

COGGOCouncil of Grain Grower Organisations Limited
ACN 091 122 039**Final Report****COGGO Research Fund for 2017 projects****1. Project information**

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| Project title | Incorporating lime to depth in duplex wheatbelt soils |
| Commencement Date | 1st January 2017 |
| Completion Date | 31st December 2017 |

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|-----------------------|--------------------------------|
| Name of Proponent | Facey Group Inc. |
| ACN/Legal Name or ABN | 59 136 484 550 |
| Mailing Address | PO Box 129 Wickepin WA 6370 |

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| Administrative Contact | Bronwyn Dew |
| Position | Administration Manager |
| Telephone | 08 9888 1223 |
| Fax | 08 9888 1295 |
| Email | admin@faceygroup.org.au |

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| Project Supervisor/Principal Researcher | Chloe Turner |
| Position | Agricultural Research & Extension Coordinator |
| Telephone | 08 9888 1223 |
| Fax | 08 9888 1295 |
| Email | agrec@faceygroup.org.au |

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| Project Number | |
| Date Received | |

2. Project results

Achievement of the Project Aim

The trial aimed to test the most practical and economical methods of incorporating lime on duplex soils in the Wheatbelt, and was accomplished by measuring the impact of acidity levels on plant growth and production. This project is a continuation from the 2015 and 2016 trial, which compared various incorporation methods against the standard practice of top-dressing. Treatments included control (nil lime), top-dressed lime (2t/ha), direct drilled Omya Calciprill (100kg/ha), top-dressed lime then deep ripped and top-dressed lime then deep ripped then spaded.

Results from 2017 show that pH levels in the control treatment have steadily decreased since the start of the trial (2015), highlighting the importance of maintenance lime applications. Spading again had the most consistent pH across the profile, though this year saw a drop in pH in the top 0-10cm across all other treatments. Top-dressing saw a very positive correlation in the 20-30cm and 30-40cm from 2016, indicating some movement down the profile, though it did have the biggest pH drop compared to the other treatments in the 0-10cm zone. The deeper soil amelioration treatments had higher levels of nitrogen and nitrate in the tissue tests, possibly due to the mixing, aeration and breakdown of the soil organic matter which resulted in increased mineralisation of nitrogen.

The economic analysis was conducted at the end of 2017 season, which showed the cost and gross margin for each of the treatments throughout the trial since 2015. Spading again was the highest yielding treatment, though given the high cost of implementing the treatment, it also had the lowest return on investment. Calciprill had the highest return on investment, because it did not require a large upfront cost to implement.

The Lime Incorporation Workshop, facilitated by DPIRD's Chris Gazey was a great success, with pits dug for a visual representation of the pH levels throughout the profile between 4 treatments. The extension of on ground works and trial updates were presented to members throughout the year including the presentation of the 2016 trial outcomes at the annual Trials Presentation Event in March 2017. The results from this season will also be presented in March 2018, as well as a report in the Trials Presentation Event attendees booklet.

Project Outputs

| | | |
|---|---|--|
| 1 | - | Post Seeding Assessments |
| | | Plant establishment counts, weed burden and growth stage assessments were completed on 20 th June. Plant tissue samples were taken on the 11 th July and sent to Summit Fertilizers for analysis. |
| 2 | - | Hay Yield and Quality |
| | | The trial was cut and windrowed on the 3 rd October using the farmers hay contractor. Biomass samples were taken from each plot on the 20 th October with weights recorded, to provide yield and a subsample of each taken to Balco Australia for fodder quality testing. |
| 3 | - | Publications |
| | | <p>The results from the 2016 trial were presented at the annual Facey Group Trials Presentation Event on 9th March 2017. This also included the final trial report with the economic analysis in the booklet given to all attendees. The results and economic analysis from the 2017 trial will be presented at the Trials Presentation Event on the 8th March 2018 as well as a final report included in the attendees booklets. This is one of the Facey Group's premier events and attracts approximately 100 attendees including growers, industry personnel, advisers and researchers, and provides an opportunity for results to be communicated.</p> <p>The on-ground work and assessments were regularly updated throughout the season to our members through the Agricultural Research & Extension Coordinators report in the Facey Group bi-monthly newsletter. Also included in these newsletters was an article about the trial to date, as well as the highlights from the 2017 Lime Incorporation Workshop held on the 20th July. These were also extended through various social media updates.</p> <p>Examples of these are included in the "Communication/Extension" section of this report.</p> |
| 4 | - | Final Trial Report 2017 & Economic Analysis |
| | | As provided |

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| Project results | |
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Trial Details

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| Property: | Craig Jespersen, Hazeldene, Wickepin |
| GPS Coordinates: | SW corner -32.785316 117.636913 |
| Plot size & replication: | 11m x 180m x 3 replications |
| Soil type: | Sandy Loam/ Gravel |
| Crop Variety: | Carrolup Oats |
| Application Date (lime and soil amelioration): | 7 th May 2015 |
| Liming Rate: | 2t/ha |
| CalciPrill Rate: | 100kg/ha |
| Sowing Date: | 18 th May 2017 |
| Soil Testing Date: | 27 th March 2017 |
| Crop Establishment Assessment Date: | 20 th June 2017 |
| Weed Burden Assessment Date: | 20 th June 2017 |
| Tissue Testing Date: | 11 th July 2017 |
| Hay Sample Date: | 20 th October 2017 |
| Fertiliser (kg/ha): | Vigour 85 kg, MOP 40 kg, MAXamFLO 80 L, UAN 40 L |
| Paddock rotation: | 2014 Barley, 2015 Canola, 2016 Wheat, 2017 Oaten Hay |
| 2017 Rainfall (mm): | 416 mm |

The treatments are:

- Control (NIL)
- Top dressed lime
- Direct drilled Omya CalciPrill
- Top dressed lime, deep ripped and then spaded
- Top dressed lime then deep ripped

The treatments are replicated 3 times (Figure 4), with the treatments applied in 2015. The lime was applied at a rate of 2 tonne per hectare and the CalciPrill was drilled at a rate of 100kgs per hectare. The trial is broad acre scale with the plots 11m wide x 180m long.

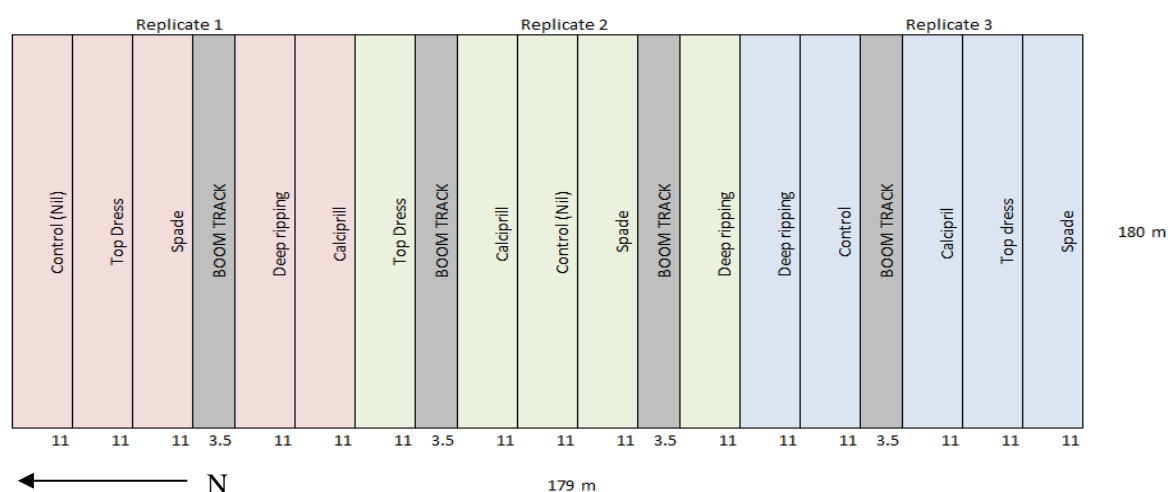


Figure 1: Trial layout

Pre-Seeding Soil Testing

The site soil test was completed on the 27th March, with 3 cores taken per plot. These were sampled to 40cm at 10cm increments. The results below in Figures 2, 3, 4 & 5 show the average pH across each of the treatments, across the three seasons.

Prior to lime application in 2015, the pH varied from 4.4 to 5.8 throughout the site. The 2017 soil sample results showed the most prevalent change being in the 0-10cm section across the treatments, with the 2016 pH ranging from 5.2-6.0 to 5.0-5.3 in 2017. The control treatment (nil lime) saw a steady decrease in pH down the profile between 2016 and 2017, which highlights the importance of maintaining lime applications.

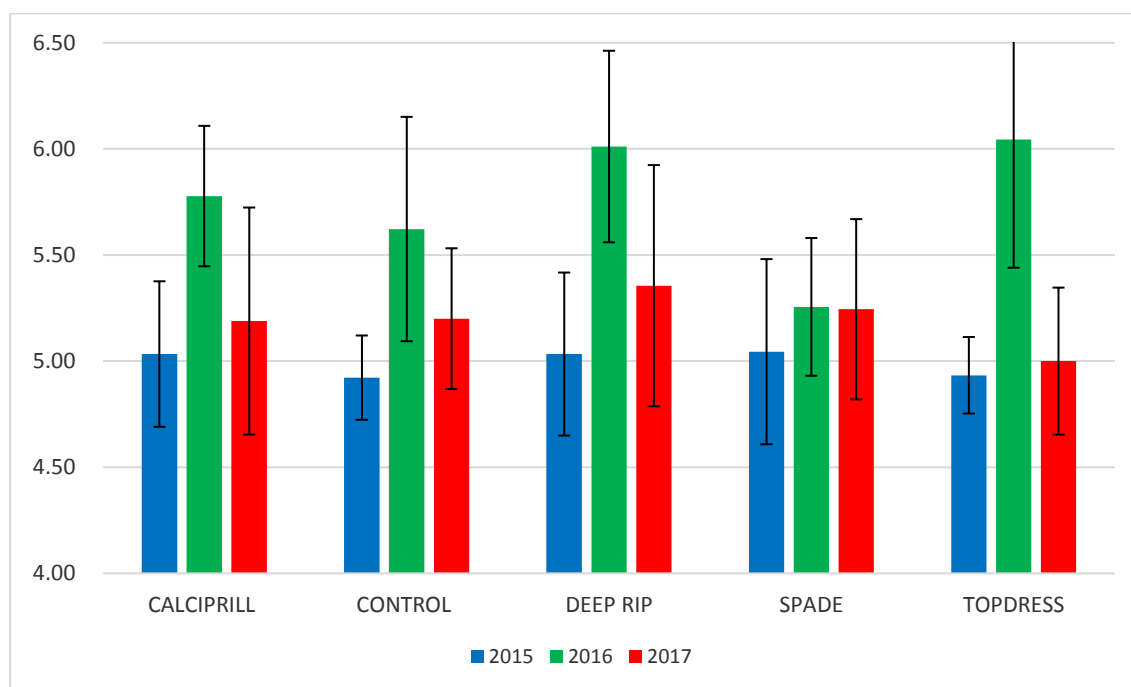


Figure 2: Average 0-10cm soil pH by treatment 2015-17

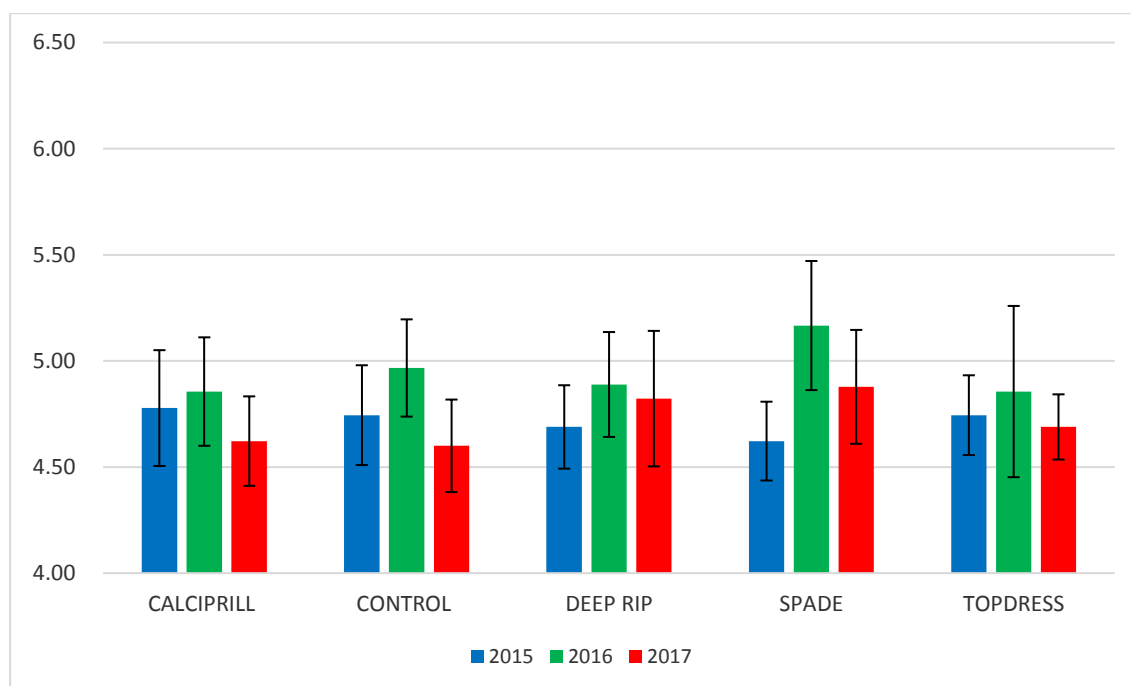


Figure 3: Average 10-20cm soil pH by treatment 2015-17

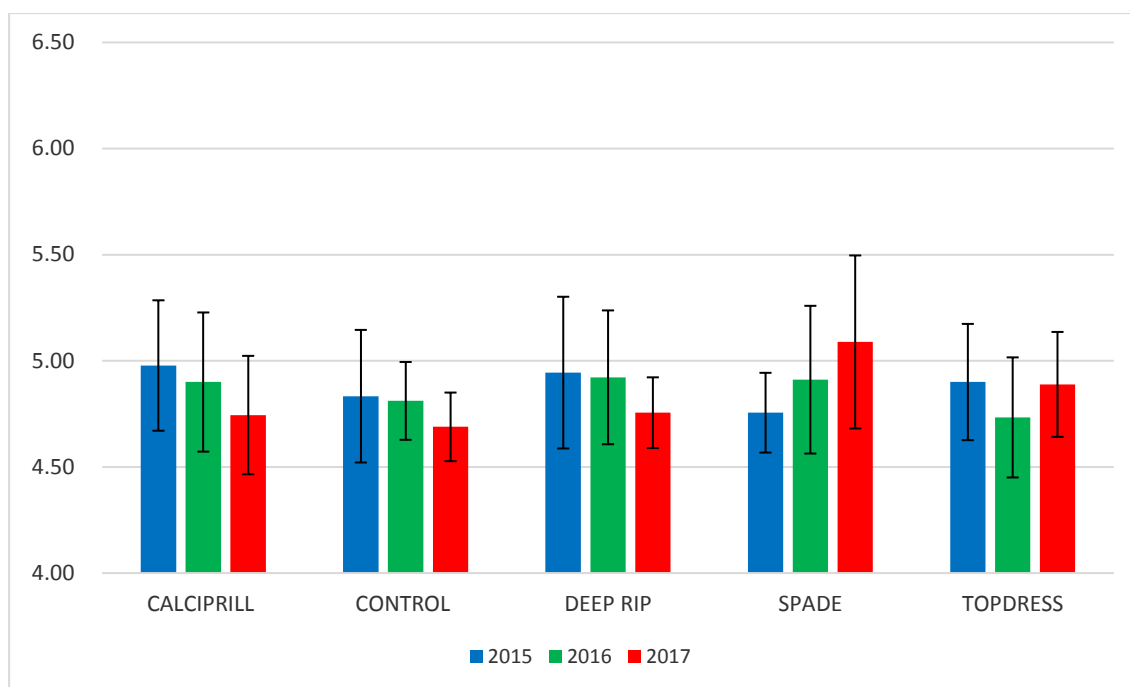


Figure 4: Average 20-30cm soil pH by treatment 2015-17

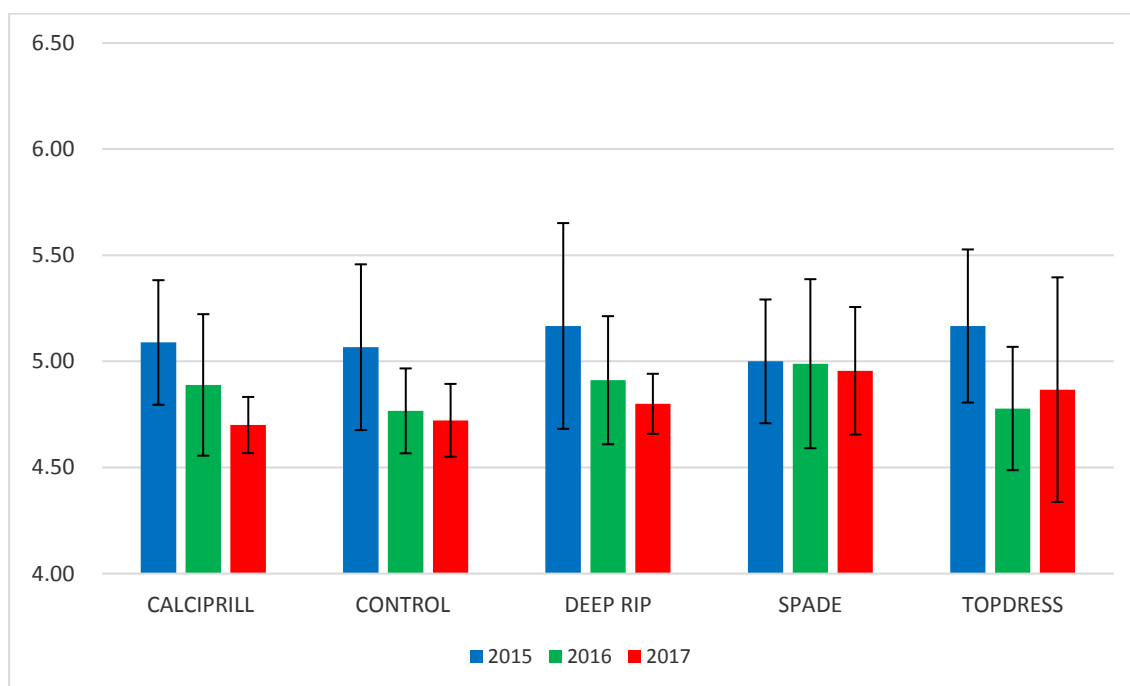


Figure 5: Average 30-40cm soil pH by treatment 2015-17

Crop Establishment

The trial was dry sown to Carrolup oats on the 18th May 2017 at 130 kg/ha, with some subsoil moisture, light showers and morning dews assisting with germination. Establishment counts were completed on the 20th June, with the trial site visually uniform in germination between the treatments, though given the drier start to the season, growth stages were staggered ranging from Z09-Z15 across the entire trial. Nine plant counts were taken per plot at 20m intervals on randomized rows, to ascertain a true composite average across each plot. As the trial was sown to oaten hay this year, plant counts are normally expected to be between 240-320 plants/m² (Department of Primary Industries and Regional Development: Agriculture and Food 2017, *Oats: seeding and establishment*), with the average counts just in the bottom of this range as shown in Figure 6. The germination data cannot be conclusive due to the unseasonal conditions, as they are not a reflection of treatments alone.

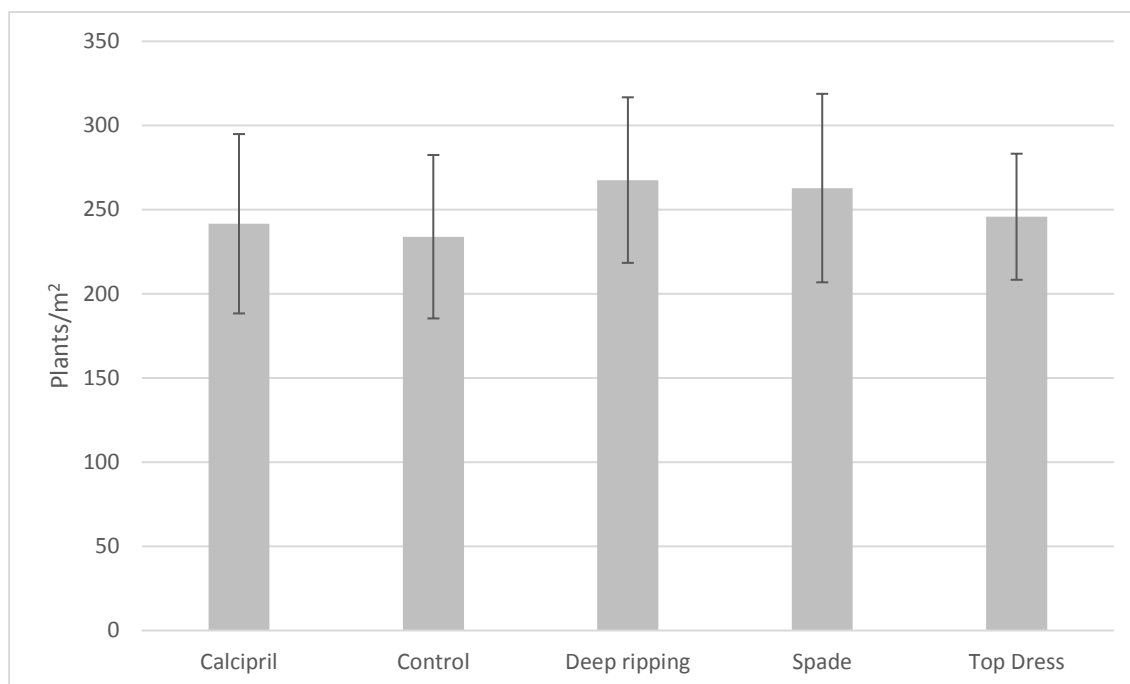


Figure 6: Average oat establishment across treatments – 18th May 2017

Weed Burden

The winter weed burden was higher than 2016, as the host farmer last season managed to get a good double knock down prior to seeding, which went into a wet soil profile. Given the 2017 season had a dry start, the weeds emerged at the same time as the crop. Capeweed and ryegrass were still the most evident throughout the trial with the spaded treatment still maintaining the lowest weed burden out of all the treatments, given the inversion of the weed seeds with the topsoil (Figure 7).

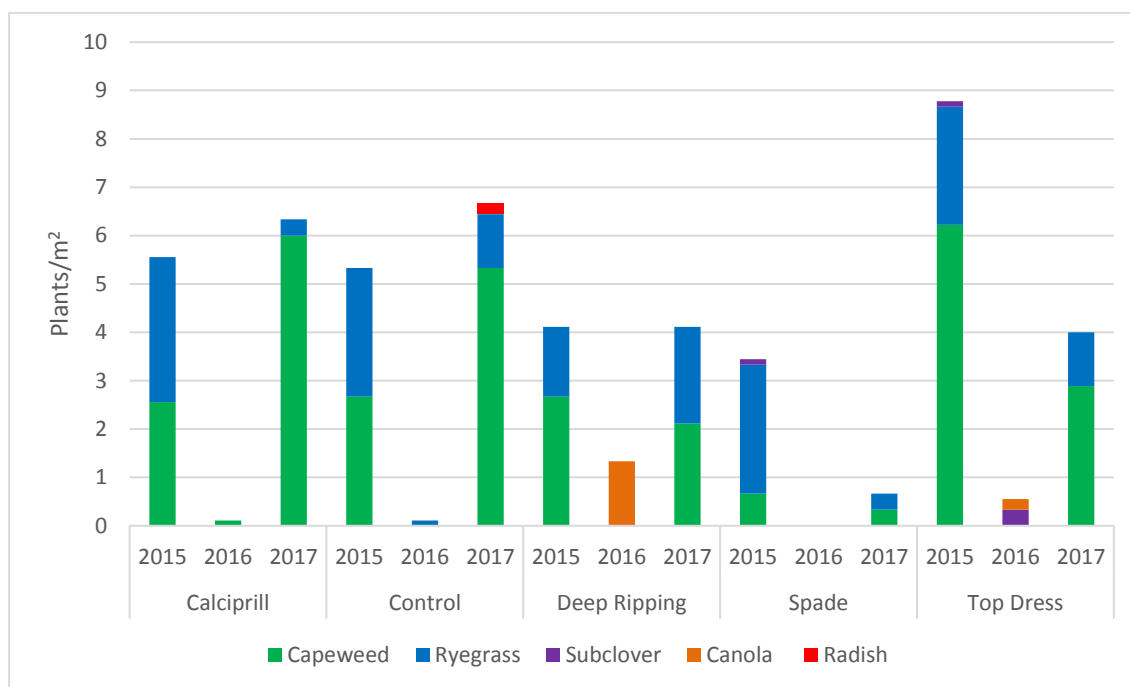


Figure 7: Weed burden per treatment – 2015-2017 (average plants/m²)

Tissue Testing

Plant tissue tests were performed on the 11th July 2017 at plant growth stage Z24 (mid-tillering). These were taken from the same nine sample points in each plot as the plant establishment and weed count assessments. The plant tissue samples were sent to Summit Fertilizers for analysis. The tissue tests showed the spaded treatment again had the highest concentration of nitrogen and nitrates in the shoot green matter, which is likely due to an increased mineralization from the amelioration treatment, reduced compaction due to deep cultivation, as well as improved and more even wetting of the soil profile as a result of the reduction of any water repellence through this type of cultivation (Figure 8 & 9).

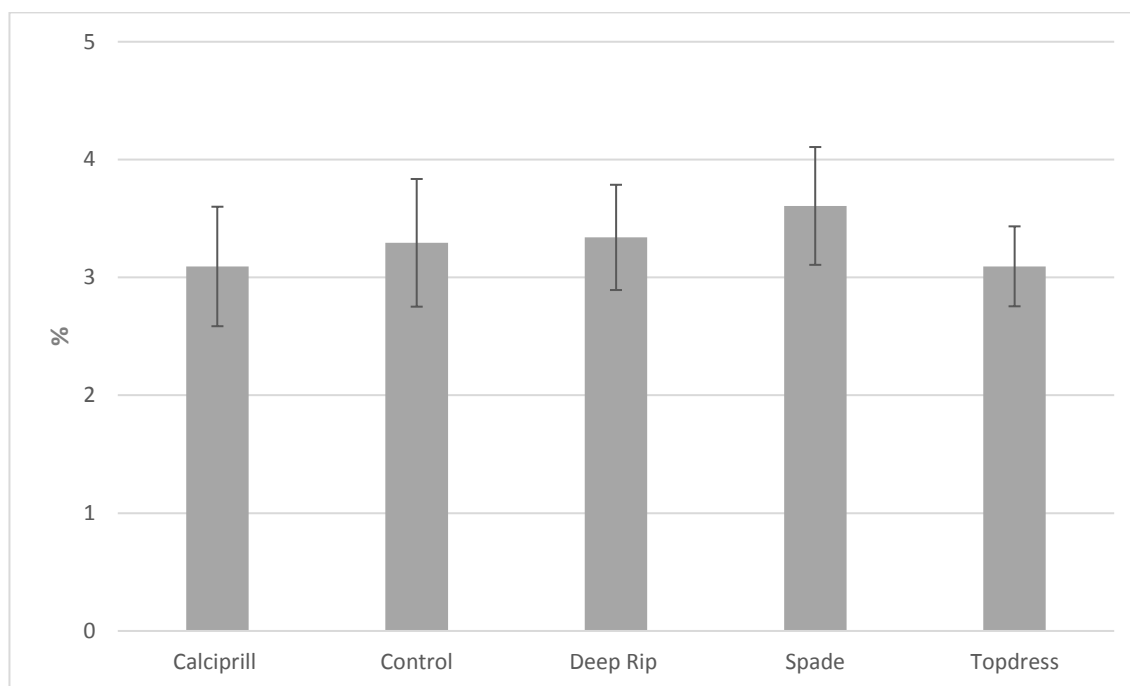


Figure 8: Plant tissue tests nitrogen percentage (%) with standard deviation) – 11 July 2017

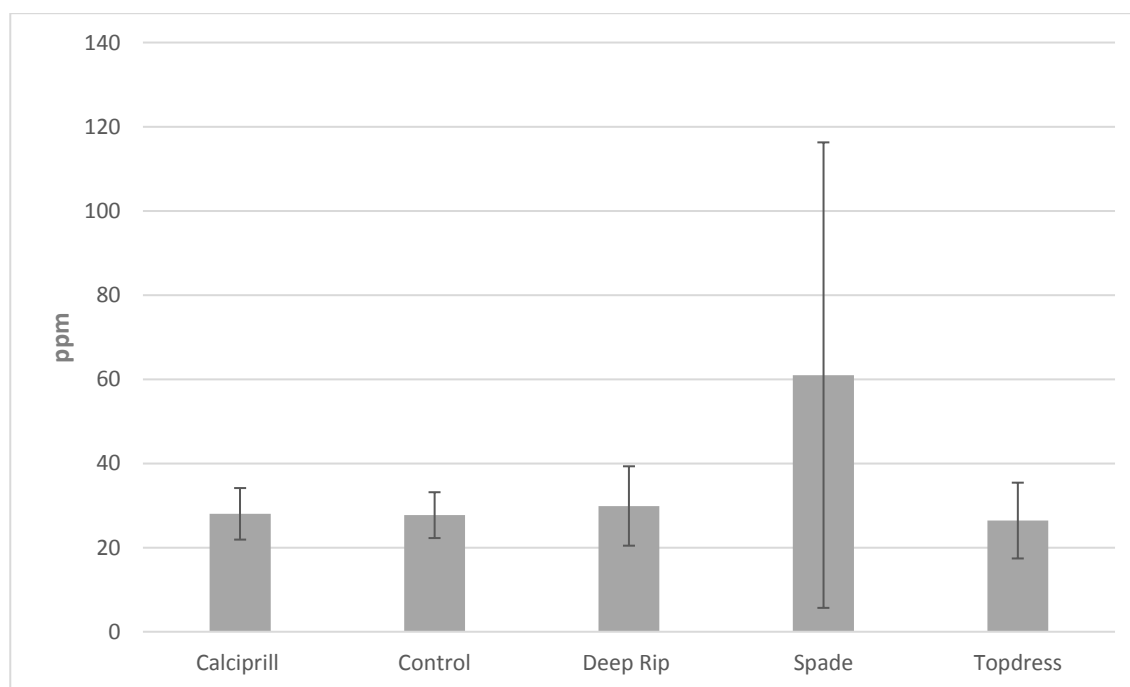


Figure 9: Plant tissue nitrate concentration (parts per million with standard deviation)

Hay Yield and Fodder Quality

The trial was cut and windrowed on the 3rd October by the farmers hay contractor. Biomass samples were taken (2 x 2m windrows = 22m²/plot of cut crop) on the 20th October, with weights recorded to provide yield (Figure 10) and with a composite subsample of each taken to Balco Australia for fodder quality testing.

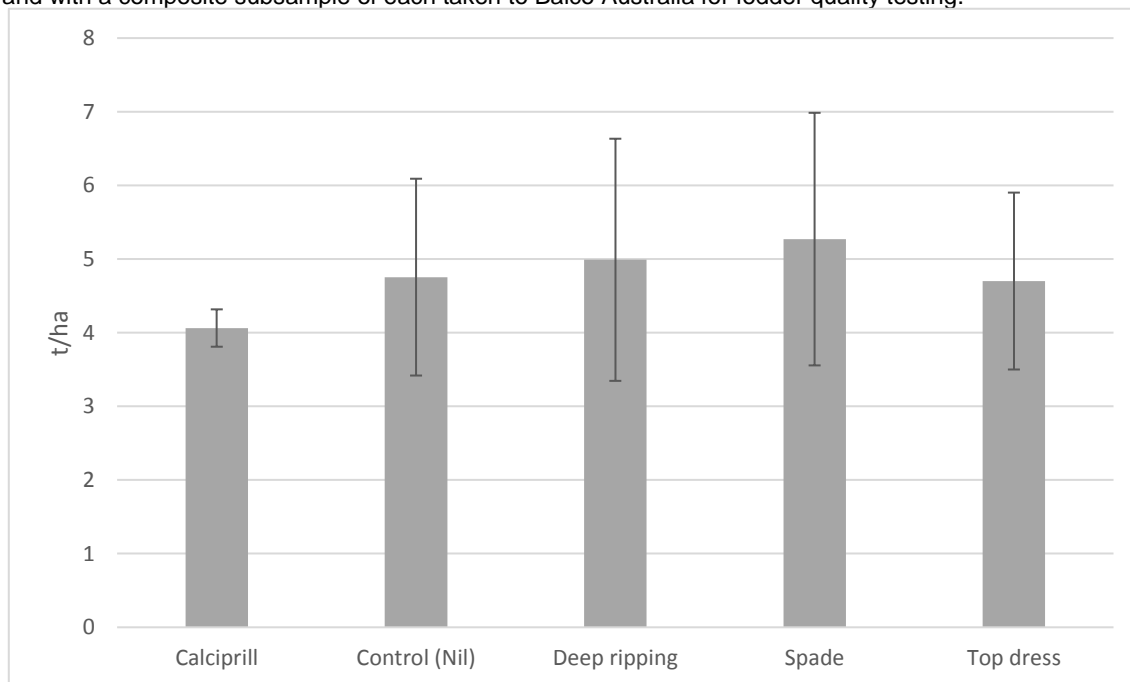


Figure 10: Hay yield of each treatment (with standard deviation)

Fodder quality tests (Crude Protein %, Acid Detergent Fibre %, Neutral detergent fiber organic matter % and Water-soluble carbohydrate %) showed consistency across the site, with almost half of the samples achieving export Grade 1. The remainder of the samples went to export Grade 2, due to marginally falling short of the Acid Detergent Fibre % required (Table 1).

Table 1: Fodder quality test results for export hay grading

| Plot | Treatment | Crude Protein % | Water-soluble carbohydrate % | Acid Detergent Fibre % | Neutral detergent fiber organic matter % | Export Hay Grade |
|------------------------------|------------|-----------------|------------------------------|------------------------|--|------------------|
| Export Grade 1 Limits | | 4-10 | >22 | <30 | <55 | |
| 1 | Control | 6.9 | 28.2 | 31.9 | 51.2 | 2 |
| 2 | Top-dress | 6.9 | 36.3 | 27.5 | 47.5 | 1 |
| 3 | Spade | 7.2 | 29.8 | 31.7 | 49.5 | 2 |
| 4 | Deep Rip | 5.9 | 31.4 | 29.9 | 49.2 | 1 |
| 5 | Calciprill | 6.1 | 28.6 | 29.5 | 48.0 | 1 |
| 6 | Top-dress | 6.7 | 27.3 | 29.2 | 49.8 | 1 |
| 7 | Calciprill | 6.1 | 37.0 | 27.5 | 48.9 | 1 |
| 8 | Control | 7.0 | 27.8 | 32.4 | 48.9 | 2 |
| 9 | Spade | 6.8 | 33.1 | 29.5 | 50.1 | 1 |
| 10 | Deep Rip | 6.2 | 30.8 | 30.0 | 48.9 | 2 |
| 11 | Deep Rip | 5.9 | 30.8 | 31.3 | 49.6 | 2 |
| 12 | Control | 6.8 | 35.6 | 29.1 | 46.4 | 1 |
| 13 | Calciprill | 6.8 | 33.6 | 27.6 | 47.2 | 1 |
| 14 | Top-dress | 6.8 | 31.3 | 31.2 | 49.1 | 2 |
| 15 | Spade | 6.7 | 33.3 | 30.7 | 49.1 | 2 |

Economic Analysis

As these soil amelioration treatments and their effects are long-lasting, it is appropriate to amortise these costs to calculate gross margin per hectare. Table 2 outlines the costs of applying the treatments in year one and then amortises the cost over the period that the trial has run (three years). Treatments 4 and 5 costs were high compared to the other treatments applied because of the high cost to deep rip and spade.

Table 2: Initial cost of treatments in year one and amortised treatment cost over three years

| Treatment | Initial Treatment Cost (\$/ha) | Amortised Treatment Cost over three years (\$/ha) |
|------------------------------------|--------------------------------|---|
| 1. Control | \$ 0 | \$ 0.00 |
| 2. Calciprill (100kg/ha) | \$ 57 | \$ 19.00 |
| 3. Top dress lime (2t/ha) | \$ 86 | \$ 28.67 |
| 4. Deep rip Lime (2t/ha) | \$ 126 | \$ 42.00 |
| 5. Spade + deep rip + Lime (2t/ha) | \$ 256 | \$ 85.33 |

Hay yield varied between treatments (Figure 11) and quality also differed between individual plots. This difference in hay grade was not attributed to a particular treatment except for the calciprill treatment where all replicates made Grade 1. With costs amortised over the three years of the trial, the calciprill treatment had the lowest gross margin (\$300.44/ha, Figure 12), followed by the spaded treatment (\$319.14/ha) then the deep rip treatment (\$325.64/ha). The control had the second highest gross margin (\$337.73/ha) and the highest gross margin was the top-dressed lime treatment at \$351.01/ha. However, the standard errors in all treatments (Figure 12) except the calciprill were quite large (>0.3) reflecting variability within the replicates. Hay price had a significant impact on gross margins, therefore these results could be varied if the hay price changed. Grade 1 hay was priced at \$205/t and Grade 2 hay at \$180/t. Baling price was \$30/t and cut & rake was \$50/ha.

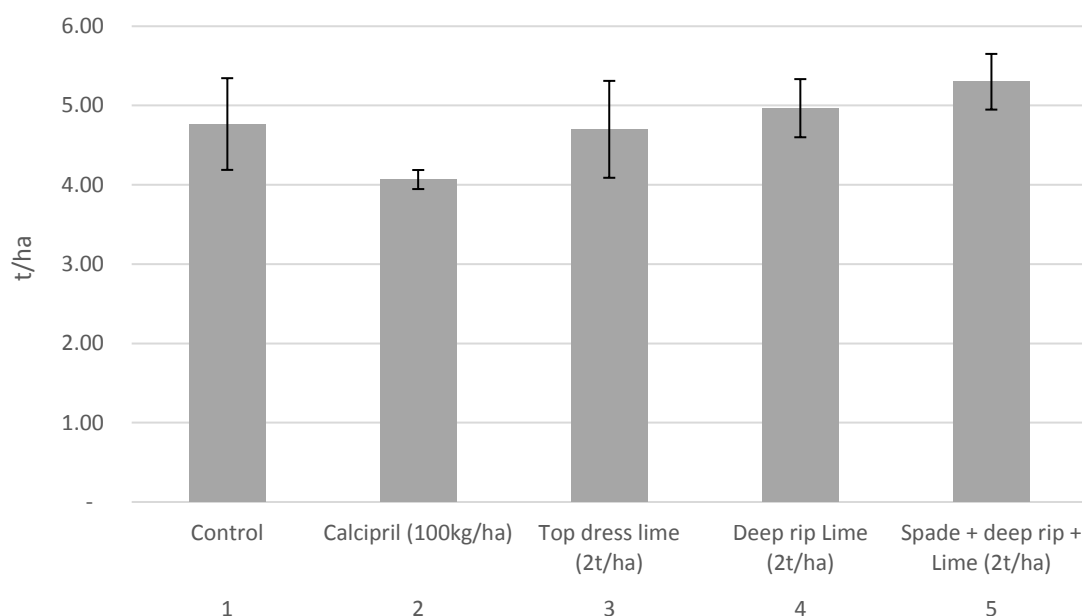


Figure 11: Oaten hay yields – 20th October 2017

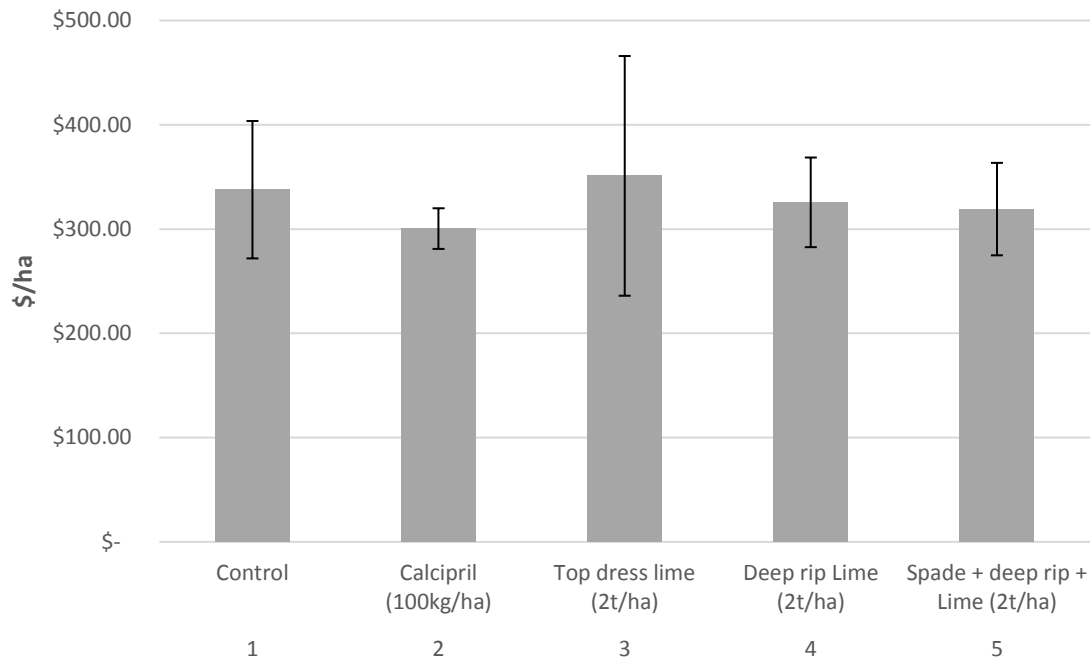


Figure 12: 2017 gross margins (\$/ha) amortised over three years for soil treatments applied in 2015

Over the three years of the trial, the return on investment (with treatment costs amortised over three years) has been highest for the treatment where calciprill was applied (9.5%). Top-dressed lime had an ROI of 6.3%, deep ripped 4.3% and spading 2.0%.

Table 3: Treatment gross margins

| Treatment | Gross Margin Year 1 (\$/ha) | Gross Margin Year 2 (\$/ha) | Gross Margin Year 3 (\$/ha) | Return on Investment over three years | Return on Investment over three years |
|------------------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------------------|---------------------------------------|
| 1. Control | \$69.49 | \$102.65 | \$337.73 | | \$509.87 |
| 2. Calciprill (100kg/ha) | \$68.77 | \$173.24 | \$300.44 | 9.5% | \$542.45 |
| 3. Top dress lime (2t/ha) | \$61.98 | \$105.88 | \$351.01 | 6.3% | \$518.87 |
| 4. Deep rip Lime (2t/ha) | \$39.04 | \$177.25 | \$325.64 | 4.3% | \$541.93 |
| 5. Spade + deep rip + Lime (2t/ha) | \$-17.76 | \$220.44 | \$319.14 | 2.0% | \$521.82 |

The calciprill treatment had the highest ROI over the three years (Figure 13), which has been largely due to its low cost (\$57/ha). Its gross return over three years (Figure 14) was also the highest \$542.45/ha. The control had the lowest gross margin over the three years (\$509.87). All treatments had a higher return than the control with the top-dressed lime returning \$518.87/ha, spading returned slightly higher with \$521.82/ha and the deep ripped treatment was the second highest treatment returning \$541.93/ha. This indicates that the full benefits of the deep soil amelioration are not yet realised and may be in future years. It is also worth noting that this years results may not be a true representation of the results as the previous two years have measured grain only and this year with the rotation being hay, the total biomass has been measured instead so the results may be less accurate.

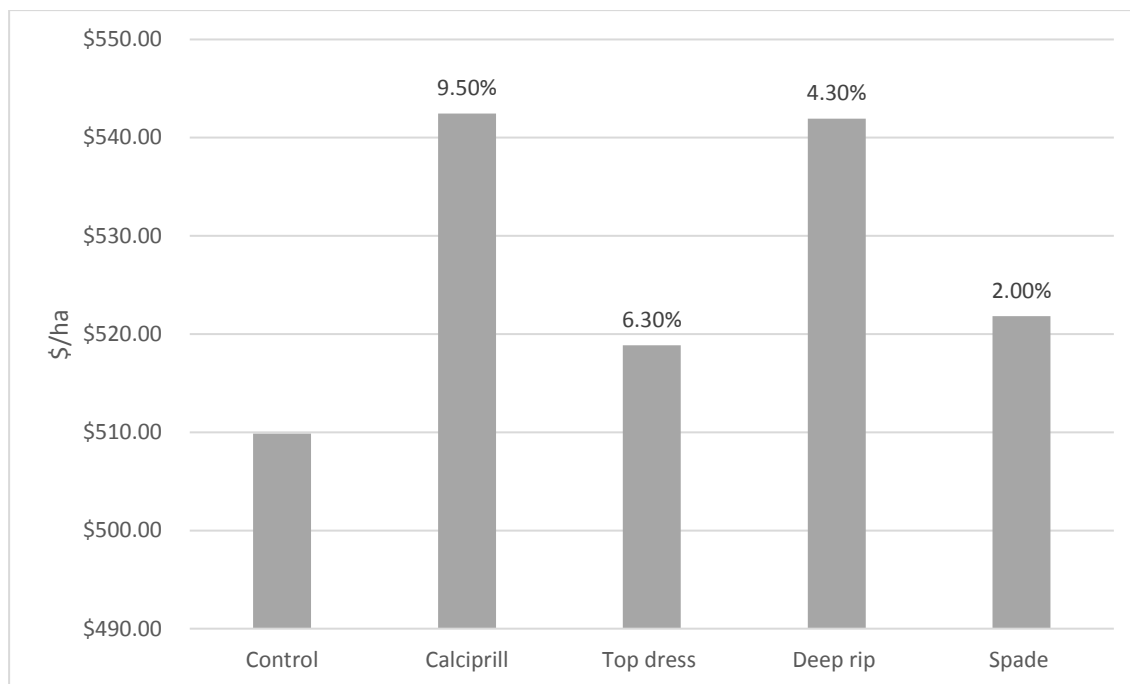


Figure 13: Treatments return on investment over 3 years

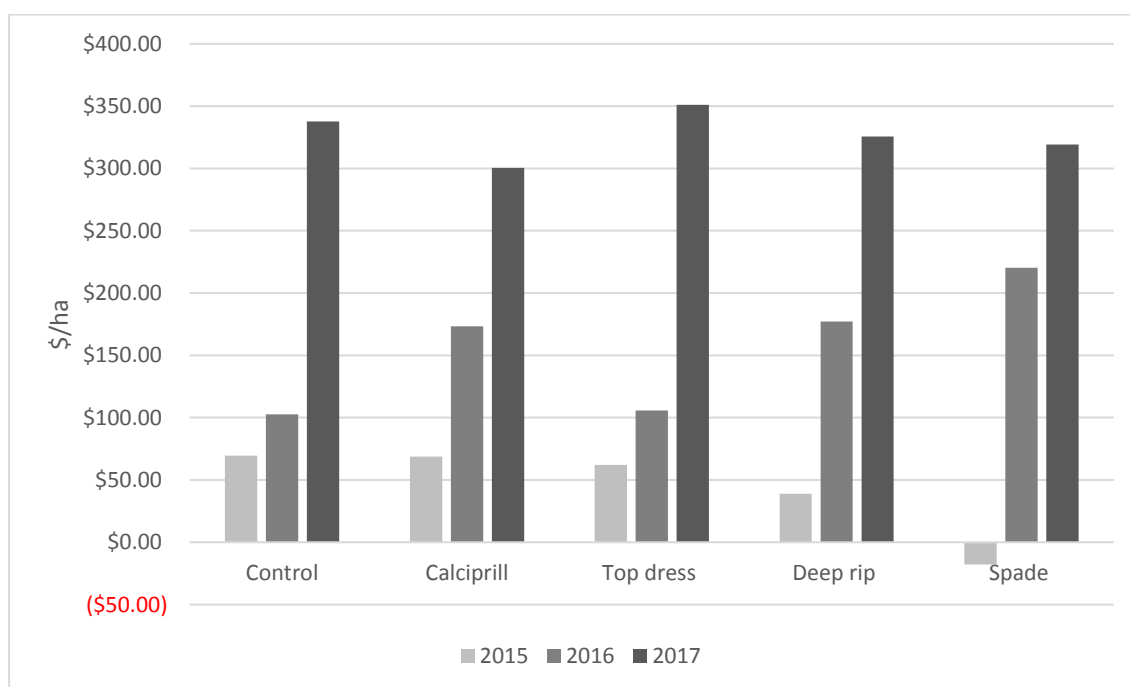


Figure 14: Three year gross margins by treatment

Difficulties Encountered

The unseasonal conditions early in the year caused staggered germination across the district, which made it difficult assessing when to take plant establishment counts.

The trial was setup to reflect farmer practice and rotations, to provide farmers with a return on investment each year, no matter where in the paddock crop rotation it was. Oats have a higher tolerance to acidic soils compared to canola and most other cereals grown in the area (Figure 14). This is likely why little variation was seen in the gross returns and hay quality.

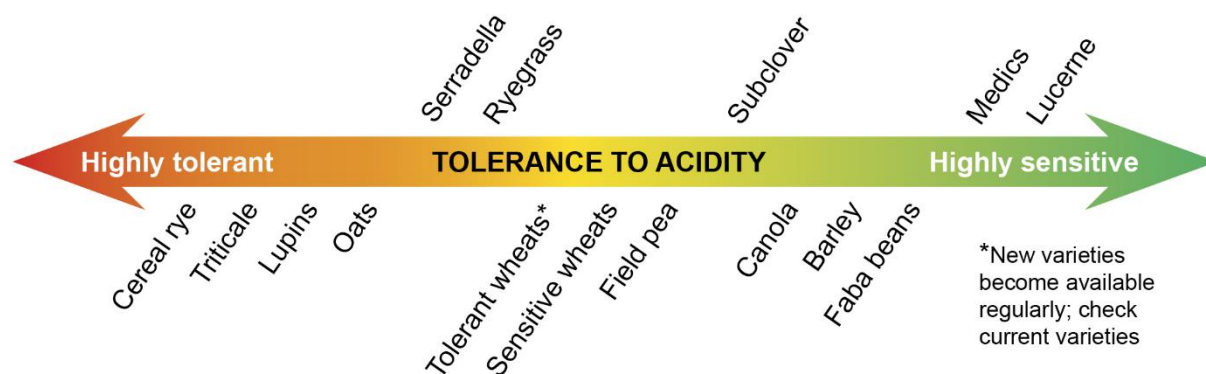


Figure 14: Relative tolerance of crop and pasture species to soil acidity and aluminum toxicity (Department of Primary Industries and Regional Development – Agriculture and Food, 2017)

Conclusions

The unseasonal conditions at seeding affected plant establishment and growth stages, which are not a true result of any treatment. The control treatment pH change from last season, shows a steady decrease and reflects the importance of maintenance lime applications. The benefits of spading were highlighted, having the lowest weed burden across the site again this season, as well as the highest concentration of nitrogen and nitrates across the trial. This was reflected in the yields, with spading having the highest average yield of all the treatments, at 5.27t/ha. The fodder quality testing did not vary greatly, though most samples bordered the limit between hay export grade 1 & 2 with Acid Detergent Fibre %.

The calciprill treatment again had the highest return on investment, as the upfront costs were significantly less than the other treatments. Even though spading had the highest yield, it also had the lowest return on investment, given the high cost of implementing the treatment.

This trial has provided a starting point to build upon to create a realistic data set of the Facey Group region that growers can utilise to make decisions. The results have also indicated through the yields and ROI to date, that the full benefits are yet to come to fruition from the deep soil amelioration treatments. It is recommended that further in-depth research continues in the Wickpin and surrounding areas on the various duplex soil types, to provide further data into the effect between lime application and soil amelioration techniques.

3. Project resources

| 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 | \$17,500 | \$22,854 | \$17,500 | \$17,500 | - |
| Operating costs | \$21,500 | \$16,157 | \$21,500 | \$21,500 | - |
| Capital | - | - | - | - | - |
| TOTAL | \$39,000 | \$39,011 | \$39,000 | \$39,000 | - |

*Funding provided by COGGO.

4. Commercialisation

This project is 'public good' research, the aim is to increase growers knowledge of lime incorporation methods and return to growers investment over specific time periods.

The trial brings new soil acidity management strategies to the district and through extension, will inform farmers of the options available. As there are different management strategies being tested, there are many different ways for growers to adapt our research to best fit their management practices. Our findings and economic analysis will be made available to growers at the Facey Groups Trials Presentation Event in March 2018.

In 2017 an economic analysis was conducted after the results were collected and it showed the gross margin and return on investment for each treatment to date. This analysis will be available to growers and industry, as it will show the cost of implementing each treatment and the return on investment for each year. We are hoping to provide information on all aspects of the trial and allow growers to be fully informed before using the treatments.

5. Communication/ Extension

Lime Incorporation Workshop

The Facey Group held the Lime Incorporation Workshop on the 20th July in conjunction with the winter Cropping Group field walk, at the COGGO funded lime incorporation trial site. Chris Gazey from DPIRD, who has extensive experience with lime incorporation trials all over the state, facilitated the discussion with the 17 attendees. They examined the soil pH differences across the profile in two pits, between top-dressing and spading; and between control (nil) and deep ripping.

Chris also discussed the other trials around the state and how the responses to the methods of incorporation have varied between soil types and acidity levels. The sandplain soils with extreme surface and subsoil acidity have had great responses to deep ripping as a method of faster changes in subsoil pH. He said growers need to take into account where the pH of the sandplain soils were 20-30 years ago, and the maintenance applications farmers in the area require to keep them from reaching those extreme acidity level. He also expressed the need for growers to test and map their subsoil acidity levels across their properties, given the pH variation of different soil types in the area. He discussed which types of crops have greater pH tolerances and for farmers to consider this when planning rotations. Chris also covered topics related to the increased nutrient availability to plants through liming, the different sources of lime in WA, how aluminium interacts with soil pH, how and when to take soil samples and what changes are planned for the trial site next year. Attendees also received a copy of the book "Soil Acidity – A guide for WA farmers and consultants".

The workshop aimed to provide growers with an intensive information session and to extend trial results to date.

Attendees had numerous questions for Chris and a energetic discussion ensued. The feedback from attendees was extremely positive, with suggestions such as holding a complete soil health workshop in the future.

The pits dug for the workshop were also made available to DPIRD's "Looking deeper into soils" tour group who visited on the 24th July.



Photo – Chris Gazey and Lime Incorporation Workshop attendees

Newsletter Article

The Facey Group published an article about the trial history, results to date and plans for the 2017 trial, one month prior to the Lime Incorporation Workshop for more effective engagement with workshop attendees. The article was published in the Facey Group Fortnightly Update on the 25th May and also in the local community Watershed News on the 30th May.

FACEY GROUP TRIAL UPDATE



Incorporating Lime to Depth on Duplex Wheatbelt Soils

2017 will be the third year of the COGGO funded trial, which focuses on both the agronomic and economic responses from five lime incorporation methods. The trial was installed in 2015 and the treatments include control (nil), top dressed lime, direct drilled Omya Calciprill, deep ripped (top dressed lime, deep ripped) and spaded (top dressed lime, deep ripped then spaded). These treatments are replicated three times on PA scale plots.

This project came about from local growers needing to see a better response from lime applications, as most growers practice no-till seeding and have previously only used top dressing for lime application. There is also a distinct lack of local sub-soil acidity research undertaken on clay/duplex soil types, as most previous research has only focused on sand plain soils.

The first year of the trial showed that the greater the level of soil disturbance, the more reduced the germination was. Yield and quality at harvest did not show any significant difference in 2015, as canola has the ability to compensate for bare areas by closing over the canopy. It is likely that if the trial area was planted to cereals, the variation between yields may have been greater in the first year.

In 2016, after a year of the soil firming, all treatments achieved consistent germination across the trial, which was sown to wheat. The spaded treatment yielded higher than other treatments, averaging 2.45 t/ha and control had the lowest yields with an average 1.7 t/ha. These results are likely due to the spaded treatment having a higher crop nitrogen utilisation, which is likely due to the mixing, aeration and breakdown of the soil organic matter which results in increased mineralisation of nitrogen; the possibility of improved root growth and access to nutrients due to the deeper tillage technique loosening the soil; as well as the mitigation of any water repellence through soil inversion. The spaded treatment also had the highest protein average and it also saw all plots grain quality assessments reach APW1 specifications. In the control treatment, there were large variations in the grade specifications, with one of the control plots even being graded to AGP1.

Over the two years the trial has run, the economic analysis shows that the spaded treatment had the highest gross margin, followed by Calciprill, deep ripping, control and lastly top dressing. The highest return on investment (ROI) was Calciprill followed by top dressing, deep ripping and then spading, which is likely due to the large upfront expense of implementing the treatment. The control was excluded from the ROI as it has no implementation expense.

The trial was sown this year on the 18th May to oaten hay and it is expected that this year will begin to balance out the full benefits and return on investment of each treatment in this trial, given the results from applying lime are expected to last for many years. Having this information at a local level will allow growers to integrate the results into their own farming systems to achieve greater yields and increase on farm productivity and profitability.



Seeding at the Incorporating Lime to Depth on Duplex Wheatbelt Soils 2017



Another article was published in the Facey Group Fortnightly Update on the 3rd August, discussing the highlights of the Lime Incorporation Workshop. The workshop outcomes were also mentioned in the Agricultural Research and Extension Coordinators report in the bi-monthly newsletter sent out on the 21st August.

Facey Group newsletters are distributed to all members of the Facey Group (currently 90+ farming entities which incorporates over 300 individuals) as well as sponsors and various local industry.



Facey Group Trial Update

Incorporating Lime to Depth on Duplex Wheatbelt Soils

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Chris Gazey from DPIRD, who has extensive experience with lime incorporation trials all over the state, facilitated the discussion with the 17 attendees. They examined the soil pH differences across the profile in two pits, between top-dressing and spading; and between control (nil) and deep ripping.

Chris also discussed the other trials around the state and how the responses to the methods of incorporation have varied between soil types and acidity levels. The sandplain soils with extreme surface and subsoil acidity have had great responses to deep ripping as a method of faster changes in subsoil pH. He said growers need to take into account where the pH of the sandplain soils were 20-30 years ago, and the maintenance applications farmers in the area require to keep them from reaching those extreme acidity level. He also expressed the need for growers to test and map their subsoil acidity levels across their properties, given the pH variation of different soil types in the area. He discussed which types of crops have greater pH tolerances and for farmers to consider this when planning rotations. Chris also covered topics related to the increased nutrient availability to plants through liming, the different sources of lime in WA, how aluminium interacts with soil pH, how and when to take soil samples and what is in store for the Facey Group trial next year.

Attendees also received a copy of the book "Soil Acidity – A guide for WA farmers and consultants". If you were unable to attend and would like a copy, please contact Chloe at the Facey Group office at agrec@faceygroup.org.au or on 0409 868 514.



Chris Gazey discussing the COGGO lime incorporation trial

Trial Report Summary

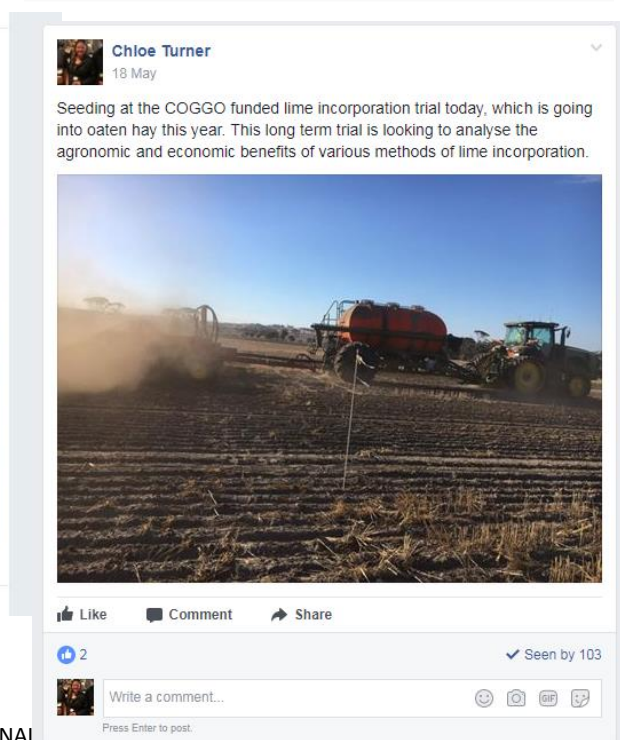
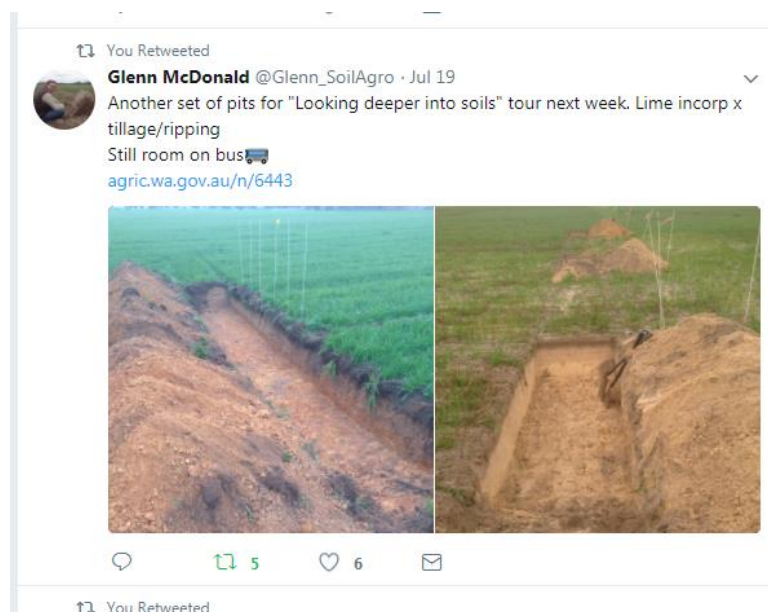
A trial summary report was included in the Spring Field Day attendees booklets, with the trial plan and results to date included which was held on the 13th September. Spring Field Day is one of the Facey Groups premier events each year, which attracted approximately 80 growers and industry in 2017.

Trial Report and Economic Analysis

A trial report of the 2016 results with the economic analysis was included in the Trials & Demonstrations Booklet, as well as the trial findings also being presented at the Facey Groups annual Trials Presentation Event held in March 2017. The 2017 trial findings will be presented and a report of the results including the economic analysis included in the Trials & Demonstrations Booklet, at the Trials Presentation Event that will be held in March 2018. This is the Facey Groups biggest annual event which attracts approximately 100 attendees including growers, consultants, advisers, researchers, sponsors and other industry experts.

Social Media

The Facey Group believes these updates are an integral part of successful extension; utilising Twitter and Facebook. With communicating updates of trials “a picture paints a thousand words” in demonstrating quickly and effectively; and creates conversation.



Future Opportunities

The level of engagement with growers and industry around the importance of maintaining soil pH has grown since the inception of this trial. Growers have commented on the trial treatments and the outcomes they have had on varying soil types. The feedback from the 2016 Spring Field Day and the 2017 Lime Incorporation Workshop were immensely positive, with great discussion and questions raised from growers. One grower stated that the results to date from this trial could have potentially saved him a large sum that he planned on investing in purchasing machinery solely for lime incorporation. The trial has been instrumental in forming new partnerships with industry, who have been able to share their expertise and encourage further scientific avenues to explore regarding on-farm liming practices. New opportunities have also arisen to investigate the application varying levels of lime and incorporation techniques on duplex soils, which will be of benefit to the entire industry.

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)

_____ Date:

Research Organisation signature _____

Name and title of authorised signatory (in Capitals)

_____ Date:

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

This project came about from local growers needing to see a better response from lime applications, as most growers practiced no-till seeding and have previously only used top dressing for lime application. There was a distinct lack of local sub-soil acidity research undertaken on clay/duplex soil types, as previous research has only focused on sand plain soils.

The trial commenced in 2015 and incorporates PA scale plots replicated three times, with five treatments including control (nil), top dressed lime, direct drilled Omya Calciprill, deep ripped (top dressed lime, deep ripped) and spaded (top dressed lime, deep ripped then spaded).

This trial demonstrates how using each tillage method moves the lime down the soil profile and how this effects production over the long term. Having this information for growers at a local level will allow them to integrate the results into their own farming systems.

The first year of the trial showed that the greater the level of soil disturbance, the more reduced the germination was. Yield and quality at harvest did not show any significant difference in 2015, as canola has the ability to compensate for bare areas by closing over the canopy. It is likely that if the trial area was planted to cereals, the variation between yields may have been greater in the first year.

In 2016 after a year of the soil firming, all treatments achieved consistent germination across the trial, which was sown to wheat in 2016. The spaded treatment yielded higher than other treatments, averaging 2.45 t/ha and control had the lowest yields with an average 1.7 t/ha. These results are likely due to the spaded treatment having a higher crop nitrogen utilisation, which is likely due to the mixing, aeration and breakdown of the soil organic matter which results in increased mineralisation of nitrogen; the possibility of improved root growth and access to nutrients due to the deeper tillage technique loosening the soil; as well as the mitigation of any water repellence through soil inversion. The spaded treatment also had the highest protein average and it also saw all plots grain quality assessments reach APW1 specifications. In the control treatment, there were large variations in the grade specifications, with one of the control plots even being graded to AGP1.

The unseasonal conditions at seeding in 2017 saw staggered and patchy germination across the trial, this was not due to any of the treatments. The trial was sown to oaten hay, which is slightly more tolerant to acidic soils than other cereals. The results showed that the spaded treatment again had the highest average yield at 5.27t/ha and Calciprill the lowest average yield at 4.06t/ha. The fodder quality was fairly consistent across the trial, with half of the plots attaining export grade 1 quality. The Acid Detergent Fibre % was the only standard which caused almost half the plots to go to export grade 2 from only marginal amounts above the standard limits.

Over the three years the trial has run, the economic analysis shows that the calciprill treatment had the highest dollar return on investment (ROI), followed by deep ripping, spading, top dressing and control. This is due to the low cost of installing the calciprill treatment.

The highest ROI percentage was calciprill followed by top dressing, deep ripping and then spading, which is likely due to the large upfront expense of implementing the treatment. The control was excluded from the ROI as it no implementation expense.

Since the start of the trial, pH levels have shown that the incorporation treatments have had a greater and more consistent increase compared to the other treatments down the soil profile. It is expected that the full benefits of these deeper lime incorporation treatments are yet to be realised and the return on investment of these would increase over time.