GRDC Regional Cropping Solutions Network funding Research Report

Determining economic rates and incorporation methods for lime in the Eastern Wheatbelt of WA

Project Number: TEK00001

Introduction

Wodjil soils in the Eastern Central Wheatbelt of Western Australia have two main issues that constrain production; low pH and high Aluminium concentration.

These subsoils typically range in pH from 3.4 to 4.2 in CaCl, therefore Aluminium is highly soluble (5-22ppm). As pH is increased above 4.8 CaCl, aluminium availability is reduced, therefore inhibited root growth for annual crops and pastures is reduced (<2ppm).

The Wodjil sandy loam has good characteristics for water holding capacity and nutrient exchange containing ~15% clay, therefore issues such as non-wetting and leaching are not experienced.
Lime (typically limesand) is used to ameliorate soil pH. The cost of the product is not inhibitive, but the cost of transport and application is. For most producers in the Eastern Central Wheatbelt, lime will cost anywhere between $35 and $50/t landed on farm, and costs vary due to distance from the pit and the farmer's ability to cart their own lime.

Aglime recommendations throughout the area have rates ranging from 5-8t/ha over 10 years to fix the acid problem, however, growers that are approaching 3-5t/ha of applied lime are seeing topsoil pH's of 5.5-6.6 in CaCl, but their subsoils are still below 4, therefore they are not gaining any extra benefit from applied lime. This is due to the lime not leaching through the profile as once thought, to ameliorate the subsoil. Therefore, the soil has to be mechanically tilled to ameliorate the subsoil to raise the pH which in turn drops Aluminium out of solution. This increases the bucket size for roots to grow into to utilise nutrients and stored moisture.

Incorporation is the next issue. There is a lack of capital, equity and cash reserves for most farming operations in the Eastern Central Wheatbelt, therefore expensive treatments such as Spading and Mouldboard ploughing pretty much rule themselves out of decision criteria due to expense. One-way ploughs, deep rippers, off set discs and full cut cultivators are already available either on the producer's farm in question, or the machinery can be borrowed, hired or contracted to get the job done at a reasonable cost. We aim to assess the economic returns of each of these combinations so that struggling businesses can make the amendments needed for these soil types. They can then start increasing productivity and profitability, rather than being caught up in the spiral of ever diminishing returns.

With recent seasons, we have had dry winters which have held back the more productive heavier soil types. The water use efficiency of these soils are much less than that of lighter sand plain type soils. Lighter soil types with favourable conditions for root growth are becoming the more productive and profitable soil types in dryer seasons due to average yields coinciding with high grain prices, which in turn carries the business. With future trends of global warming predicting more erratic and extreme weather events has shifted our focus to make sure that farms in the Eastern Central Wheatbelt are drought-proofed as much as possible, this is something that needs to be taken into consideration for future planning.

Some other benefits of increasing the production potential of these soil types are raising the value of the land and thus the owner's equity. Increasing the production potential of

the land that the farmer already owns is a cheaper and more economical alternative than acquiring extra unproductive land. Economies of scale come into the profit equation by having one set of fixed costs, herbicide application, fertiliser applications, along with been able to service the same amount of land with the same machinery that the farmer already owns such as boom-spray's, seeders and harvesters.

Weeds are the next consideration due to Wild Radish and Ryegrass which have been prolific on these soil types. Different types of tillage will have different results to weed control; each form of tillage will stimulate multiple germinations. Weed control from the Mouldboard treatment should be far superior to that of the other treatments, however the physical characteristics of the subsoil brought to the surface may make this the worst treatment in yield results.

Objectives

The Kwinana East RCSN identified that growers (and advisors) want to know when it is better to spend money on lime and gypsum rather than phosphorous, and identified that the provision of regional trials will provide confidence that certain rates of application and practices will work on Eastern Wheatbelt farms.

By having access to these regional trials that provide key indicators, growers will be able to determine how much ameliorant should be applied, what the impact will be on their soil pH, what type of machine would be best to incorporate it, and how much that will cost them.
The main outcome to be achieved is that soils are managed to improve pH levels in a low cost manner, and that these practices improve long term profitability to growers in the Eastern Central Wheatbelt of W.A.

Main aims of the project are:

- Demonstrate different methods of lime incorporation.
- Assess rate responses to lime through subsoil amelioration.
- Economics of lime rate by tillage method

Methodology

1. Trial Layout
    a. Lime treatments run across tillage treatments
    b. Tillage treatments run with the farmer's workings
    c. Nearest neighbour controls added to help with potential statistical analysis.

2. Site selection – the site needed to be as even as possible and line up with the farmer's machine tramlines so yield data can be easily collected. To facilitate this we had to;
    a. Trace paddock boundary.
    b. Set-up tramlines for 13.5m centres.
    c. Align plots with tramlines.
    d. Construct a VRT lime prescription map for a variable rate spreader.
    e. Peg trial according to spatial positioning.

Costs of Lime, Incorperation, Fertiliser and Chemical									→ N	
Lime t/ha	Control	Full Cut	Chisel Plough	Control	Spader	Mouldboard	Control	Twin Disk	One Way Disk	Control
0	$168.60	$176.60	$176.60	$168.60	$348.60	$288.60	$168.60	$182.60	$174.60	$168.60
1	$208.60	$216.60	$216.60	$208.60	$388.60	$328.60	$208.60	$222.60	$214.60	$208.60
2.5	$248.60	$276.60	$276.60	$248.60	$448.60	$388.60	$248.60	$282.60	$274.60	$248.60
0	$168.60	$176.60	$176.60	$168.60	$348.60	$288.60	$168.60	$182.60	$174.60	$168.60
0	$168.60	$176.60	$176.60	$168.60	$348.60	$288.60	$168.60	$182.60	$174.60	$168.60
5	$368.60	$376.60	$376.60	$368.60	$548.60	$488.60	$368.60	$382.60	$374.60	$368.60
0	$168.60	$176.60	$176.60	$168.60	$348.60	$288.60	$168.60	$182.60	$174.60	$168.60
7.5	$468.60	$476.60	$476.60	$468.60	$648.60	$588.60	$468.60	$482.60	$474.60	$468.60
10	$568.60	$576.60	$576.60	$568.60	$748.60	$688.60	$568.60	$582.60	$574.60	$568.60
0	$168.60	$176.60	$176.60	$168.60	$348.60	$288.60	$168.60	$182.60	$174.60	$168.60

Table 1: Cost of lime, incorporation, fertiliser and chemical by treatment.

3. Lime treatments were applied first. The spreader used was a Marshall Multispreader with a VRT kit attached. This facilitated one pass with the spreader and not having to worry about rate calibration issues. Spreader spread 8m swaths.

4. The whole site (except the mouldboard) was deep ripped (11/6/2014) to take out traffic pan issues. The mouldboard treatment wasn't ripped because it needed to have a firm surface for traction and soil flow dynamics.

5. Aligning mechanical tillage incorporation timing was difficult because;
    a. We needed adequate rain to work the profile to avoid wind erosion
    b. Most farmers and contractors were busy using their equipment trying to get the crop in.
    c. Which in turn, meant the sowing date was the 24th of June.
    d. The Spader and Mouldboard plough were sourced from outside the district.
        i. Spaded 12th June. Spading treatment copped severe weather on the 18th with minimal blow.
        ii. Other treatments 20-23rd of June

6. Herbicides – The site was long term capeweed pasture, so no real problem weeds present.
    a. Knockdown on the 5th of June from farmer applied knockdown/pre-emergent for the surrounding crop.
        i. 0.2kg/ha Diuron
        ii. 1.2l/ha Glyphosate
        iii. 1.2l/ha Trifluralin 480.

7. The seeder used was an old Alfarm airseeder and bar.
    a. The advantages of this seeder were:
        i. Light weight for minimal compaction.
        ii. Floating seed boots, so seed depth was evenly placed across different treatments (The Mouldboard, Twin Disks and Plough were very soft)

iii. Agmaster rotary harrows for a gentle light covering of the seed with minimal disturbance.
(See YouTube link in Appendix for footage)

b. Sown on the 24th of June
   i. 68kg/ha CSBP's K-Till Extra (7N, 8.2P, 7.6S, 0.07Cu, 0.14Zn)
   ii. 2kg/ha Manganese Sulphate (0.62Mn)

8. In-season measurements
   a. Germination across the site was pretty even.
      i. Average density of 148 plants/m2
   b. Weed pressure ratings were not needed due to site being clean.
   c. Penetrometer readings
      i. Were not conducted due to the long dry spell that was experienced during August.
      ii. Re compaction issues were realised when digging up the root zone for the spring field walk.
   d. NDVI wasn't taken due to the poor season producing a small stunted canopy.

9. Post – Emergent herbicide application 4th of August
   a. 750ml/ha Jaguar
   b. 400ml/ha MCPA LVE 570
      i. Clean – up of Double Gee's and Wild Radish.

10. Nitrogen Top – up
    a. 5th of August
       i. 30l/ha UAN (12.6N)
       ii. Possible waste of time and money due to the poor season.

11. Foliar Disease management wasn't needed due to the trial being planted on a pasture and a poor season.

12. Harvest: 10th of December 2014
    a. Harvested with small plot harvester by Kalyx.
    b. Samples sent away for analysis by Kalyx
       i. Screenings, Protein and Hectolitre weight.

Results

Crop establishment and development

Establishment was reasonably even across the site, with the average crop density being 148 plants/m2.

Rainfall and Climate

- 83mm fell for the growing season prior to the Spader treatment.
  - The Spader treatment received 11mm after spading, which was after a severe wind event on the 17/6/2014 with wind speeds averaging in excess of 55km/hr.
    - The spaded treatment had minimal soil loss from the plot.
  - This rainfall was prior to the other treatments.
- The rest of the site received 94mm before incorporation
- 5.5mm fell on the 22nd after the other tillage treatments were conducted.
- 9 days after sowing, 5mm was received which guaranteed establishment.
- July received 46mm
- August received 16.5mm.
- September received 28mm, with 23mm falling between the 5th and 8th of September.

- October received 10.5mm which was too late to be of any benefit.
- Therefore 90mm was received following sowing of the trial.
- Heat shock events occurred on:
    - o 25th (27.6°C) and 27th (27.8°C)of August
    - o 12th (28.4°C), 17th (30.2°C), 20th (46km/hr, 33.5°C) and 25th (46km/hr, 31°C) of September
    - o 1st (28.1°C), 2nd (29.6°C), 14th (31.5°C), 15th (37.8°C), 16th (33.5°C), 17th & 18th (30°C), 22nd (35.4°C), 24th (30.2°C), 28 & 29 (34°C) of October.

See Appendix 1 for Bencubbin Weather chart.

Yield

Due to the poor season the site only averaged 460kg/ha.

Lime t/ha	Control	Full Cut	Chisel Plough	Control	Spader	Mouldboard	Control	Twin Disk	One Way Disk	Control	Ave
0	0.32	0.45	0.38	0.42	0.33	0.41	0.39	0.54	0.51	0.44	0.42
1	0.29	0.43	0.37	0.42	0.33	0.37	0.41	0.46	0.39	0.46	0.39
2.5	0.34	0.43	0.34	0.41	0.37	0.47	0.43	0.54	0.50	0.60	0.44
0	0.32	0.46	0.43	0.49	0.44	0.52	0.30	0.57	0.67	0.66	0.49
0	0.42	0.54	0.45	0.52	0.55	0.50	0.45	0.70	0.52	0.59	0.52
5	0.49	0.61	0.62	0.71	0.66	0.53	0.61	0.69	0.60	0.61	0.61
0	0.46	0.64	0.66	0.63	0.58	0.45	0.58	0.58	0.54	0.59	0.57
7.5	0.46	0.64	0.64	0.58	0.57	0.46	0.55	0.57	0.53	0.50	0.55
10	0.28	0.45	0.42	0.36	0.29	0.13	0.31	0.36	0.24	0.35	0.32
0	0.38	0.62	0.60	0.58	0.39	0.30	0.36	0.43	0.38	0.45	0.45
Ave	0.38	0.53	0.49	0.51	0.45	0.41	0.44	0.54	0.49	0.52	

Table 2: Yield t/ha by treatment.

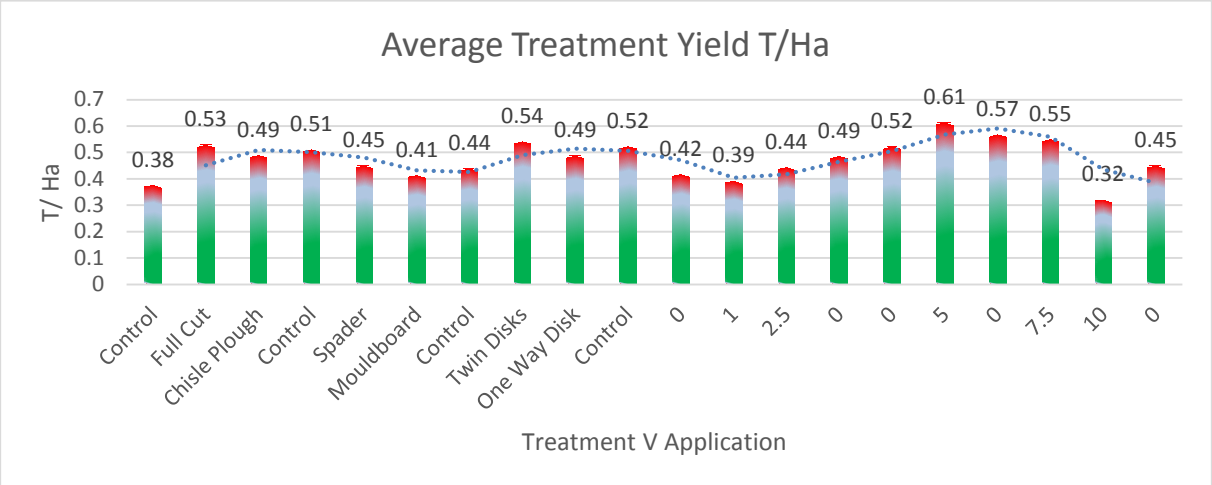


Figure 1: Average Treatment Yield t/ha

Treatments have been averaged to try and gain some sort of trend out of the different treatments. As shown above, there is a fair bit of variation in the data.

The 5t/ha of Lime and the Twin Disk treatments look to be the ones to watch going into the future.

Protein

T/Ha Lime	Control	Full Cut	Chisle Plough	Control	Spader	Mouldboard	Control	Twin Disks	One Way Disk	Control	Ave
0	14.8	14.3	13.6	14.4	14.3	14.2	13.3	13.2	13.4	13.6	13.9
1	15.3	14.1	14.0	14.0	14.8	13.9	12.3	13.9	12.8	12.9	13.8
2.5	14.9	13.8	13.5	14.4	15.0	13.8	12.7	13.3	13.2	14.1	13.9
0	14.9	13.3	13.5	13.9	13.9	13.3	12.4	12.7	12.8	13.0	13.4
0	14.2	13.4	14.3	13.9	13.0	12.7	12.6	13.2	12.7	13.3	13.3
5	14.9	13.6	13.4	12.7	14.5	12.8	13.0	13.7	13.4	14.2	13.6
0	14.4	12.9	12.4	12.9	15.0	13.7	12.3	12.7	12.9	14.1	13.3
7.5	13.8	13.7	13.0	13.5	15.1	14.5	14.9	14.2	14.3	14.5	14.2
10	14.1	13.9	12.9	13.6	15.1	14.5	13.8	14.0	14.1	15.3	14.1
0	14.6	13.8	12.7	14.4	13.9	14.4	14.1	13.6	13.8	14.9	14.0
Ave	14.6	13.7	13.3	13.8	14.5	13.8	13.1	13.5	13.3	14.0	

Table 3: Protein % by Treatment

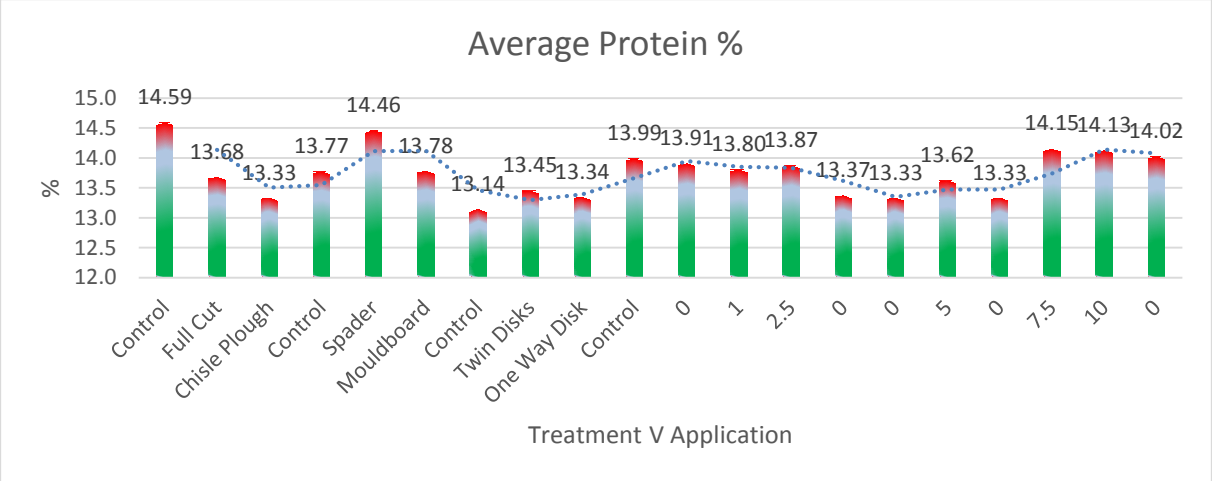


Figure 2: Average Treatment Protein %

Protein % is generally pretty high across the board which would suggest nitrogen was non-limiting on yield.

Screenings

T/Ha Lime	Control	Full Cut	Chisle Plough	Control	Spader	Mouldboard	Control	Twin Disks	One Way Disk	Control	Ave
0	9.14	2.44	1.70	2.85	3.80	1.48	0.89	0.48	1.22	0.37	2.4
1	4.59	1.25	1.87	0.40	2.70	1.43	0.90	0.94	0.42	0.38	1.5
2.5	0.49	0.41	0.40	0.96	4.11	2.76	1.59	0.67	0.43	0.83	1.3
0	2.32	1.32	2.03	3.01	2.38	0.38	0.44	0.36	0.87	1.13	1.4
0	2.78	0.78	2.89	1.43	1.89	0.80	0.40	0.70	0.68	1.82	1.4
5	2.66	0.36	1.60	0.33	2.37	0.72	0.41	0.31	0.13	0.36	0.9
0	1.38	0.79	0.33	0.75	1.10	0.86	0.39	0.35	0.39	0.37	0.7
7.5	1.47	0.26	0.23	0.17	1.13	1.16	0.39	1.54	0.84	1.43	0.9
10	0.44	0.25	0.41	0.39	0.43	1.03	0.35	0.23	0.17	0.40	0.4
0	1.47	1.07	1.52	0.66	2.67	1.02	0.80	1.12	0.45	1.77	1.3
Ave	2.67	0.89	1.30	1.10	2.26	1.16	0.66	0.67	0.56	0.89	1.22

Table 4: Screenings % by Treatment

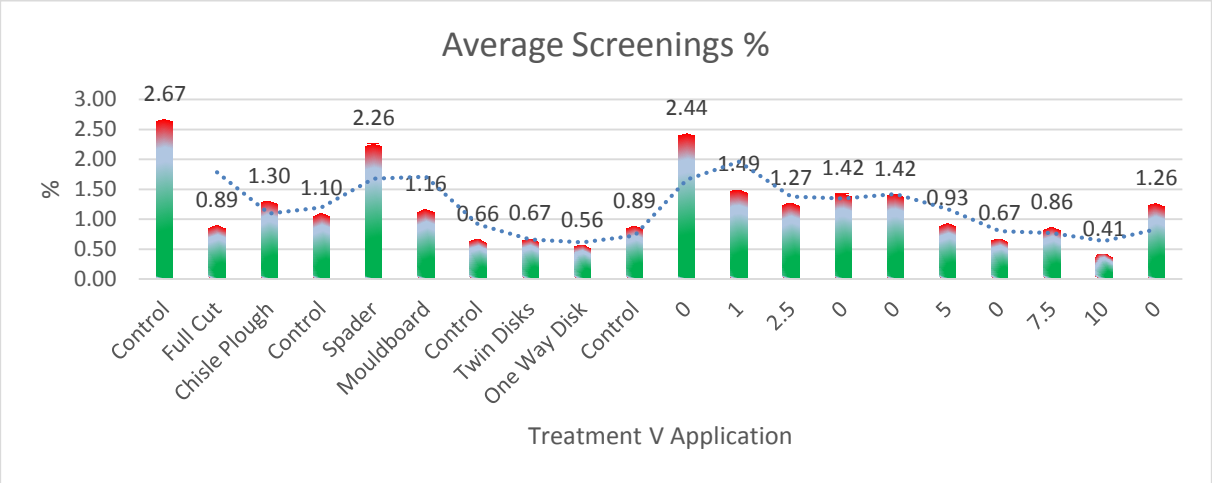


Figure 3: Average Treatment Screenings %

Some of the high screenings in the first control could be attributed to tree effect (tree roots), while the high screenings in the first 0 lime treatment could possibly be attributed to machinery set-up.

Hectolitre Weight

T/Ha Lime	Control	Full Cut	Chisle Plough	Control	Spader	Mouldboard	Control	Twin Disks	One Way Disk	Control	Ave
0	64.8	68.8	69.8	68.4	68.6	70.2	69.6	69.6	68.8	68.8	68.7
1	72.2	71.2	71.4	70.6	70.4	71.8	70.2	70.6	70.4	69.8	70.9
2.5	70.0	69.2	71.8	70.0	68.0	70.4	69.6	71.0	70.8	69.4	70.0
0	68.0	73.0	69.2	69.2	68.8	72.0	69.4	68.6	70.6	70.6	69.9
0	68.8	70.2	71.2	69.8	70.0	71.0	69.6	70.6	70.0	70.2	70.1
5	69.2	69.8	69.4	70.6	68.6	70.6	68.2	70.4	67.6	71.0	69.5
0	68.8	69.8	67.8	70.2	68.0	68.2	70.2	70.8	71.4	70.4	69.6
7.5	68.8	70.0	69.8	69.0	69.2	69.8	70.4	71.8	70.8	71.4	70.1
10	70.4	72.0	70.4	69.4	70.4	70.2	70.6	72.0	72.0	70.2	70.8
0	72.6	71.2	70.6	70.2	69.2	71.8	69.6	70.4	70.2	68.4	70.4
Ave	69.4	70.5	70.1	69.7	69.1	70.6	69.7	70.6	70.3	70.0	70.0

Table 5: Hectolitre Weight (kg/hL) by Treatment

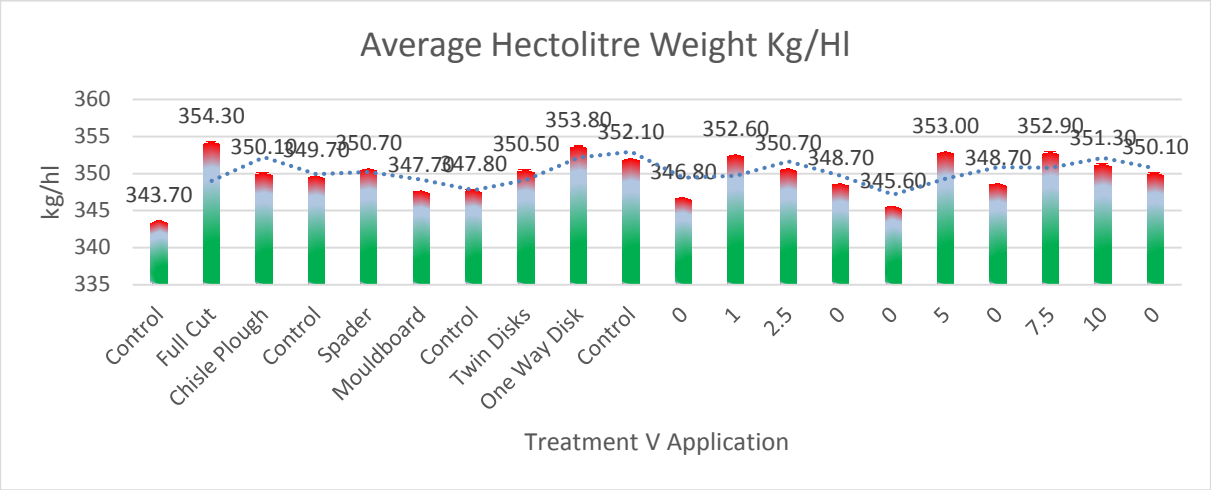


Figure 4: Average Hectolitre Weight (kg/hl)

Statistics

A linear mixed model with an autoregressive error structure was fitted to the yield data, revealing a significant effect of lime but not of the machinery treatments, and no interactions. The lime effect was due to reduced yield at 10t/ha, showing that in this season with this rainfall that 10t/ha of lime impacted negatively on yield; while none of the other lime rates were significantly different from 0t/ha.

The predicted means for lime rates are:

Lime	Yield
0	0.46
1	0.40
2.5	0.43
5	0.52
7.5	0.49
10	0.29

The lsd for the results was 0.09 when comparing with 0 t/ha lime so only the 10 t/ha plot is significantly different from nil lime. The lsd for other comparisons is larger because of the reduced replication but 10 t/ha lime is significantly less than all the other rates. So, a question to ask is why is 10 t/ha plot yield so low?

The predicted means for machinery treatments were

Treat	Yield
Chisel Plough	0.45
Control	0.42
Mouldboard	0.35
Twin Disks	0.48
One Way Disks	0.40
Full Cut	0.53
Spader	0.37

There were no significant differences among these.

(French, Per Comm 2015)

Economics

The most economic treatments for 2014 were 0t/ha of lime and no subsoil incorporation.

Profit/ha										
Lime t/ha	Control	Full Cut	Chisel Plough	Control	Spader	Mouldboard	Control	Twin Disk	One Way Disk	Control
0	-$89.77	-$63.99	-$82.76	-$63.49	-$266.02	-$187.25	-$71.00	-$47.46	-$46.97	-$59.74
1	-$135.67	-$108.79	-$124.64	-$103.96	-$306.15	-$236.64	-$107.13	-$108.44	-$116.30	-$94.44
2.5	-$162.59	-$168.29	-$190.59	-$146.66	-$356.22	-$270.74	-$140.29	-$148.81	-$150.36	-$98.88
0	-$89.41	-$60.86	-$70.00	-$46.77	-$238.95	-$157.63	-$92.45	-$39.45	-$7.08	-$4.13
0	-$63.48	-$42.81	-$65.11	-$37.99	-$211.62	-$164.36	-$57.11	-$7.40	-$43.99	-$22.07
5	-$246.25	-$224.48	-$221.18	-$190.03	-$383.26	-$356.32	-$216.48	-$210.64	-$225.79	-$216.48
0	-$53.95	-$16.09	-$12.82	-$11.37	-$204.47	-$177.23	-$24.47	-$38.47	-$40.30	-$21.19
7.5	-$352.86	-$315.85	-$315.85	-$323.92	-$507.14	-$472.86	-$330.35	-$341.14	-$342.78	-$343.21
10	-$497.98	-$463.61	-$470.67	-$479.15	-$675.62	-$655.64	-$490.92	-$493.15	-$513.39	-$481.50
0	-$74.49	-$20.84	-$27.33	-$22.57	-$251.25	-$213.96	-$77.74	-$75.51	-$80.49	-$55.02

Table 6: Profit/Loss by plot in $/ha

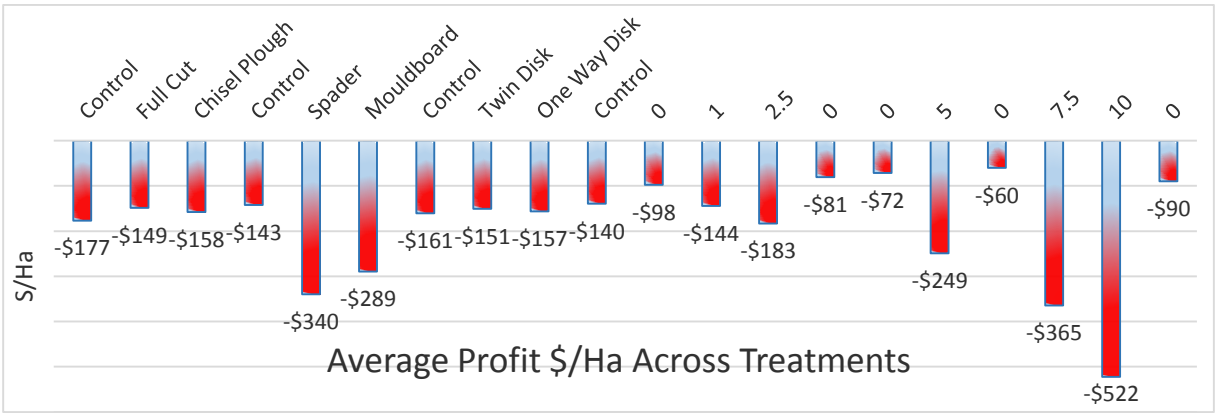


Figure 5: Average Profit/Loss by Treatment in $/ha

Recommendations

Due to the low amount of rainfall received after incorporation in 2014, we would have to have significant rainfall in 2015 to activate the lime to show up differences between treatments. If we receive 200-300mm for the year, then soil samples could be taken after harvest to track changes in soil pH and Aluminium concentrations. The paddock is planned to be dry sown to Triticale in 2015.

If the season is promising, NDVI imagery can be flown from the site for analysis and yield collected from the farmer's harvester. If the season is good, then a small plot harvest can be employed to take accurate yield data. To take a round of measurements, I envisage we would need approximately $20,000.

Due to the high cost associated with purchasing, transport and applying lime, the expensive tillage treatments rule themselves out of consideration economically. The use of a single or twin disk machine looks to be more effective at lime incorporation then tyned implements and are a lot more productive and economic to use then a mouldboard or spader. (See Appendix 2 – Photos)

Mould boarding in these soil types is fraught with danger with the high concentration of subsoil that is brought to the surface, maybe a split application of lime such as 2.5t/ha pre and 2.5t/ha post would resolve this issue. This was one of the proposed treatments but we ran out of lime before applying this treatment.

Spading looks to have a good level of mixing through the profile, however, cost and low productivity (hectares/hr) make this treatment undesirable.

Tyned implements have good topsoil mixing, but don't invert the profile sufficiently to place lime into the subsoil.

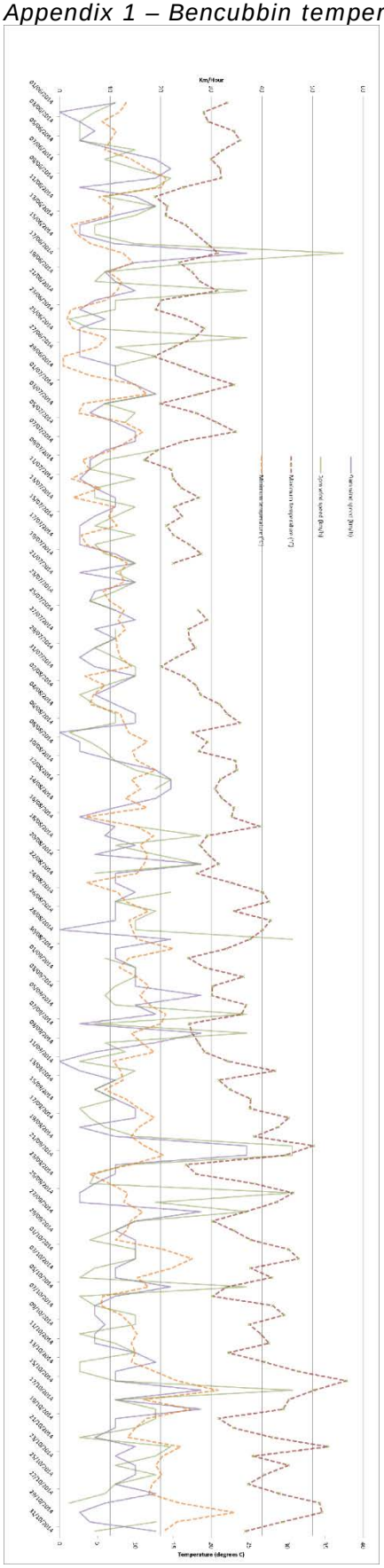
A standard deep ripper does a good job of breaking up the hard pan, however, there is minimal lime falling through the profile. There is a lot of interest in the development of boots to be attached to deep ripper tynes to allow the flow of topsoil applied lime to fall down behind the tyne, this could be a good alternative to allow lime to fall through the profile with minimal disturbance. Although, this will not solve the issue of having a high topsoil pH and very low mid/sub-soil pH that has high Aluminium levels due to the small amount of active (lime) that is transferred into the subsoil by this operation.

Ultimately, the farmer needs to source the most cost effective source of lime for their operation and apply rates which are in their budget means. As demonstrated in this trial, the use of Variable Rate Technology (VRT) allows high rates (3-5t/ha) to be applied to these small areas of the paddock, while treating the better soil types with the rates they need to more effectively target soil types and lime requirements.

This trial has been set-up for the long term and we look forward to watching developments unfold into the future. This trial conducted over a 12 month period has not conclusively proved any one practice or application is more cost effective when taking into account the long term effects of liming and the incorporation methods that were trialled. It is recommended that a further 2 years trial data be collected from this site.

Appendix

Appendix 1 – Bencubbin temperature and wind speed June – October 2014.



DTPA Iron mg	A Copper m
26.75	0.25
31.02	0.15
34.14	0.25
19.22	0.16
31.75	0.36
26.39	0.27

Appendix 2: Comprehensive Soil Test results 2014 pre liming.

Appendix 3 – Photo's

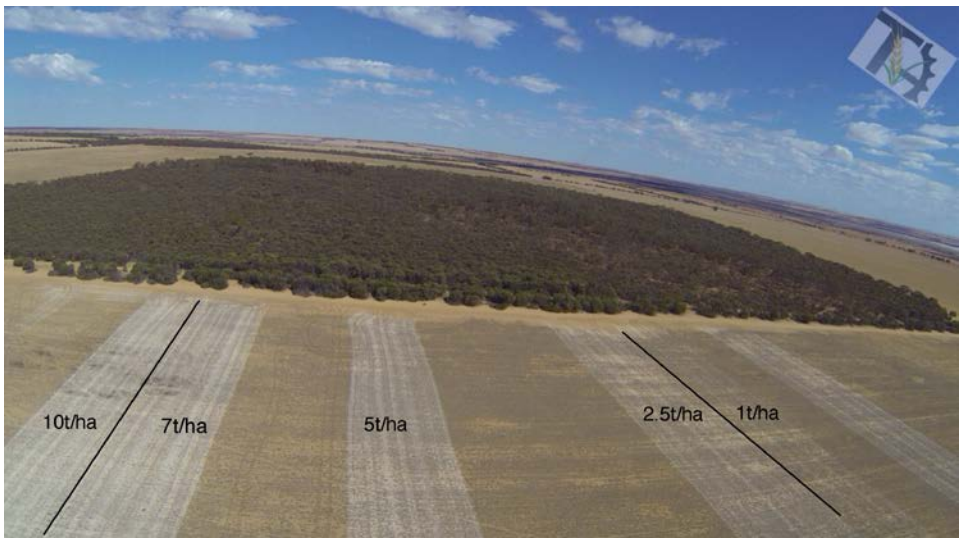


Photo 1: Post Lime Application

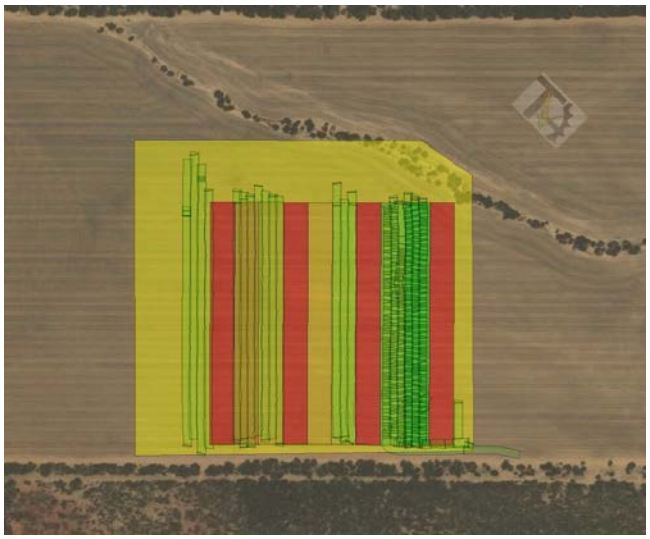


Photo 2: Application map layered on top of prescription map.

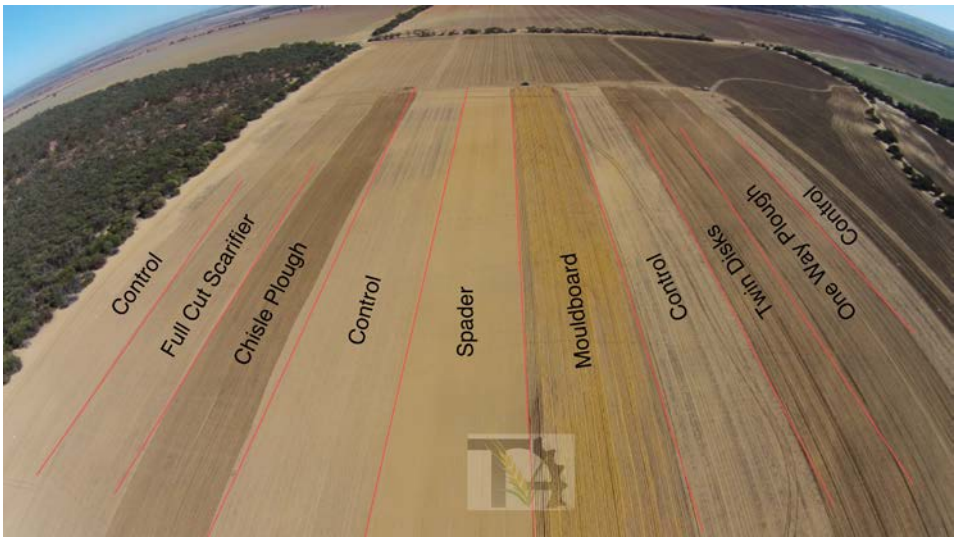


Photo 3: Post incorporation, pre sowing.

Photo 4: Mid tillering crop, relatively even establishment

Photo 5: Crop at flowering

Photo 5: Spader Lime Incorporation

Photo 5: Mouldboard burying of lime and topsoil below toxic subsoil.

Photo 6: One way disk plough, note the layer effect.

Photo 6: Site during harvest

Wodjil Workout photo's

Tek Ag YouTube

For a comprehensive collection of photos and YouTube footage taken during the project, please click on the following links or scan the QR codes.

http://s34.photobucket.com/user/Tyrone_Henning/library/Wodjil%20Workout

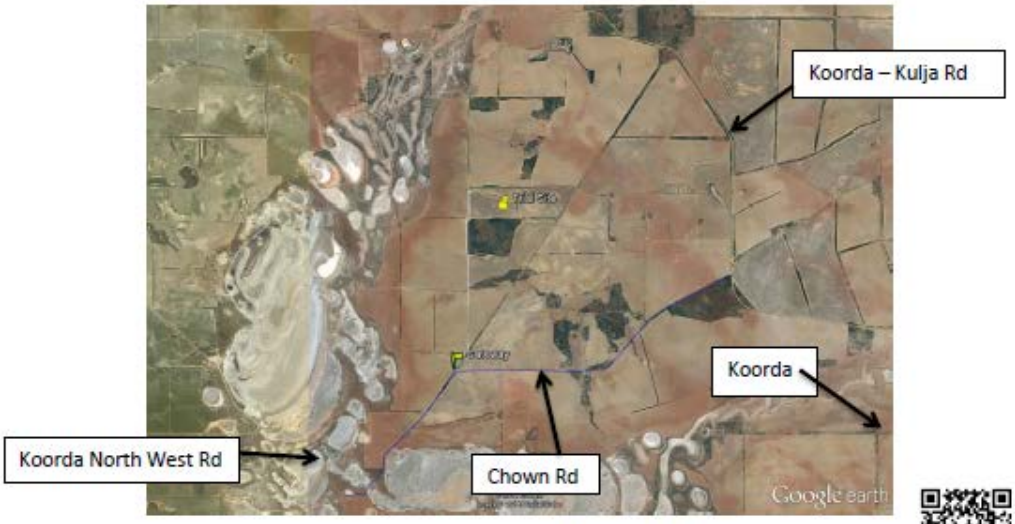
https://www.youtube.com/channel/UCp6qAsbp0bCZzCHv95rhv4w

Wodgil Workout Field Walk

Lime Rate X Tillage

24th of September 3pm

Where : Grahme and Noreen Fuchsbichler's property, off Chown Rd



Some refreshments available afterwards to facilitate discussion

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Agenda

3-3.20pm Welcome & move to 7-10t/ha treatments.

- Soil test results
- Different lime sources
  - Testing
- Technology use
  - Inaccuracies of free to air GPS
- Prescription & Application Maps

3.20 – 3.45 Chisel Plough vs Scarifyer and Deep ripper

- Root Inspection
- Machine Challenges
- Economics

3.45 – 4.15 Look at lime incorporation with Spader V Mouldboard

- Root Inspection
- Machine Challenges
- Economics

4.15 – 4.40 Off Sets V Chamberlain Plough

- Root Inspection
- Machine Challenges
- Economics

4.40 – 5pm Walk through lime treatments

5 – 5.15 Look at herbicide effect on germination

5.15 - 5.30 Other issues/questions

5.30 - 6.30 Refreshments.

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Knockdown 5th of June

Spaded 12th of June

Mouldboard and other treatments 20th of June

Sown : 23rd June 2014

70kg/ha Speedy Triticale

68kg/ha K-Till Extra

2kg/ha Manganese Sulphate

4th August 2014

750ml/ha Jaguar

400ml/ha MCPA LVE 570

5th of August 2014

30l/ha Flexi-N and 30l/ha Water

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Soil Acidity Management Plan

Prepared by the Building Better Soils professionals:
Helping to ensure the future profitability of your farm.

PRECISION SoilTech
Aglime of Australia

Aglime of Australia (Wodgil Workout II)
PO Box 212
BELMONT WA 6984

pH Results

Paddock	Site	Zone	Easting	Northing	Soil Type	Top pH	Mid pH	Sub pH	10yr Rec
pH Wodgil Workout	8	50J	537117	6603657	Sand	4.2	3.8	3.8	6t
Wodgil II	1	50J	536984	6603692	Sand	4.2	4.0	3.5	6t
Wodgil II	10	50J	536722	6603778	Sand	4.2	3.8	3.8	6t
Wodgil II	2	50J	537121	6603583	Sand	4.3	4.1	3.5	6t
Wodgil II	3	50J	537169	6603773	Sand	4.2	4.1	3.6	6t
Wodgil II	4	50J	536984	6603581	Sand	3.9	3.6	3.4	6t
Wodgil II	5	50J	537090	6603720	Sand	4.1	3.7	3.8	6t
Wodgil II	6	50J	537195	6603611	Sand	4.8	4.1	3.8	6t
Wodgil II	7	50J	537062	6603639	Sand	3.6	3.7	3.4	6t
Wodgil II	8	50J	537203	6603694	Sand	3.9	3.7	3.6	6t
Wodgil II	9	50J	537038	6603767	Sand	3.8	3.7	3.8	6t

Colour key for quick soil acidity assessment

Colour	Soil pH	Acidity Rating	Urgency for Lime Application
	Less than 4.5	Extremely Acid	Very Urgent – This season is highly desirable
	4.5 to 5.0	Moderately Acid	Urgent – Within the next year or two
	5.0 to 5.5	Slightly Acid	Maintenance Liming
	5.5 to 6.0	Target	Maintenance Liming
	Above 6.0	Above Target	Monitor pH every 4 years if no subsoil acidity

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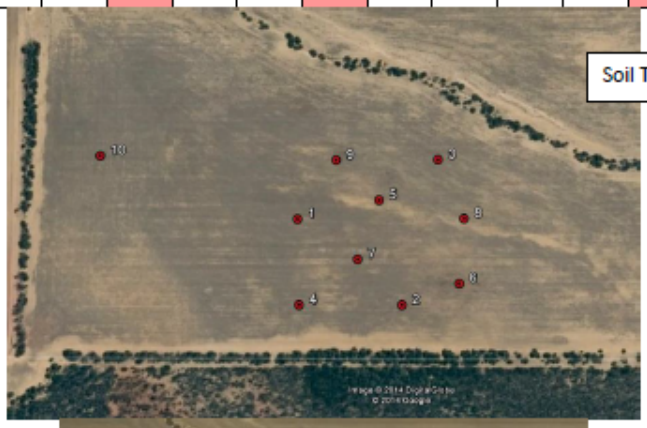
Aglime Lime Recommendation

Paddock	Site	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	10yr Rec
pH Wodgil Workout	8	2			2					2		6t
Wodgil II	1	2			2					2		6t
Wodgil II	10	2			2					2		6t
Wodgil II	2	2			2					2		6t
Wodgil II	3	2			2					2		6t
Wodgil II	4	2			2					2		6t
Wodgil II	5	2			2					2		6t
Wodgil II	6	2			2					2		6t
Wodgil II	7	2			2					2		6t
Wodgil II	8	2			2					2		6t
Wodgil II	9	2			2					2		6t



Soil Test Site Locations

Lime prescription map in background, with application coverage layer on top.

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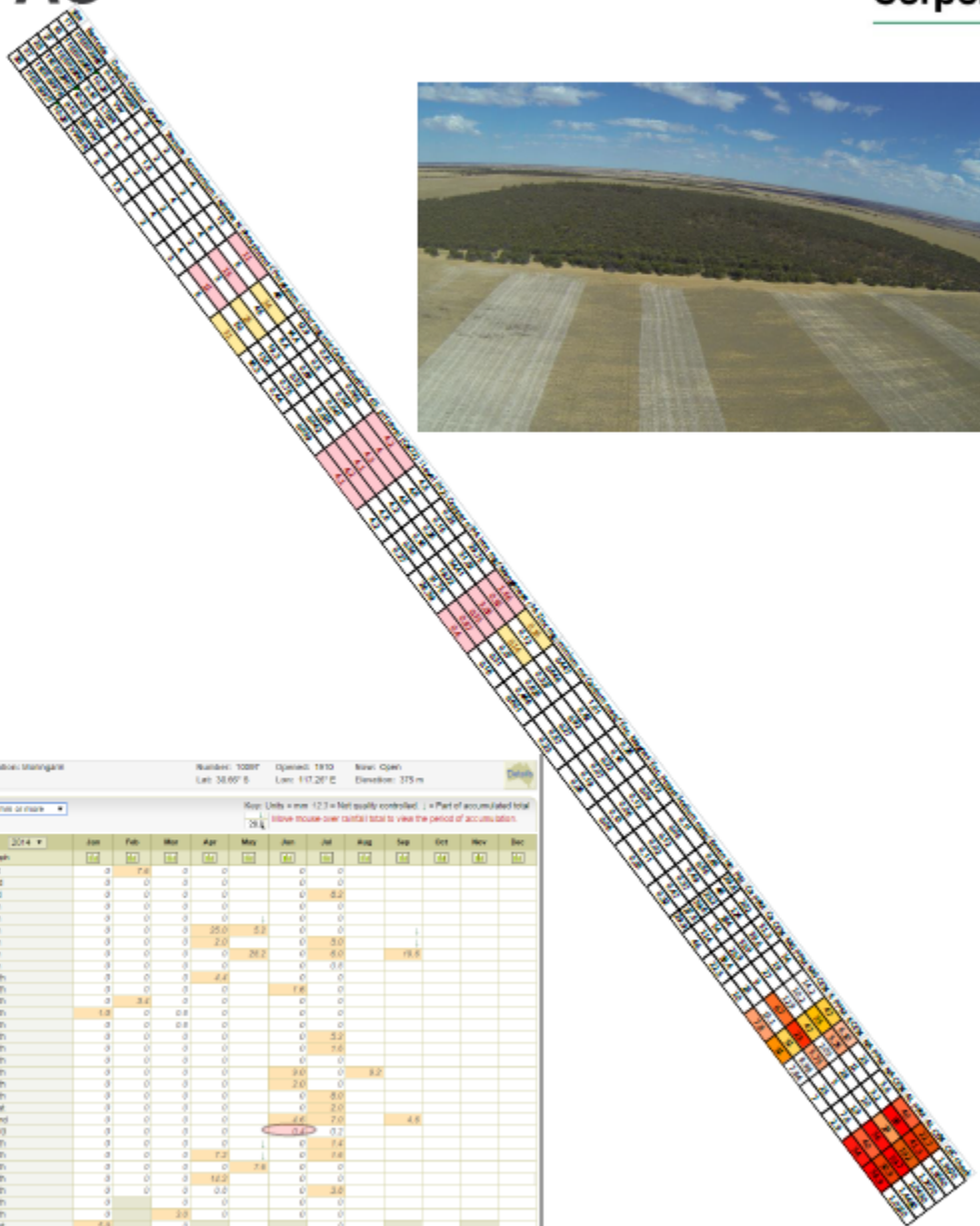

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ChemCentre
Inorganic Chemistry Section
Report of Examination

Chem Centre
EXPERT SOLUTIONS

PO Box 1250, Bentley Delivery Centre
Bentley WA 6983
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F +61 8 6422 9801
www.chemcentre.wa.gov.au
ABN 40 991 866 700

Purchase Order: None
Your Reference:
ChemCentre Reference: 13A0457

Tek Ag
531 Hawkins Rd
Badgerin Rock WA 6475

Attention: Tyrone Henning

Final Report on 2 samples of lime received on 23/05/2014

LAB ID	Client ID and Description
13A0457 / 001	Fushy crushed
13A0457 / 002	Tek Ag Optimal Pit

Lab ID			13A0457/001	13A0457/002
Client ID			Fushy crushed	Tek Ag Optimal Pit
Sampled			12-Apr-2014	12-Apr-2014
Analyte	**Method**	**Unit**		
%weight	0-0.125	%	8.4	1.1
%weight	0.125-0.25	%	36.2	45.4
%weight	0.25-0.5	%	25.8	46.3
%weight	0.5-1.0	%	10.2	6.4
%weight	> 1.00	%	19.4	0.8
NV	0-0.125	%	89.4	80.1
NV	0.125-0.25	%	82.4	79.9
NV	0.25-0.5	%	61.8	87.5
NV	0.5-1.0	%	59.7	68.2
NV	> 1.00	%	84.4	82.5
Moisture	Bulk	%ar	6.0	2.7
NV	weighted	%	75.8	82.7
NV	Bulk	%	73.6	81.9
Ca	Bulk	%	29.1	29.8
Mg	Bulk	%	0.3	1.7
Na	Bulk	%	<0.1	0.2

$40/t x WNV = $48/t of Effective Lime on Farm

1t/ha = 827kg/ha lime 5t/ha = 4.132t/ha Lime 10t/ha = 8270kg/ha Lime

** Watch your lime source, it makes a big difference.

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TEK AG

GRDC Grains Research & Development Corporation

Costs by Treatment							
					K-Till	$64	
Lime	$8.00	Full Cut	$8		Seeder	$20	
Transport	$32	Twin Disk	$14		Seed	$20.00	
	$40.00	Chisle Plough	$8		MnSo4	$2	
Spader	$180	One Way Plough	$6		UAN	$20	
Mouldboard	$150	Deep Ripp	$30		Radish	$12.60	
						$139	

→ N

Lime t/ha	Control	Full Cut	Chisle Plough	Control	Muldboard	Spader	Control	Twin Disk	One Way Disk	Control
0	$168.60	$176.60	$176.60	$168.60	$288.60	$348.60	$168.60	$182.60	$174.60	$168.60
1	$208.60	$216.60	$216.60	$208.60	$328.60	$388.60	$208.60	$222.60	$214.60	$208.60
2.5	$248.60	$276.60	$276.60	$248.60	$388.60	$448.60	$248.60	$282.60	$274.60	$248.60
0	$168.60	$176.60	$176.60	$168.60	$288.60	$348.60	$168.60	$182.60	$174.60	$168.60
0	$168.60	$176.60	$176.60	$168.60	$288.60	$348.60	$168.60	$182.60	$174.60	$168.60
5	$368.60	$376.60	$376.60	$368.60	$488.60	$548.60	$368.60	$382.60	$374.60	$368.60
0	$168.60	$176.60	$176.60	$168.60	$288.60	$348.60	$168.60	$182.60	$174.60	$168.60
7.5	$468.60	$476.60	$476.60	$468.60	$588.60	$648.60	$468.60	$482.60	$474.60	$468.60
10	$568.60	$576.60	$576.60	$568.60	$688.60	$748.60	$568.60	$582.60	$574.60	$568.60
0	$168.60	$176.60	$176.60	$168.60	$288.60	$348.60	$168.60	$182.60	$174.60	$168.60

Thanks To:

- GRDC and the RSCN Network as the major sponsor
- The Fuchsbichler family for use of their land, machinery and time.
- Mike Clark for Deep Ripper, Seeder and time.
- Faulkner Brothers of Beacon for the use of the VRT Spreader
- Stephan Fiorri and Matt Hill for effort taken to bring out the Spader and Mouldboard.

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Background to the project.	Please include your Regional Cropping Solutions Project ID (or Full Project Name if you don't have a project ID) on your cover page
Objectives	Objectives of the project
Methodology	Including a description and justification.
Results	Including statistical analysis.
Discussion of Results	Compared with the objectives.
Implications	Assessment of the impact of the outcomes on industry in Australia (where possible provide a statement of costs and benefits).
Recommendations	The activities or other steps that may be taken to further develop, disseminate or to exploit commercially the results of the Project.
Appendices	Including communication and extension activities, events and attendances
Glossary	Optional.
References	Footnotes/References/Cross-references

As part of the Research Report (please see following page), authors need to provide a one page, plain English summary along with each Research Report in electronic format. If there were any trial booklets produced throughout the year then these may be included as part of the Research Report. We are also very keen for publishable photos to be included in your report.

If using a digital camera for publishable photos, always use the highest definition and save it without attempting to reduce file size; or send photos in a separate email as attachment.

If you have any questions call

- Julianne Hill (0897261307, 0447261607 or email regionalcroppingsolutions@gmail.com).

Plain English Summary

Project Title:	Determining economic rates and incorporation methods for lime in the Eastern Wheatbelt of WA
GRDC Project No.:	**TEK00001**
Researcher:	Tyrone Henning
Organisation:	Tek Ag 531 Hawkins Rd Badgerin Rock W.A. 6475
Phone:	0429843025
Fax:	
Email:	ty@tekag.com
Objectives	Main aims of the project are: • Demonstrate different methods of lime incorporation. • Assess rate responses to lime through subsoil amelioration. • Economics of lime rate by tillage method.
Background	The Wodjil soil type is naturally low in pH, but high in Aluminium. This soil type has approximately 15% clay, therefore does not have issues with non-wetting and nutrient leaching. To increase the productivity of this soil type, we need to increase the subsoil pH to above 4.8 CaCl to drop Aluminium out of solution.
Research	To do this we need to assess different methods of incorporating lime into the subsoil along with been mindful of heavy economic restrictions. We tested these options, using machinery that is readily available to the producer vs the 'Rolls Royce' treatments such as Spading and Mouldboarding. Different lime rates were run across the different tillage treatments to help guide an economic rate response to lime along with tillage method.
Outcomes	Due to the poor season, the results were not strongly significant. The only significant treatment was the reduction in yield from 10t/ha of lime vs 0t/ha. The trial average yield was 460kg/ha, which was a result of low growing season rainfall (with only 90mm falling after sowing) and severe heat shocks through late August, September and October. More time and rainfall is needed to allow the lime to react with the acid soil, which is typical of lime trials that don't tend to shine in their first year of results. 5t/ha of lime and Twin Disk incorporation will be the treatments to watch into the future.
Implications	Deep ripping with twin disk incorporation look to be the most economic treatment for subsoil mixing, however, the results from this one year with poor yield results from a poor season would suggest otherwise.
Publications	2015 Western Australian Crop Updates