APAL
Australian Precision Ag Laboratory

BIGG Conference 2019

Soil Testing

March 19

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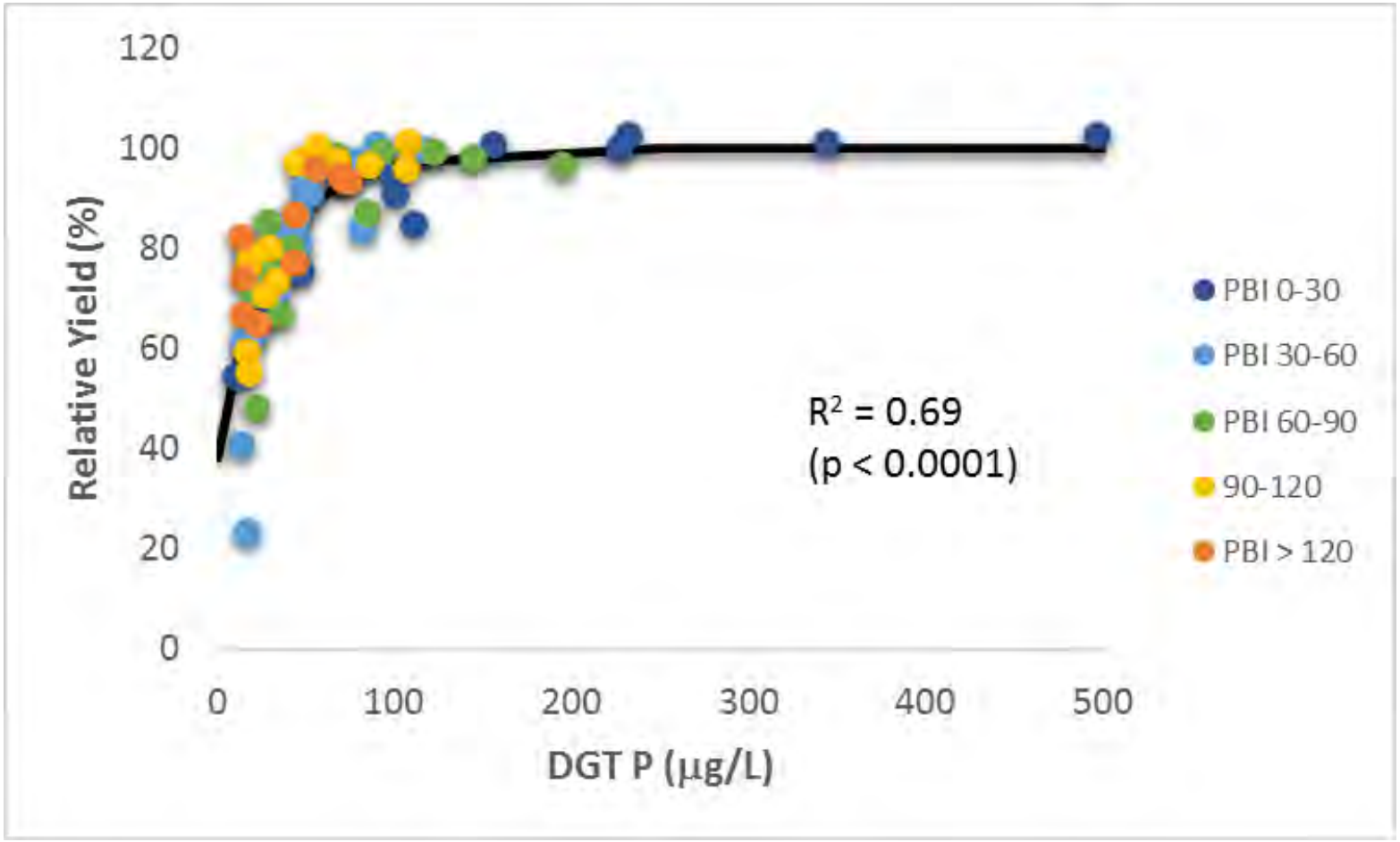
Summary

- Understand soil variability
- Identify paddock zones, characterise soils and review if adoption of precision Ag is profitable for you.
- Big profitability gains from refining fertiliser/lime applications in pastures
- GPS- locate soil sampling points
- Phosphorus in grazing systems – understand fertiliser placement to ensure best response
- New technologies
  - Infrared (IR), provides more detailed soil physical information

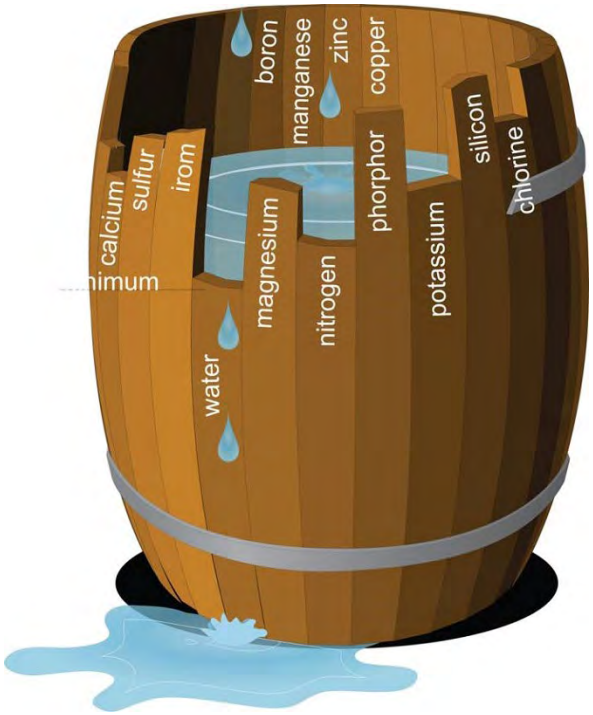
Critical levels – Why Soil test



Nutrition- Essential Plant Nutrients

"The yield of a plant is limited by a deficiency of any one essential element, even though others are present in adequate amounts"

This also applies to other facets of management, for example moisture, structure, weed management, disease management etc.



Liebig's Law of the Minimum.

Source:

http://www.greencare-concept.nl/eng/pagina/141/prevention-through-nutrition.html)

Soil or plant testing?

Use of soil testing by crop area

	% crop area tested to at least 10cm in 2016	% crop area having a deep soil test in past 5 years
SA Mid-north/Lower EP	14	21
SA/Vic Bordertown, Wimmera	21	26
SA/Vic Mallee	14	27
Vic. High Rainfall	34	16
NATIONAL	***26***	***35***

Understanding the LAB process

What happens to your samples?

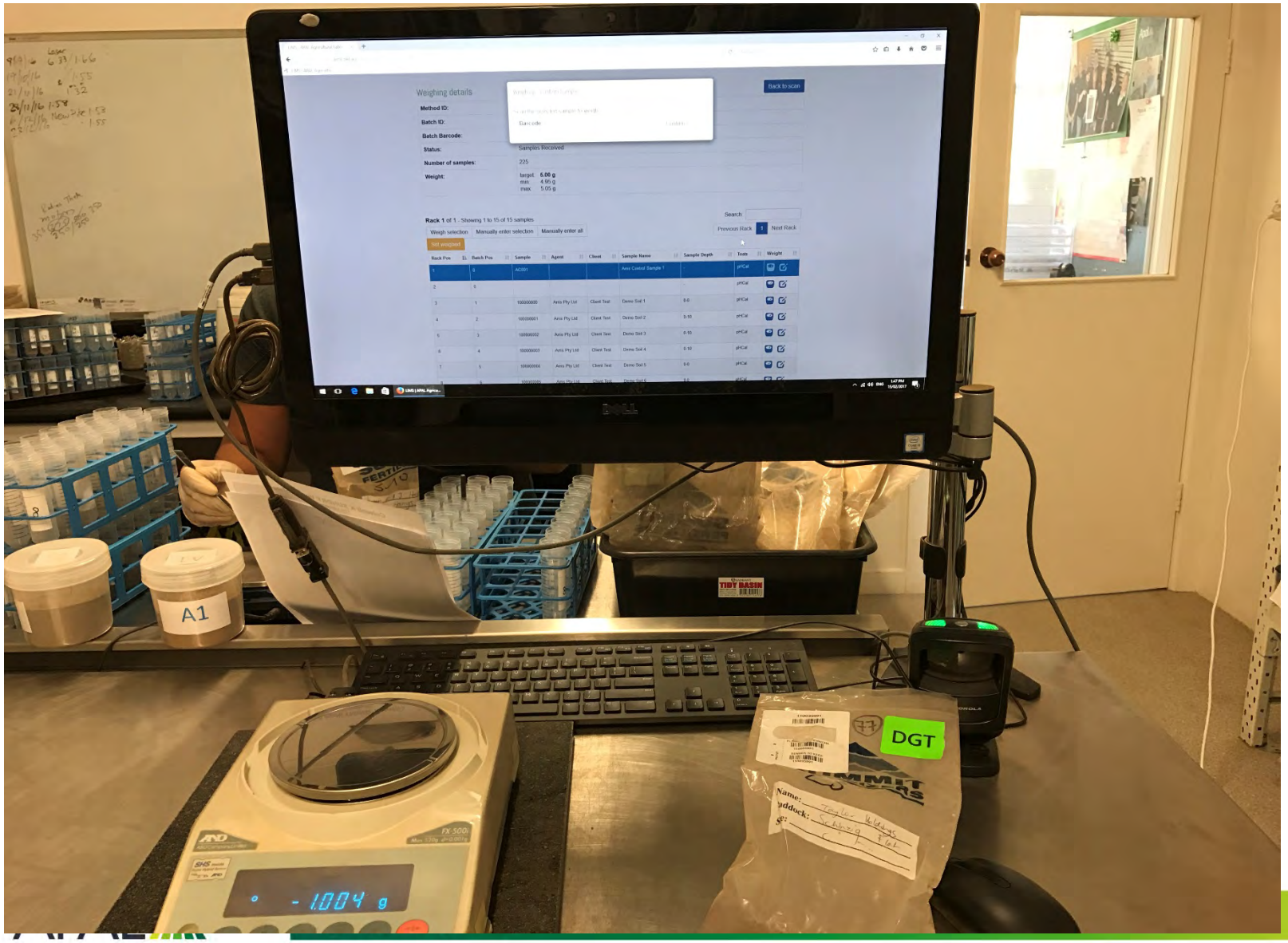
Understanding the LAB process

Sample drying- Soils

Sample Preparation- Grinding

Sample Preparation – Grinding

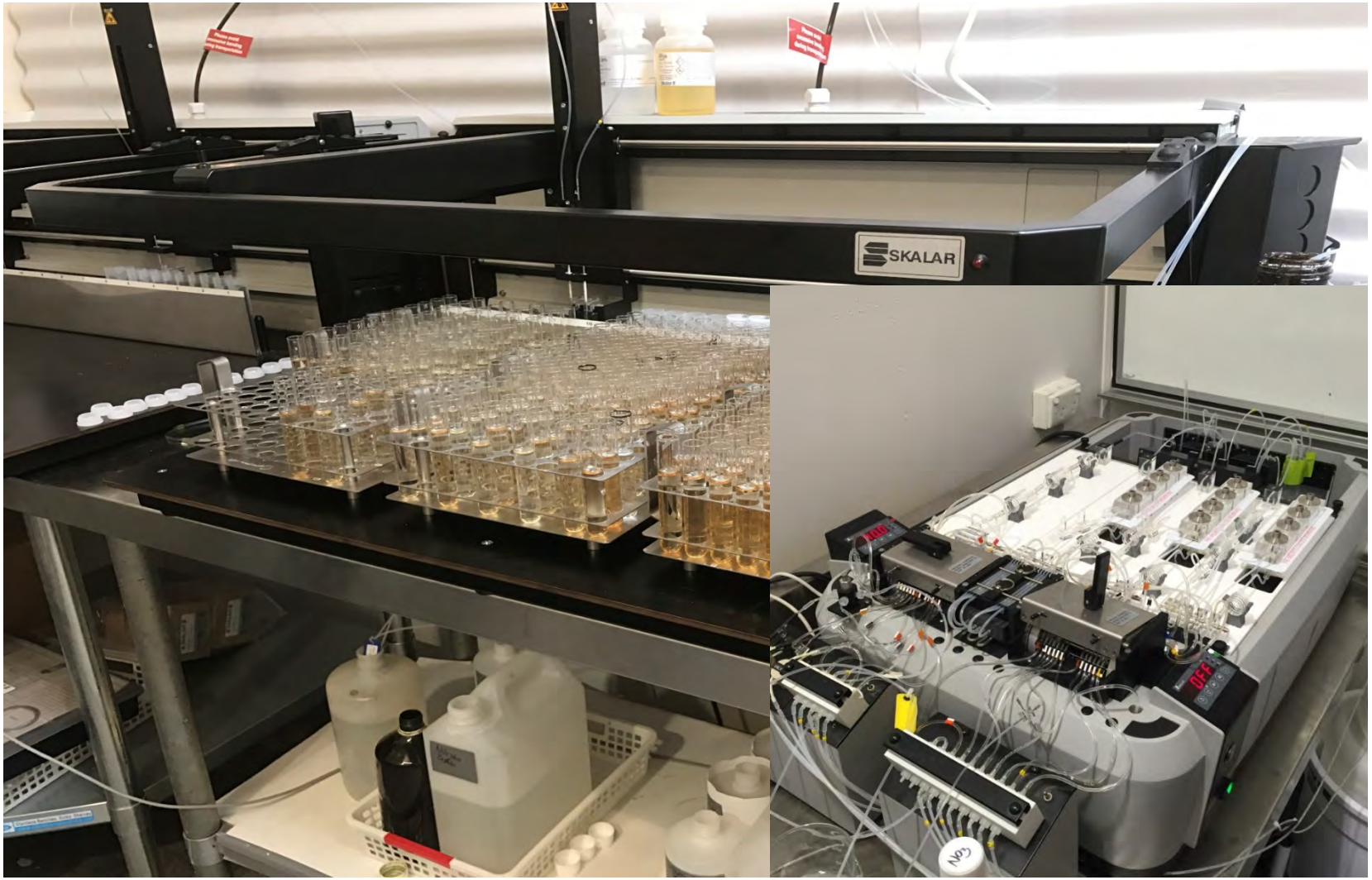
Sample Weighing



Sample Weighing

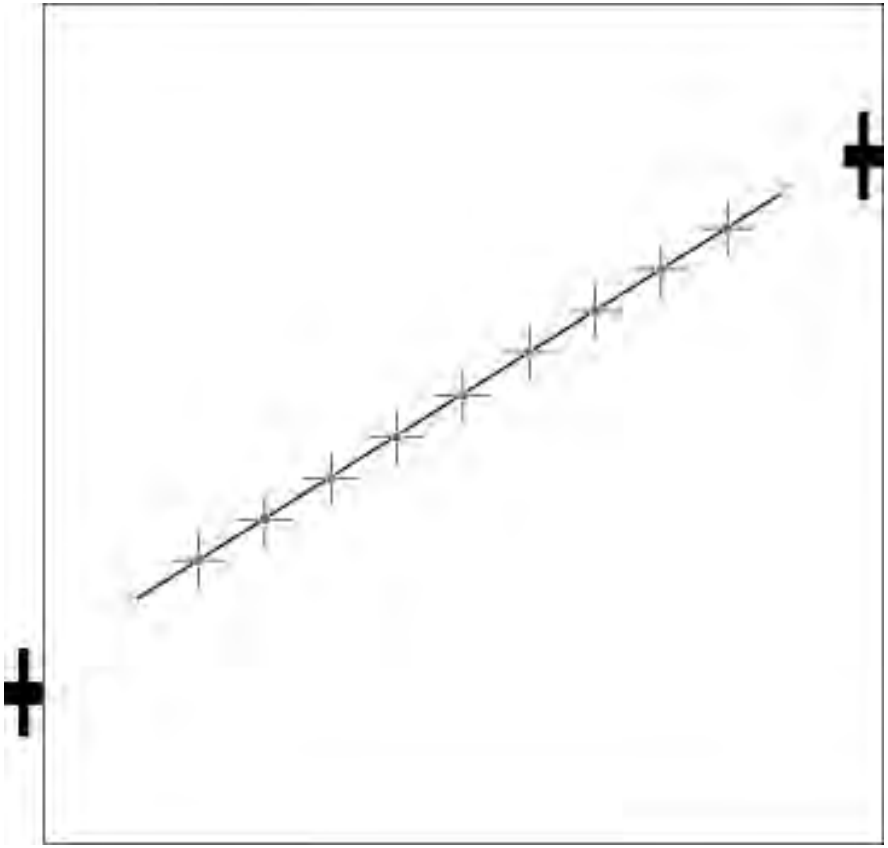
Sample Extraction

Nitrogen – Phosphorus

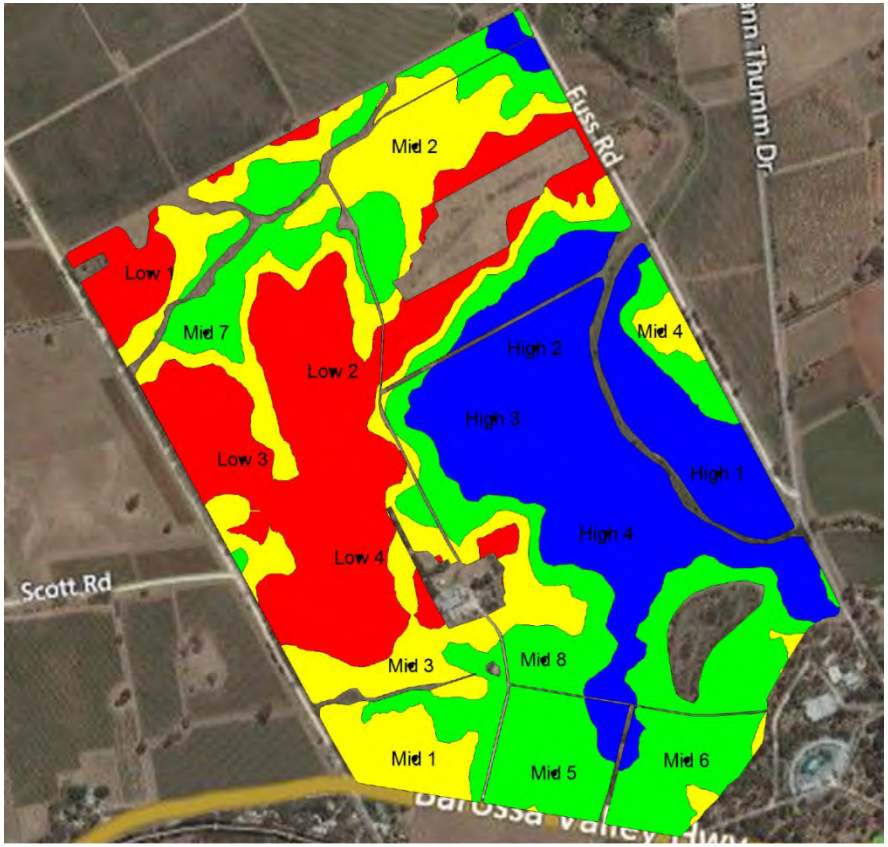


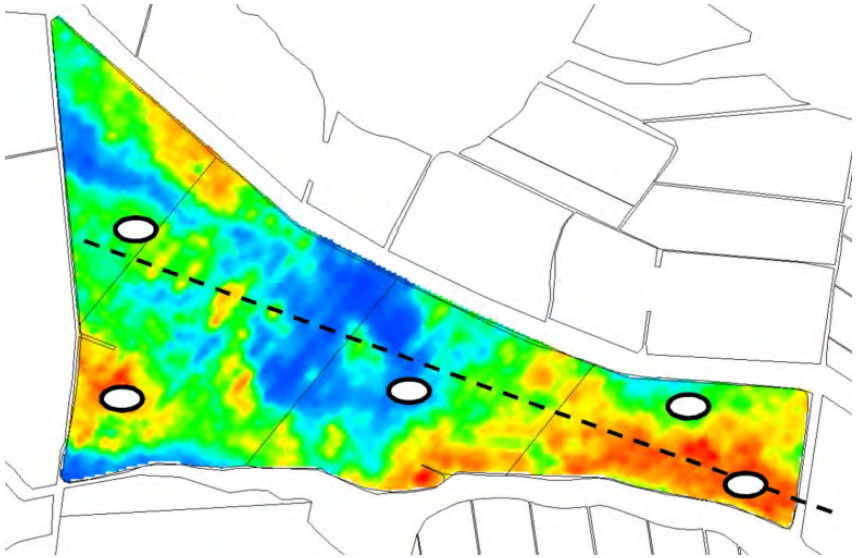
Soil sampling strategies

Traditional Sampling strategies



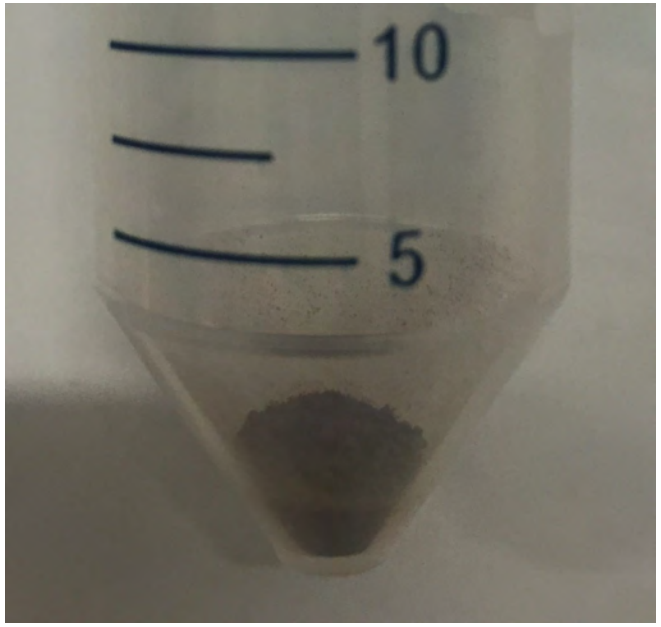
- **Transect** (Random with bias)


Fuss Rd
Mid 2
Low 1
Mid 7
Low 2
High 2
Mid 4
High 3
Low 3
High 1
High 4
Low 4
Scott Rd
Mid 3
Mid 8
Mid 1
Mid 5
Mid 6



The importance of soil sampling procedures!!!

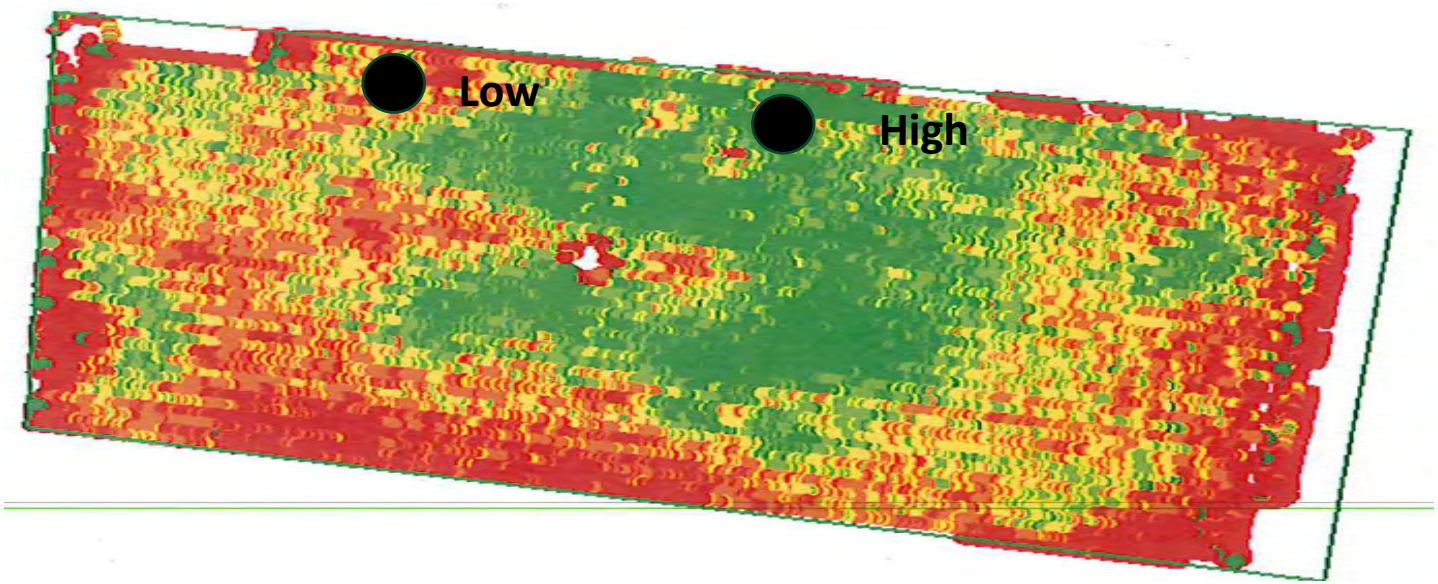
Colwell P – How many grams of soil?



Protocols for 2019 - Sampling

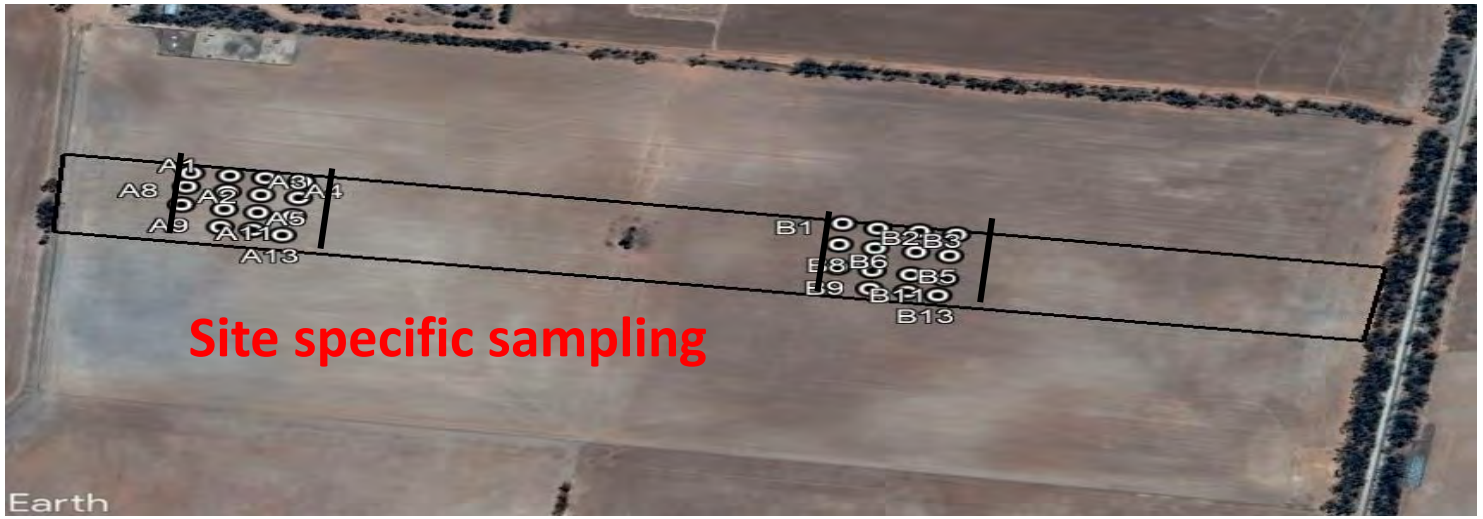
Two zones located in each of the six paddocks (per grower)

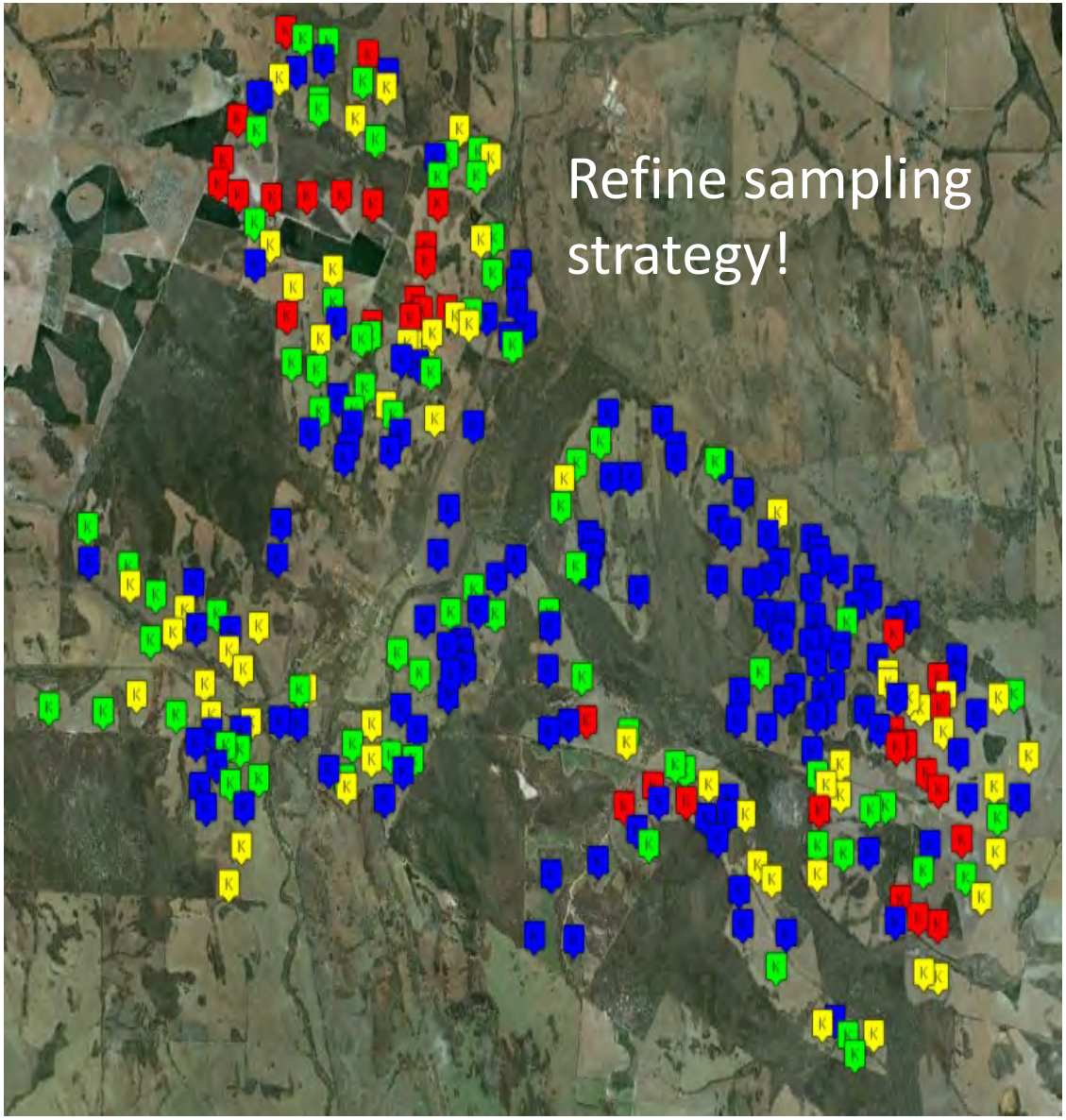
- Located along sowing lines



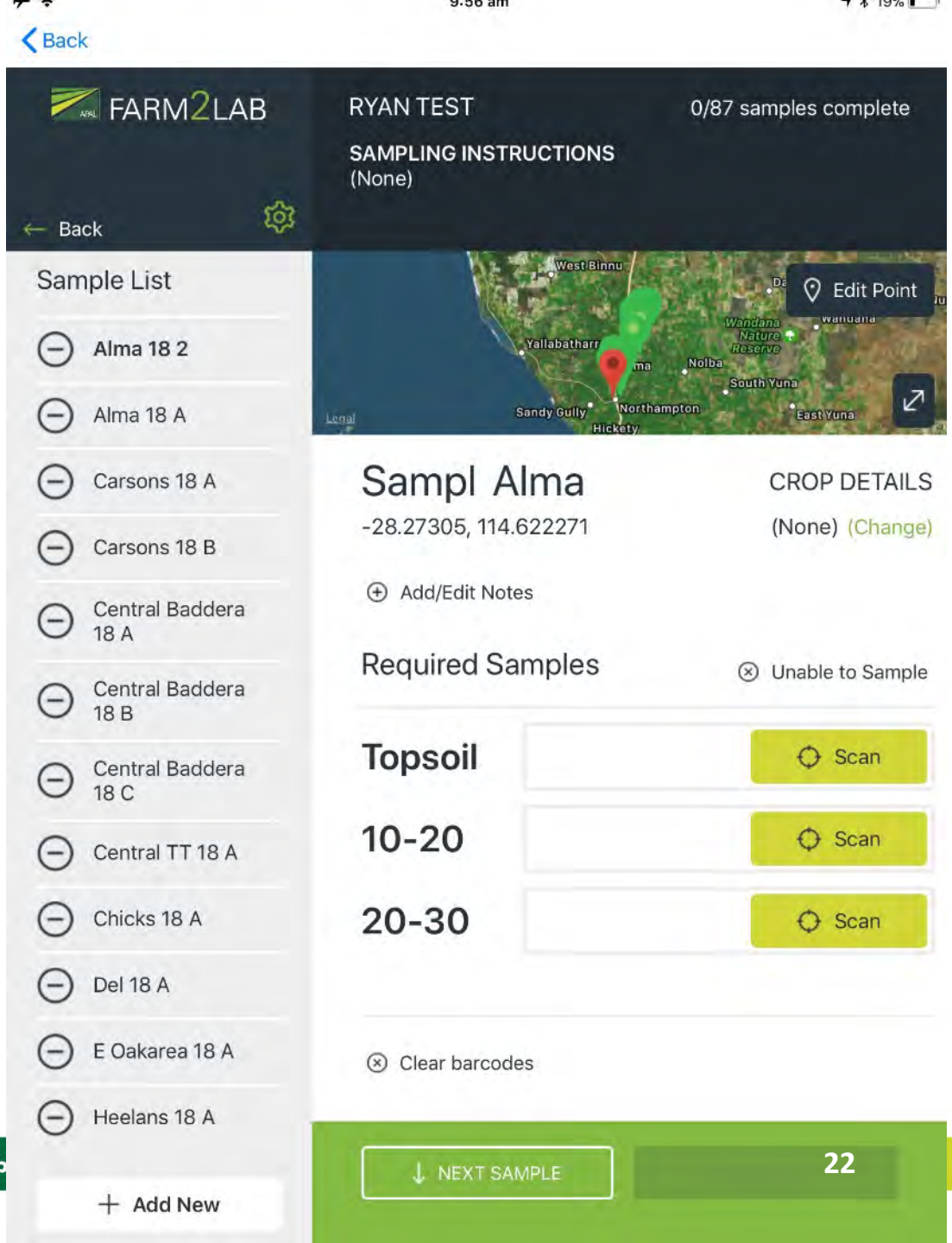
Protocols for 2019 - Sampling

Within the two different production zones identify a 1 ha (100 x 100m) area for soil sampling




Refine sampling strategy!

FARM2LAB



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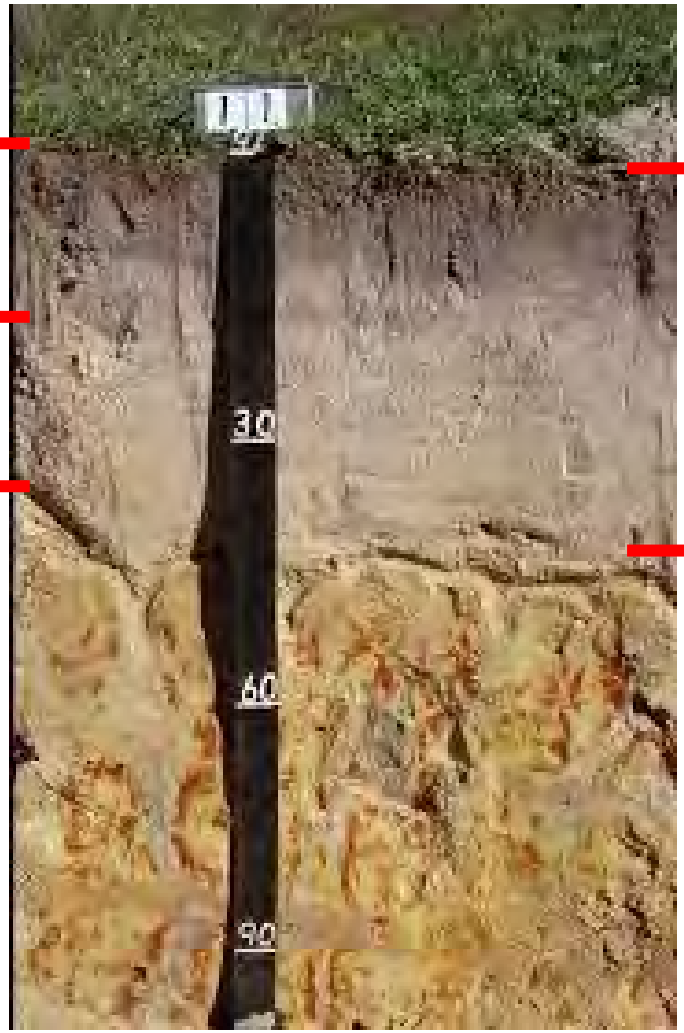
@apallab

Depth – layers vs Horizon (Characterisation)



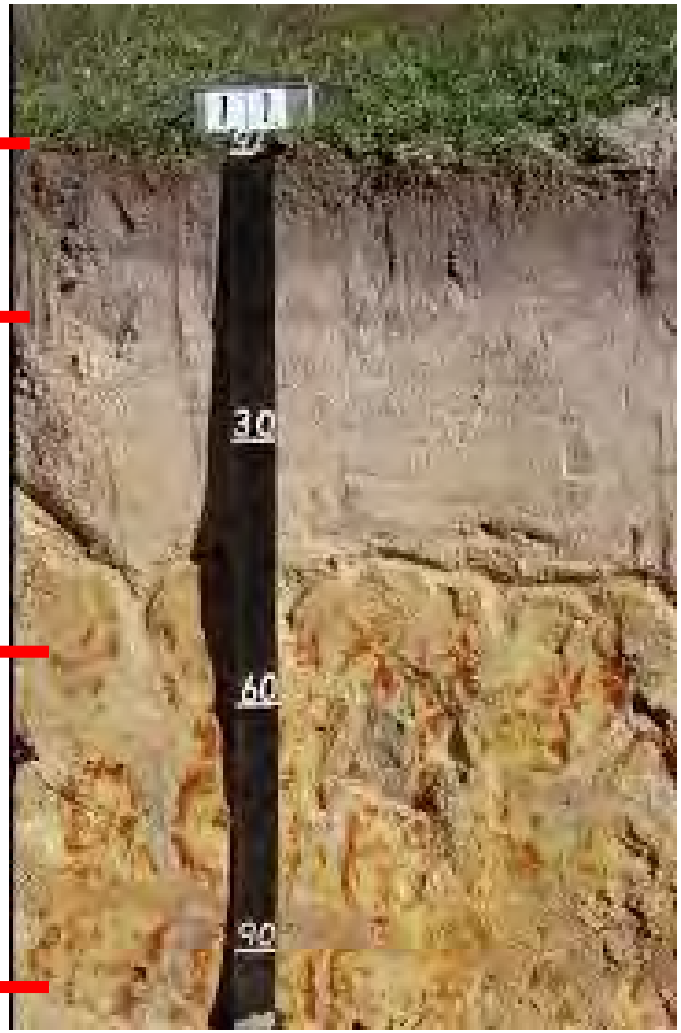
By Horizon – Characterisation.

pH ?

0-10 still required for P interpretation.

Establish crop response

Depth – layers vs Horizon (Monitoring)

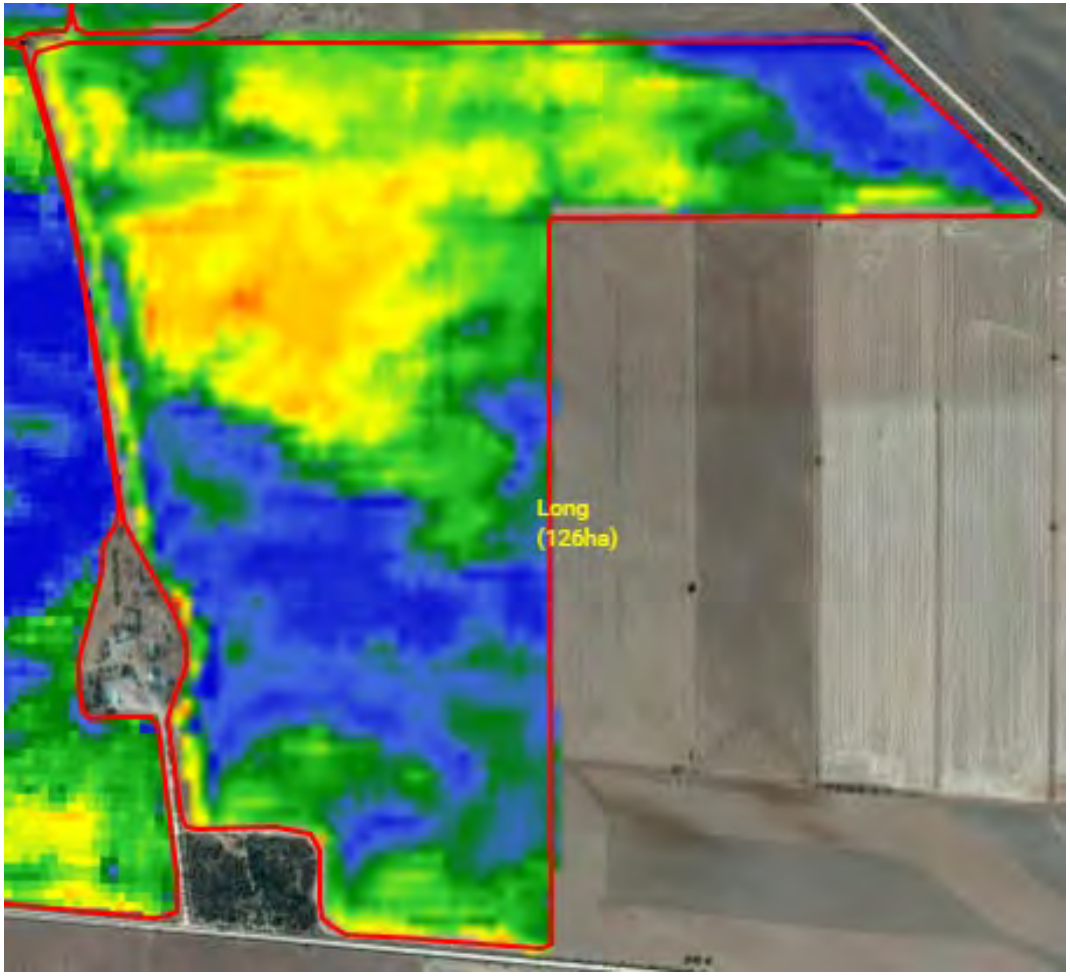


Assuming no restriction to rooting depth

Continue in 30 cm increments (i.e. 60 -90 cm)

Need to segment to locate mobile elements in profile

Imagery? - Validation



Making fertiliser decisions

Nutrient removal

Phosphorus in Pastures

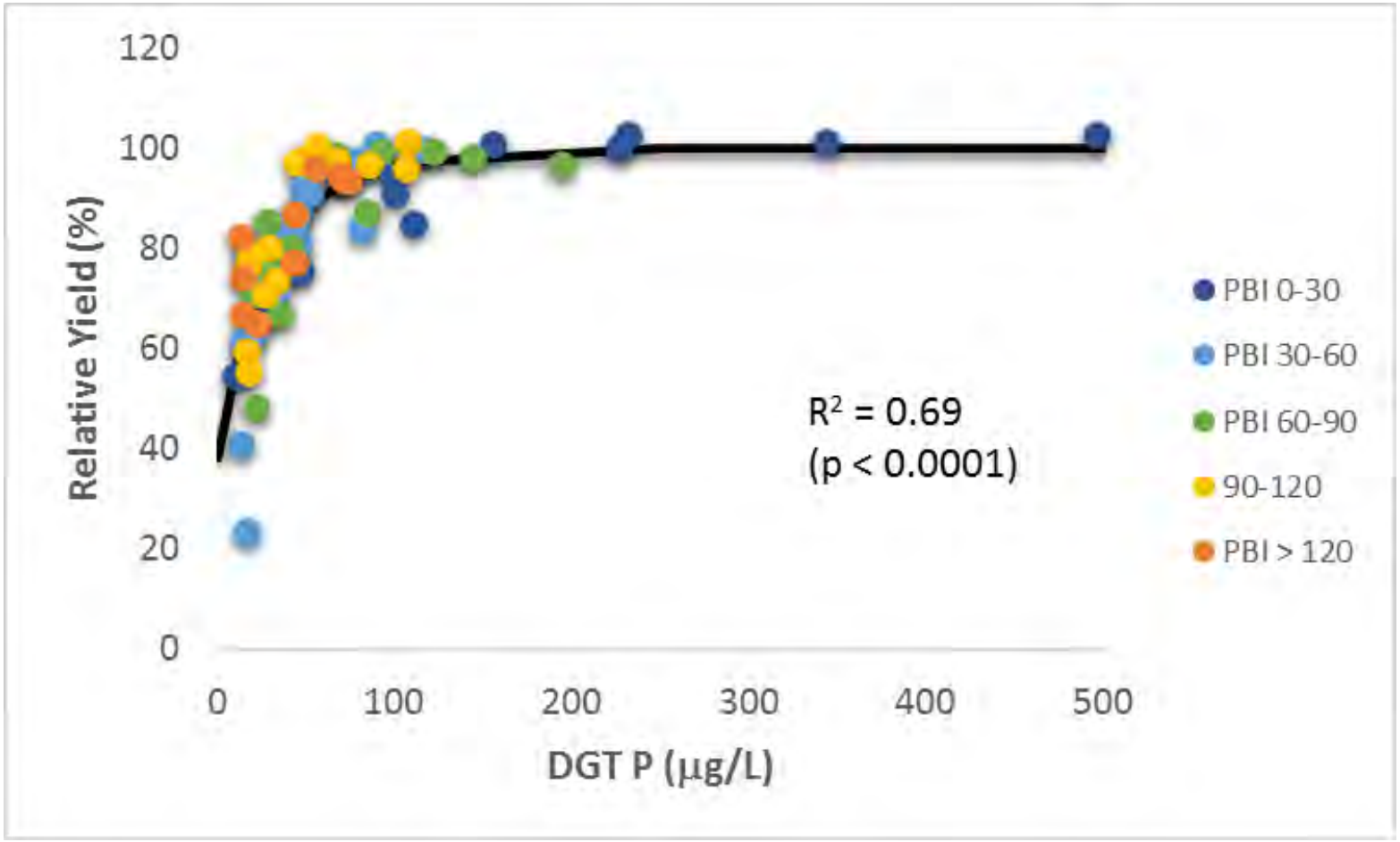
Fertiliser strategies

BUILD – Low soil levels, responsive

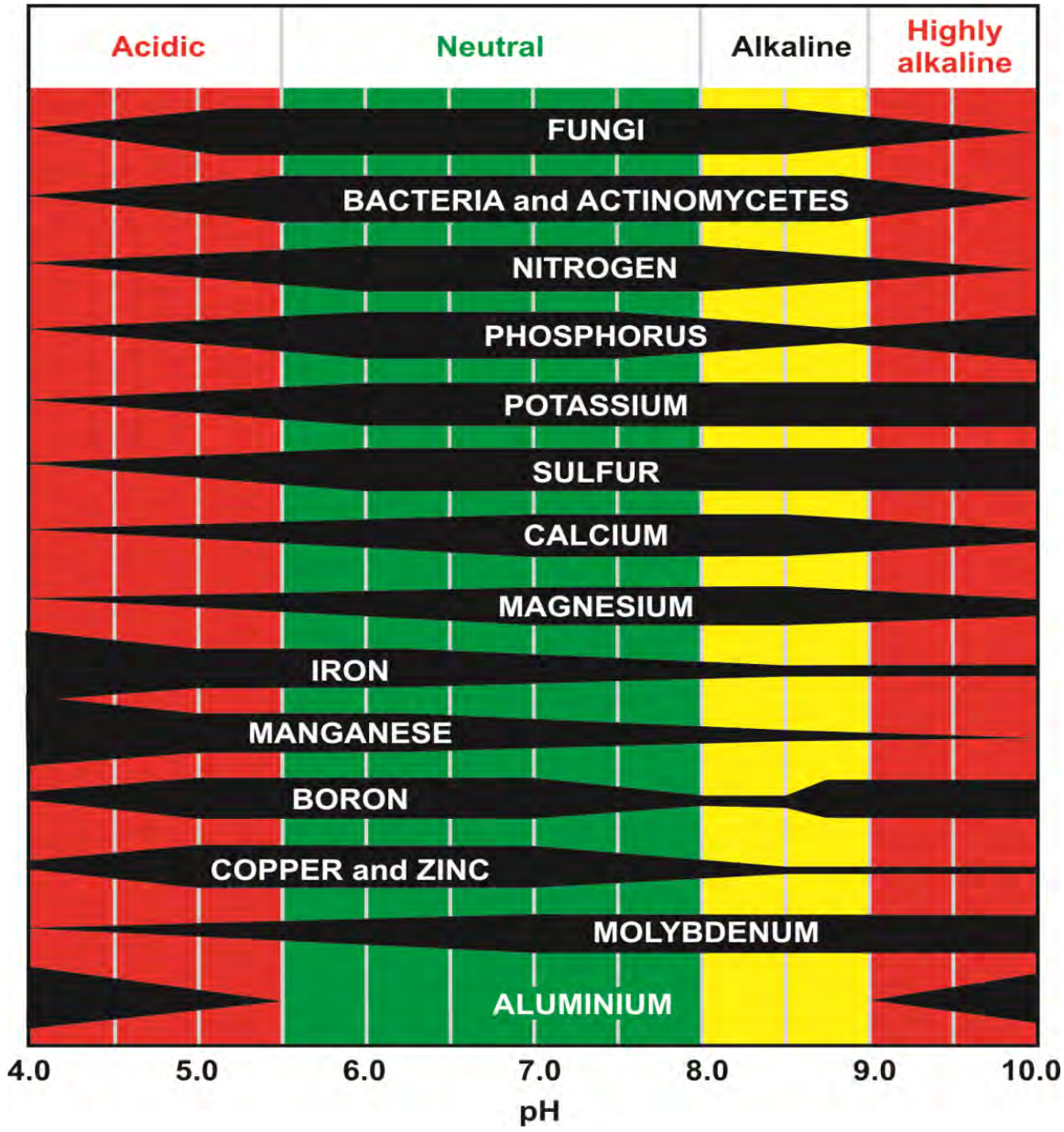
MAINTAIN – Adequate soil levels

MINE- Excessive soil levels, mine based on availability

Critical levels – Why Soil test



Nutrient availability & pH



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pH – Lime applications – How is it done?

Target pH (CaCl)	5.5
Soil Test pH (CaCll)	5
Difference	0.5
Soil Type	Clay
Tonnes/ha Lime	1.92
Organic Carbon %	2
Organic Matter (%)	3.44
Lime ENV (%)	90
Tonnes/ha lime Adjusted (ENV)	2.1
Organic Carbon Adjusted	2.50
Gravel %	0
FINAL LIME RATE	2.50

, if contains magnesium value tested display products below

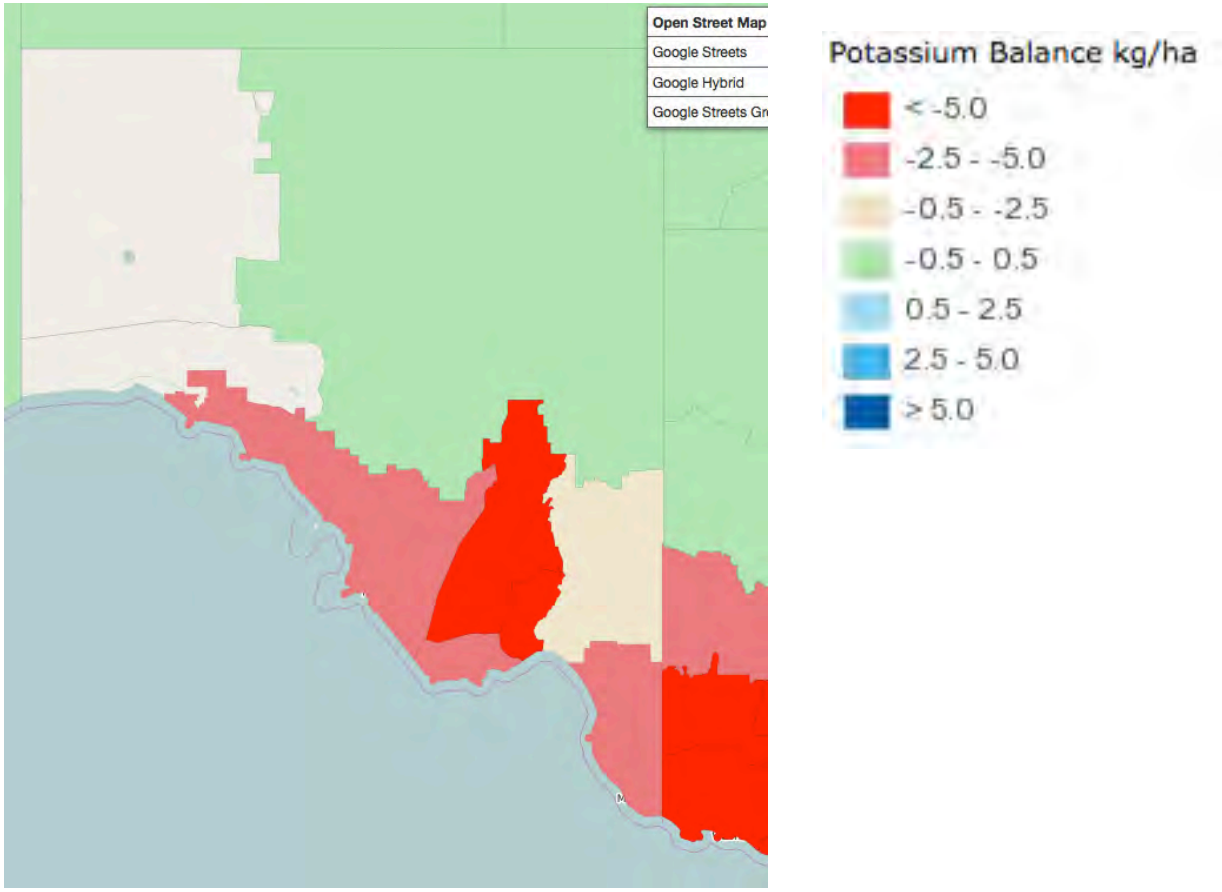
Magnesium value	120
CROP (Wheat)	Crop critical value (i.e 100)

Nutrient balance – what are we removing from our farm

	N	P	K	S
Wheat Grain	17-23	2-4	4-6	1.5-3.0
Wheat Straw	4-6	0.5-1.0	10-14	1.0-2.0
Wheat Hay	*20*	*1*	*20*	*1.5*
Canola Grain	15-40	4-7	8-10	2-6
Canola Straw	4-10	2-4	25-31	3-12
Canola Hay	*30*	*3*	*35*	*8*

Potassium balance

Net K balances



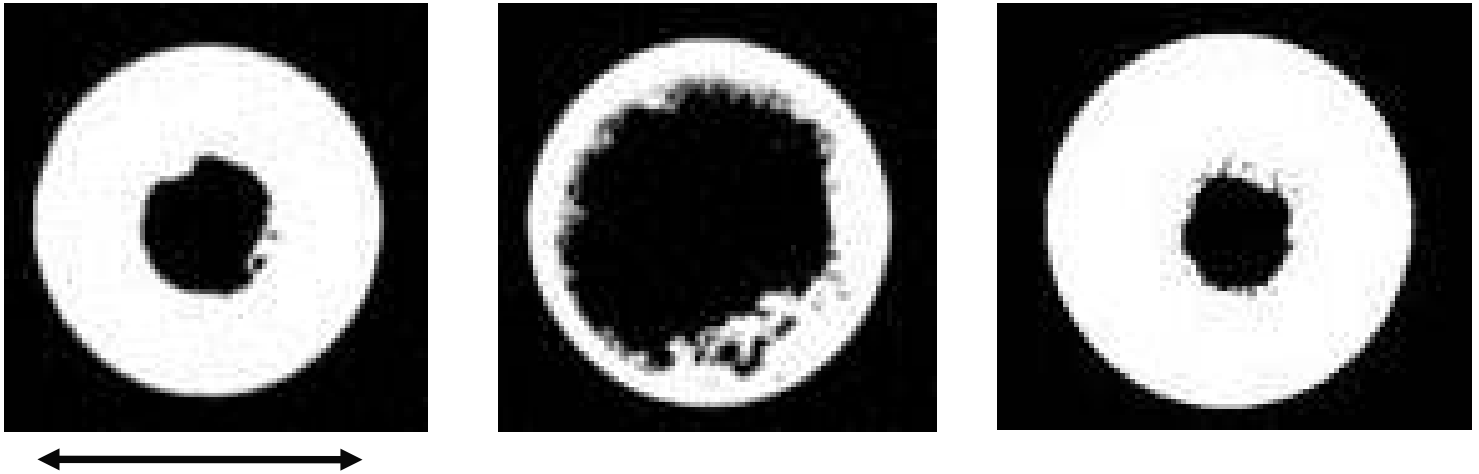
Source: IPNI (Rob Norton)

Phosphorus in pastures

Phosphorus management in pastures

- Phosphorus doesn't move far from application point
- Therefore to match crop early demand for P, fertiliser needs to be placed with or just below the seed

Redvale (Oxisol) Monarto (Alfisol)



5.5cm Grijalva et al. unpublished

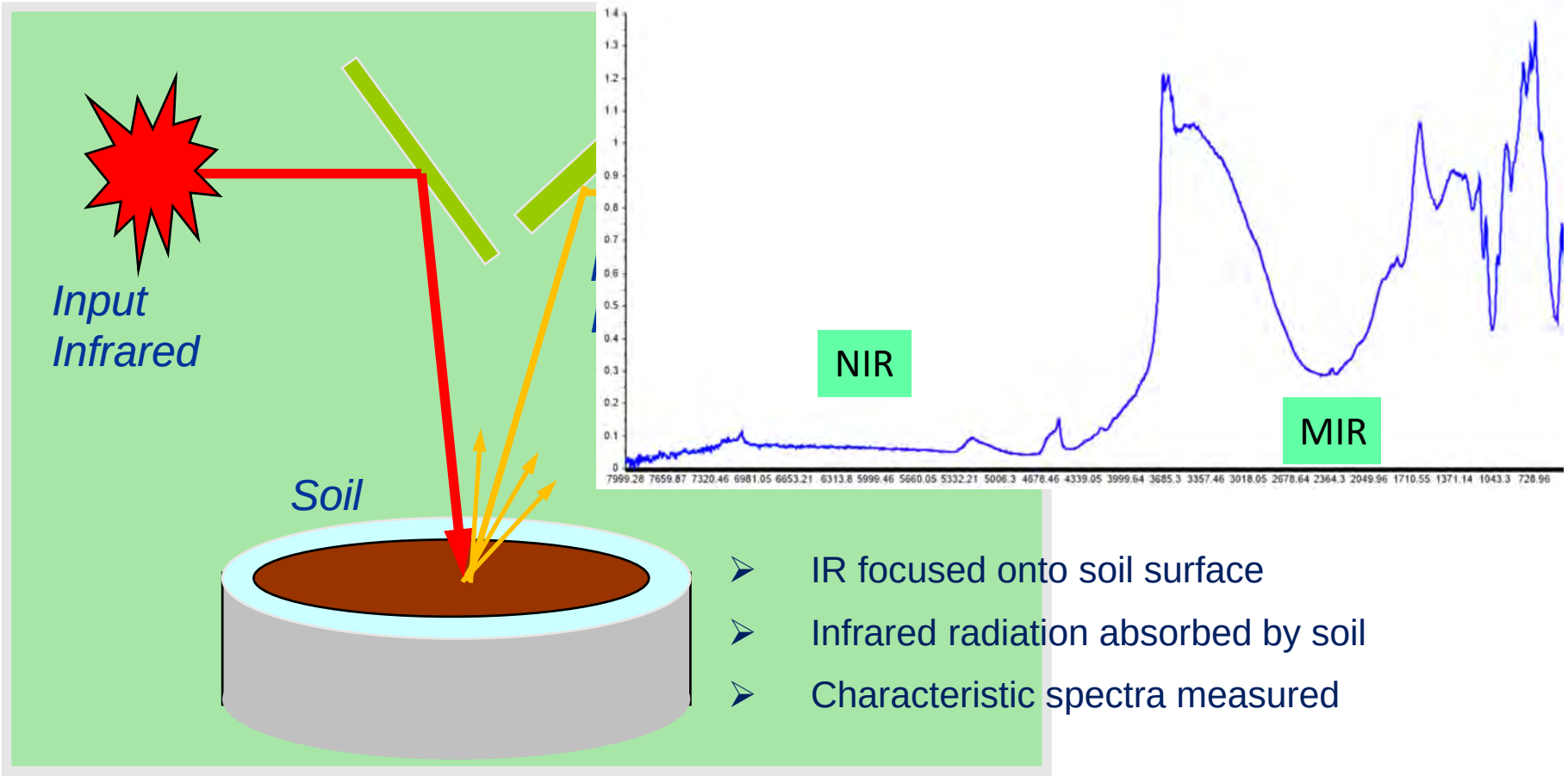
Pasture – renovation? Placement of fertiliser. P – K?

PASTURE - COLWELL-P		
Type	**Name**	**Value**
Lab input	PBI	40
Lab input	Colwell-P	20
User Input	Growing season length (months)	7.5
User input or fixed parameter	Years of target P status	5
User Input	Paddock size (ha)	100
User Input	Target DSE/ha	15
User Input	Rainfall (mm)	800
User Input	Pasture type	Improved
User Input	Soil type	Recent alluvial soils, low rainfall loams
User Input	Grazing type & terrain	Set stocked or intermittent grazing & flat or rolling country
Int. calc	Critical Colwell-P	28.0
Int. calc	Potential DSE/ha	17.2
Int. calc	Graph x1	5.0
Int. calc	Graph x2	28.0
Int. calc	Graph y1	2.0
Int. calc	Graph y2	17.2
Int. calc	Intercept	-1.308
Int. calc	Slope	0.662
Int. calc	Target soil fertility	24
Int. calc	PT abb	Imp
Int. calc	ST abb	L
Int. calc	GT&t abb	L
Int. calc	PSTt	Imp/L/L
Int. calc	Mtce slope	0.0003
Int. calc	Mtce intercept	0.4217
Int. calc	Mtce P/DSE	0.68
Int. calc	Mtce P/ha	10.23
Int. calc	Capital Colwell-P/ha	4.0
Int. calc	Capital fert-P/ha	10.6
Output rate	P rate (kg P/ha)	12

New Soil testing technologies

New Technology - How does IR work?

Note: It measures surface characteristics, does not penetrate sample



- IR focused onto soil surface
- Infrared radiation absorbed by soil
- Characteristic spectra measured


INNOVATIVE ENGINEERING SOLUTIONS
KUKA

New in testing space?

MIR

Soil Methods:

- Organic Carbon – Carbon fractions
- Total Nitrogen
- **Particle Size Analysis (% Clay, % Sand, % Silt)**
- **Carbonate**
- Cation Exchange (CEC), ESP
- PBI
- Bulk density
- Water Upper and lower limits (PAWC)

Potential for Plant tissue testing in the FIELD

Real-time determination of crop N status

Using ASD Hand-held VNIR

In field ASD Spectral data ready for calibration
Roseworthy 2016

Compass 100N

Compass 0N

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