Precision Agriculture – making it work on KI

Background

The use of GPS and satellite technology has come a long way. Recent developments in precision technology now make mapping of pH and soil nutrients across paddocks not only accessible but also affordable.

The initial trial work with Precision Agriculture, on Rick and Annie Morris's property in 2013, showed the potential for mapping the variability in soil pH across a paddock. In just over four years, technology has improved and the company is now able to precisely map and monitor, not only pH, but many other soil nutrients that landholders want measured.

The mapping of soil pH and nutrients across a paddock enables landholders to accurately determine application rates of lime and fertiliser. This can reduce the need for blanket applications, which are both time-consuming and expensive.

What was done?

In 2017, Precision Agriculture mapped over 2,500 ha on 14 properties for pH and a range of nutrients (including phosphorus, sulphur and potassium).

The mapping involves collecting eight soil cores along a 100m transect in each grid. The grid size is determined by the landholder and can range from 0.25 ha to 2 ha. The 8 cores are combined into one sample, which is then tested by an accredited lab to ensure the soil results are highly accurate. The cost of the mapping service varies according to the grid size and the nutrients tested for (most KI farmers chose either 1.5 or the 2ha grid) refer to TABLE 1.

Note - this cost includes the soil analysis and development of maps.

***TABLE 1**: Cost of pH and nutrient mapping per grid size*

Grid size (ha)	pH	pH and phosphorus	pH, phosphorus and potassium	pH, phosphorus and Sulphur
1	$30.00	$35.00	$40.00	$39.00
1.5	$22.00	$27.00	$32.00	$27.00
2	$15.00	$19.00	$23.00	$21.00

Each sample site is plotted using GPS, enabling accurate maps to be produced showing the nutrient and pH range across the paddock. The data is used to develop prescription maps for variable rate spreaders. Meaning, your contractor can simply take the map file and drive across the paddock, spreading lime or fertilizer at varying rates on the go. However, if you use your own spreader and don't have access to variable rate technology, don't worry, as Precision Agriculture can simply include an aerial photograph of the paddock as an underlay and you can use that as a guide.

The recommended lime and fertiliser rates are calculated using the soil test values plus local knowledge. Lime application rates are based on KI data (2.5t/ha resulting in a 0.5 pH unit increase). The phosphorus application maps are calculated using the Phosphorus Buffering Index (PBI) to calculate the critical P levels plus the individual farmers stocking rates.

Results

pH and lime maps

The mapping work to date, indicates that the greatest financial benefit occurs on the second or third rotation of lime. Specifically, if you have never limed, it's highly likely that all the paddock will be a low pH and a blanket application will be required. However, on land that has previously been limed (refer to FIGURE 1) significant savings are possible.

Soil Nutrient maps

The phosphorus (P) application maps are calculated using the Phosphorus Buffering Index (PBI), which is measured in each paddock and factoring in the individual farmers stocking rates. Three application rates were utilised. Zones with low phosphorous readings (i.e. below critical P values) receive 1.5kgP/DSE/ha, zones at critical P levels received 1kgP/DSE/ha and zones with high phosphorus readings (i.e. well above critical P values) receive 0 to 0.5kgP/DSE/ha (refer to TABLE 2).

***TABLE 2**: Predicated soil test values for standard PBI categories for pasture.*

PBI category		Critical P (Colwell ppm)	Range
< 15	extremely low	23	20 - 24
15 - 35	very very low	26	24 - 27
35 – 70	very low	29	27 - 31
70 – 140	low	34	31 - 36
140 – 280	moderate	40	36 - 44
280 – 840	high	55	44 - 64
>840	very high	na	na

Whilst it might be tempting to simply not apply any P fertiliser in zones with high P, care must be taken with sulphur levels, i.e. no fertiliser spread will mean no sulphur going out and sulphur levels can decline rapidly in many of our KI soils. It is also useful to map sulphur levels so informed decisions can be made about fertiliser applications in the high P zones. If in doubt apply P at 0.5kgDSE/ha.

The number one rule is to set up some soil testing sites i.e. at least one in each zone to monitor the ongoing pH, P and S status. Sulphur (S) is critical to monitor in the high P zones. As you will be applying half, or less than your normal fertiliser rate you will also be halving your S rate (and you don't want to run into a sulphur deficiency!).

These soil test sites should ideally be sampled yearly or biennially at least, to monitor the ongoing soil nutrient status.

The cost/benefit of mapping

The Heinrich's had their entire property mapped in 2017. Refer to FIGURES 1 and 2. Most paddocks have been limed at least twice and the mapping clearly indicates which areas need further liming and which don't. Much of the farm will only require a maintenance rate of 1t/ha to be applied, resulting in a significant cost saving. The mapping cost $18.00/ha and the lime saving alone equates to almost $60/ha. The phosphorus (P) mapping (FIGURE 2) also showed that almost half the property had P levels greater than 50ppm. This cut the Heinrich fertiliser order from 120t to 80t.

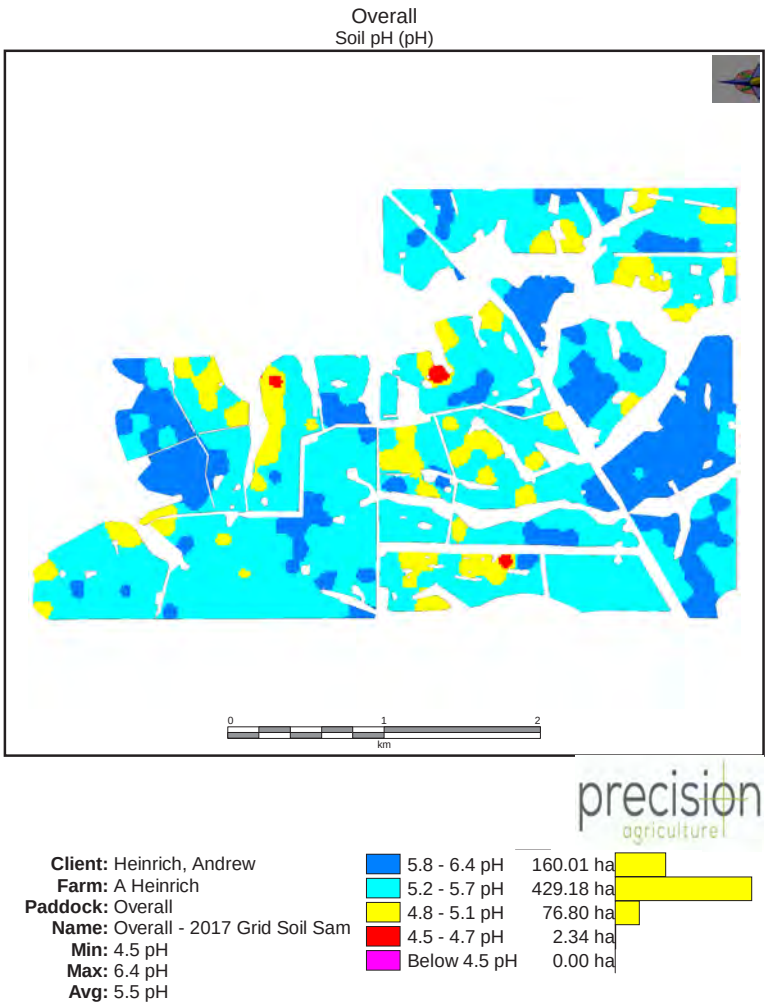

FIGURE 1: Soil pH map.

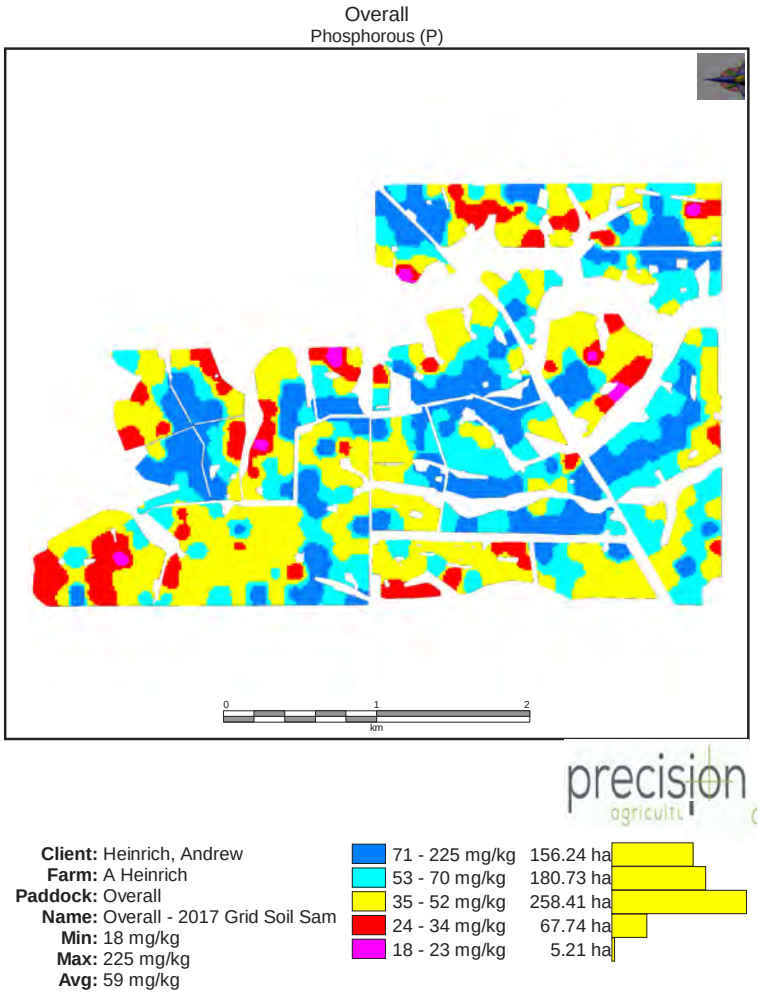

FIGURE 2: Soil phosphorus map.

Take Home Messages

- Precision soil mapping for pH and nutrients can result in significant cost savings for producers
- Mapping soil pH has greatest value if the paddocks are into their second or third rotation of lime
- Consider including sulphur in the testing if mapping phosphorus
- Establish several sites across the farm to monitor the ongoing pH, P and S status.

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