Using VR technology to manage within-field variability

Department of Agriculture and Fisheries

Armidale Pty Ltd, Tasmania

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Key outcomes

- Veris® soil mapping identified variable pH.
- Variable rate (VR) lime application is used across the entire farm. In this case study, lime was applied to one field at nine different rates to match varying pH zones.
- Re-mapping with Veris® demonstrated soil pH was significantly more uniform post VR lime application.

Background

David and Will Whishaw of Armidale Pty Ltd produce a range of vegetable crops as part of their mixed farming operation. The Whishaws were interested in Veris® soil mapping to:

- identify the causes of soil variability on their farm, and
- determine if the variation is spatial (across the field) and/or temporal (through the season and across subsequent crops).

David and Will's initial interest in VR technology was for fertiliser spreading. However, being aware of the variability in their soils, particularly pH, initial work

Figure 1. Veris® soil mapping rig uses on-the-go soil sensors with geo-referencing to create a soil map of an area.

Grower: David and Will Whishaw

Location: Carrick, Tasmania

Area: 130 ha cropping and 310 ha grazing

What they grow: peas, poppies, grass seed, onions, beans, shallots, Lucerne and pasture for their thoroughbred racing stud operation

Soils: Vertosol, Sodosol and Chromosol

Topography: river flats and undulating country

Average annual rainfall: 711 mm (winter dominant)

Precision technologies implemented: Veris® soil mapping, variable rate (VR) irrigation, fertiliser and soil amendments

Figure 2. (right) Will and David Whishaw talking Veris® soil mapping with John McPhee, Tasmanian Institute of Agriculture.

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focused on reducing this variability before investing in VR fertiliser applications. The key driver for the adoption of VR technology was the visible variability in crop performance.

Activities

Veris® soil mapping was conducted on an 18 m swath width across several fields. Soil sampling and laboratory analysis was undertaken on 20 samples to 10 cm depth from each of the lowest and highest pH zones to calibrate the Veris® data. The laboratory results were used to adjust or correct the Veris® data. Experience over many paddocks has shown the Veris® data to be 0.3 pH units lower than laboratory analysis.

Veris® mapping of pH for four fields at Armidale, Tasmania, is shown in Figure 3. The western-most field of 16.2 ha was selected as a case study field given the significant variability in the soil pH across this field – ranging from pH 5.6 to 6.6.

This field was then classed into pH zones based on the Veris® pH data with 0.1 pH unit difference between zones. This is a fine division of zones and this level of detail in prescription mapping is greater than what most precision agriculture (PA) consultants would produce. Areas of less than 0.2 ha were merged with the surrounding pH zone as it is not practical to manage very small areas separately.

Given that Will and David were targeting a pH of 7, all areas of the field required some lime. Based on the lime rate or prescription map (Figure 4), nine lime (in the form of dolomite) application rates, ranging from 1 to 9 t/ha were allocated across the pH zones, as shown in Table 1. The prescription map was produced using PCT software.

The prescription maps were uploaded into the VR controller on the spreader to vary the amount of lime applied to different areas of the field. If the lime rate changes are outside the capacity of the spreader gate adjustment, the only way to vary the rate is by varying the ground speed. So, having numerous finely defined zones can be challenging for speed adjustments.

Table 1. Lime (as dolomite) rates for different pH zones.

Zone	pH value	Area (ha)	Prescribed lime rates (t/ha)
1	5.76	0.33	9
2	5.86	0.98	8
3	5.95	3.23	7
4	6.05	5.03	6
5	6.15	6.47	5
6	6.24	5.88	4
7	6.35	5.16	3
8	6.44	2.85	2
9	6.54	1.04	1

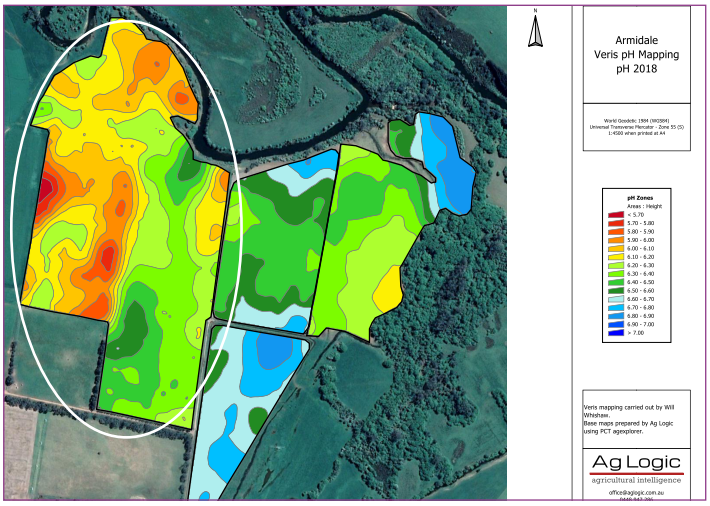

Figure 3. Soil pH map from Veris® soil mapping. Note that the eastern fields tend to be more uniform in soil pH. Case study field is circled. Source: AgLogic

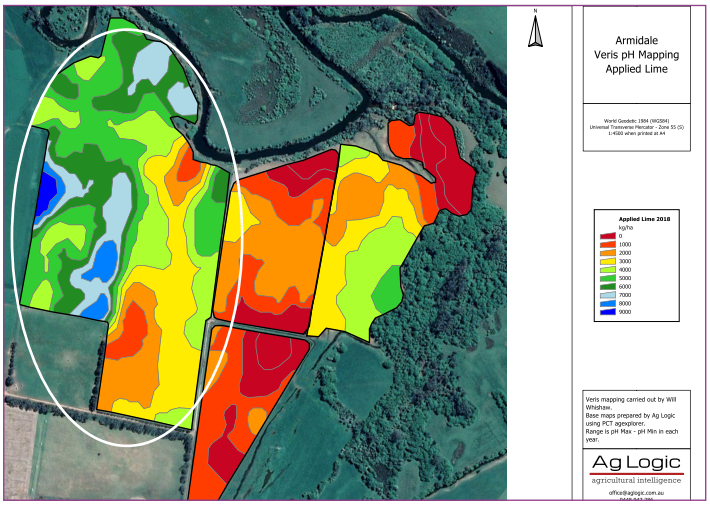

Figure 4. Lime prescription map based on pH zones with lime rates of 1–9 t/ha. Source: AgLogic

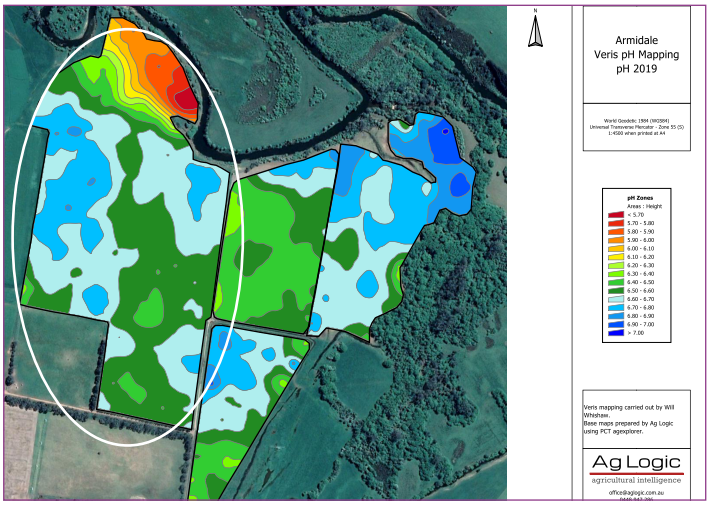

Figure 5. Post VR lime application soil pH map. Source: AgLogic

"We accept that VR applications are not necessarily about saving input costs immediately but rather targeting placement to where it is most needed."

– David and Will Whishaw

Historical practice of applying 2.5 t/ha every second year was replaced with low pH zones now receiving 7 to 9 t/ha with incremental declines in the lime rate as soil pH increased.

The VR lime application for this field was completed in May 2018. Grass seed was grown in the same year and the paddock was re-mapped with Veris® in May 2019. Figure 5 shows the soil pH map post VR lime.

Key observations from this comparison are:

- significantly greater uniformity in soil pH following VR lime application (see Figure 6),
- reduced range in soil pH post-VR (6.5 to 6.8) compared to 5.9 to 6.3 pre-VR,
- overall, the field average pH increased by 0.35 units from 6.19 in 2018 to 6.54 in 2019.

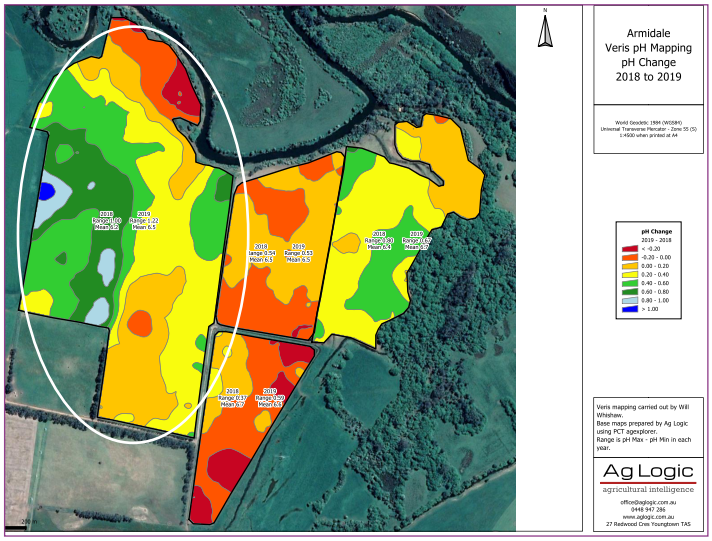

Figure 6. pH change following VR lime.

Costs

The cost of Veris® mapping was $35/ha + GST. The Whishaws have a VR-capable Amazone spreader that is not yet unlocked for VR operation so the VR lime application was contracted at a cost of $12.50/t. This is comparable with the blanket spreading rate of $11.50/t. The key cost was a 3.5-fold increase in the total lime applied compared with the standard blanket rate application. This equated to a 4-fold increase in costs when including costs of pre- and post-VR Veris® mapping.

In this case, data processing costs were $3/ha for soil pH maps. The prescription map was developed by Will using PCT software so this was not an additional cost.

Overall, as a result of the initial Veris® mapping and subsequent VR application, the annual lime budget was consumed on only half the cropped area.

"We expect to see increased yields over time and accept that this may require higher inputs initially and a longer term cost benefit analysis."

– David and Will Whishaw

Challenges

Key challenges David and Will faced included:

- use of the software and compatibility issues,
- use of spreading contractors meant different hardware and software depending on the job,
- as an early adopter of VR technology in Tasmania, sources of advice and guidance were limited.

PA service providers: AgLogic and Altrac Spreading

Authors: Julie O'Halloran and Gayathri Rajagopal, Queensland Department of Agriculture and Fisheries and John McPhee, Tasmanian Institute of Agriculture

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Costs presented in this document were accurate as of October 2019. These will change over time and between data processing service providers.

Funding and Project Partners

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