

Investigating acidity in sub-surface soils

Father and son duo Neil and Charlie Vallance are farming in the high rainfall, high yielding region of Western Victoria. Purchasing this farm in April 2018, it was previously managed as an Australian phalaris pasture system with no history of lime addition for pH management or fertiliser inputs.

Following on from surface lime applications in 2018, Neil and Charlie wanted to investigate potential variation in pH down through the soil profile, in particular what was happening in the sub-surface layers.

WHAT WAS DONE

Kirsten Barlow from Precision Agriculture explained that paddocks were initially grid sampled (0-10cm) in 2018, followed by a Variable Rate (VR) lime application. The paddocks were then re-sampled (using the same GPS referenced locations) in 2021. These grid soil sampling results are summarised in [GRID SOIL MAPPING HELPS NEW FARM DEVELOPMENT – Southern Farming Systems \(sfs.org.au\)](#)

Following the remapping, additional soil samples were collected from 3 paddocks in January 2022. These segmented samples were divided into 0-5 cm, 5-10 cm, 10-15 cm, and 15-20 cm intervals.

“This sampling strategy is recommended for detection and monitoring of acid throttles and sub-surface acidity. The samples were tested for pH CaCl₂ and were strategically selected across the paddock based on the change in pH between samplings and the variation in Cation Exchange Capacity (CEC) of the topsoil,” said Kirsten.

FOR MORE INFORMATION OR TO READ MORE CASE STUDIES [BUILDING THE RESILIENCE AND PROFITABILITY OF CROPPING AND GRAZING FARMERS IN THE HIGH RAINFALL ZONE OF SOUTHERN AUSTRALIA. – Southern Farming Systems \(sfs.org.au\)](#)



Picture: Charlie Vallance, Aberfoyle Farms Pty Ltd.

FARM SNAPSHOT

Producer: Charlie & Neil Vallance, Aberfoyle Farms Pty Ltd.

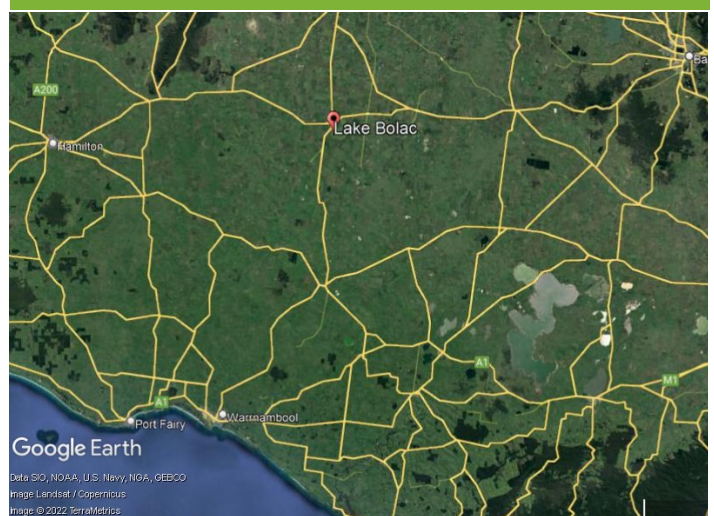
Agronomist: Craig Drum, DAgro

Location: Lake Bolac, Victoria

Annual Average Rainfall: 525mm

Soil Type: Heavy black clay on the river flats to light sandy gravel on the hills.

Enterprise: Mixed Farming



RESULTS

Soils on the property range from sandy soils through to clays along the river flats. This variation in soil type, reflected in the CEC of the soil, will affect the soils ability to buffer against a pH change either through acidification or lime addition. Previous research has also shown that this also influences the potential development of acid throttles and sub-surface acidity.

"The pH in the 0-5cm segment is generally less acidic than the 5-15cm depths due to the surface application of lime and the accumulation of organic material. The pH then declines in the 5-10cm and 10-15 cm layers, with 10-15cm generally being the most acidic depth." Kirsten explains.

In both Walkers (Figure 1) and Driveway (Figure 2) paddocks there was one sampling location where the pH was above 5.2 through the full profile. For the remainder of the sampling locations, the pH of all three paddocks was below 5.0 in the 5-10 and 15-20cm layers. Both Driveway and Lower Laurels (Figure 3) paddocks had samples with pH of 4.0 down to 20cm depths highlighting significant sub-surface acidity in regions of the farm.

Across all points from each paddock, except one

point in Walkers paddock the pH declined from 0-10cm suggesting that the lime that has been spread in 2018 had not yet made its way beyond the 5cm mark.

Neil and Charlie practice minimum tillage where possible, only using cultivation equipment where necessary for smoothing out rough paddocks. Cultivation and 'mixing' the soil after lime applications can be beneficial to help speed up the process of neutralization further down the profile, as opposed to allowing the lime to slowly work its way down over the years.

Charlie was surprised by the variability of the pH through the profile and assumed that the differing soil types contributed to this variability.

Management history including fertiliser and lime use as well as production all influence soil acidification and pH variability within a paddock. However, soil type can vary significantly within a paddock which will also impact on soil acidification and pH. For example, in Walkers paddock the pH in the sub-surface layers was lowest in Walkers 2 which had a CEC of 3.5 cmol+/kg and was highest in Walkers 10 which had a CEC of 14 cmol+/kg. As CEC is a largely defined by clay type and content as well as organic matter the variation in CEC and pH are affected by the variation in soils across the paddock.

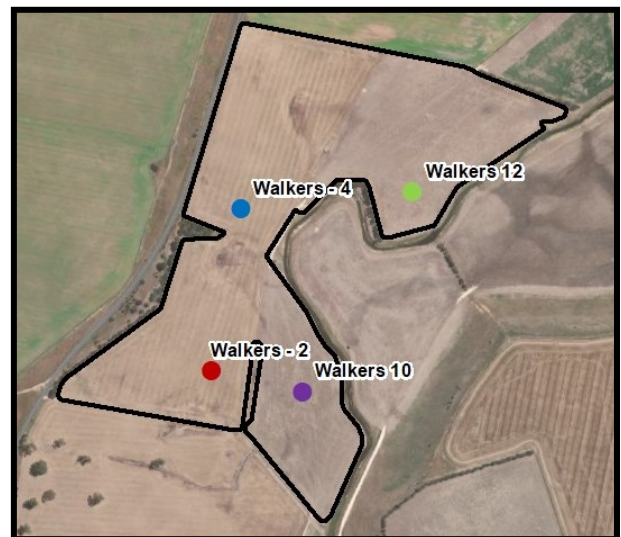
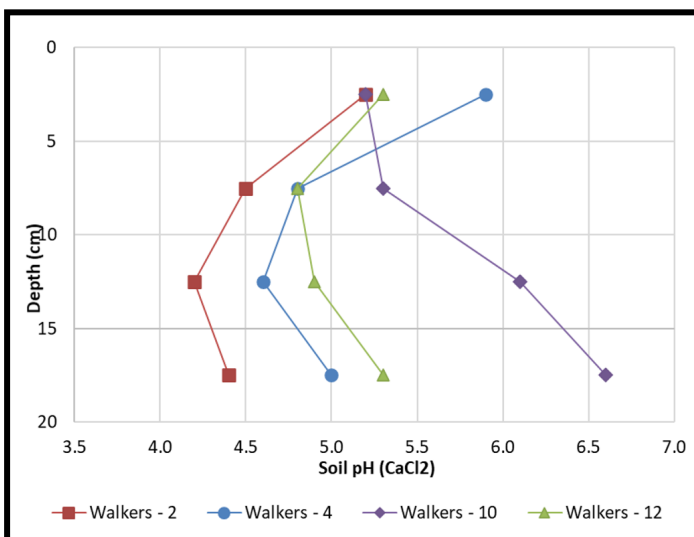


Figure 1. Walkers Paddock Soil pH changes down the soil profile and testing points

RESULTS continued...

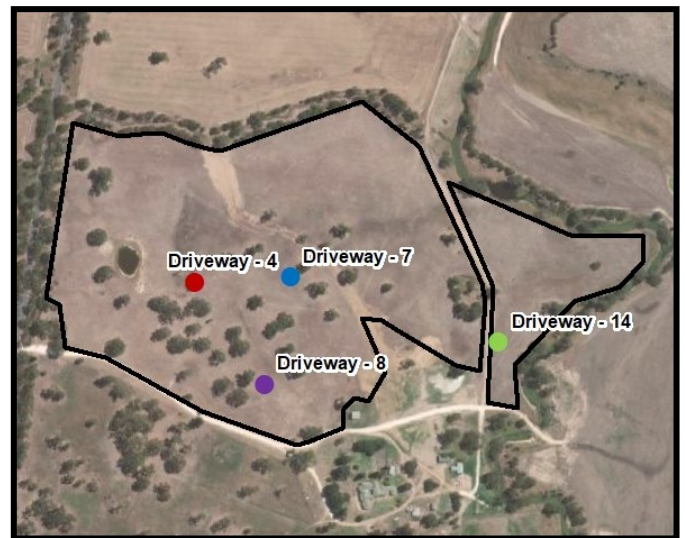
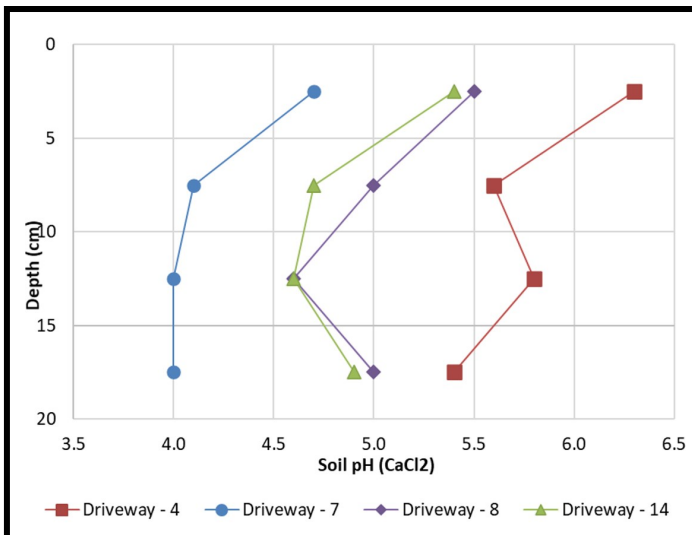


Figure 2. Driveway Paddock Soil pH changes down the soil profile and testing points.

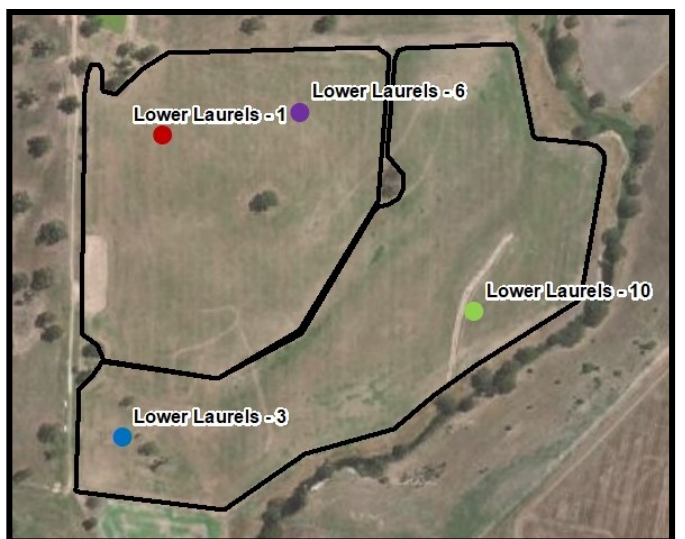
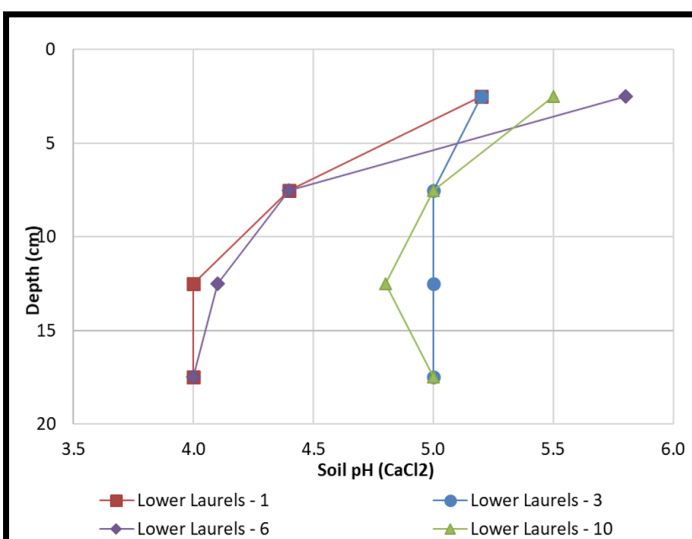


Figure 3. Lower Laurels Paddock Soil pH changes down the soil profile and testing points.

WHERE TO NEXT & CONCLUSIONS

Kirsten said the findings were consistent with research.

“The strategic sampling shows increased acidity with depth especially in the 5-15cm layers. This acidity is often averaged out by 0-10cm soil sampling which can potentially mask problem acidic areas. The results also highlight those soils are acidifying beyond the topsoil which is in line with earlier research. It is important to maintain a surface soil (0-10cm) pH above 5.5 to ensure that over time, in either a tilled or no-tilled farming systems, there is downward movement of lime.” said Kirsten.

Understanding the pH down through the profile is

important in identifying appropriate management strategies.

Upon reflection of the results Charlie indicated that the use of strategic tillage at depth to get an instant pH improvement through the profile would be something he would consider, saying “do not be afraid to incorporate to depth when required”.

The segmented sampling has also helped Charlie recognise that future applications of lime need to be more strategic. “As we move forward in minimum tillage practices, spreading less lime more frequently will allow the natural movement of lime through the profile”.

FOR MORE INFORMATION

Kirsten Barlow, Precision Agriculture, M: 0437 374 947 or
www.sfs.org.au