

COGGO

Council of Grain Grower Organisations Limited
ACN 091 122 039

Final Report

COGGO Research Fund for 2016 projects

A project completion report covering the project. The acceptance of a satisfactory report against the objectives of the project, and agreement on the sharing of any commercial returns and/or IP will trigger payment within 4 weeks, by COGGO for any outstanding payments.

This Final Report should be completed with reference to the Research and Intellectual Property Agreement (the Research Agreement) signed between the proponent and COGGO Pty Ltd.

1. Project information

Project title	Developing and testing innovative, practical and reliable methods for incorporating lime into acidic sandplain subsoils
Commencement Date	January 2014
Completion Date	December 2015

Name of Proponent	West Midlands Group
ACN/Legal Name or ABN	47 325 820 894
Mailing Address	PO Box 18 Dandaragan WA, 6507

Administrative Contact	Anne Wilkins
Position	Executive Officer
Telephone	08 9651 4008
Fax	08 9651 4107
Email	anne@wmgroup.org.au

Project Supervisor/Principal Researcher	Chris Wilkins
Position	WMG R&D Coordinator
Telephone	0427 940 925
Fax	
Email	cwilkins@synergyco.com.au

COGGO Use Only

Project Number	
Date Received	

2. Project results

This section provides a final report against the Project Aim and the Planned Outputs for the Project.

Achievement of the Project Aim

Brief statement of achievement in relation to the aim of the project

A trial concept was developed with local farmers and industry experts to develop experimental techniques to incorporate lime that can easily be adopted by farmers that have a deep ripper currently and are cheaper than current methods e.g. spading.

The final trial concepts for the first trial in 2014 that the group decided on were the Shallow Leading Tyne Ripper (SLTR) supplied by DAFWA, Deep Digger a new deep tillage implement supplied by McIntosh & Son, and three experimental attachments to bolt on the back of tynes of the SLTR. These attachments were: (1) Angle iron attachment from Peter Horwood a farmer at Mingenew; (2) Railway line joining plates or Fish plates; and (3) peanut cutter sweeps. The experimental attachments are very cheap and easily modified to attach onto a deep ripping tyne.

The trial was established at Peter Negus's Dandaragan property. The site was spread with 3t/ha of lime and incorporated with the different methods. Initial results of the incorporation of lime from the trial were taken by Stephen Davies (DAFWA) using a universal pH indicator. Results below:

- SLT Ripper only – some incorporation into the topsoil but little below that, about 10-12 cm.
- SLT Fish plates – incorporation to about 19-23 cm in quite a wide slot, up to 14 cm wide.
- SLT Horwood – deepest incorporation to about 20-16 cm but slot narrows with depth, about 9 cm wide at its widest just below the surface.
- Grizzly Deep digger – incorporated some lime to depths of 20-26 cm but only in a narrow slot, maximum width of ~7cm just below topsoil.
- SLT Peanut cutter sweeps – delved some subsoil up which allowed some reasonable incorporation to a depth of 23-25 cm, maximum width 9cm.

1. The COGGO lime project had lime applied on 24 April for both the lime trial and lime demonstration.

2. 28 April - replicated incorporation trial established (Gartner, Hollins, Negus); video recordings of soil flow behind modified ripper tines captured; images of ripper tine modifications captured

3. 21 May 2014 - undertook visual soil pit face observations, measurement and photographic recording of lime and topsoil incorporation using universal soil pH indicator; soil cone penetrometer used to measure impact of ripping on soil strength and to accurately measure and map soil loosening (breakout) depth and pattern across different treatments - findings were written up and discussed at WMG R&D committee meeting and lime committee meeting in August 2014 (notes attached, Davies)

4. The demo was seeded to wheat on 6 June, 2014.

5. 19 August 2014 - soil sampling undertaken on and off riplines for soil pH measurements (Hollins, Davies); additional visual assessment of lime incorporation and photography was undertaken, samples were sent for pH analysis.

6. Harvest was late December 2014 and the results were:

Blade Plough	2.48
Peter's DR	2.1
Deep Digger	2.5
Spading & DR	3.52
Grizzly Offsets	2.89

7. Soil tests were done on 28 January 2015

In November 2014 and April 2016 the first trial site the soil was sampled for pH at four depths.

	pH at each depth - Nov 2014			
treatment	0-10cm	10-20cm	20-30cm	30-40cm
Control	5.75	4.58	4.11	4.53
Deep digger	5.18	4.55	4.43	4.56
Fish SLT	5.43	4.57	4.09	4.24
Horwood SLT	5.31	4.99	4.48	4.29
SLT Ripper	5.09	4.30	4.19	4.47
Wings SLT	5.15	4.38	4.16	4.41
<i>LSD</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>

	pH at each depth - April 2016			
treatment	0-10cm	10-20cm	20-30cm	30-40cm
Control	5.57	4.40	4.33	4.53
Deep digger	5.27	4.40	4.13	4.30
Fish SLT	5.30	4.10	4.00	4.27
Horwood SLT	5.93	4.33	4.23	4.63
SLT Ripper	5.90	4.63	4.37	4.67
Wings SLT	5.90	4.60	4.33	4.35
<i>LSD</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>

Tables 1 & 2: Soil pH at 0-10cm, 10-20cm, 20-30cm, and 30-40cm, for each tillage treatment, from November 2014 and April 2016.

Figure 1: “Horwood” attachment, as used by WMG in the 2014 trial.

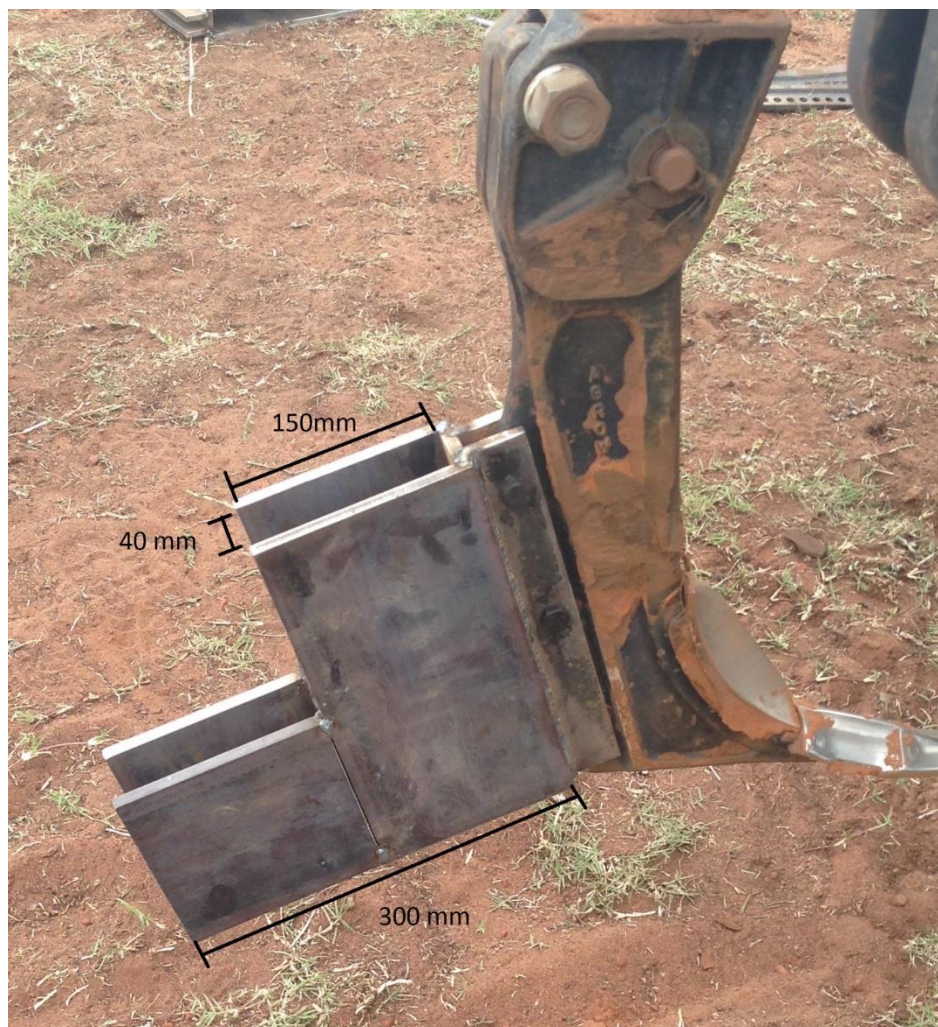


In March 2015, WMG manufactured a set of “Long Bottom Boots” designed to fit onto the back of Agrowplow deep ripper tines. The boots were designed to hold the ripped slot open and (hopefully) allow surface soil to flow down the back of the tine. The boots had an open (internal) area at the top of 40 mm X 150 mm, and 40 mm X 300 mm at the bottom.

WMG established the second trial at “Kayanaba”, Dandaragan, the property of Andrew and Pauline Roberts. The second trial compares these boots to three other treatments. The treatments are listed in the table below, together with plant counts collected in July 2015.

Plots were ripped on Tuesday 28 April 2015, using DAFWA’s experimental ripper (same as first trial) with AFGRI-provided Fastrac tractor. The soil was dry for the top 7.5cm, wet underneath.

Figure 2: “Long Bottom Boot” attachment, as used by WMG in the 2015 trial.



The Long Bottom Boots functioned reasonably well at first, but tended to plug with soil from underneath after multiple passes.

We think that a design that was wider at the back (60 – 80 mm) and therefore more open would improve soil flow down the boot, and reduce the risk of plugging.

The trial was seeded by Charles Roberts as he seeded the remainder of the paddock. The trial was sown on 25 May with Mace wheat at 100kg/ha. 80 kg/ha of MAXamRITE and 50 litres/ha of MAXamFLO applied at seeding. 100kg NKS applied in late June.

Treatment		plants / m ²
1	Nil	155
2	Deep rip - single tine. 350 mm depth	157
3	Deep rip with wings / sweep point just below surface (peanut cutter)	160
4	Deep rip with "long bottom boot"	153
5	Deep rip with "long bottom boot", positioned 2cm deeper	153

Table 3: Treatments and plant establishment counts for the second trial.

Soil tests were taken in April 2016 by Soiltech and the results were analyzed below.

	pH at each depth - April 2016		
	0-10cm	10-20cm	20-30cm
Nil (control)	6.49	4.63	4.54
Deep rip - single tine. 350 mm depth	6.38	4.84	5.05
Deep rip with wings / sweep point just below surface (peanut cutter)	6.34	4.81	4.69
Deep rip with "long bottom boot"	6.55	5.00	4.80
Deep rip with "long bottom boot", positioned 2cm deeper	6.14	4.93	4.64
<i>LSD</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>

Table 4: Soil pH at 0-10cm, 10-20cm, and 20-30cm for each tillage treatment, from April 2016.

The "Long Bottom Boot" unfortunately did not increase subsoil pH significantly above other treatments, as soil flow was impeded by the narrowness of the aperture.

We are gratified to see that the same concept has been explored further by Dr. Paul Blackwell (DAFWA) with his 'inclusion plates', which have a much wider (120-150mm) aperture. This has allowed successful incorporation of topsoil in to the subsoil with a ripper.

Project Outputs		Please provide a report on the achievement, or otherwise, of the project outputs as per the planned outputs provided in the Project Proposal.
1	Jan 2015	Milestone (from Project proposal) Measure soil pH in first trial
		Progress: Done; results are above.
2	Mar 2015	Milestone (from Project proposal) Manufacture further modifications / boots for second trial.
		Progress: Done: David Paish a local Badgingarra farmer modified the attachments so they could be attached to the back of the SLTR. See photo and report above.
3	May 2015	Milestone (from Project proposal) Establish a second trial, testing further modifications.
		Progress: Completed. See above.
4	-	Milestone (from Project proposal) Measure soil pH at both trials at end of project
		Progress: Done. See results and interpretation above

Project results	Please provide brief statements on the results of the Project
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Unfortunately, none of the 'bits and pieces' bolted to deep ripper tines that WMG trialed over 2014 and 2015 were able to significantly increase subsoil pH, although the concept showed great promise.

Dr Paul Blackwell of DAFWA was more adventurous with the design of the 'inclusion plates' that he trialed in 2015, and that design was successful in allowing topsoil to flow into the subsoil and change pH at depth. He referred to the WMG / COGGO work at the 2016 Research Updates in Perth as having inspired his work in 2015. That basic design is being trialed and modified by many farmers in 2016. Prior to this current research, "inclusion plates" did not exist in WA and therefore have not been used commercially.

Nufab Engineering of Geraldton are manufacturing inclusion plates for attachment to their deep rippers.

Below is a 'tweet' from Bindi Isbister, who works with Dr Blackwell, showing some of the work being done in 2016.

<https://twitter.com/BindiIsbister/status/734670151514226690>

Observations of topsoil slotting plate orientation in moist yellow sand showed:

- Inverse orientation helped more moist topsoil to get deeper into the rip zone
- Lower speed enabled more and deeper topsoil inclusion (deeper depth of ripping)
- The original orientation encouraged more mixing of topsoil and subsoil

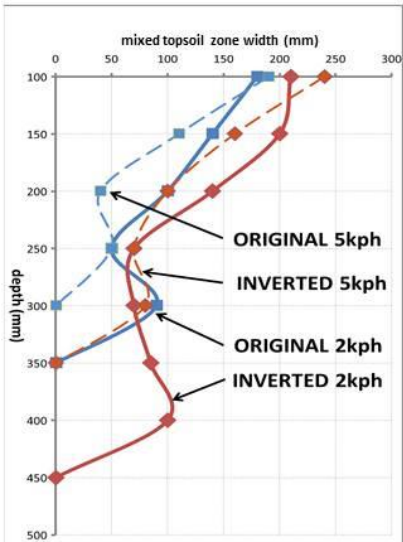
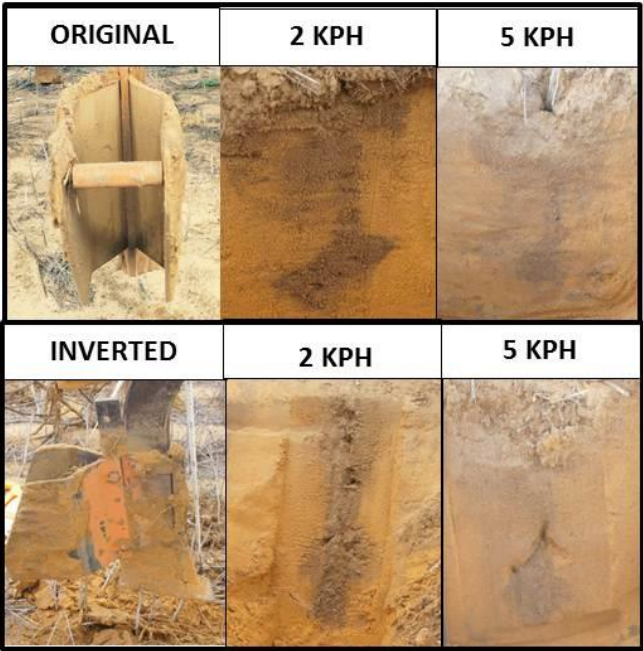


Figure 1 The effect of topsoil slotting plate orientation of mixing soil deep ripping 400-460mm in a yellow sand Yuna 5th May (moist soil conditions).



Acknowledgements: Thank you Brady Green and Guy the ripper driver who suggested inverting the plates.



Further investigation in different soil conditions is required.

Source: DAFWA's GRDC funded Soil compaction project DAW00243

3. Project resources	This section describes use of the funding listed in the initial plan and any refunds due to COGGO
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Expenditure of funds requested from COGGO	\$ Total funds budgeted	\$ Total funds expended (actual)	\$ Total funds requested from COGGO*	\$ Total COGGO funds expended	\$ Refund due to COGGO of any unexpended COGGO funds
Salary/Contractors	20000	20000	20000	20000	
Operating costs	72000	49788	72000	49788	
Capital					
TOTAL	92000	69788	92000	69788	

*Funding provided by COGGO.

IMPORTANT: Return of unused funds to COGGO is required as per *Clause 3.3* of the Research Agreement.

To date, COGGO has paid WMG \$56,750. Final invoice and COGGO payment is \$13,038

4. Commercialisation	<p>Insert details of the proposed commercialisation process, as applicable, with reference back to the planned commercialisation plan in the project proposal) for any outputs from the project.</p> <p>This should include recommendations for the commercialisation of the results of the project and the registration or other protection of Project IP and Project Confidential Information as per the Research Agreement.</p>
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There will be no commercialisation of the lime incorporated implements.

It is understood that this may require further discussion and agreement with COGGO via its' agent GIWA, as per the undertakings given and terms agreed, in the project proposal. This can be the subject of an appended letter and attachments. In all cases such discussion and subsequent agreements need to be governed by *Section 8 Project IP, Improvements and Project Confidential information* of the Research Agreement.

5. Communication/ Extension

Insert details of how the communication and extension of the project outcomes has been achieved to date and recommendations for future activities to disseminate and promote adoption of the results of the Project.

The second trial in 2015 was at the Roberts family property "Kayanaba". This is where the WMG 2015 main trial site was located. The spring field day was on 8 September 2015 where over 200 people attended. Bill Bowden talked about the trial which was very popular.

Lime incorporation trial report in WMG research 2016 which was distributed at the WMG Crop Updates on 25 February, 2016 in Moora.

Media article in the Farm Weekly and Advocate on 19 March 2015.

Lime incorporation trial report in WMG research 2015 which was distributed at the WMG Crop Updates on 10 March, 2015 in Badgingarra.

Lime incorporation presentation by Dr. Stephan Davies, DAFWA at WMG Crop Updates 2015.

On 19 February 2015, Dr. Stephan Davies gave a presentation to 21 Summit fertiliser area managers on Soil Amelioration included COGGO ripper modification results (pdf of presentation slides attached); findings to be presented to WMG (10 March) and MIG (5 March) 2015 Crop Updates.

Dr Stephen Davies, DAFWA presented a lime talk at a DAFWA soil acidity workshop on 9/12/14, Dongara to agronomists and consultants in the Northern Agricultural region. The COGGO lime trial was included in his presentation.

Dr Stephen Davies, DAFWA also gave a presentation to ConsultAg in December 2014 in Perth on lime incorporation and he included the COGGO lime trial information.

Dr Stephen Davies requested to submit a paper for the Perth Crop Updates on "Lime incorporation into acidic soils" which includes information about the COGGO WMG lime trial. This was a written paper and was accepted by the Perth Crop Updates committee.

On 9/9/14, the WMG had their Spring Field Day at the main trial site at Judeen, Warradarge.

Chris Gazey and Liam Ryan, DAFWA gave a presentation at the WMG Spring Field Day. The presentation was titled "Soil acidity update". At the end of the presentation, a lime survey was conducted and the results.

The summary of the survey results were:

- From the survey the average farm property is between 1000-2000ha.
- They test both topsoil and subsoil, apply 1-2 t/ha of limestone in a single pass operation.
- Most farmers surveyed believe soil acidity is a moderate issue which is manageable.
- There is a varied response to lime incorporation.
- Most farmers surveyed get lime advice from consultants and "What is pH and why is it acidifying" is the most relevant topic growers would like to hear more about.

On the 5 June 2014, Farm Weekly and the Midwest Times on 15 May 2014 and the Advocate 15 May 2014 published a media release on "Trialing different lime

incorporation methods in the west midlands”.

The first media release was in November 2013, WMG published a media release on WMG successfully winning COGGO funding for the lime incorporation project in the Midwest Times and the Advocate.

In March 2013, the WMG Crop Updates theme was lime and there were numerous presentations on lime + a panel discussion in the afternoon.

The COGGO lime Project overview is on WMG website under the project section which also links it to COGGO website.

Note: As per *Clause 7.3 (b) (ii)* of the Research Agreement COGGO may require the Researcher to produce an edition of the Final Report in a form suitable for general distribution. If so required by COGGO, the Researcher must produce a non-confidential version of the Final Report within 28 days of receiving a request to that effect from COGGO.

6. Certification

The Project Supervisor and the Research Organisation certify that all information contained in, and forming part of, this final project report is complete and accurate. The project supervisor and research organisation further warrant that the project complied with all the relevant guidelines affecting the conduct of research, for example in relation to ethics, bio-safety, environmental legislation, GMAC or National Health and Medical Research Council Codes.

Project Supervisor's signature



Name (in Capitals) ANNE WILKINS

Date: 1/06/2016

Research Organisation signature



Name and title of authorised signatory (in Capitals)

ANNE WILKINS

EXECUTIVE OFFICER

Date: 01/06/2016

Completed Final Project reports

Email to coggoresearchfund@giwa.org.au or mail to
COGGO Research Fund, GIWA, PO Box 1081, Bentley DC, WA 6983

For any further enquiries please email questions to coggoresearchfund@giwa.org.au

Or phone (08) 6262 2128

COGGO representative

For the purpose of this Project agreement contract, COGGO will be represented by Grains Industry Association of Western Australia (GIWA), or such other representative that is nominated by COGGO as authorised to operate on behalf of COGGO.

PROJECT SYNOPSIS SUITABLE FOR GENERAL PUBLICITY AND COGGO WEBSITE

Various attachments were bolted to the back of deep ripper tines, to attempt increase subsoil pH by increasing topsoil flow into the subsoil when ripping. None of the attachments tried by the WMG were successful, but the same concept has been explored further by Dr. Paul Blackwell (DAFWA) with his 'inclusion plates', which have a much wider (120-150mm) aperture. This has allowed successful incorporation of topsoil in to the subsoil with a ripper.