Soil Testing - Making the Best Use of Technology

Background

Precision Agriculture has now been mapping paddocks on KI since 2013. But are we making the best use of this technology? It's one thing to have the 'pretty maps' and a spreader that will apply lime and fertiliser to match paddock variability, but how does that relate to grazing pressure and other sub soil constraints? AgKI received funding through the National Landcare Program, to set up two demonstration sites to investigate the use of pH and nutrient mapping (using PrecisionAg, in the top soil (0-10cm)) with pasture growth monitoring (using Decipher) and sub soil constraint mapping (using the EM38).

What was done?

The two demonstration sites are located on Rick and Annie Morris' property, Mt Taylor Rd and Bolto Partners, Woods Rd. Both sites were mapped by PrecisionAg in November 2017 for pH, PBI, phosphorus, potassium and sulphur on a 1.5 ha grid. In addition, an EM38 survey was also undertaken at both sites, mapping at two depths 0 - 0.75m and 0 - 1.5m.

EM38, or electromagnetic mapping, sends an electromagnetic signal into the soil which generates a secondary magnetic field which is then measured. The strength of the signal received can be used to measure subsoil characteristics including moisture, texture and salinity, as well as identifying potential constraints. EM38 maps correlate well with yield, particularly in dry years.

In addition at the Bolto site, each 1.5 ha grid was mapped twice, with one transect running N-S and one E-W to check the repeatability of the mapping. At the Morris site, PBI was measured at each 1.5 ha grid to ascertain how variable PBI is across a paddock. The usual practice is to test one or two composite samples per paddock.

The next step in the project will be to correlate the soil data to pasture growth rates using NDVI maps. NDVI (Normalised Difference Vegetation Index), is basically an index of greenness. Changes in NDVI are strongly correlated to the variation of green herbage during the season and can be used as a means of monitoring density and vigour of green vegetation growth.

Results

1) Nutrient mapping, EM38 and NDVI.

Nutrient and EM38 mapping has been completed on both sites. Work will be undertaken this year to correlate the soil and NDVI results and to further investigate soil limitations. Stay tuned for next year's write up for the results. Refer to **Figure 1** for an EM38 map of the Bolto demonstration site highlighting the variation across the site.

2) Mapping reliability

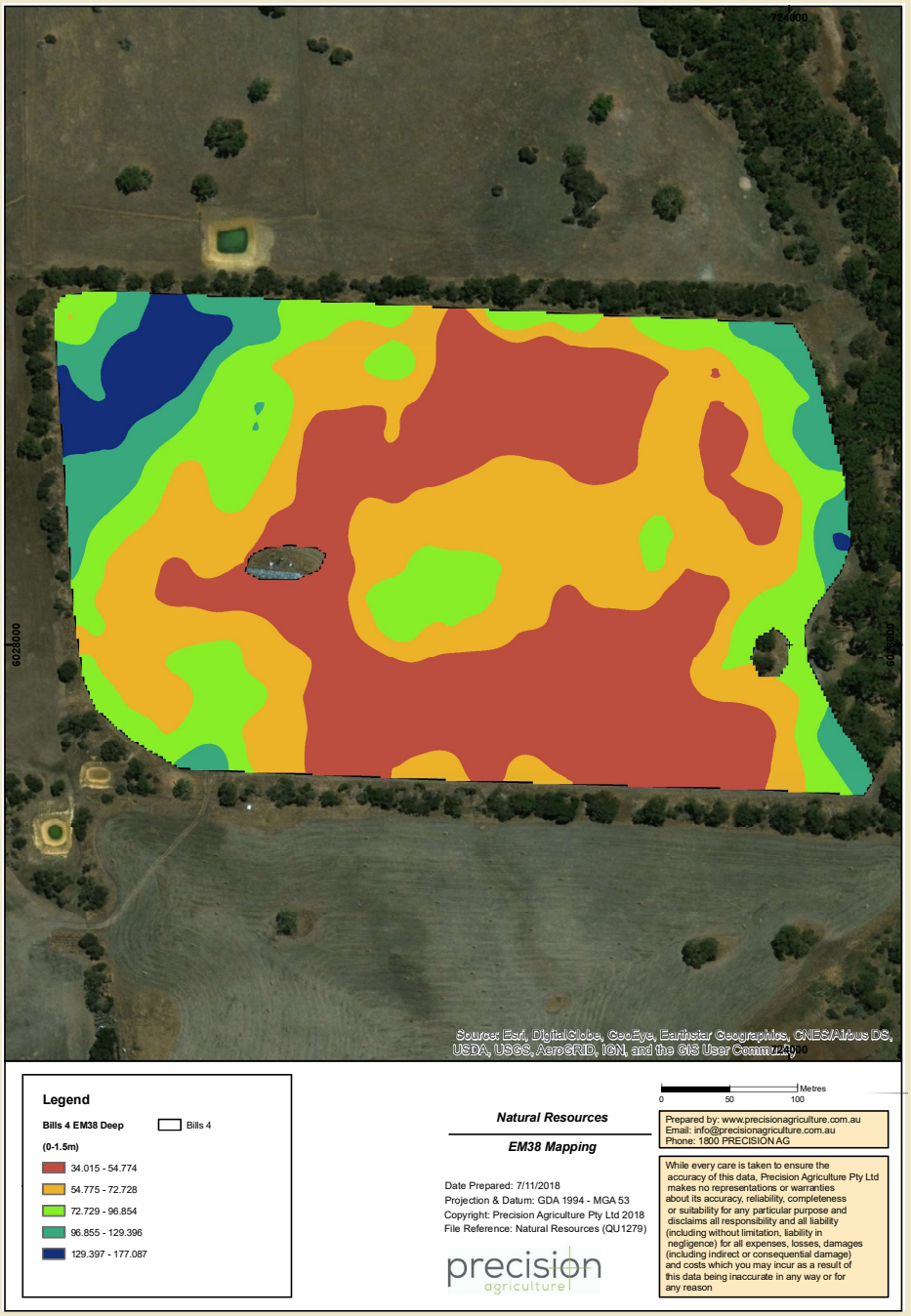
At the Bolto site, the paddock was divided into 12 x 1.5 ha grids and each grid was mapped twice (one transect running N-S and one E-W).

The pH ranged from 5.3 to 6.2 across the paddock. The pH mapping was reasonably robust, with 75% of all the readings the same or within 0.2 units difference. This is consistent with the natural variation we would expect to see within replicated soil transects.

Two grids had a 0.3 unit difference and one with 0.6 unit difference. If the pH target for the paddock was 5.5, these variations would have resulted in an under/ over lime application of approximately 0.5t/ ha on those 4.5 ha, or the potential for an extra 2.25t of limesand application on a 18 ha paddock.

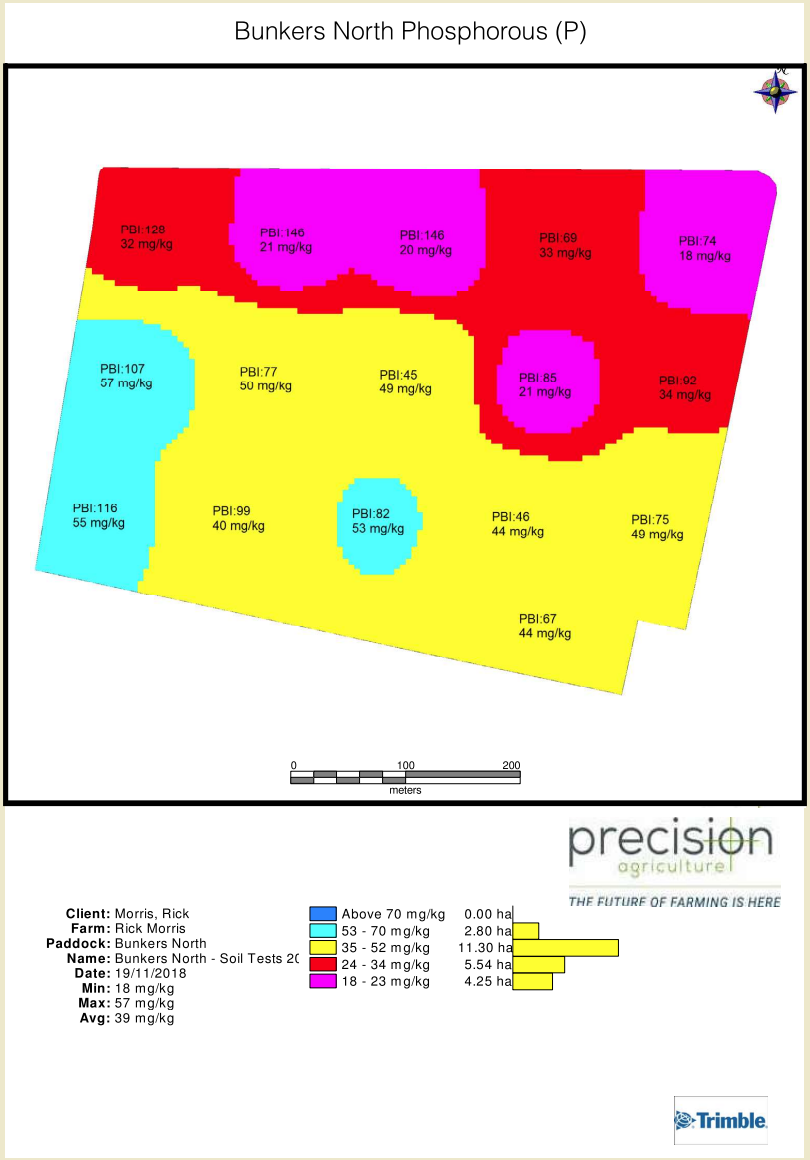
The phosphorus ranged from 15 to 67 ppm and Sulphur ranged from 8 to 15ppm across the paddock. Again this is consistent with the natural variation we see across paddocks. The phosphorus and sulphur maps were also reasonably robust with 80% of all readings having less than 25% variation. Two grids had phosphorus results that were different enough to have caused an under/over application of up to 1 kgP/DSE/ha. The sulphur readings in the two grids varied by 3 units, but this variation would not have warranted a change in the fertiliser recommendations.

Figure 1: Map of Bolto demonstration site, showing the variation in the 0-1.5m depth EM38 readings



Soil Testing (cont.)

Figure 2



The potassium was the most variable with only 67% of the readings having less than 25% variability. Although, at this site there were only two grids of readings below the critical value of 120 ppm, meaning; only 2 sites that may have required potassium could have been missed.

Overall, the N-S and E-W transects for the grid sampling were generally consistent with the few exceptions outlined above. This provides confidence in the grid soil mapping being used whilst highlighting the soils are variable and this variability can affect the results within an individual grid.

Only two PBI readings were taken at the Bolto site, with only 3 points difference between the two readings. On Morris property, the PBI was mapped on a 1.5 ha grid. Usually the PBI is calculated from a single composite sample per site. PBI's are critical for calculating phosphorus application rates i.e. a site with a phosphorus reading of 25ppm in a soil with a PBI of 30, would require a maintenance application of 1kgP/DSE whereas, the same phosphorus reading in a soil with a PBI of 140, would be considered phosphorus deficient and would require an application of 1.5-2.0kg P/DSE. On the Morris site the PBI varied from 45 to 146.

The paddock mapping shows the inherent variability in all paddocks (refer to **Figure 2**). If traditional soil sampling had been undertaken (where samples are taken in a single transect to get one result for the whole paddock), a transect running E-W would have given an entirely different reading than one running N-S, resulting in over 50% of the paddock being either over or under fertilised. This highlights the variability in P and PBI across the paddock and the value of more intensive soil sampling to inform fertiliser decisions.

Take home messages

- Precision mapping of soil provides a more accurate understanding of pH and nutrient status than traditional sampling
- Soils are highly variable, so even replicate samples of the same transect will vary and there is no 'perfect result' so just be aware of this in the interpretation of the maps.
- If your paddock varies in soil type ensure extra samples are analysed for PBI.

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Bolto Family

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