SUMMARY: Precision soil management for pasture productivity

Case study farm: West Cuyuac

Introduction

Soil types, landscape, and management practices can all contribute to large differences in soil nutrients and characteristics like soil acidity within a single paddock.

This demonstration project aimed to support adoption by providing a series of relevant case studies with detailed information on the cost and benefit of VRA in real pasture systems.

Focus farm: West Cuyuac

Richard and Sardie Edgar manage 13,000 composite ewes and 200 cattle across 6300 acres (including 1500 acres under development from forestry) at *West Cuyuac,* Nareen.

"I had been trying to improve the poorer performing parts of paddocks relative to other parts and thought than nutrient was the biggest issue", explains Rich.

Method and soil test results

At West Cuyuac, two pairs of neighbouring paddocks with comparable landscape and history were grid soil sampled in December 2020 for pH (CaCl2), Phosphorus (P), Potassium (K), sodium (Na), magnesium (Mg), Calcium (Ca), sulphur (S), cation exchange capacity (CEC) and various micronutrients. Several segmented soil samples (0-5,5-10,10-15,15-20cm) were also collected to determine whether there were any sub-surface acid throttles.

One paddock in each pair received a VR application of one nutrient, and the other received a conventional blanket application (Control), with the target nutrients decided by Rich in consultation with his agronomist and the project team. Management within each pair was otherwise kept as identical as possible.

Throughout 2021 and 2022, Richard recorded all animal movements and fertiliser applications using AgriWebb livestock management software. Cibo Labs' PastureKey service was used to monitor feed on offer (FOO).

In December 2022, the paddocks were re-sampled following the original sampling plan. This revealed that the VR treatments had successfully controlled or reduced soil nutrient variability compared to the control paddocks, but they had also cost more.

Pasture production

The recorded livestock movement data was summarised as DSE grazing days/ha/paddock for each month for analysis. Unfortunately, despite excellent quality data, monthly DSE grazing days/ha for each of the four paddocks was highly variable and there was no clear pattern of difference between VR and control.

Cibo Labs estimates of total standing pasture dry matter (TSDM, both dead and green) was summarised as monthly paddock average TSDM kg/ha for analysis. These were calculated back to 2017 prior to project commencement. As with the DSE measurements, data was highly variable. Unsurprising, given both the impact of seasonal conditions and grazing, but it was further complicated by gaps in the data caused by adverse weather.

There was no obvious or statistically significant difference (based on a paired-samples t-Test) in average monthly TSDM between control and VR paddocks throughout the demonstration. There was also no significant difference between the paddocks when data was split into pre- and post- VR spreading datasets. This is positive in the sense that the paired paddocks appear to have been very well chosen as extremely similar prior to any intervention, but also means that no substantial impact of VR on pasture growth was detected.

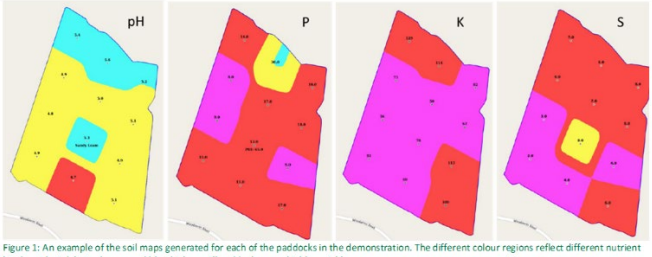

Figure 1: An example of the soil maps generated for each of the paddocks in the demonstration. The different colour regions reflect different nutrient levels, with pink being lowest and blue highest. All paddocks were highly variable.

Since there was a measured improvement in soil nutrients, there are several factors which could explain a lack of measurable pasture response in the collected data:

- The limitations of using satellite data as the primary pasture measurement.
- The DSE rating system only provides an estimate of animal requirements, not actual pasture intake. Actual metabolizable energy (ME) intake can be different to ME requirements which might mask some differences in pasture growth and quality.
- Supplemental feeding and other activities might have meant that grazing pressure was not always consistent between paddocks.
- Most importantly, P and K may not have been the most limiting soil nutrients, and hence there may have been no response because growth was still limited by other factors.

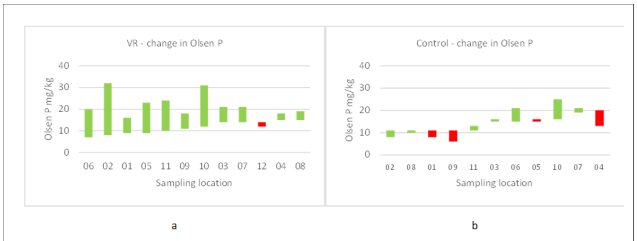

Figure 1: Change in Olsen P soil test 0-10cm between December 2020 and December 2022 for a) the treatment paddock, which received a VR Phosphorus application in May 2021 (average of 16.4 kg/ha P across the paddock), and the control paddock which received a uniform application of 18kg/ha P at the same time. Sampling locations are sorted in order of lowest to highest initial soil test result (and consequently highest to lowest VR P applications). Green bars indicate an increase in Olsen P between sampling dates at each point, with the bottom of the bar representing Dec 2020 and the top of the bar Dec 2022. Red bars indicate a decrease in Olsen P, with the top of the bar representing Dec 2020 and the bottom of the bar Dec 2022.

Visually Rich believes that there might have been some improvements in the VR paddocks: “I saw some improvement in pasture composition, with more clover in areas of the paddock that had been poorer performing. However, due to the amount of variables I was unable to establish any changes in carrying capacity. This is not to say they didn’t occur but I believe we haven’t got an accurate enough method of measurement.”

Next steps and conclusions

This demonstration highlighted the extent of variability in pasture systems and the limitations of conventional soil sampling approaches to identify them. Positive changes in soil conditions resulted from variable rate P and K spreading, but despite some visual observations of improved pasture quality, there was no measured change to pasture or animal condition.

Despite this, Rich believes that it can still be a very valuable tool if used correctly. “Grid soil mapping gives you a great understanding of your farm soils and may be a useful tool for pasture selection, fence location and of course nutrient application,” he explains. “I will continue to target low K areas of paddocks rather than blanket spreading and continue to investigate how VR and soil mapping can work in my system”.

Rich also emphasizes that a different approach to benefits measurement may be needed in future trials: “My main observation is that we were unable to find an accurate measurement tool to establish the true benefit/cost of VR spreading.”. A higher intensity approach than was possible in these paddocks may be needed.

For further information: Sebastian Ie **M** 0476 849 665 **E** sebastian@precisionagriculture.com.au