



University of
**Southern
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Comparison of spatial soil moisture sensing technologies

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Background and Overview

Background: Soil moisture content is a critical factor for crop growth, nutrient availability and irrigation management decisions, directly influencing the yield, water usage efficiency and long-term farm sustainability.

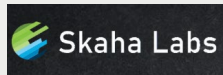
Purpose: To evaluate the accuracy and usability of current soil sensing equipment being the Geonics EM38Mk2 and Skaha Labs P-Band Polarimeter.

Geonics EM38Mk2:



- Electromagnetic Induction sensor.
- Measures soil electrical conductivity (ECa) to depth of 1.5m.
- ECa values are influenced by soil moisture, salinity and texture.
- Provides non-invasive mapping of soil variability across fields.

Skaha Labs P-Band Polarimeter:



- Polarimetric microwave sensor operating in the P-Band (380-420MHz).
- Measures difference in polarisation of microwave signals to sense soil moisture up to 50cm (Theoretical depth).
- Non-destructive, remote sensing technology emerging in research and precision agriculture.



Methodology

Location:

- Trials were conducted in multiple fields at Bowenville, QLD on the Darling Downs with heavy clay soils to light red sandy soils.

EM38 Soil Conductivity Trials:

- Instrument was dragged on sled behind vehicle across field travelling along every second tramline (60m apart), with data transmitted to handheld Archer 2 device.
- Data compiled and mapping completed independently with QGIS.

Skaha Labs P-Band Polarimeter Trials:

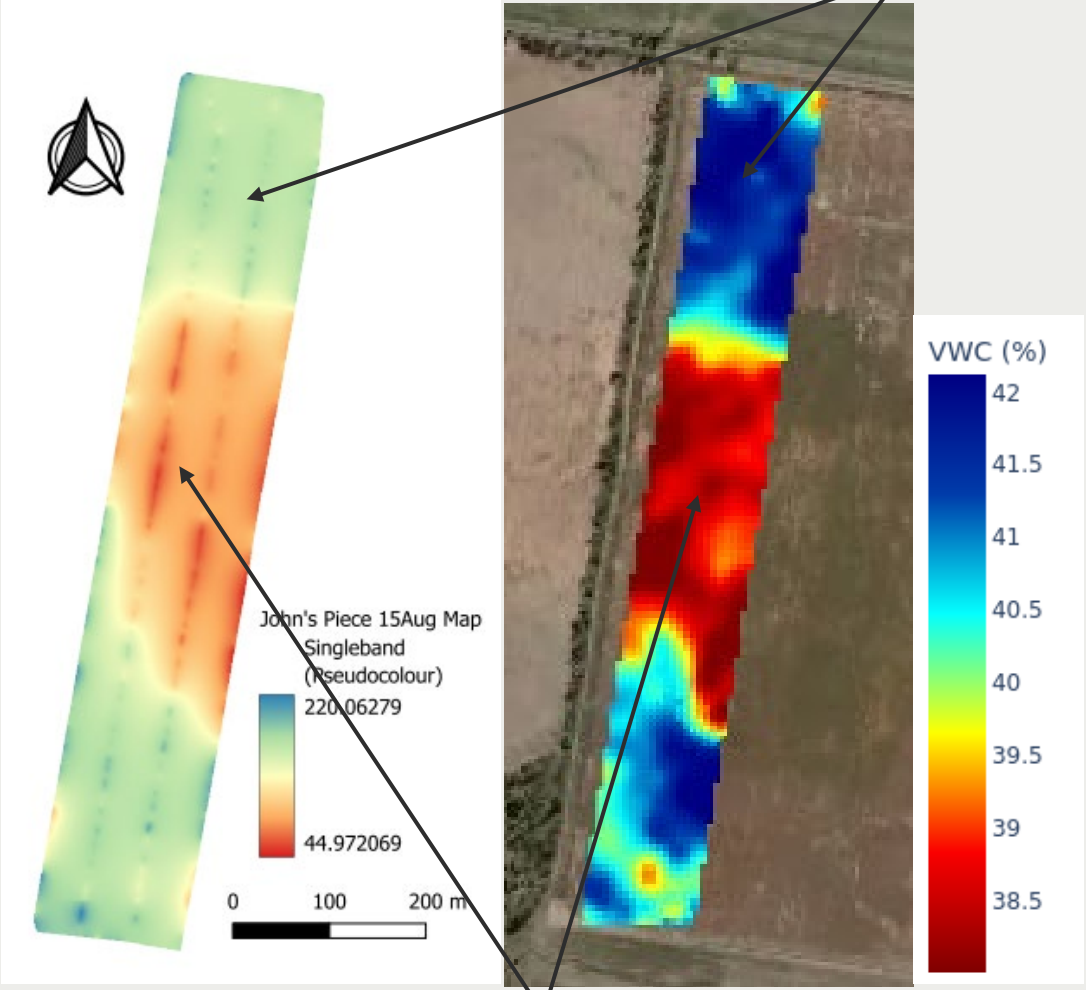
- Polarimeter was mounted on side by side, travelling along tramlines (30m apart).
- Data was logged onboard and sent autonomously for processing by Skaha Labs.



Key Results and Comparison

Fallow Ground
(Zero Tillage)

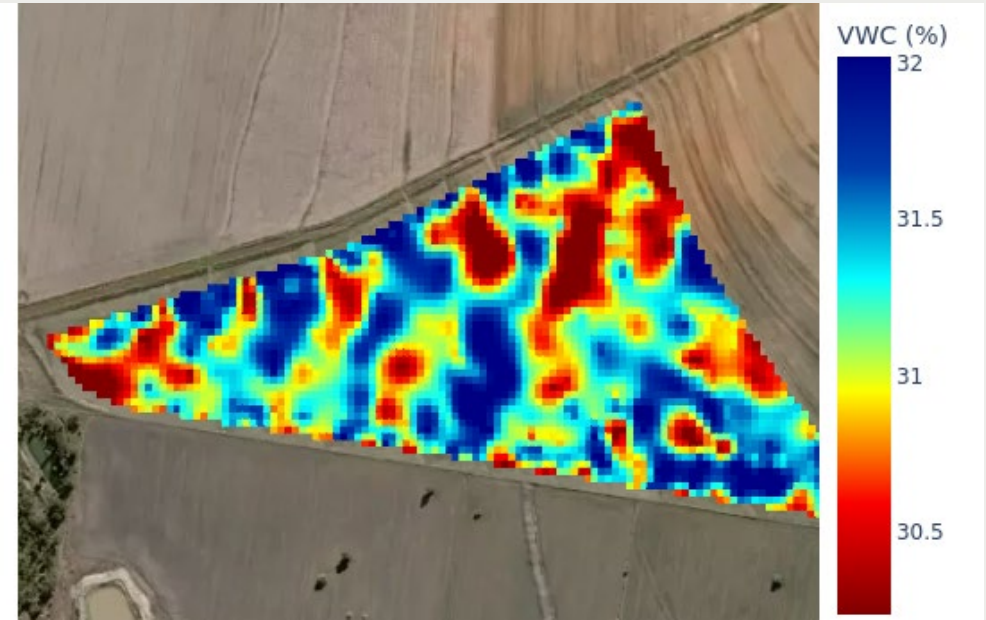
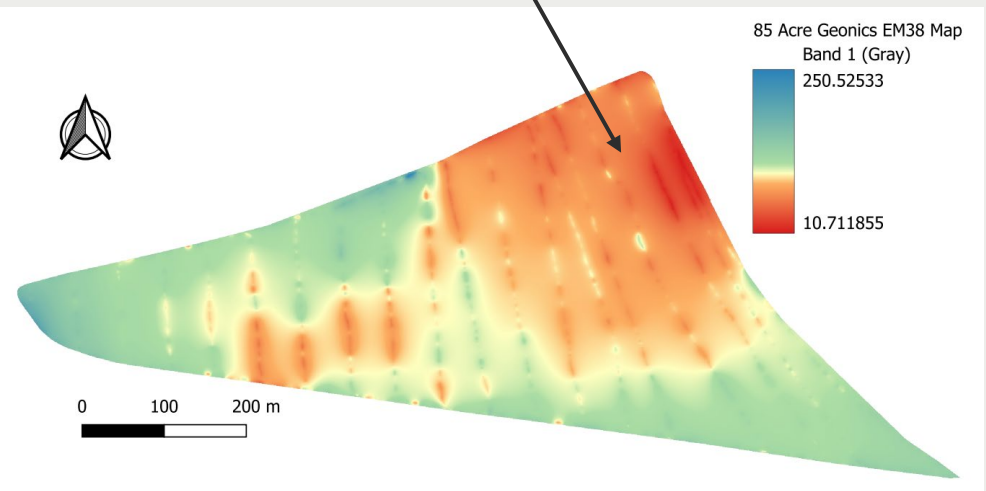
Heavy Clay Soils



Sandy Red Soil

Sunblade Wheat
Crop in ground
(approx. 9 weeks
growth)

Sandy Red Soil



Conclusions and Future Work

Geonics EM38Mk2:

Strengths: Reliable soil conductivity measurements, effective for mapping variability within a field.

Limitations: Relatively slow process in comparison, and difficult without further work to determine actual soil moisture content (%).

Skaha Labs P-Band Polarimeter:

Strengths: Simple, relatively quick and non-invasive, data processing is done remotely from Skaha Labs, valuable volumetric water content data.

Limitations: Device information is limited so far, limited research has been conducted in Australian agricultural operations.

Overall Evaluation:

- Both sensors are valuable, demonstrating effective field mapping for data driven decision making.
- Polarimeter isolates soil moisture content whereas EM38Mk2 assess moisture, texture and salinity.

Future Recommendations:

- Conduct multiple trials across seasons, soil types and areas of Australia.
 - Integrate soil moisture probes for cross verification.
- Investigate real time variable rate planting, fertilising and irrigation prospects for technology.



Acknowledgements

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