

Project Catalyst Trial Report

Variable Rate Phosphorus Trial

Grower Information

Grower Name:	Stephen & Brendan Accornero/Michael Waring
Entity Name:	Accornero Family Trust T/A/ Waring MJ & AM
Trial Farm No/Name:	F# 416A/ F#0094A B# 7-6/B#25-5 Trial 1/Trial 2
Mill Area:	Victoria, Herbert region
Total Farm Area ha:	500ha/140ha
No. Years Farming: (Grower Experience)	30 years/21 years
Trial Subdistrict:	Bambaroo/Lannercost
Area under Cane ha:	490ha/134ha

Trial Status

Completed Continuing

Background Information

Aim:

Strategic application of phosphorus, where it is required as opposed to broad rate application of phosphorus.

Background: (Rationale for why this might work)

By using variable rate technology, the grower can target phosphorous application to where it's most needed. It is anticipated that the use of variable rate phosphorus applications could lead to the following benefits: a more even yield across the block, reduced weed pressure from improved germination of cane, reduced phosphorus loads in water being exported from the field and possibly better NUE by the plant.

Potential Water Quality Benefit:

Benefits will be through reduced P losses in runoff through targeted application.

There is a potential reduction in N losses as improved crop growth across the paddock allows improved N utilisation.

Expected Outcome of Trial:

By applying P at a VR, the grower can target and improve yield across his block.

Economic benefits could be achieved through improved profitability by reduced costs of applied phosphorous or through improved yield for same total phosphorous applied.

Service provider contact: Megan Zahmel: 0447 317 102

Where did this idea come from:

Stephen and Brendan Accornero- Grower's frustration with lack of response to lime and other treatments for the poor strike in section of his cane field. Further investigations found huge variation in available phosphorous, hence the farmer wanted to investigate the use of his crop management approach.

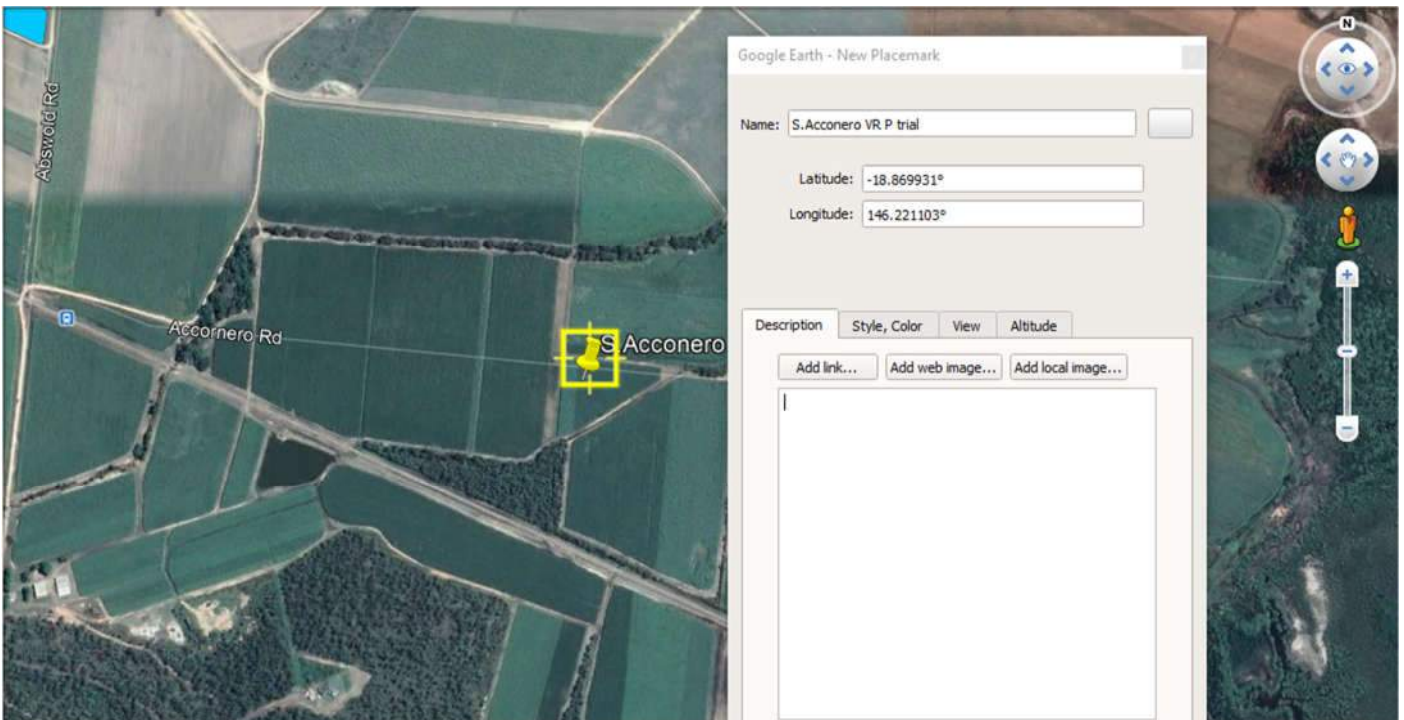
Michael Waring- believes that uneven yields across his blocks could be due to low phosphorus variations that standardised soil sampling is overlooking.

Plan – Project Activities	Date : (mth/year to be undertaken)	Activities ☹️ breakdown of each activity for each stage)
Stage 1	Establish trial 1	<ul style="list-style-type: none"> - 1/11/2019 – Soil tests taken at all soil points - 17/11/2019 – Soil tests are interpreted, and variable rate map is created - 21/11/2019 – Trial design is created - 24/11/2019 – Trial is marked out - 24/11/2019 – Fertiliser is applied with VR box according to trial design - 19/12/2019 – KPI water samplers installed at the trial
Stage 2	Sampling 2020	<ul style="list-style-type: none"> - 29/01/2020 – Water samples collected. 200ml Rain recorded. Trial site flooded. Some KPI samplers failed to collect sample. - 24/02/2020 – Water samples collected. 157ml rain recorded. Trial site flooded at one end of block. Some KPI samplers failed to collect sample. - 1/03/2020 - 1st set of water sample were send to TropWaters lab for analysis. Only three samples were captured due to faulty water samplers in the field. 2nd set of water samples were not sent for analysis due to flooding compromising the trial data. - 3/08/2020 - Trial was harvested for mill data.
Stage 3	Re-Establish trial 2 2021	<ul style="list-style-type: none"> - 27/09/2021 - Possible blocks EM mapped and compared with soil maps. - 28/09/2021 - Trial block chosen, and trial set up - 6/10/2021 - Baseline soil samples taken for Standard phosphorus application - 8/10/2021 - Variable rate soil samples taken for VR phosphorus application - 28/10/2021 -Soil test interpreted, and prescription map created. - 8/11/2021 - Phosphorus applied using a rate controller according to trial design
Stage 4	Sampling 2021	<ul style="list-style-type: none"> - 24/12/2021 – Drone flight to monitor plant grow progress.
Stage 5	Sampling 2022	<ul style="list-style-type: none"> - Trial will be harvested in the 2022 season to compare yield differences
Stage 6		
Stage 7		

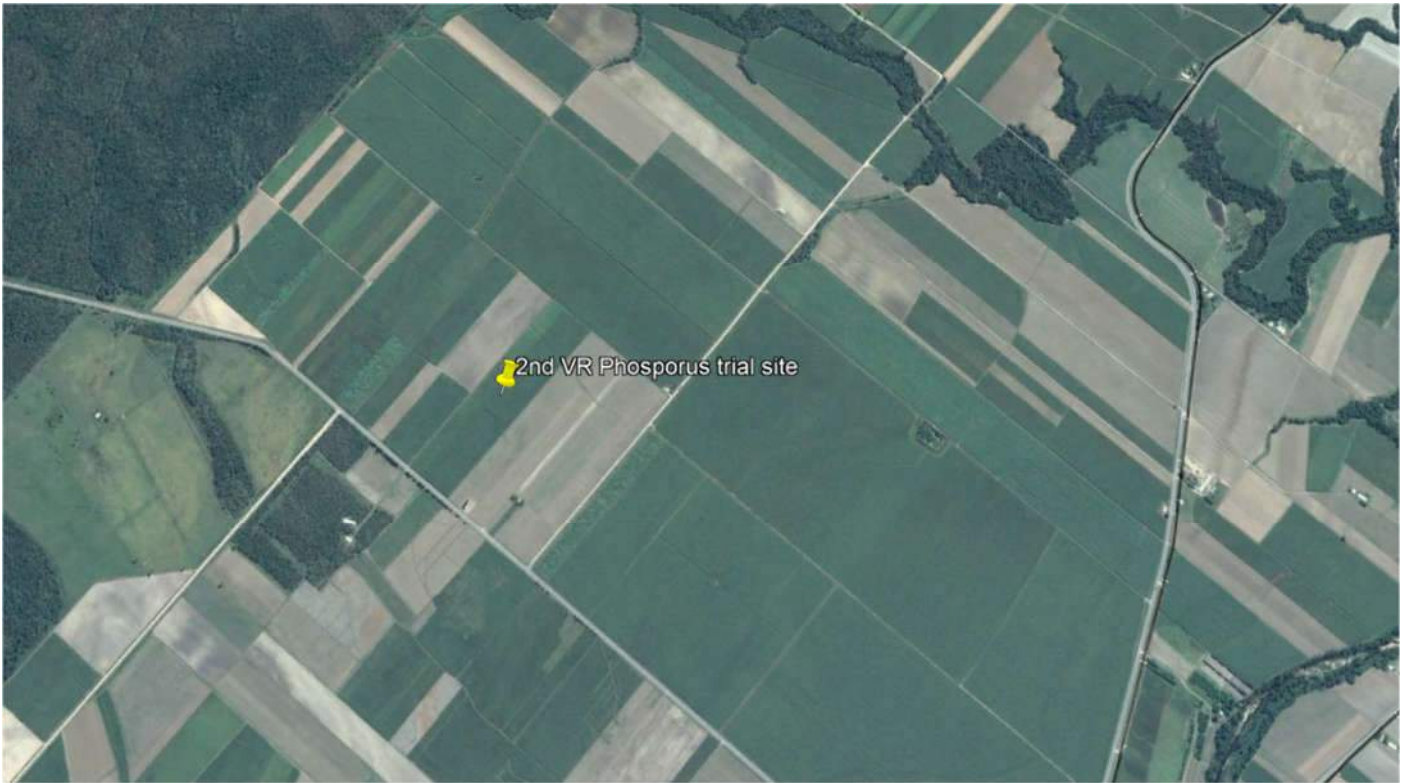
Project Trial site details

Trial Crop:	Sugarcane
Variety:	Q250/Q208
Rat/Plt:	Planted 2019/1 st Ratoon
Trial Block No/Name:	B# 7-6/B#25-5 VR P
Trial Block Size Ha:	5.78 ha/5.74ha
Trial Block Position (GPS):	Refer to google earth map
Soil Type:	Clay/Clay with Sand ridges

1st trial site location.



2nd trial site location.



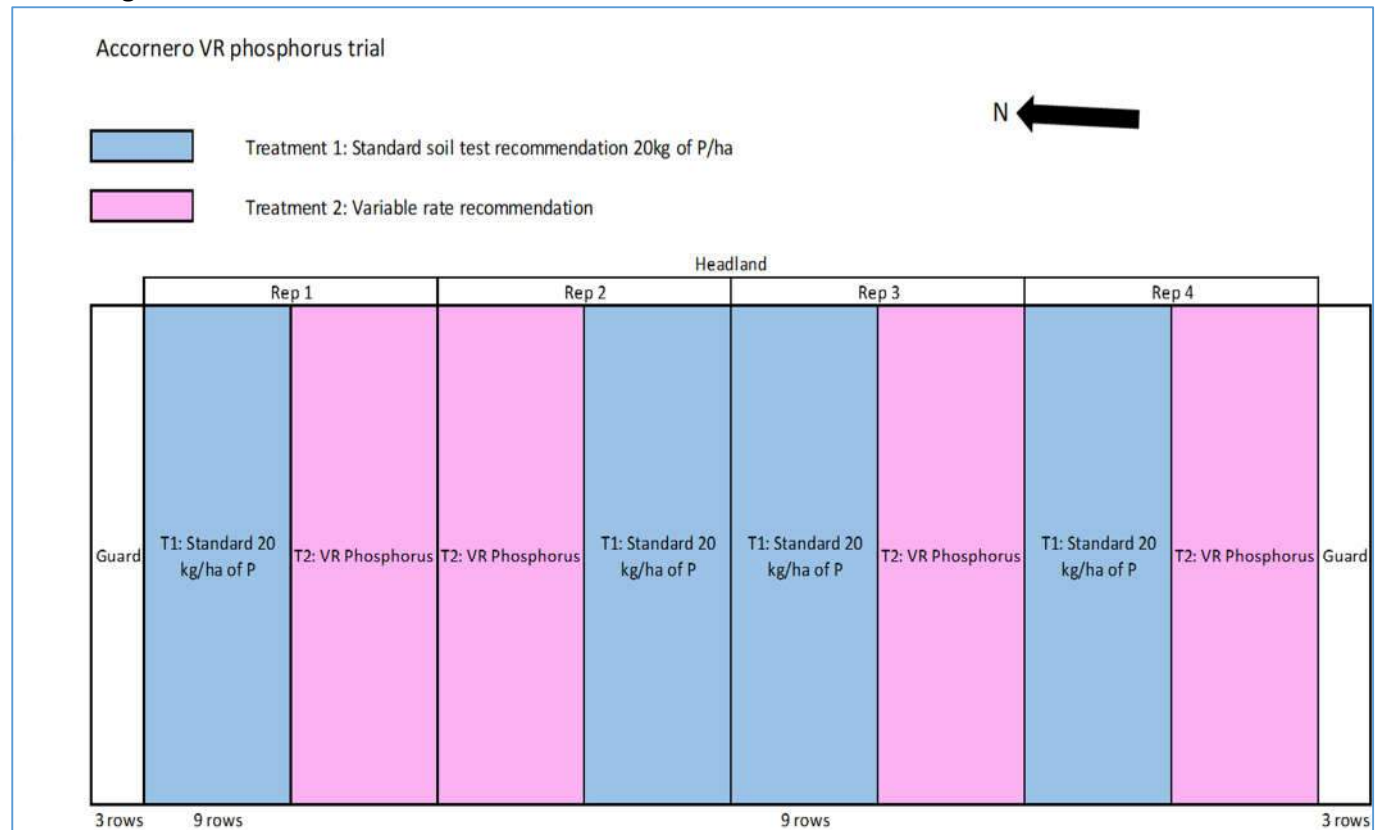
Block History, Trial Design:

History:

2020 – The history of this block (7-6) has consistent uneven germination of cane. Lack of response to lime and other treatments for the poor germination (strike) in sections was why this block was chosen to trial variable rates of phosphorus.

2021 – The history of this block (25-5). Was planted in 2020 and had a blanket rate of 15kg/ha of phosphorus applied, as per randomised soil test recommendations. This block was chosen to trial variable rates of phosphorus due to the grower experiencing lower than average yields consistently.

Trial Design #1:



Trial Design #2:

Variable Rate Phosphorus trial									
Michael Waring									
F# 0094A		1.9m row spacing							
B#25-2		Wallaman Falls road							
B# 7-1	5 guard rows	Rep 1		Rep 3		Rep 2		12 guard rows	B# 25-1
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6		
		Trt 1 Standard 9 rows	Trt 2 VR P 9 rows	Trt 1 Standard 9 rows	Trt 2 VR P 9 rows	Trt 2 VR P 9 rows	Trt 1 Standard 9 rows		
B# 7-1		Trt 1 Standard	Trt 2 VR P	Trt 1 Standard	Trt 2 VR P	Trt 2 VR P	Trt 1 Standard		B# 25-1
Headland									

Treatments:

2020 -Trt 1: Standard 20kg/ha P rate

2020 -Trt 2: VR P rates of 0-40kg/ha according to soil testing

2021 - Treatment 1 – Standard 15kg/ha of Phosphorus applied

2021 - Treatment 2 – Variable rates of 0-20kg/ha of Phosphorus applied

Results: 2020

Variable Rate Map for trial #1. 2020

Soil samples were collected at random places across the block to understand phosphorus variation within the block. Sample were analysed at the Nutrient Advantage lab. From these results a prescription map was created to apply variable rates of phosphorus via a rate controller. Variable rates of phosphorus were applied at side dress of plant cane.





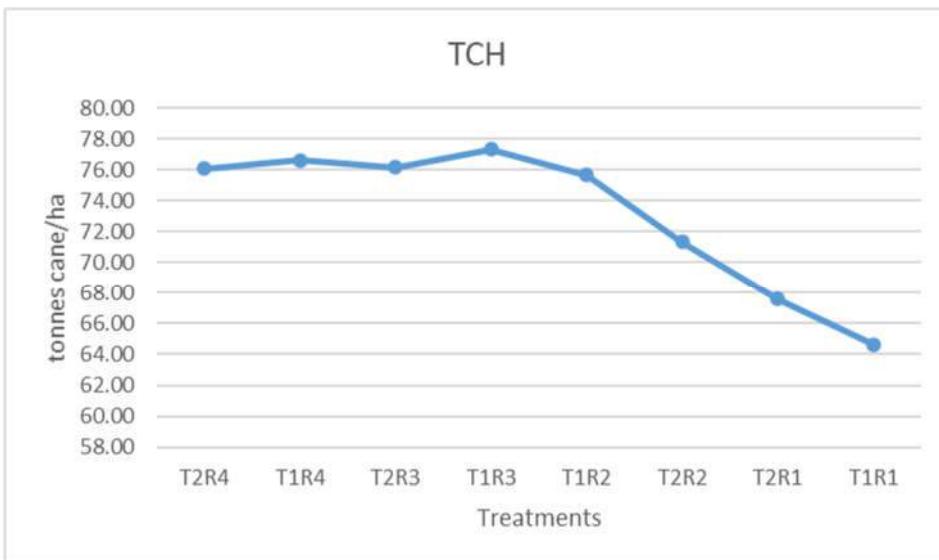
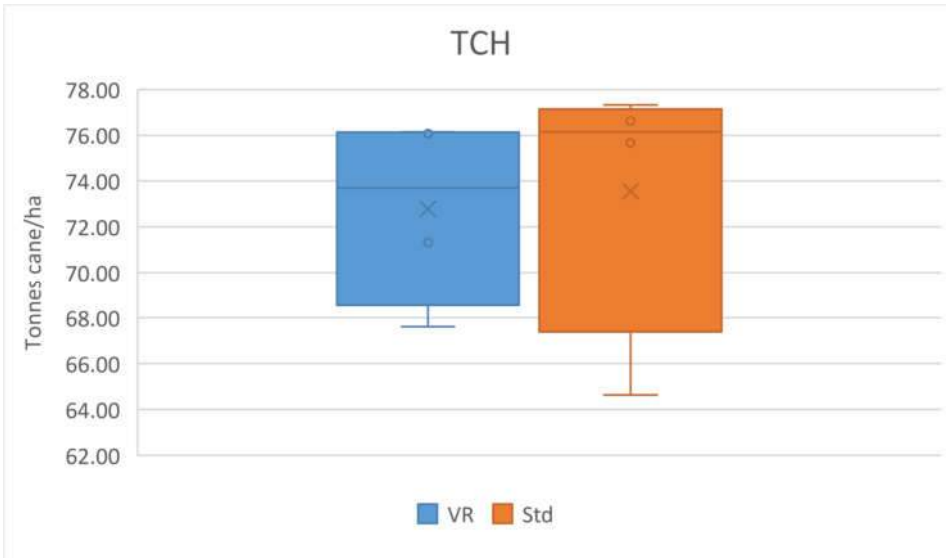
Water Samples results collected from trial site #1 in Jan 2020.

KPI samplers were used to collect water samples, these were installed at the end of the cane rows. KPI samplers were frequently malfunctioning during rain events, resulting in only three samples being collected.

Sample #	Treatment	Results for Total P ($\mu\text{g P/L}$)	Results for Total dissolved P ($\mu\text{g P/L}$)	Filterable Reactive P ($\mu\text{g P/L}$)
A1	Standard 20kg/ha P	83	42	15
A2	Variable Rate P	86	15	3
A3	Variable Rate P	160	48	22

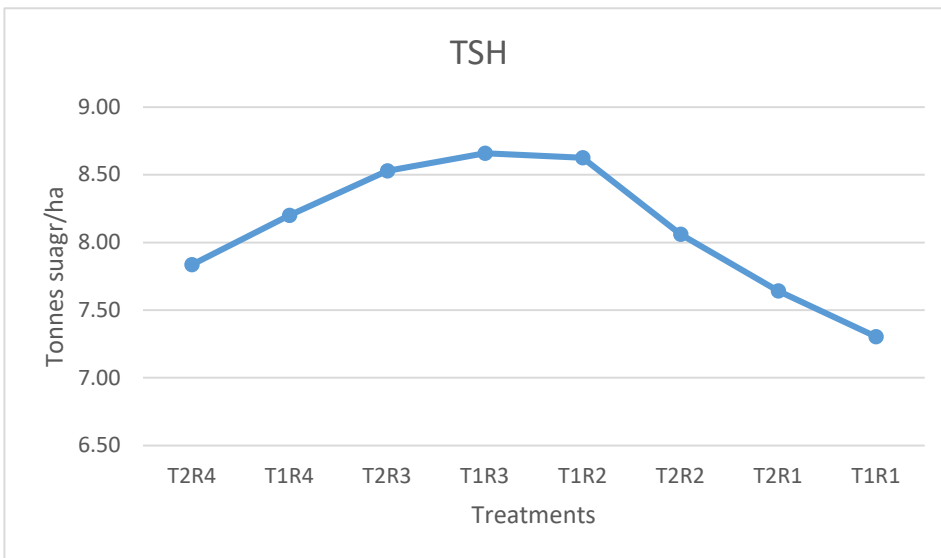
Tonnes Cane per Hectare Harvested from trial site #1 - Aug 2020

Trial was harvested with a harvester in August 2020, results were collected using cane rakes and sent to the Wilmar Victoria Estate Mill in the Herbert district.



Tonnes Sugar per hectare from trial site #1. Harvested Aug 2020.

Trial was harvested with a harvester in August 2020, results were collected using cane rakes and sent to the Wilmar Victoria Estate Mill in the Herbert district.



Economics Table from trial site #1 - 2020:

HCPSL staff used current sugar pricing to create economic results.

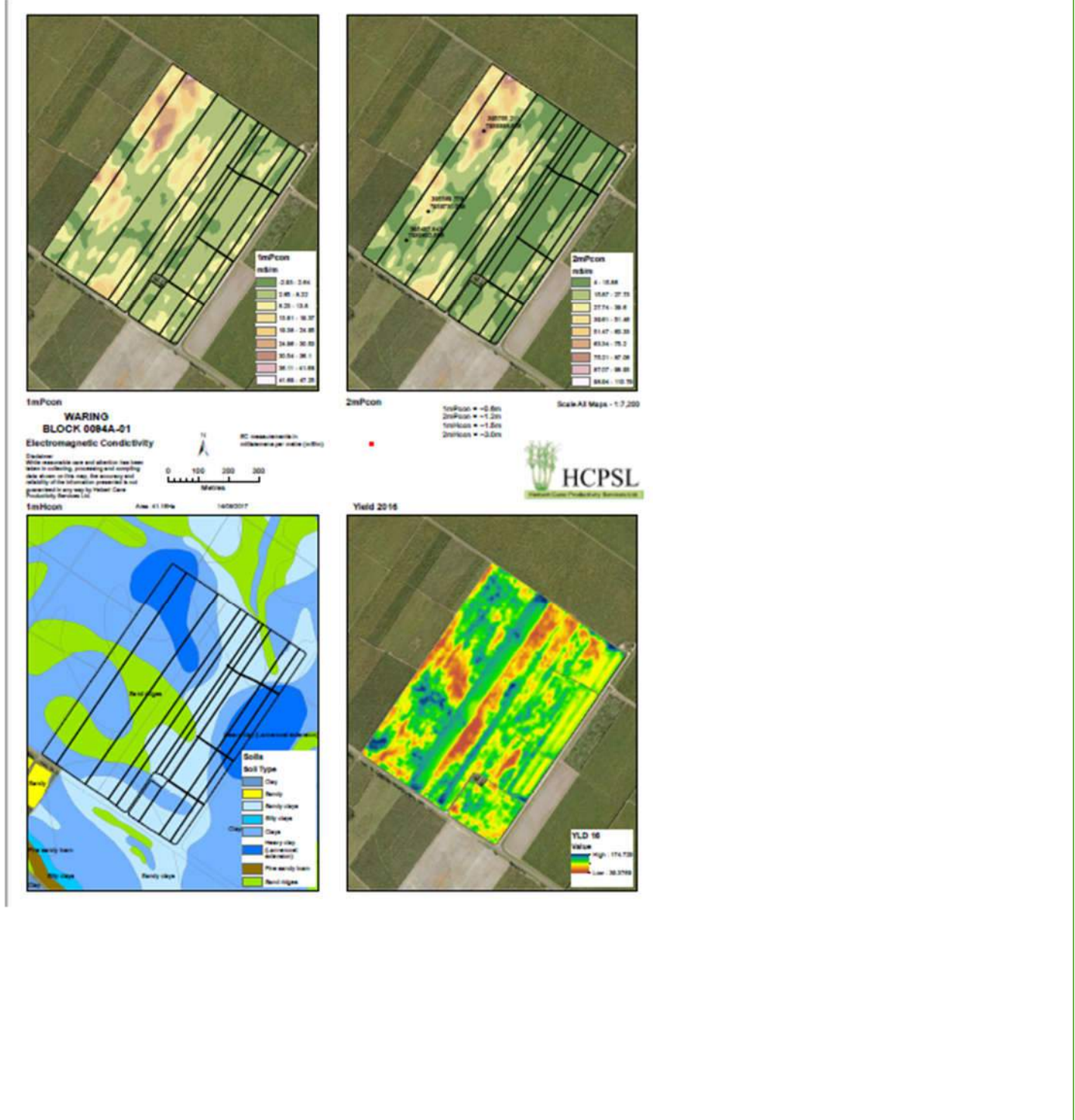
\$400 per t of sugar														
	TCH		TSH		Gross income		Harvesting cost		P Fertiliser cost		Minus variable costs		Difference	Difference percent
	VR	Standard	VR	Standard	VR	Standard	VR	Standard	VR	Standard	VR	Standard		
R4	76.08	76.63	7.84	8.20	\$3,134	\$3,280	\$654.3	\$659.0	\$219.7	\$261.3	\$2,260.37	\$2,359.51	-\$99.14	-4.39%
R3	76.15	77.32	8.53	8.66	\$3,412	\$3,464	\$654.9	\$664.9	\$219.7	\$261.3	\$2,537.00	\$2,537.59	-\$0.59	-0.02%
R2	71.33	75.66	8.06	8.63	\$3,224	\$3,450	\$613.4	\$650.7	\$219.7	\$261.3	\$2,390.92	\$2,538.18	-\$147.27	-6.16%
R1	67.62	64.64	7.64	7.30	\$3,056	\$2,922	\$581.5	\$555.9	\$219.7	\$261.3	\$2,255.15	\$2,104.42	\$150.73	6.68%
	72.79	73.56	8.02	8.20	\$3,207	\$3,279	\$626.0	\$632.6	\$219.7	\$261.3	\$2,360.86	\$2,384.92	-\$24.07	-1.02%
* Assuming NKS fert has remained constant, spraying, cultivation, man hours and levees have remained constant. Harvesting cost is @ \$8.60. P cost is @ \$4.7/kg Average kg of P/ha in VR treatment is 17.25kg/ha														

Results from trial site #2 - 2021:

Due the number of environmental issues encountered with the first trial a second trial was set up to continue the work investigating the variable rate phosphorus concept.

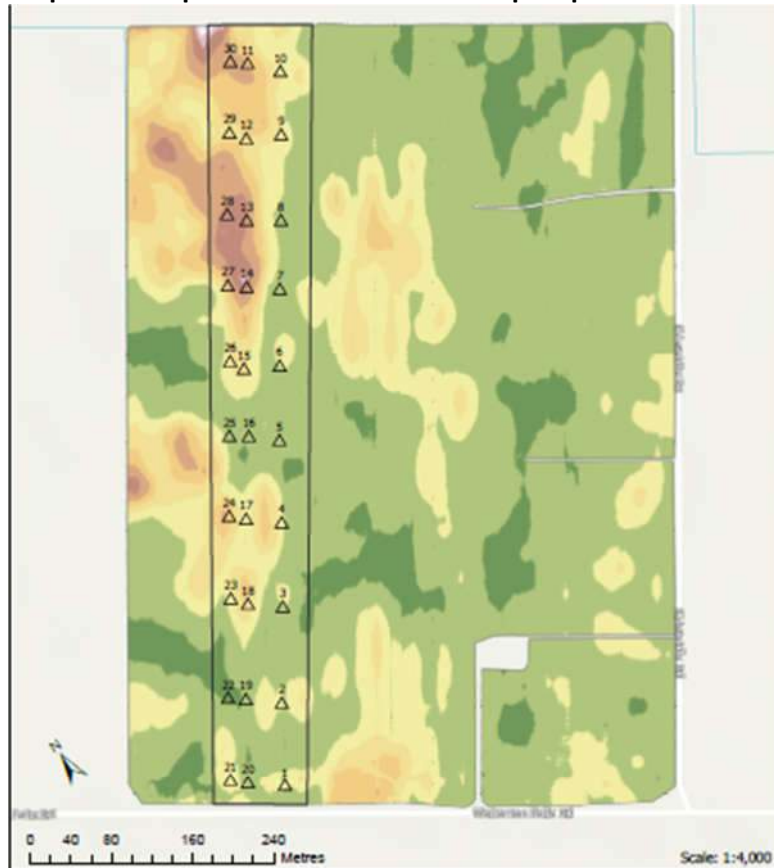
Grower knowledge and EM mapping were used to identify a potential trial block. The below block (25-5) was chosen after the grower confirmed that yields were under district average and EM mapping suggested potential soil constraints.

EM map with soils & yield:

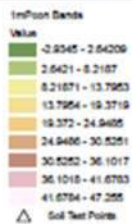


The block (25-5) was split into strips and soils were collected at 75m allotments to understand varying rates of phosphorus across the trial.

Map with soil points for variable rates of phosphorus:



**GPS Soil Test Points
Block 25-2**



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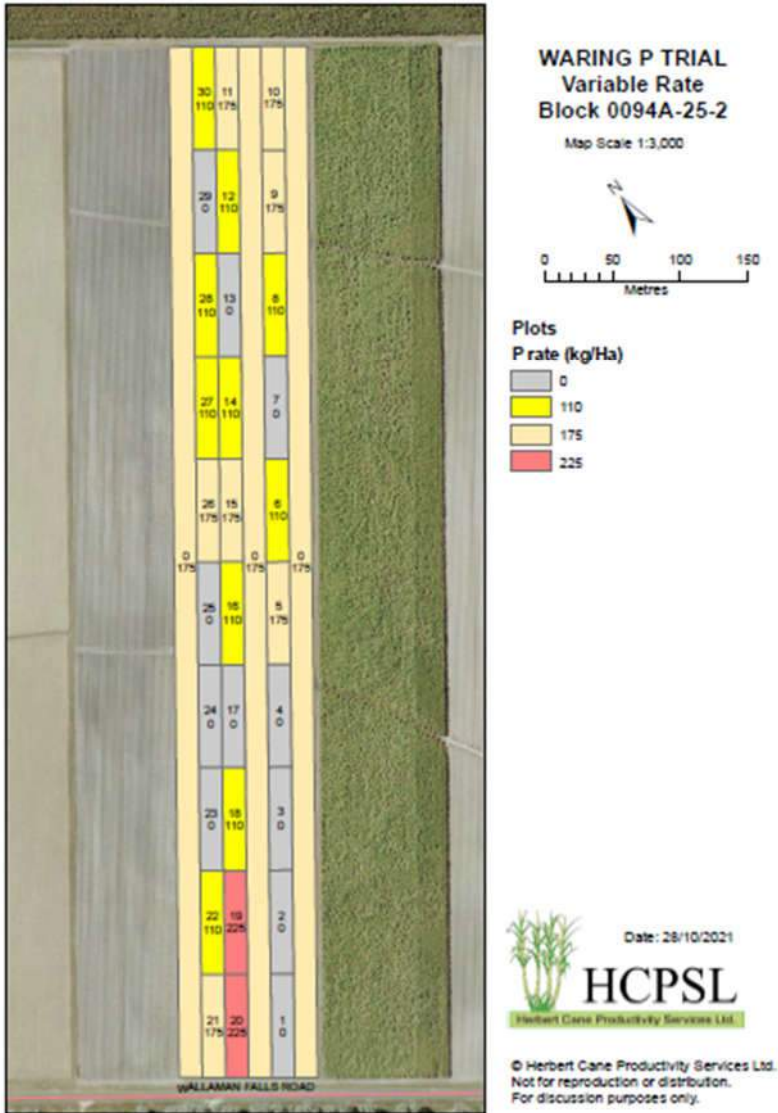
Soils were collected using the above method and sent to the Nutrient Advantage lab for analysis.

Variable rate Phosphorus results from trial site #2 - 2021:

Sample Name	Paddock Name	Phosphorus per kg/ha	Super Phosphate per kg
GPS 1	P2	0	
GPS 2	P2	0	
GPS 3	P2	0	
GPS 4	P2	0	
GPS 5	P2	15	175kg
GPS 6	P2	10	110kg
GPS 7	P2	0	
GPS 8	P2	10	110kg
GPS 9	P2	15	175kg
GPS 10	P2	15	175kg
GPS 11	P4	15	175kg
GPS 12	P4	10	110kg
GPS 13	P4	0	
GPS 14	P4	10	110kg
GPS 15	P4	15	175kg
GPS 17	P4	0	
GPS 16	P4	10	110kg
GPS 18	P4	10	110kg
GPS19	P4	20	225kg
GPS 20	P4	20	225kg
GPS 21	P5	15	175kg
GPS 22	P5	10	110kg
GPS 23	P5	0	
GPS 24	P5	0	
GPS 25	P5	0	
GPS 26	P5	15	175kg
GPS 27	P5	10	110kg
GPS 28	P5	10	110kg
GPS 29	P5	0	
GPS 30	P5	10	110kg

A prescription map was created after analysing results so varying rates of phosphorus could be applied using a variable rate controller. NK & S was applied subsurface a day before the varying rates of phosphorus were applied via sub surface methods.

Prescription map for trial site #2:



NDVI plant health indication map from trial site #2:

NDVI satellite imagery was used to capture plant colouration which is an indicator for plant health and can be used to predict cane growth vigour.



Conclusions and comments

2020 Conclusion - Unfortunately, the trial had several issues to deal with.

- Extreme dry weather when the trial was planted effected cane growth and cause variation within the block.
- Then flooding in early 2020 effected the cane growth again.

These events have resulted in bias variations within the block affecting cane vigour and yields. The trial should be run again to fully understand the potential benefits of targeted phosphorus.

The KPI water samplers failed due to faults with the type of samplers used. Several technical issues were encounter such as:

- One sampler has completely burnt out and could not be fixed.
- Two of the floats will not prime, so even though the float rises the sampler is not collecting the water runoff.
- Float switches are very temperamental in that on occasions they will work then other times they will get stuck and not actuate.

Due to these issues the water quality data could not be captured arcuately and therefore no comprehensive results were capture to analysis water quality data

2021 Conclusion - Variable P soil test results didn't show major phosphorus variation due to being sampled after plant phosphorus applied the year before. Waiting on Harvest results in 2022 season to compare treatments.

Advantages of this Practice Change:

By targeting phosphorus application throughout the block using soil analysis, improved plant germination and overall yields could be improved.

Economic advantages could be attained due to the grower reducing the amount of phosphorus needed with benefits returning by improving consistent yield across the block.

Disadvantages of this Practice Change:

Growers would have to take multiple soil samples across blocks to understand variable phosphorus needs which potentially would not return overall profits.

Growers would need to be up to date with precision agriculture and the technologies.

Will you be using this practice in the future:

2020 Conclusion - At this stage no. The trial needs more study and more reliable data to confidently suggest that it would be beneficial.

2021 Conclusion – Waiting on 2022 harvest data before a decision can be made.

% of farm you would be confident to use this practice:

2020 Conclusion - More trial work is needed. Unfortunately, the grower is too busy at this stage to rerun the trial.

2021 Conclusion – Another grower believes there are potential benefits of the practice and will continue to trial the innovative practice on his farm.