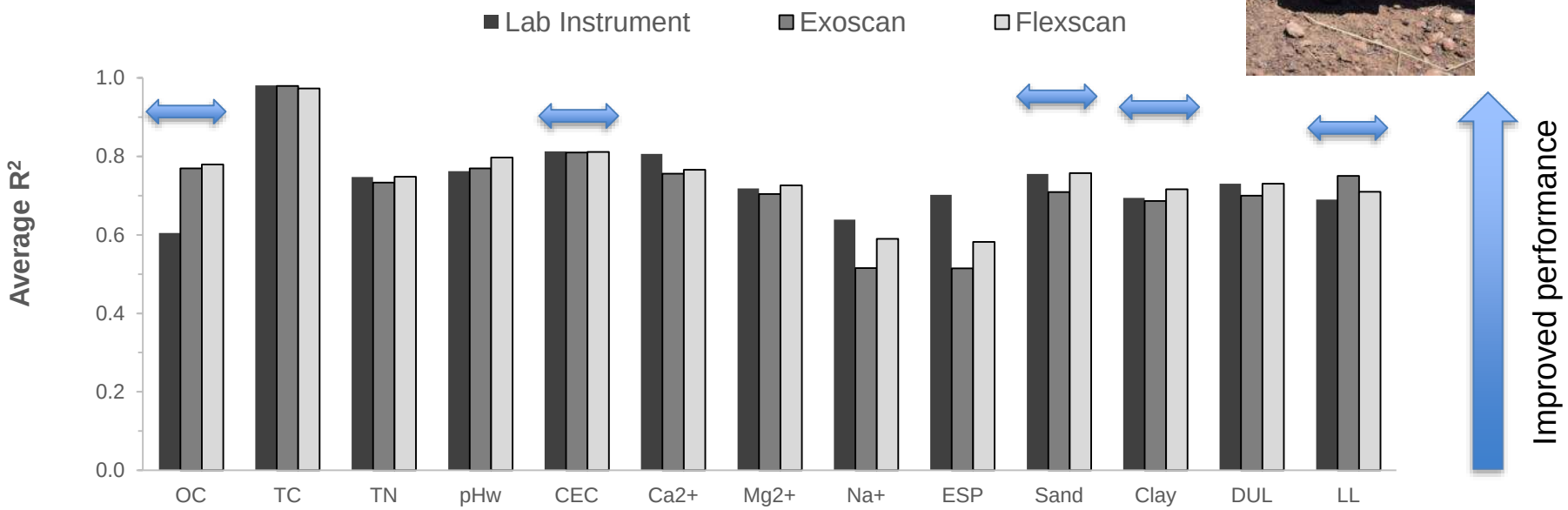
In field soil testing



Hand-held MIR instruments as good or better than laboratory instrument

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In field soil testing

- IR technology has significant potential to provide rapid analysis of several soil characteristics and crop N status in the field
- Not a fit for all – need specific skills in order to run spectral data and perform a prediction
- Reliant on cheap, robust sensors - new sensor technology coming on line every year
- Also reliant on continued validation, quality control with a laboratory

- Potential Soil characteristics predicted by IR

pH, OC, TC, TN, Texture, PBI, CEC, $CaCO_3$, DUL, Wilting point

More research required to assess impact of soil moisture
Incorporation onto soil sampling machinery

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Accuracy of commercial Laboratories

ASPAC proficiency rounds: Soil and plant

- Obtain certification for each test which is posted on the ASPAC website: www.aspac-Australasia.com

- Unknown soils (4) are posted to participating laboratories 3 times a year
- These samples are heavily prepared – fine ground/homogenised
- Laboratories perform their relevant tests and submit results back to a central body – Global Proficiency Ltd.
- Each laboratory only allowed a certain number of demerit points before they are not accredited for that test.
- If they are within an accuracy range they obtain certification.

- No certification available for Colwell K

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GLOBAL PROFICIENCY

Round SOILCHEK-08/06/2015

ASPAC

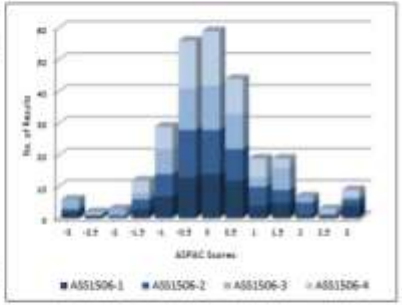
Lab Code: 50045 Rpt 1

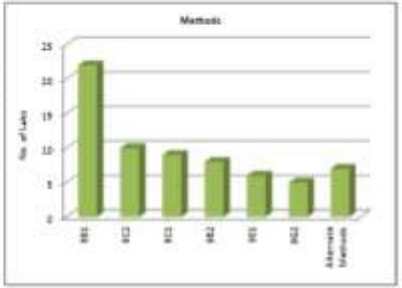
Round 614 for SOILCHEK due 08/06/2015

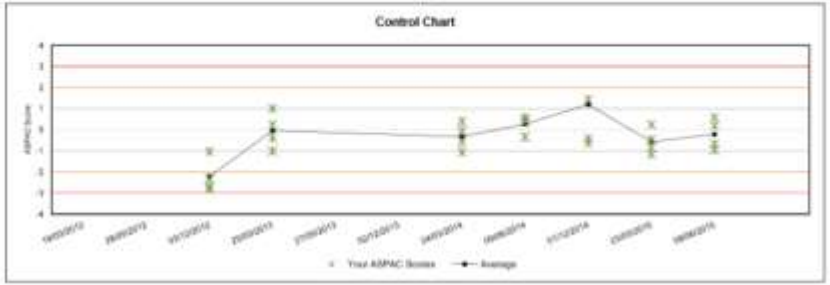
ASS - Soils - Extr P Colwell 9B1 9B2 (mg/kg)

Your method is: 9B1

	Sample AS51506-1	Sample AS51506-2	Sample AS51506-3	Sample AS51506-4
Your Result (mg/kg)	137	6.00	49.0	19.0
Lab Uncertainty (mg/kg)				
ASPAC score	-0.674	0.579	-0.987	0.183
ASPAC Lower Limit	120	1.7	43.3	8.27
ASPAC Upper Limit	178	6.4	65.4	27.9
Total Outliers	4	0	2	1
Total Stragglers	1	1	0	0
ASPAC Scores > (2) and < (3)	3	4	0	0
ASPAC Scores > (3)	3	1	0	0
METHOD RESULTS				
No. of Analysable Results	25	24	28	29
Method Mean	150	5.56	54.2	19.1
Method S.D	13.8	1.46	5.04	3.54
Method CV%	9.05	26.1	9.31	18.6
OVERALL RESULTS				
Total No. of Results	30	30	30	30
No. Historic Results	0	0	0	0
No. of Results excl. Outliers	25	24	28	29
Overall Mean	150	5.56	54.2	19.1
Overall Median	148	5.55	54.3	19.1
Overall S.D	11.9	1.66	4.82	4.3
Overall CV%	9.05	26.1	9.31	19.6
Std Error of the Mean	2.71	0.298	0.953	0.867







GLOBAL PROFICIENCY

Round SOILCHEK-08/06/2015

ASPAC

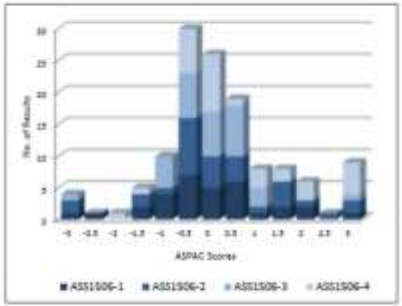
Lab Code: 50045 Rpt 1

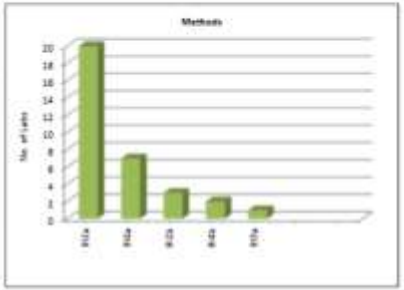
Round 614 for SOILCHEK due 08/06/2015

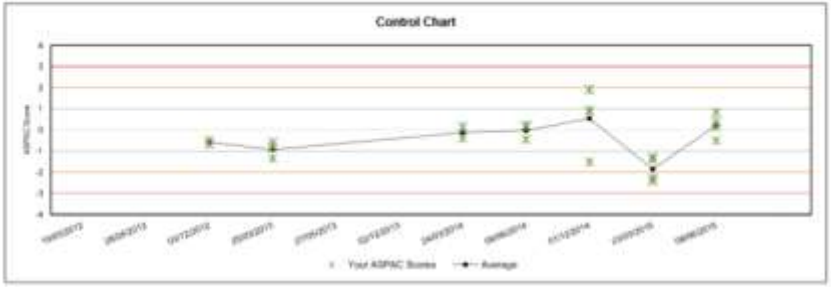
ASS - Soils - PBI Colwell 9I2a 9I2b 9I2c (L/kg)

Your method is: 9I2a

	Sample AS51506-1	Sample AS51506-2	Sample AS51506-3	Sample AS51506-4
Your Result (L/kg)	284	49.0	247	41.0
Lab Uncertainty (L/kg)				
ASPAC score	0.616	-0.516	0.375	0.139
ASPAC Lower Limit	204	44.7	161	25.2
ASPAC Upper Limit	332	58	306	54.8
Total Outliers	2	3	1	3
Total Stragglers	0	2	0	0
ASPAC Scores > (2) and < (3)	0	4	0	2
ASPAC Scores > (3)	1	3	1	1
METHOD RESULTS				
No. of Analysable Results	21	18	22	20
Method Mean	288	51.3	234	40.9
Method S.D	27.1	3.78	21	7.69
Method CV%	10.2	7.33	9	18.8
OVERALL RESULTS				
Total No. of Results	23	23	23	23
No. Historic Results	0	0	0	0
No. of Results excl. Outliers	21	18	22	20
Overall Mean	288	51.3	234	40.9
Overall Median	288	50.3	234	40
Overall S.D	26.7	2.3	30.4	6.15
Overall CV%	10.2	7.35	9	16.8
Std Error of the Mean	5.81	0.887	4.48	1.72







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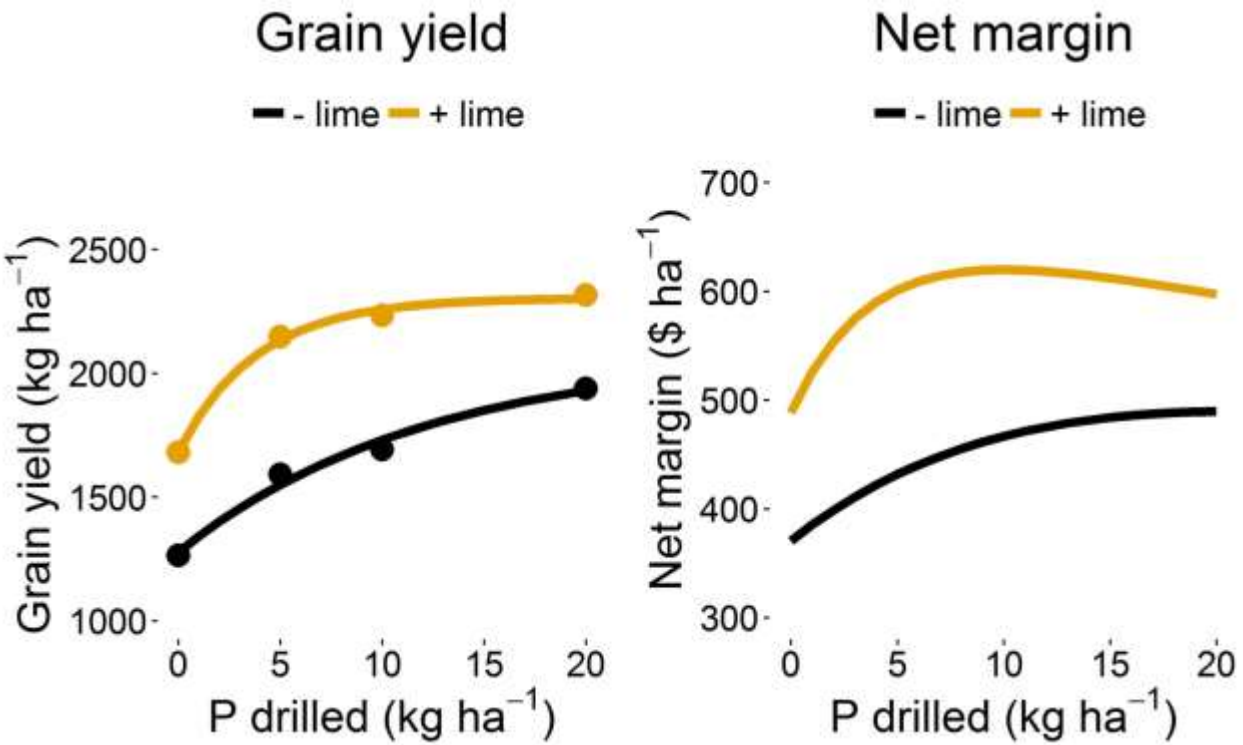
Lime treatment changed the profit response to P fertiliser for wheat at Wongan Hills in 2012.

Soil pH ($CaCl_2$)

Depth (cm)	-lime	+ lime
0 - 10	4.5	5.5
10 - 20	4.1	4.6



A grey repellent sand with soil nutrients within or above critical ranges.

Depth	Organic carbon (%)	pH ($CaCl_2$)	Colwell P (mg/kg)	Colwell K (mg/kg)	Sulphur (mg/kg)	MED	WR rating
0 to 10	1.69	6.4	18	49	12	3.2	Very severe
10 to 20	0.66	5.8	9	35	9		
20 to 30	0.35	5.6	8	29	5		
30 to 40	0.25	5.5	12	25	3		
Critical range (90%)			16 to 25 (0 to 10 cm)	32 to 52 (0 to10 cm)	2.5 to 3.1 (0 to 30 cm)		

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