# FINAL RESULTS FROM THE BEST PRACTICE LIMING TO ADDRESS SUB-SOIL ACIDITY IN NORTH EAST VICTORIA TRIALS

## KEY MESSAGES

- **A replicated liming rate and incorporation trial at Lilliput clearly demonstrated how applying lime, followed by incorporation, increased subsurface pH values and reduced aluminium availability in the soil.**
- **There was no difference in yields due to liming rate or incorporation method in the replicated plot trial during 2024 or 2023, likely due to good seasonal and growing conditions.**
- **A demonstration trial looking at fine verses coarse lime quality highlighted how the rate of lime applied (3 t/ha) was more influential than the type of lime for increasing pH in this soil.**
- **Incremented soil testing helps identify the severity of acidification and allows the right amount of lime to be calculated for your soil type. It will also help identify any other subsoil constraints that could affect the incorporation method.**
- **While deep incorporation of lime has shown positive results in this trial, it's important to only incorporate lime to the depth that is suitable for that soil, considering the presence of other soil constraints (i.e. sodicity, slaking).**
- **Tools for economic analysis of liming and incorporation exist and are useful for scenario modelling, however they do not reflect the complexity of the issue.**

## OVERVIEW

Acid soils have long been a major constraint to crop and pasture production in north east Victoria, with the reacidification of previously limed soils, along with pH stratification, becoming increasingly important for grain farmers in the Riverine Plains.

The *Best practice liming to address sub-soil acidity* project was developed to increase awareness of the speed of acidification and stratification of soils in the region, as well as the tools available to assist management decisions.

The project involved the establishment of a replicated field trial to demonstrate best practice liming strategies, as well as a field demonstration of the impacts of lime quality, each year for three years from 2022–2025.

The trials were designed to demonstrate different incorporation methods, evaluate the impact of different lime types and sources and extend findings, including comparisons of the economic and agronomic returns using the *Acid Soils SA* calculator tools.

The data generated through this project is supporting farmers to evaluate the most practical and economical methods to manage soil pH and paddock variability.

## AIM

The project aims to support growers and advisers in north east Victoria to have an improved understanding of the state of topsoil and subsoil acidity, the limitations to crop profitability it causes, and an improved knowledge of the agronomic and economic benefits of different lime sources, lime quality and incorporation methods.

## METHOD

Treatments for the project were developed in consultation with a steering committee made up of growers and researchers, as shown in Table 1.

The treatments were applied to a trial site established at Lilliput, in the Rutherglen district of Victoria, and monitored for three years from 2022–2024.

**Table 1** Best practice liming trial treatments

| TREATMENT # | DETAILS |
|---|---|
| 1 | Control – nil applied lime with nil incorporation |
| 2 | Nil lime, with incorporation by shallow discs |
| 3 | Lime to target pH 5.2, incorporated by sowing |
| 4 | High rate of lime (targeting pH 5.8 in 0–10 cm value), incorporated by sowing |
| 5 | High rate of lime (targeting pH 5.8 in 0–10 cm value), incorporated by shallow discs |
| 6 | High rate of lime (targeting pH 5.8 in 0–10 cm value), deep incorporation to 10–15cm, follow up with speed-tiller |
| 7 | High rate of lime (targeting pH 5.8 in layers to depth), deep incorporation to 10–15cm, follow up with speed-tiller (rate calculated for pH 5.8 at depth)—Deluxe option |

An intense soil sampling regime was completed in February 2022 across each replicate. This provided baseline information to characterise the whole site, as well as an understanding of current pH levels and other constraints, such as sodicity, to ensure that the proposed incorporation methods were appropriate. Using this information, it was calculated that the rates of lime applied in that year would be:

- Lime required to achieve a target pH of 5.2 = 1.2 t/ha
- Lime required to achieve a target pH of 5.8 (high rate) = 5.0 t/ha
- Lime required to achieve a target pH of 5.8 to depth (high rate to depth, deluxe option) = 8.5 t/ha

The application of lime was done using a range of surface and incorporation techniques, including a shallow incorporation by sowing, incorporation by discs to a depth of 10 cm and a deeper incorporation by a Horsch Tiger to a depth of 15 cm (Treatments 6 and 7). A nil control—where no lime is applied—was used to highlight the cost of complacency when addressing pH issues in both the short and long term.

The field site was established and managed by AgriSci Pty Ltd. Table 2 shows the layout of the field-scale replicated trial.

At one end of the replicated trial, demonstration trials were established to assess the impacts of two types of lime quality, granular (Mt Gambier lime) and fine (Galong lime), applied at 3 t/ha and incorporated with sowing. The lime from Galong was very fine, with bulk density of 1.4, while the Mt Gambier lime was much coarser, with a bulk density of 1.1.

**Table 2** Best practice liming replicated and demonstration trial layout, Lilliput, 2022–2024

| TRIAL PLAN | |
|---|---|
| Demonstration 1: Mount Gambier lime 3 t/ha, incorporate by sowing | |
| Demonstration 2: Nil lime, incorporate by sowing | |
| Demonstration 3: Galong lime 3 t/ha, incorporate by sowing | |
| 1 5 t/ha applied lime with deep incorporation | 28 5 t/ha applied lime with incorporation by sowing |
| 2 5 t/ha applied lime with incorporation by shallow discs | 27 Nil applied lime with shallow disc incorporation |
| 3 Control, nil applied lime with nil incorporation | 26 1.2 t/ha applied lime with incorporation by sowing |
| 4 1.2 t/ha applied lime with incorporation by sowing | 25 5 t/ha applied lime with incorporation by shallow discs |
| 5 Nil applied lime with shallow disc incorporation | 24 8.5 t/ha applied lime with deep incorporation |
| 6 8.5 t/ha applied lime with deep incorporation | 23 5 t/ha applied lime with deep incorporation |
| 7 5 t/ha applied lime with incorporation by sowing | 22 Control, nil applied lime with nil incorporation |
| 8 Control, nil applied lime with nil incorporation | 21 8.5 t/ha applied lime with deep incorporation |
| 9 5 t/ha applied lime with incorporation by sowing | 20 5 t/ha applied lime with incorporation by shallow discs |
| 10 5 t/ha applied lime with incorporation by shallow discs | 19 5 t/ha applied lime with incorporation by sowing |
| 11 Nil applied lime with shallow disc incorporation | 18 1.2 t/ha applied lime with incorporation by sowing |
| 12 5 t/ha applied lime with deep incorporation | 17 Nil applied lime with shallow disc incorporation |
| 13 8.5 t/ha applied lime with deep incorporation | 16 Control, nil applied lime with nil incorporation |
| 14 1.2 t/ha applied lime with incorporation by sowing | 15 5 t/ha applied lime with deep incorporation |

Plot size 40m x 13 m, buffer 30 m

Lime was applied on 16 February 2022, with incorporation completed the next day. A Horsch Tiger (tynes 125–150 mm, discs 100 mm), was used for the deep incorporation, with calibration to ensure that the depth of the lime was kept above 20 cm, as the site has a sodic layer below this depth. A speed tiller was run over both incorporated treatments to a depth of 50–75 mm, to ensure a smooth surface for ease of sowing. Once the treatments were completed, the host sowed and managed the trial site in line with the management practices used for the remainder of the paddock.

Soil sampling was conducted in January 2022, before the treatments were established, and resampled in January 2023, 2024 and 2025 to enable a direct comparison of liming treatments and their effect on soil properties over time. Soil samples were collected in increments of 0–5, 5–10, 10–15, 15–20 cm using a hand corer, while the 20–30, 30–40, 40–50cm depth increments were collected using a hydraulic trailer-mounted corer.

The site was sown to canola in 2022, however the trial was abandoned due to waterlogging and slug damage prior to harvest, meaning that no yield results were collected. During May 2023, the site was sown to Scepter wheat, with results published in Research for the Riverine Plains 2024. On 11 April, 2024 the site was sown to Scepter wheat, for the second year in a row, along with 80 kg MAP/ha. In-crop urea was applied at 250 kg/ha during the season.

GreenSeeker® measurements of Normalised Difference Vegetation Index (NDVI) were taken on 19 August, 4 September and 19 September to try to assess a difference in growth of the plots (data not presented). Photos were also taken during the season as a record of plot growth.

Harvest was carried out for both the replicated and demonstration trials by Kalyx, using a plot header on 20 December 2024. The host farmer harvested the crop remaining on the site with the rest of the paddock.

# RESULTS, OBSERVATIONS AND COMMENTS

## RAINFALL

While total 2024 calendar year rainfall at the site was 700 mm, only 269 mm fell during the growing season (April to October), with the site receiving very poor early spring rainfall. This meant that crops needed to rely on stored moisture for grain fill, impacting yields. The area also received 209 mm over nine days during November, which skewed the yearly total.

During 2024, the site received similar rainfall to the 2023 season, although the timing was different, however this was much less rainfall than received during the 2022 season (1159 mm) (Figure 1).

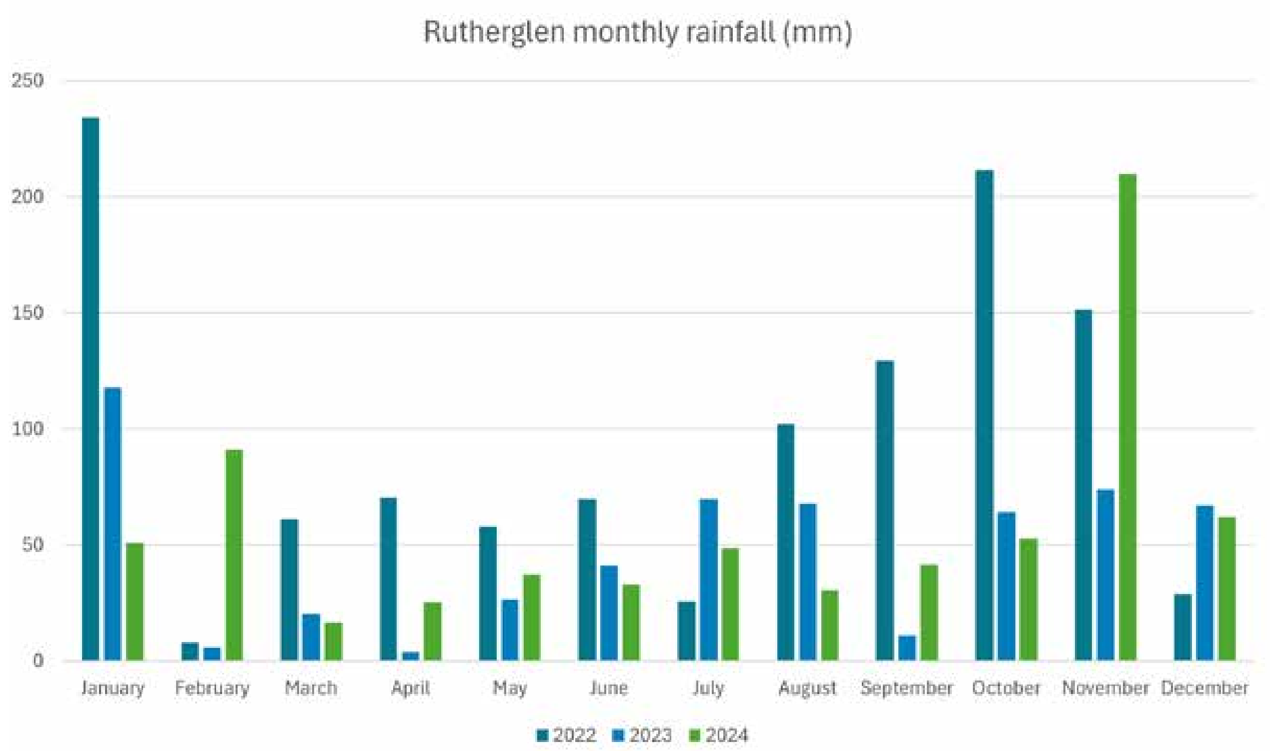


**Figure 1** Monthly Rainfall taken from the Riverine Plains on-farm Rutherglen weather station , 2022–2024.

## SOIL ANALYSIS

Note, while standard errors of the mean (SE) have been calculated for the following results, analysis of variance has not yet been completed due to delays in accessing statistical support. This means that any reference to treatment effects is estimated based on the SE values, not p-values.

### Treatment effect on soil pH and aluminium percentage

The following graphs show soil pH and aluminium percentage in depth increments of 0–5, 5–10, 10–15, 15–20, 20–30, 30–40 and 40–50 cm along the y-axis, with the measured characteristic along the x-axis. The bars are standard error of the mean and each graph shows annual results from 2022 (prior to treatments being applied), 2023, 2024 and 2025 (after the trial was completed), sampled at the same time each year.

### Treatment 1: Control – Nil applied lime with no incorporation

This is treatment was the control, with no lime applied in 2022 and sown as per the surrounding paddock.

This treatment aimed to show the result of a "do nothing" approach to soil pH, however the results show some year-on-year variance in the results which is expected in large scale plot experiments (these would all be within error, noting that the bars as measures of SE only).

From Figure 2a, pH gradually decreases in this soil as we move from the surface (0–5cm) to the subsoil, with pH then increasing down the profile, indicating the presence of an acid throttle. Mirroring the pH results, aluminium saturation is highest (>15–20 percent) at the 10–20 cm depths, which is likely causing some toxicity to plants (Figure 2b). Aluminium above five percent may affect root growth.

### Treatment 2: No applied lime with shallow disc incorporation

No lime was applied to these plots, however this plot had a set of shallow discs run through it prior to sowing at the same time as incorporation was applied to the other treatments. The discs incorporated the soil to a depth of between 5–10 cm.

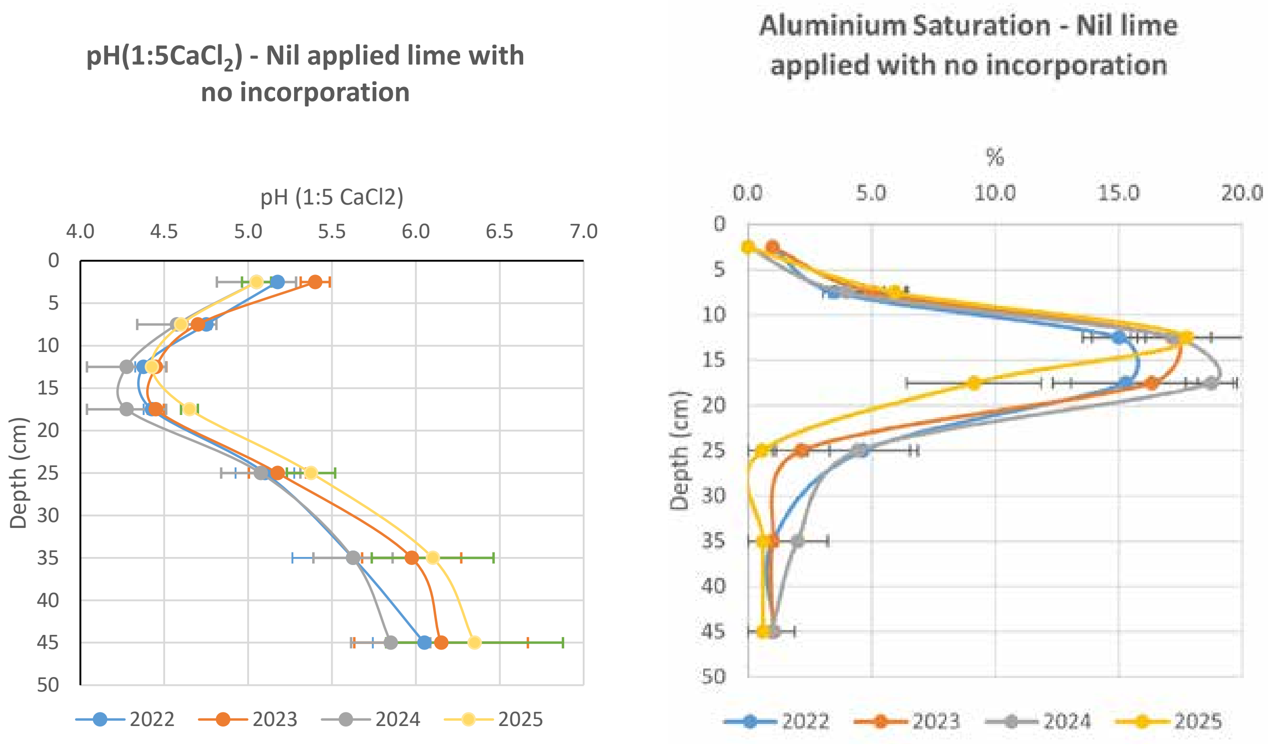


**Figure 2a and 2b** Soil pH and aluminium saturation (% of the CEC) in the nil lime applied with no incorporation treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

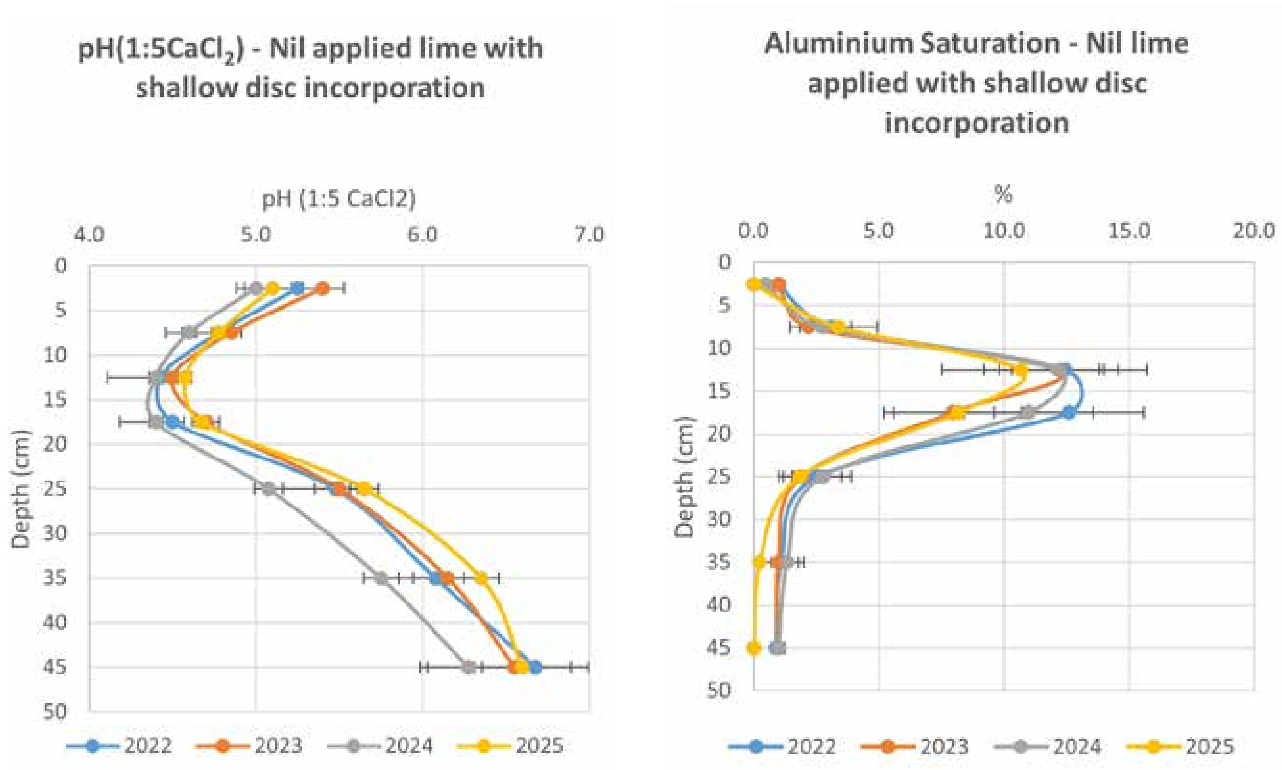


**Figure 3a and b** Soil pH and aluminium saturation (% of the CEC) in the nil lime applied with shallow disc incorporation treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

Similar to the control treatment, there was no change in pH or aluminium saturation across the years (Figure 3a, b).

**Treatment 3: Lime applied to target pH 5.2 and incorporated by sowing.**

Traditionally, farmers in the Riverine Plains have targeted a pH of 5.2 for grain production, which generally allows a range of crops, including legumes, to be grown without the risk of yield loss. To achieve a target pH of 5.2 across the 0–10cm depth, 1.2 t/ha of lime was applied and then incorporated by sowing.

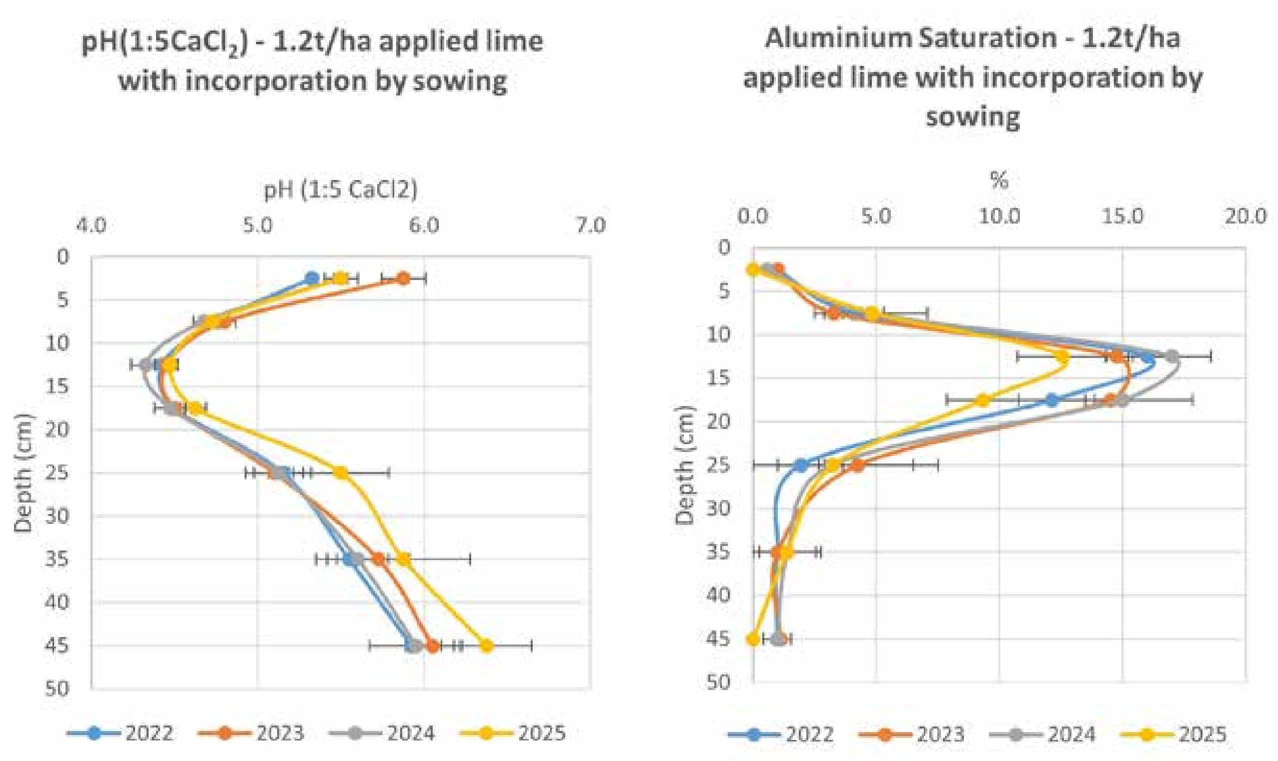


**Figure 4a and 4b** Soil pH and aluminium saturation (% of the CEC) in the 1.2 t/ha lime applied with incorporation by sowing treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

The addition of lime in 2022 caused a transient pH increase at the 0 – 5cm depth in the 2023 sampling, which may be statistically significant (pending analysis of results). However, only a small shift in pH was evident at the time of the 2025 sampling time (Figure 4a, b).

**Treatment 4: Lime applied to target pH 5.8 (at 0–10 cm depth), incorporated by sowing**

It is now recommended that farmers target a pH of 5.8 to optimise growth across all crop varieties and provide sufficient alkali to move down into the subsurface. Initial soil testing in 2022 at this site indicated the application of 5 t/ha of lime was likely achieve this target.

The results indicate that the surface application of lime in this treatment has not yet impacted the high aluminium levels at depth in this soil, with saturation levels still at 15 percent (Figure 5a, b). The high surface pH values indicate that there is excess alkali in the surface which may be available to move down over time, however the relative impact and time requirement of this is unknown.

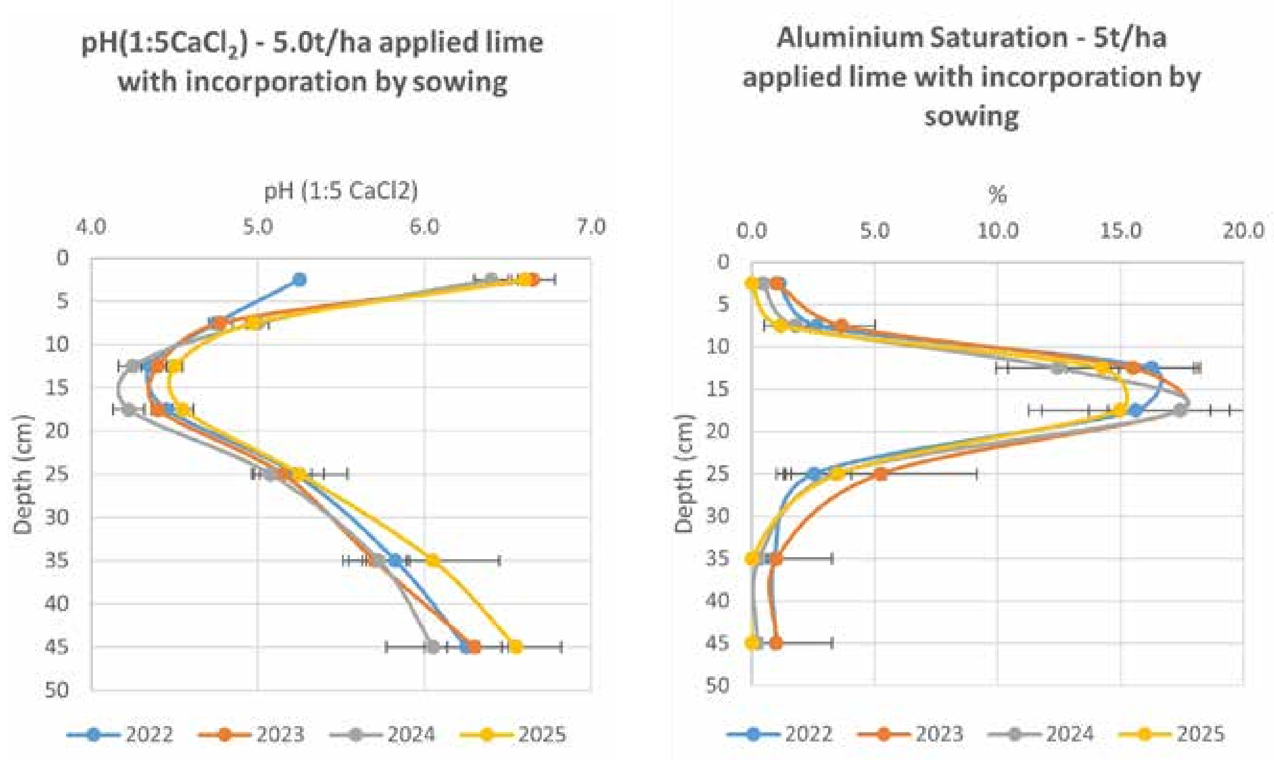


**Figure 5a and 5b** Soil pH and aluminium saturation (% of the CEC) in the 5 t/ha applied lime applied with incorporation by sowing treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

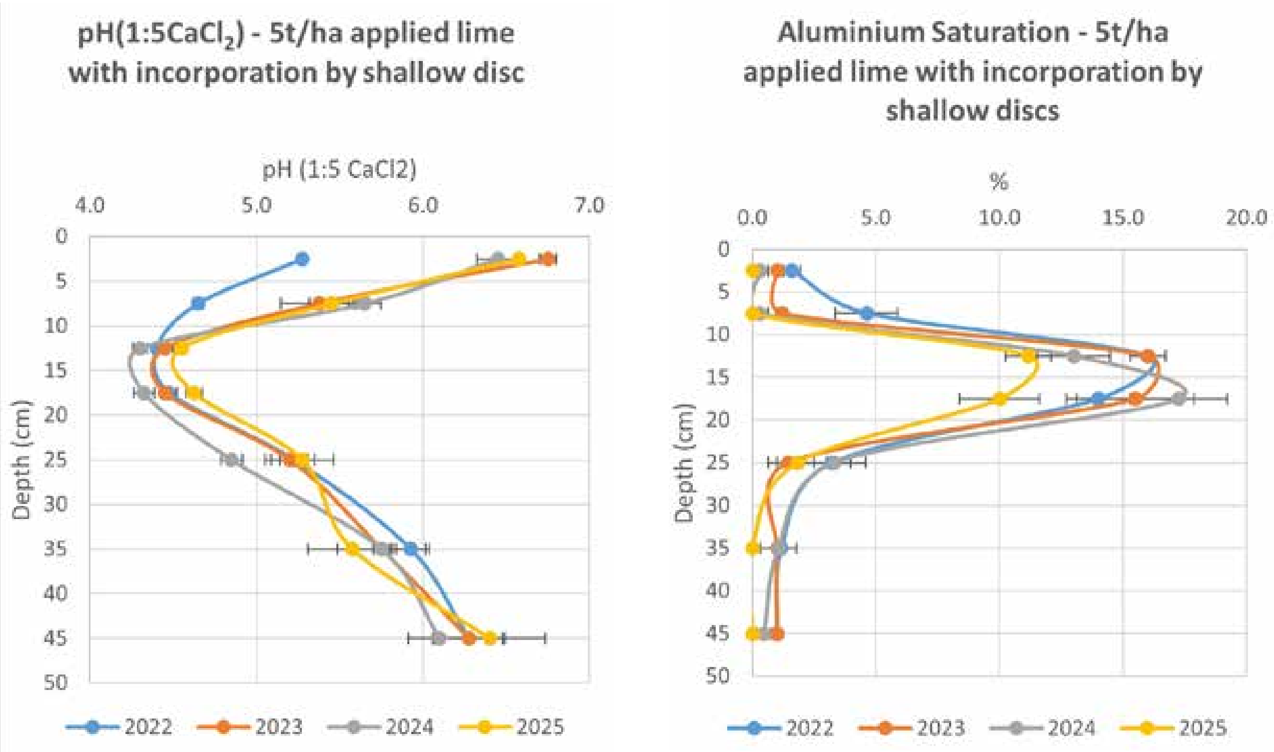


**Figure 6a and 6b** Soil pH and aluminium saturation (% of the CEC) in the 5 t/ha applied lime with incorporation by shallow discs treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

### Treatment 5: Lime applied to target pH 5.8 (at 0–10 cm depth), incorporated by shallow discs

Similarly to the 5 t/ha applied lime with incorporation by sowing treatment, the 5 t/ha applied lime with incorporation by shallow disc treatment aimed to achieve a target pH of 5.8 across the entire 0–10 cm depth, with the rate applied based on initial soil test results. The 5 t/ha lime incorporated using shallow discs treatment resulted in an increase in pH down to the depth of incorporation (Figure 6a, b).

By January 2025, soil pH had increased significantly down to the target depth of 10 cm after lime was applied and incorporated by shallow discs in 2022. There was also a resulting decrease in aluminium in the same target area (0–10 cm), measured across the same period; this indicates that the lime was successfully moved down the profile during the incorporation process and that it was able to react to increase soil pH within this zone.

### Treatment 6: Lime applied to target pH 5.8 (at 0–10cm depth), deep incorporation (15cm)

This treatment aimed to mix the 5 t/ha of lime required to raise pH to 5.8 in the 0–10 cm depth to a depth of 15–20 cm. To do this, a Horsch Tiger was used, however a limited depth of incorporation (10–15  cm) was applied due to the presence of a sodic layer beneath this depth (mixing sodic subsoil with the surface soil would likely cause dispersion and crusting on the soil surface, potentially affecting crop emergence and limiting water infiltration).

The results show that the Horsch Tiger was successfully able to move lime down to the depth of incorporation (15 cm), with pH increasing in the 0–5, 5–10 and 10–15 cm depths between 2022 and 2025. Aluminium saturation was also reduced down to a depth of 15 cm (Figure 7a, b).

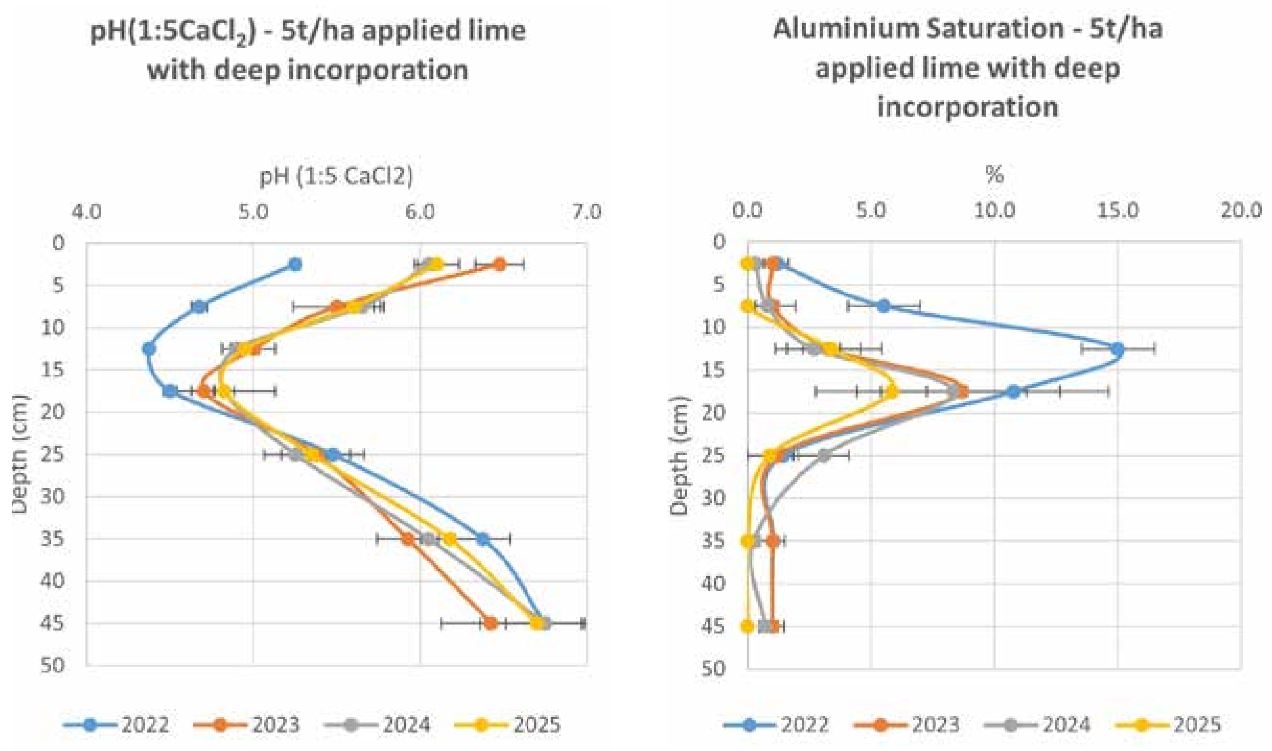


**Figure 7a and 7b** Soil pH and aluminium saturation (% of the CEC) in the 5 t/ha applied lime with deep incorporation treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

### Treatment 7: Lime applied to target pH 5.8 (0–20 cm depth), deep incorporation (15cm)

This treatment reflects a "deluxe" treatment approach not limited by the cost and practicalities of farming. The treatment targeted a pH of 5.8 from the surface, right down the profile to a depth of 20 cm. To do this, 8.5 t/ha of lime was applied and incorporated to 15 cm depth using a Horsch Tiger.

The results show that the combination of a high lime application rate and deep incorporation was able to completely ameliorate soil acidity in this situation, which resulted in a decrease in aluminium concentrations to below the toxicity threshold (Figure 8a, b). This means the soil should now support optimal root growth.

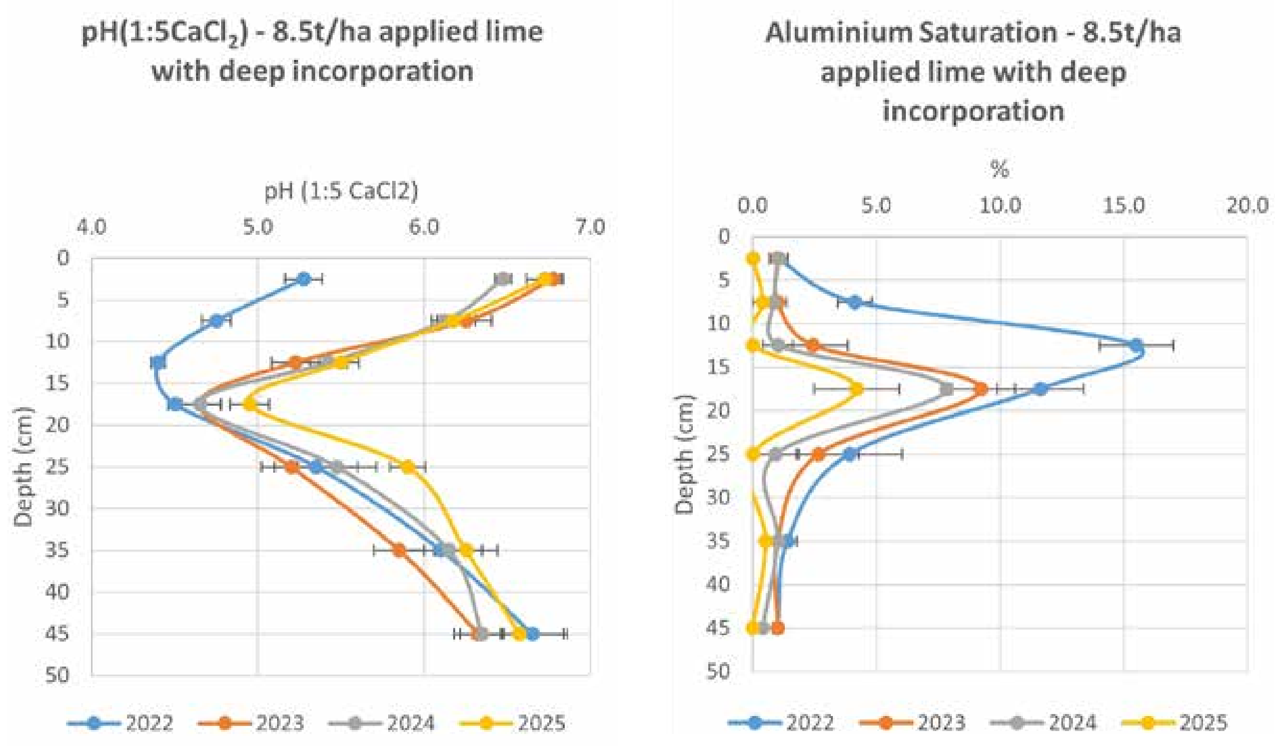


**Figure 8a and 8b** Soil pH and aluminium saturation (% of the CEC) in the 8.5 t/ha applied lime with deep incorporation treatment at Lilliput, 2022–2025. Bars are measures of standard error (SE).

## OVERALL RESULTS

These results have clearly supported the premise of this project, that the incorporation of adequate lime is required for the amelioration of subsurface acidity.

The results from the January 2025 sampling, compared with the previous three years sampling, show that when lime is applied without incorporation, it only changes the pH value on the surface. Incorporating lime by sowing increases pH in the top 5 cm, with the rate of increase depending on the amount applied. However, incorporating lime with shallow discs, or moving lime even deeper using a cultivator like the Horsch Tiger, enables the lime to move to the depth of incorporation. In this trial, shallow discs moved lime to 10–15 cm while the Horsch Tiger was able to move lime to 15– 20 cm.

At this site, the application of 5 t/ha of lime resulted in a significant change in pH and aluminium saturation at the surface when incorporated by sowing, compared to the original test results. The 5 t/ha incorporated by shallow discs and 5 t/ha deep incorporation treatments also resulted in a significant change in pH to the depth of incorporation.

As expected, when no lime was applied, there was no change to subsurface acidity and aluminium saturation levels.

The CEC values for this soil (data not presented) show low cation levels in the 5–15 cm depth, which is typical of duplex soils with a bleached A2 horizon in the Riverine Plains region. The band of low CEC values (and low clay content) aligns with the general zone of high root activity, which is the depth of greatest subsurface acidification. Changes in CEC over time are not shown, as results only vary within the background context of clay content, with no significant impact due to treatment.

Exchangeable aluminium levels also clearly reflect the changes in pH due to amelioration in the highly acidic 5–20 cm depth, with high rates of lime and incorporation reducing aluminium to levels which may not affect plant growth.

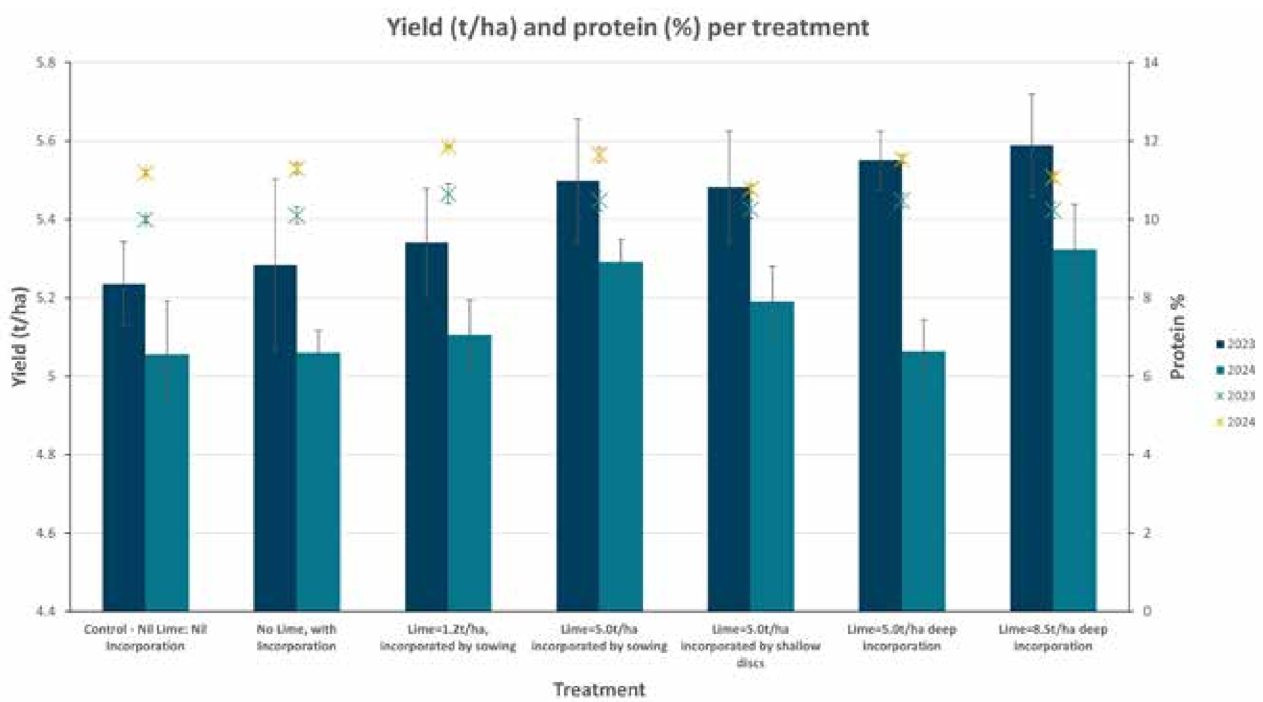


**Figure 9** Yield and protein response from various treatments at the Riverine Plains and GRDC 2023 and 2024 Best practice liming trials at Lilliput. Bars are measures of standard error (SE).

### GRAIN YIELD AND QUALITY

Although the lime moved to the targeted depth through incorporation in some treatments, there was no effect of lime application on yield. Due to waterlogging and slug damage at the trial site in 2022, yield was unable to be measured, thus Figure 9 shows 2023 and 2024 yields only. Overall yields were higher in 2023 compared to 2024, and there was a trend for higher yield in the 5 t/ha incorporated by sowing and 8.5 t/ha deep incorporation treatments across both years of the trial.

The 2024 replicated trial produced yields ranging from 5.05 t/ha (nil lime, nil incorporation) to 5.32 t/ha (8.5 t/ha lime, deep incorporation), which was slightly lower than observed in 2023, when the nil lime, nil incorporation treatment yielded 5.23 t/ha and the 8.5 t/ha lime, deep incorporation treatment yielded 5.59 t/ha. Both the 2023 and 2024 growing seasons had high yield potential, with minimal disruptions and timely rainfall. This helps explain the relatively small (approximately 0.3 t/ha) yield difference between the control and the deluxe treatment; had the season been drier, with plants under considerably more moisture stress, it is likely that the nil lime control treatment would have yielded comparatively less due to impaired root growth under high aluminium levels.

While there was little difference in protein results in 2023, during 2024 the higher lime rate (5 and 8 t/ha) plots with deep incorporation, also showed higher protein levels. While the reason for this is unclear (no nitrogen data was collected to provide insight), it is likely that improved nitrogen use efficiency in the treatments where acidity had been ameliorated led to higher grain protein. This was more evident in 2024 than 2023, due to the drier spring which caused moisture to be more limiting. It is also likely that water use efficiency may have shown a similar trend had moisture measurements been taken.

While 250 kg/ha urea was applied to the crop in 2024, the crop was potentially nitrogen limited at different growth stages given the high yields extracted in 2023.

Frost damage is also often exacerbated under low soil pH conditions and although severe frost events occurred across the Riverine Plains during 2024, they did not impact this specific trial site.

### FUSARIUM CROWN ROT & SLUGS

Riverine Plains has been managing another GRDC investment looking at the link between cereal stubble, subsurface acidity and crown rot. A Predicta B disease assessment was done on the control, 5 t/ha incorporated by shallow disc and 5 t/ha applied lime with deep incorporation plots from this trial. The control showed a high risk level while the other treatments had a low risk level. Unfortunately, all samples from the control plots were grouped together, so it was unable to be determined if there was a correlation between subsurface acidity and crown rot levels, which may have impacted yield.

In 2022, when the trial site was decimated by slugs and then waterlogging, it was observed that the treatments that received lime with deep incorporation were less impacted by slugs. This was confirmed with NDVI imagery, however no further analysis of slug populations or damage between treatments was completed and this may be a future area for investigation.

### ECONOMIC ANALYSIS

An important aspect of any major change in a farming system is determining its economic viability. The application of lime and its incorporation is a major cost for farmers, and the production benefits need to be considered over the longer term, especially when high application rates are being considered.

As part of this investment, we assessed the usability and relevance of some common tools that can calculate the effect of lime on soils, as well as the economic impact of the change. When researching tools it was found that there is currently no suitable tool for assessing lime application rates and incorporation in the Riverine Plains—while a scenario analysis was completed using the Acid Soils SA calculator tools (https://acidsoilssa.com.au/index.php/home/resources/), the pH values were in 0.5 increments, which was too broad to represent the issues being investigated in this trial. We also looked at LimeAssist tool (https://limeassist.sfs.org.au/), however this tool only addressed the cost of incorporation, without considering the long-term effect (benefit) of the incorporation.

Costing assumptions used in the analysis are listed in Table 3 below.

**Table 3** Costs used for calculating amelioration options at the Riverine Plains and GRDC Best practice liming trials, Lilliput

| | FREQUENCY OF APPLICATION | LIME COST# ($/HA) | SPREADING^ ($/HA) | INCORPORATION* ($/HA) | TOTAL COST ($/HA) |
|---|---|---|---|---|---|
| **Nil lime, nil incorporation** | | 0 | 0 | 0 | 0 |
| **Nil lime, incorporated by shallow discs** | | 0 | 0 | | |
| **1.2 t/ha applied lime, incorporated by sowing** | 3 years | 90 | 24 | 0 | $114 |
| **5 t/ha applied lime, with incorporation by sowing** | 6 years | 300 | 80 | 0 | $380 |
| **5 t/ha applied lime, incorporated by shallow discs** | 6 years | 300 | 80 | 50 | $430 |
| **5 t/ha applied lime, with deep incorporation** | 9 years | 300 | 80 | 150 | $530 |
| **8.5 t/ha applied lime, with deep incorporation** | 9 years | 510 | 136 | 150 | $796 |

#Based on a lime cost of $60/tonne

^Based on a spreading cost of $16/tonne

In the Riverine Plains, moderate rates of lime are typically applied to a paddock every 3–5 years, with the cost of liming considered over its years of effectiveness.  A key message is that liming is an investment and the costs of application incurred in year 1 will increase paddock productivity for many years after. Figure 10 shows the cost of liming for the selected treatments, the potential increase in productivity for canola and wheat, and how long it would take to break even.

While this is a very simplistic approach which doesn't factor in the potential for a cumulative effect that decreases the years to break even, it's clear that the time to break even is accelerated when lime application results in a yield increase. Moreover, this economic analysis does not consider the opportunity cost of not liming, with ever-decreasing crop growth and yield if soil acidity is not ameliorated.

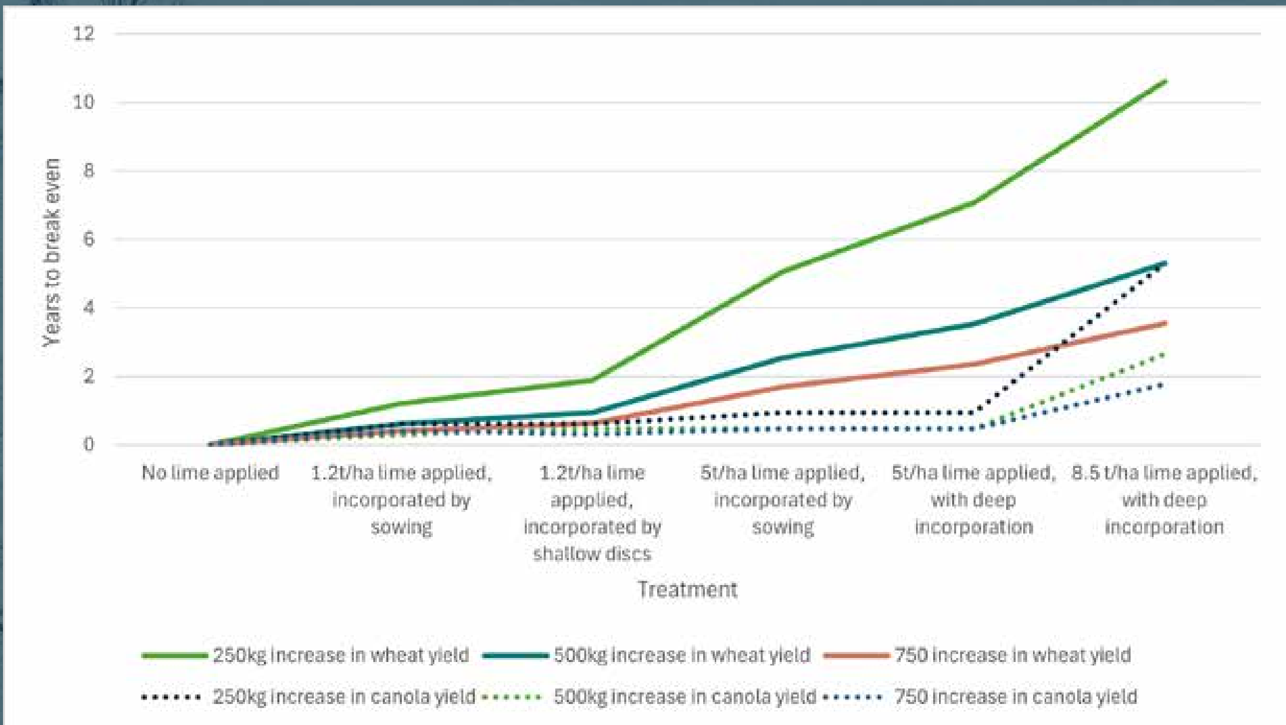


**Figure 10** Potential increase in canola and wheat yield and years to break even for selected treatments at the Best practice liming trial, Lilliput

## DEMONSTRATION TRIAL

The demonstration trial tested the impact of lime from different lime sources. Treatments included a coarse, soft lime from Mt Gambier, a fine lime from Galong—both applied 3 t/ha and incorporated by sowing—and a nil lime. The demonstration strips were harvested in 2024 only with a plot header, with one strip harvested in each plot (strip length 40 m).

The 2025 pH testing results clearly show an increase in pH (reduction in acidity) at the surface (0–5cm) in treatments where lime was applied in 2022 compared to the nil treatment (Figure 11). A relatively high rate of lime (3 t/ha) was applied in 2022, which explains the sizeable increase in pH seen from 2022 to 2025. However, it is difficult to draw any conclusions as to whether one source of lime is better than the other, given the trial was not replicated.

### pH results

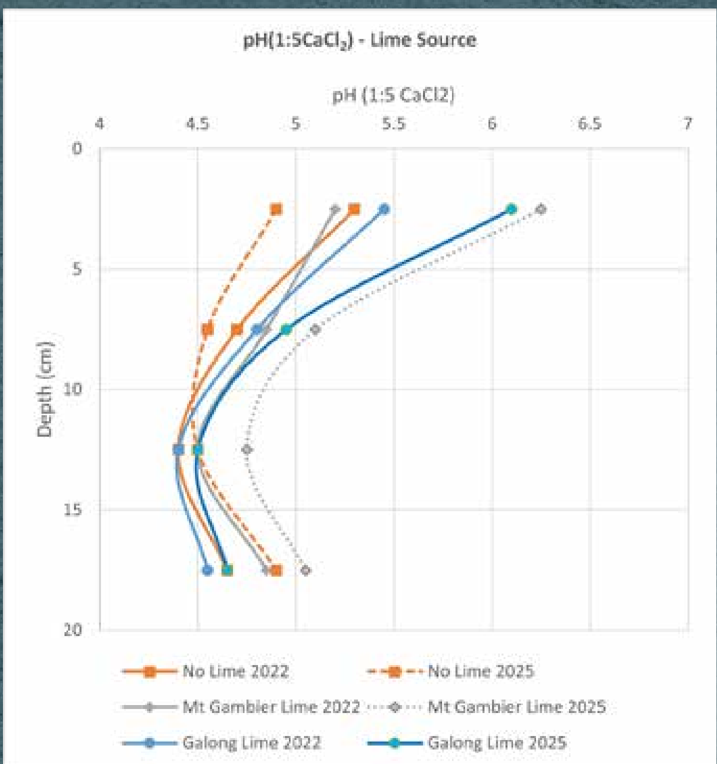


**Figure 11** pH results from the lime quality demonstration (unreplicated) trial at Lilliput, sampled prior to application of lime in 2022 and re-tested in 2025

## CONCLUSION

The final soil analysis completed in January 2025 clearly demonstrated that applying lime, followed by incorporation, increased subsurface pH values and reduced aluminium availability in the soil.

While the results show that the correct rate of lime, incorporated to the target depth, ameliorated soil pH in this soil, we are not yet seeing this reflected in yield responses. This is perhaps due to favourable growing conditions in 2023 and 2024 which reduced plant stress, however, in a year with lower rainfall and moisture-limited conditions, a more pronounced yield response would likely have been observed.

Wheat demonstrates relatively high tolerance to acidic soils, while pulses are generally more sensitive. Had a pulse crop been grown at this site, a substantially greater negative impact on yield and plant performance would have been expected. This would also have affected the economic outcomes and extended the time to break even.

During the 2024 growing season and early in 2025, Riverine Plains hosted a number of events where results from the *Best practice liming* trial were discussed with farmers. Follow-up discussions indicated the key messages are being heard, with the top three take-away messages for farmers attending our February 2025 breakfast meetings that:

1. lime needs to be incorporated
2. the application rate of lime needs to meet the target pH, which is 5.8; and
3. soil testing for pH is important, and furthermore, that soil tests should be incremented to identify subsurface acidity

While deep incorporation of lime has shown positive results in this trial, it is important to only incorporate lime to the depth that is suitable for that soil, considering the presence of other soil constraints (for example sodicity, slaking), seedbed preparation, emergence and trafficability. If you can only cultivate to a depth of 10 cm, it's recommended to load up that zone with adequate lime for full amelioration, so that it can move to depth over time.

## ACKNOWLEDGEMENTS

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