



Performance through collaboration

THE QUOLL[®] ELECTRONIC NOSE

Sniffing out soil biological activity

INNOVATIVE SOILTECH FOR AUSTRALIAN FARMERS

The Soil CRC's QUOLL[®] electronic nose (e-nose) is an emerging soil sensing technology under development to support faster, cheaper and more accessible assessment of soil biological activity.

The system has been designed to provide near real-time indicators of biological change in soil, helping researchers and farmers better understand how management practices and inputs influence soil function over time. It detects volatile organic compounds emitted by the soil microbiology which are an indicator of soil biological activity.

SNAPSHOT

- **Real-time indicators:** Designed to provide timely feedback on changes in soil biological activity.
- **User-friendly design:** Easy to install and move around the farm to monitor and test different areas.
- **Data-driven decision-support:** Data and models can provide insights into on-farm soil management decisions.
- **Affordable technology:** Less expensive than traditional testing methods for biological activity.
- **Early market interest:** Existing interest from companies producing inoculants and other soil amendments seeking to demonstrate product impact.
- **Broader application opportunities:** Potential for use in carbon farming and emissions reduction, environmental and land rehabilitation, agri-chemical product assessment and biological research and education.

INDUSTRY CHALLENGE

Farmers and researchers lack rapid, field-deployable tools to assess soil microbial activity and understand the impact of management practices on soil function.

Without timely insights, growers risk ineffective soil interventions, suboptimal carbon sequestration strategies and reduced farm productivity.

Most current soil biology measurement methods are costly and do not provide real-time data, making it difficult for landholders to evaluate whether soil management strategies are improving soil biological activity and soil health.

THE SOLUTION

The QUOLL[®] e-nose has been developed to address this gap by exploring new ways to sense biological activity directly in the soil environment. It builds on existing e-nose technology with micro-sized sensors and gas analysis. As the soil environment changes, so does the activity of all the organisms in the soil. They produce volatile organic compounds that are detected by the QUOLL[®] e-nose.

Inserted around 5cm into the soil (where most biological activity occurs), the QUOLL[®] e-nose supports the development of site-specific biological baselines in a given area, and highlights when meaningful shifts occur.

Detecting changes in the biological activity of the organisms in the soil is important because they respond to changes in the physical and chemical environment of the soil. This provides information on how the soil is functioning.

This information might be used to detect when an application of an amendment to soil has changed the type of soil activity and when this activity starts to return to its previous state. Or it might be used to tell when vehicle traffic on soil is starting to impact on how the soil is functioning.



The QUOLL® e-nose in the field at the University of Tasmania's Forthside Vegetable Research Facility (source: Tasmanian Institute of Agriculture).

KEY FEATURES

- **Compact device** designed for easy deployment and multi-location utilisation
- **Multi-gas sensing capability** responsive to biologically derived soil volatiles, capturing pattern-based signals rather than single-compound identification
- **Direct in-soil deployment** at biologically active depths to monitor activity in situ
- **Time-series measurement capability** supporting baseline development, trend tracking and detection of relative change over time
- **Research-grade data capture** suitable for calibration, validation and modelling against independent soil and environmental indicators

- **In situ measurement approach** that reduces reliance on manual sampling and laboratory-based testing for biological activity assessment
- **Adaptive, site-specific sampling system** enabling local baseline establishment and reducing the need for complex calibrations

NEXT STEPS

The QUOLL® e-nose is at Technology Readiness Level 5, with the prototype already validated in a relevant environment. Further engineering, calibration and broader field validation are underway.

The device has been listed on the AgriFutures grow^{AG} platform seeking investment and research partners for development, field validation, and commercialisation of the technology. Learn more at www.growag.com/organisation/soil-crc

University of Tasmania researchers are also investigating the potential to use the device to monitor carbon cycling in the soil (with funding from the Tasmanian Government's Agricultural Development Fund).

GET IN TOUCH

Dr Rhona Hammond, Intellectual Property Manager, Soil CRC.

Email: rhona.hammond@soilcrc.com.au

Simon Edwards, Soil CRC researcher and Agtech Innovator, University of Tasmania.

Email: simon.edwards@utas.edu.au

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