THE SOIL CRC:
WHAT’S ON THE HORIZON?

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Talkin’ Soil Health

York, WA

12 March 2020

SOIL CRC

Performance through collaboration

The Soil CRC is a collaboration of farmers, industry and scientists working together to find practical solutions for Australia's underperforming soils

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SOIL CRC PURPOSE

Give farmers the **tools and knowledge** to **better manage their soils** to increase their **productivity and profitability**

Allow Australian agriculture to grow to **$100 billion by 2030**

It **starts with the soil**

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THE SOIL CRC

- Commenced in July 2017
- Funded for 10 years until June 2027
- $39.5 m cash from Australian Government
- $20 m cash and $108 m in-kind from 40 partners

The largest collaborative soil research effort
in Australia's history

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40 PARTICIPANTS

- 8 Universities
- 4 State Government Agencies
- 7 Industry Partners
- 1 International Partner
- 20 Farmer Groups

Farmer-driven research

20 FARMER GROUPS

- Wheatbelt NRM – WA
- Corrigin Farm Improvement Group – WA
- Facey Group – WA
- Gillamii Centre – WA
- Liebe Group – WA
- West Midlands Group – WA
- WANTFA – WA
- Birchip Cropping Group – Vic
- Southern Farming Systems – Vic/Tas
- Mallee Sustainable Farming – Vic/NSW/SA
- Riverine Plains – NSW/Vic
- Farmlink – NSW
- Holbrook Landcare Network – NSW
- Central West Farming Systems – NSW
- Mackillop Farm Management Group – SA
- Eyre Peninsula Agricultural Research Foundation – SA
- Hart Field Site Group – SA
- Burdekin Productivity Services – Qld
- Herbert Cane Productivity Services – Qld
- Society of Precision Agriculture Australia – All states

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A NATIONWIDE, REGIONAL CRC

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RESEARCH IN
PROGRESS
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INVESTMENT TO DATE

- 4 Programs
- 8 Scoping Studies
- 24 Research Projects
- 32 PhD Scholarships
- $16 million of Soil CRC funds allocated to date

Research projects have commenced in 2019
and will deliver over the next three years

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SOIL PERFORMANCE METRICS

- New indicators of soil performance - biological
- New tools for measuring soil performance
  - Sensors - in situ, hand held, machine mounted
  - Lab-on-a-chip, electronic noses
- Managing big ‘soil’ data

SMART SOIL SENSORS

Marcus Hardie – University of Tasmania

- The ‘Smart’ Fork: A fork with sensors that can measure soil moisture, salinity and compaction with data mapped and visualised through smart phones whilst in the paddock.
- Below Ground Sensor Data Transmission: Develop the ability to send sensor data wirelessly through soil, so that sensors can be buried without risk of damage from stock, pests or machinery.
- Self-learning moisture sensors. Development of algorithms that use existing soil moisture sensors to learn soil properties needed for use with models such as APSIM, and enable growers to relate moisture content to crop stress.

Prototype buried sensor system

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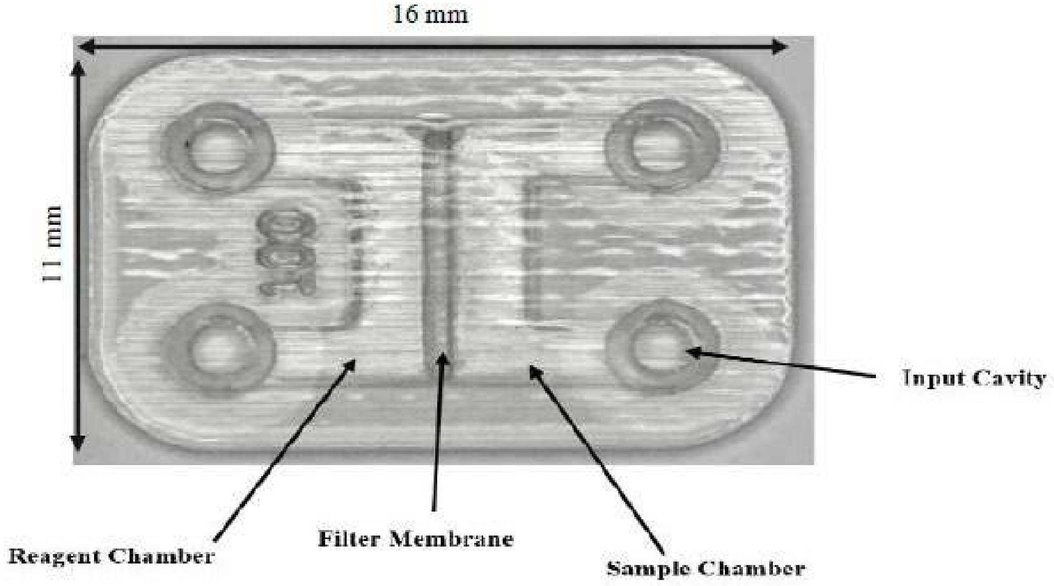
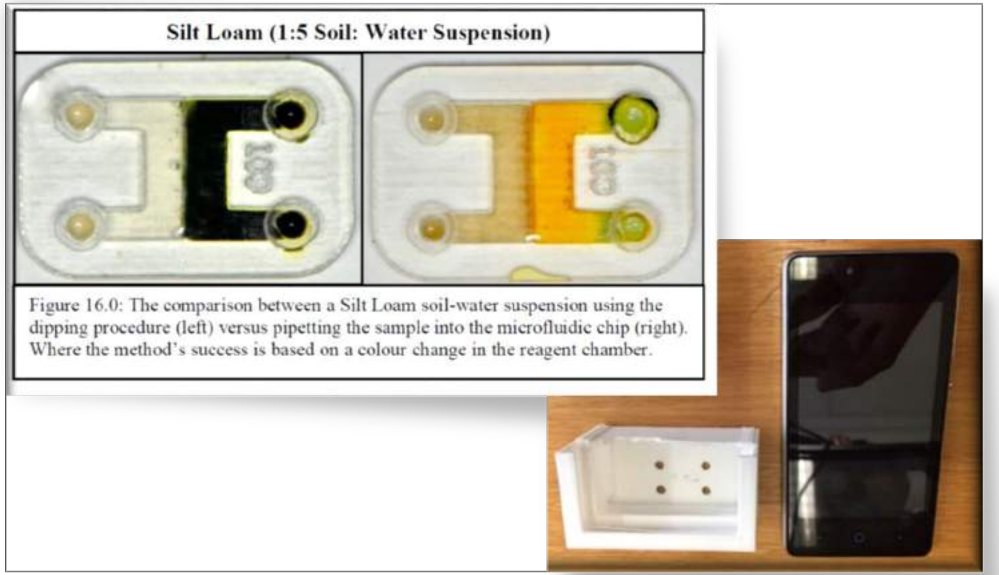
RAPID FIELD-BASED SOIL TESTS - "LAB ON A CHIP"

Liang Wang - University of Newcastle

- 3D-printed, microfluidic devices with multiple embedded reagents that use colourimetric methods to directly measure soil solutions in the field
    - Multi-chemicals in once: N, P, K, pH, etc.;
    - Simple to use;
    - Affordable;
    - Rapid;
    - Field-based.

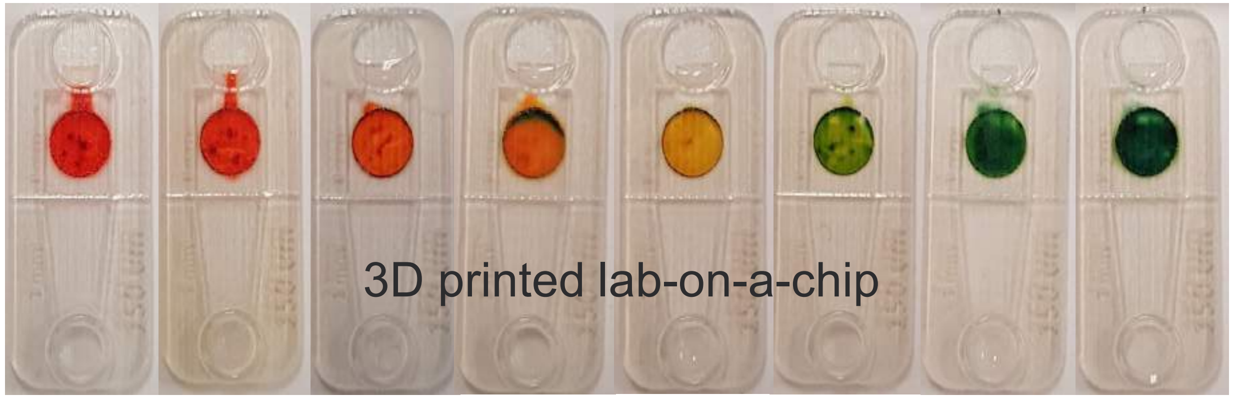




EXAMPLE (pH CALIBRATION)

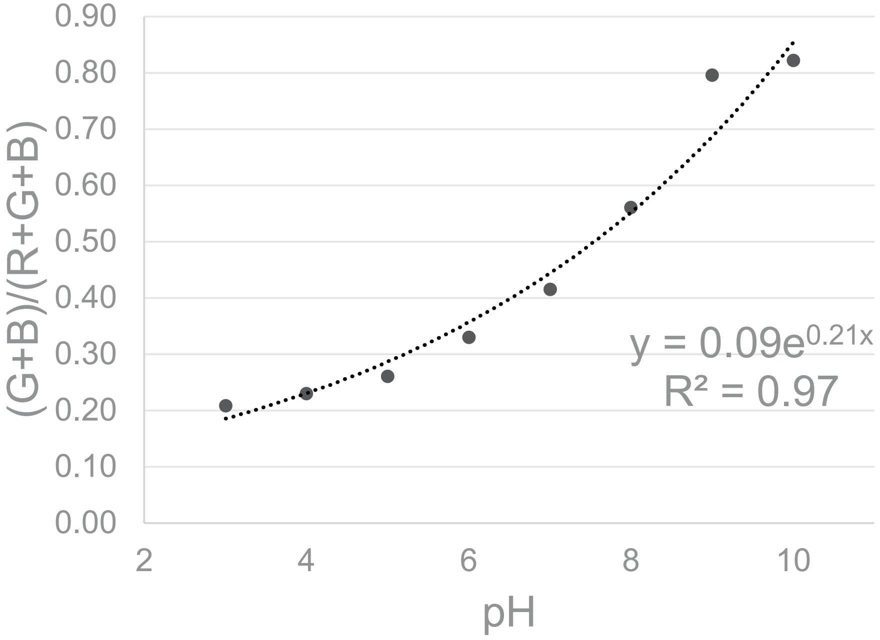
- To develop the chemometric method and mobile applications
  - Apply digital camera to obtain colour values;
  - Build-up calibration models to interpret the testing results;
  - Study the interferences to improve the testing accuracy

pH 3 4 5 6 7 8 9 10



RGB values

Red (R)	190.3	192.7	189.3	175.1	187.3	90.8	24.3	17.5
Green (G)	29.5	36.7	52.6	68.5	116.5	104	64.6	49.3
Blue (B)	20.6	20.9	14.3	17.7	16.7	11.7	29.9	31.4
(G+B)/(R+G+B)	0.21	0.23	0.26	0.33	0.42	0.56	0.80	0.82



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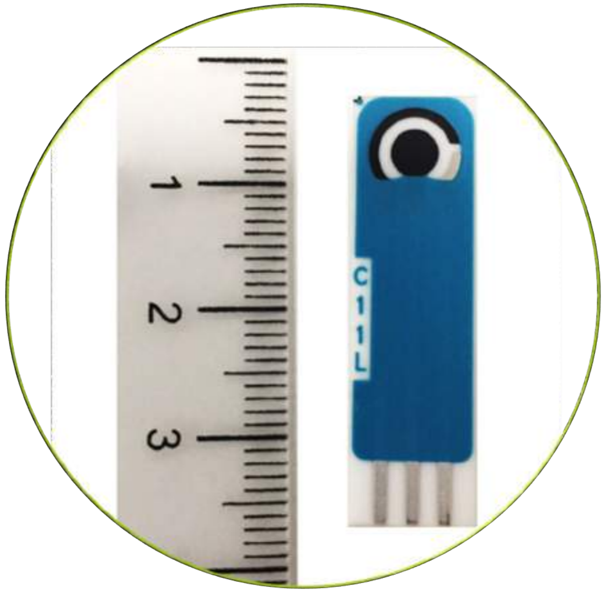
NEW SENSOR TECHNOLOGIES

Craig Lobsey - University of Southern Queensland

1 Low cost and disposable electrochemical sensors for rapid assessment of soil chemical properties (e.g. nitrate, potassium, phosphate, sodium and pH).



2 New techniques and algorithms to improve estimates and mapping of soil water and hydraulic properties (using proximal and open access remote sensing).

3 Automated sensor based measurement of soil water retention curves enabling more efficient, accurate and high throughput sample characterisation.

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SMELLING SOIL

Shane Powell – University of Tasmania

- Farmers often intuitively assess soil by smell
- The ‘fingerprint’ of gases emitted from soil can identify the composition and activity of the microbial community
- An ‘electronic nose’ using miniature gas sensors offers the ability to quantify this
- A prototype will be built and tested, and correlations with other soil measures developed.

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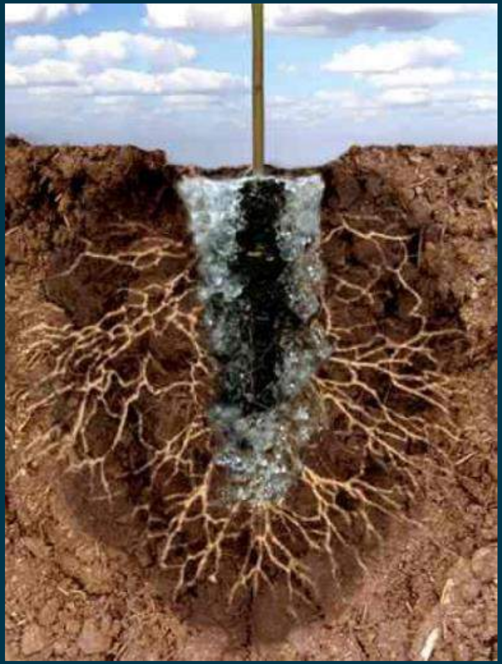
NEW PRODUCTS FOR SOIL FERTILITY AND FUNCTION

- New soil fertilisers and amendments
  - Alternatives to synthetic, chemical fertilisers
  - Organic-based products that recycle and reuse nutrients

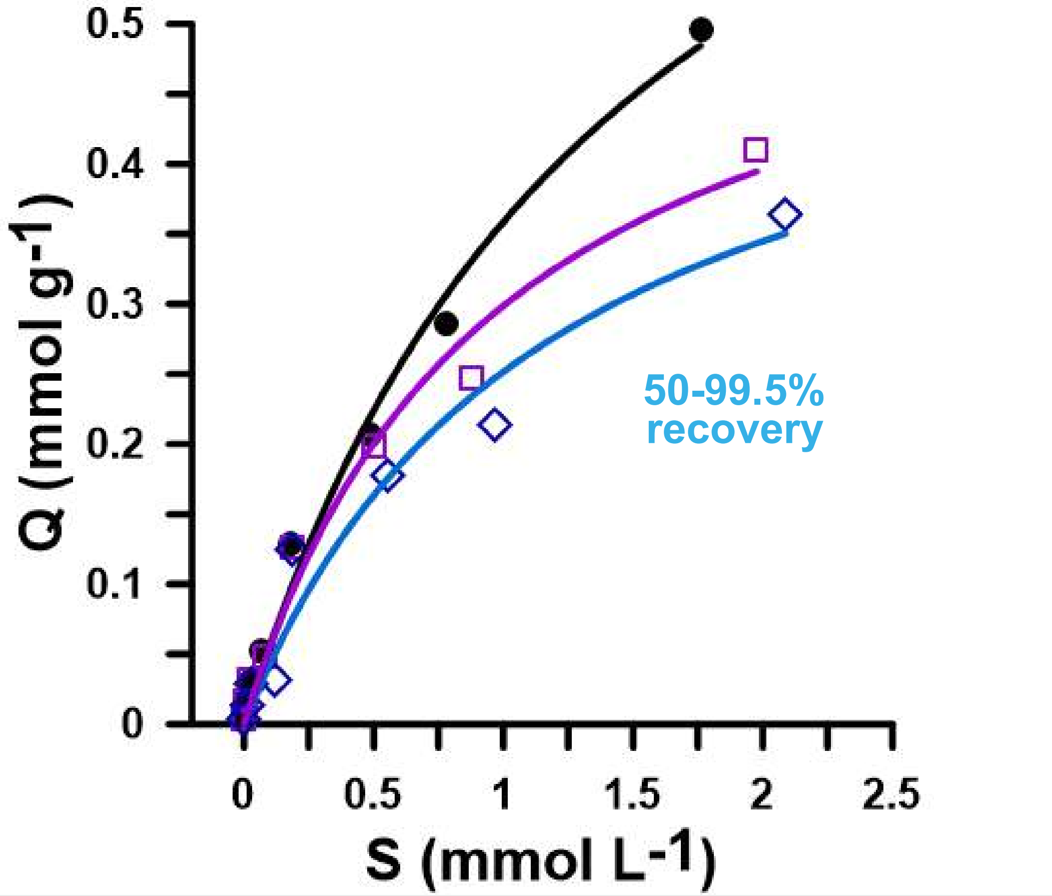


RECOVERING NUTRIENTS FROM ORGANIC WASTE STREAMS

Dane Lamb - University of Newcastle

The purpose of the project is to derive N, P, S, Ca and Mg fertiliser products from a range of organic waste streams

- Characterisation of the chemical form of nutrients and contaminants in organic waste streams
- Development of innovative technologies for the recovery of nutrients from waste streams
- Trials show diverse potential for P recovery ranging from ~ 50% (poor recovery) to highly efficient (99.5%)
- Results to date show positive influence of high Ca and Mg for P recovery materials
- Sugarcane effluent (high in P) = efficient vs dairy effluent (low in P) = low recovery



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NEW PRODUCTS FOR SUBSOIL CONSTRAINTS

Ehsan Tavakkoli – NSW DPI

Purpose: To develop and utilise sub-micron organic-based gypsum and lime as novel amendment formulations to ameliorate subsoil sodicity and acidity.

- Synthesis and characterization of submicron organic-based gypsum and lime products to ameliorate multiple subsoil constraints
- Investigation of the potential of submicron organic-based amendments to boost the agronomic efficiency
- Small scale field studies to verify the effective placement of organic-based amendments and mineral-enhanced organic matter

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NEW AMENDMENTS FOR SANDY SOILS

Richard Bell – Murdoch University

Purpose: To develop greater mechanistic understanding of soil processes and the resulting changes to plant production from *amending sandy soils with clay and organic materials*.

- ***Meta-analysis*** of field experiments and demonstration sites assessing the benefits of clay and organic matter addition.
- ***Mapping/ grouping of sands into management classes*** based on likely responses to clay and organic matter.
- Develop and test the ***efficacy of novel clay and organic matter products*** that increase nutrient- and water-use efficiency.
- ***A long-term, multi-site field program*** to evaluate clay and organic amendment technologies.

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