Demonstrating Precision Agriculture (PA) techniques to improve land management on intensive dairy farms

Background

The aim of this project was to demonstrate the application of various precision agriculture (PA) tools to improve resource use efficiency on a dairy farm at Mt. Compass.

A greater understanding of the soils and management zones can be achieved by identifying the limiting factors and where this occurs in paddocks. The long-term gain can provide improved management of acid soils, soil carbon, nitrogen levels and salinity.

The method

Five PA techniques were trialled and demonstrated for use in the context of smaller, intensive dairy properties; the EM38, Veris NIR Soil Carbon and EC scanner, precision pH mapping (by hand) and the hand held Greenseeker.

These techniques were used to determine the level of variation of pH, organic carbon, salinity, nitrogen and moisture storage potential across the demonstration paddocks and compare that with conventional measurements.

An evaluation was then made on the use of these techniques in influencing the management of acid soils, salinity, soil and moisture storage characteristics, nitrogen management and organic carbon.

A field day was held to highlight the use of PA tools, and various articles were delivered as part of this project.

The precision pH machine

The results

Of the five PA techniques assessed, the EM38 and Greenseeker were thought to be the technologies that were best suited to pasture based dairy farms. The other technologies required further investigation.

EM38 - provided a good relationship with major soil changes and some identification of minor changes in quality of sandier soils. This is shown in Figure 2. Soil types and distribution were reflected in EM reflectance as per the table below.

E-M reflactance	Key soil types
Very low 1-5	Podsols (mostly dry) and deep sands
Low 5-10	Podsols, dry thick sand over clay, ironstone
Moderate 10-20	Shallow SL/clay and sandstone, wet podsolsand wet sand over clay
Higher >20	Wetter thick sands over clay and soils with peat layers

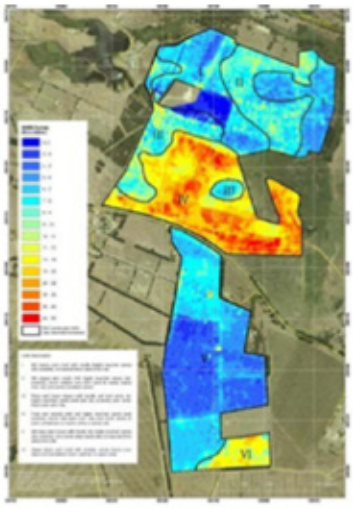

Figure 2 - Broad soil landscape units based on areas mapped at Tusmore and Whispering Pines based on EM38 and field validation

Technique	Cost	Accuracy/Further Development	Possible Users
EM38	$5-15/ha	Reasonable breakup of soils and wet areas	Soil type variation, irrigated areas variation in watering requirement, depth to clay for clay spreading or delving, salinity/water table investigations
Veris EC	Done with below	As above	As abobe
Veris Soil Carbon	$10-15/ha	Ok in wetter heavy soils/accuracy issue in sand	Needs better calibration
Greenseeker	$500/unit	Good relationship with some pasture mixes, needs further validation	Quick method of measuring pasture dry matter levels
Precision pH mapper	$15/ha	Technology needs to be tried in Fleurieu	Highlights variations in pH and consequences
Pastures by Space	Annual fee around $350/year for 500ha	Needs improved resolution and dry matter levels	Wait for improvements

Veris NIR Soil Carbon and EC scanner – The soil carbon scanner worked well on the wetter and heavier soils but had accuracy issues on the sandier drier soil types. The EC scanner gave a similar result to the EM38 and was possibly of better quality in determining sand soil variation than the EM38.

Precision pH mapping – Technical difficulties were encountered in the operation of the machine therefore samples were only done by hand in two paddocks. Initial indications are that pH variability occurs within this land use and needs some consideration when liming as pasture species establishment may be affected.

Greenseeker – was easy to use and interpret and showed potential as a quick measure of pasture cover but needs more calibration work.

The table below summarizes the key findings on each technology in smaller intensive dairy farms across the Eastern Mount Lofty Ranges.

Recommendations

Further calibration of the Greenseeker technology for different pasture types is needed and requires support from the dairy community and service providers. This will help build confidence in the use of this technology allowing the knowledge to be extended more widely. Participants identified this as a high priority.

Conclusion

EM38 (or the equivalent Veris EC scanner) and Greenseeker technologies were identified as being the best suited for use on Mt Compass dairy farms.

EM38 is a tool that can be used to quickly spatially measure soil types. It can assist to improve resource use efficiency by identifying soil constraints and this can help target the appropriate pasture species and remediation efforts.

Existing landholders believe that the greatest benefit from this technology will be where landholder knowledge is limited. For example when purchasing or leasing new land, or where intensive irrigation is required.

With further calibration, the Greenseeker can provide a labour saving opportunity that may potentially see improved pasture biomass and quality estimation. This can assist in improved pasture utilisation and better grazing management decisions.

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