

A photograph of a person wearing a hat and a green shirt, sitting in a folding chair under a white canopy in a field. They are working on a laptop. The field is filled with green plants and dry mulch. In the background, a white car is parked on a road. The sky is blue with some clouds.

Microdialysis: a new technology for investigating soil nitrogen fluxes in the rhizosphere

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ENDEAVOUR
Scholarships and Fellowships

 **THE UNIVERSITY
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Department of Agriculture

sra
Sugar Research
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The complexity of soil

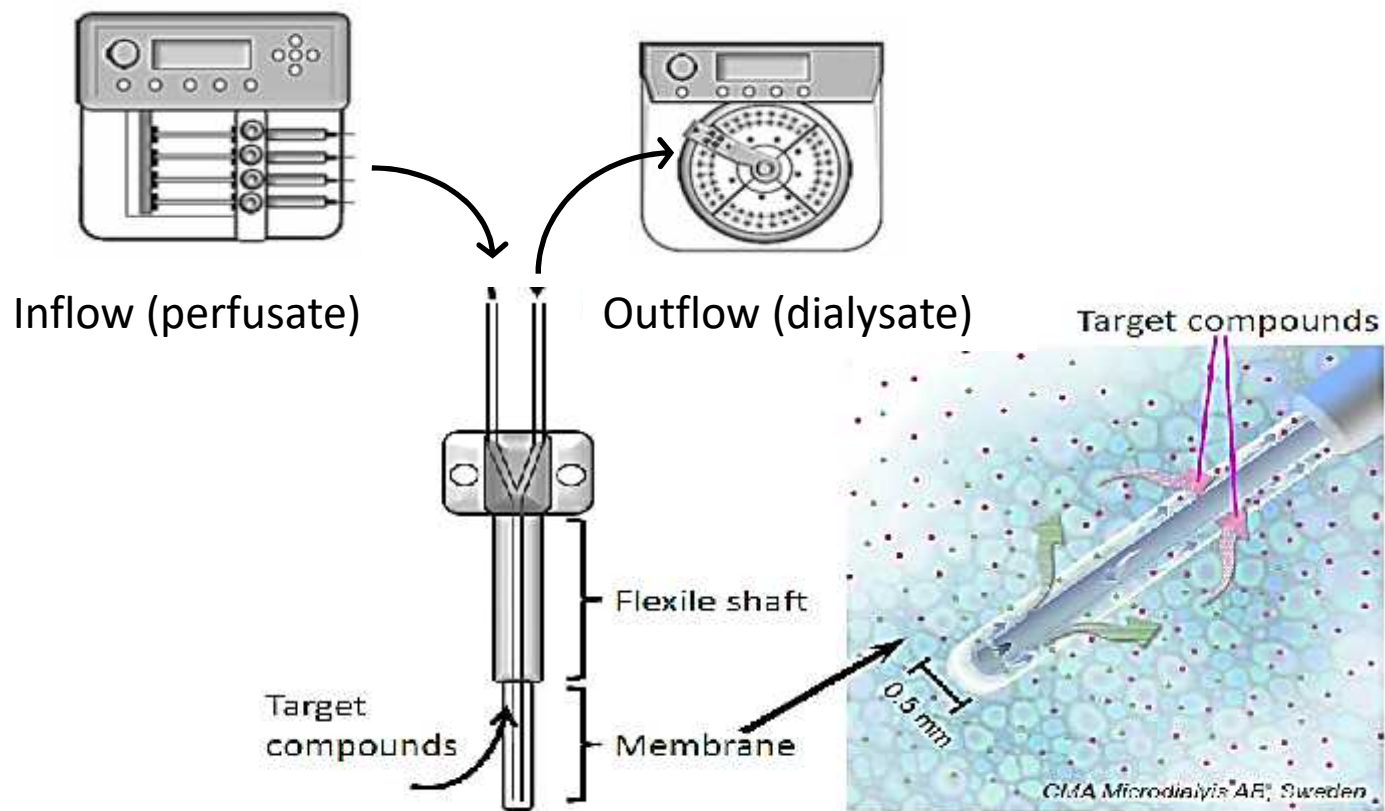


Measuring soluble soil nitrogen



- Dig a hole
 - Put soil in a plastic bag
 - Put plastic bag in a cooler
 - Travel
 - Store in the fridge...?
 - Sieve?
 - Extract using water or salt
 - Disturbance of soil structure¹
 - Damage of roots or hyphae¹
 - Mineralisation of nitrogen²
- ¹ Hobbie & Hobbie 2012; *Biogeochemistry* **107**:339-360
- ² Inselsbacher 2014; *Soil Biol Biochem* **71**: 76-86

Microdialysis



Inselbacher et al. (2011) Sci Biol & Biochemistry 43, 1321-1332



Microdialysis





Advantages

- Low disturbance
- Samples sterile
- Similar mode of action to plant roots
- Measures fluxes rather than concentrations

Disadvantages

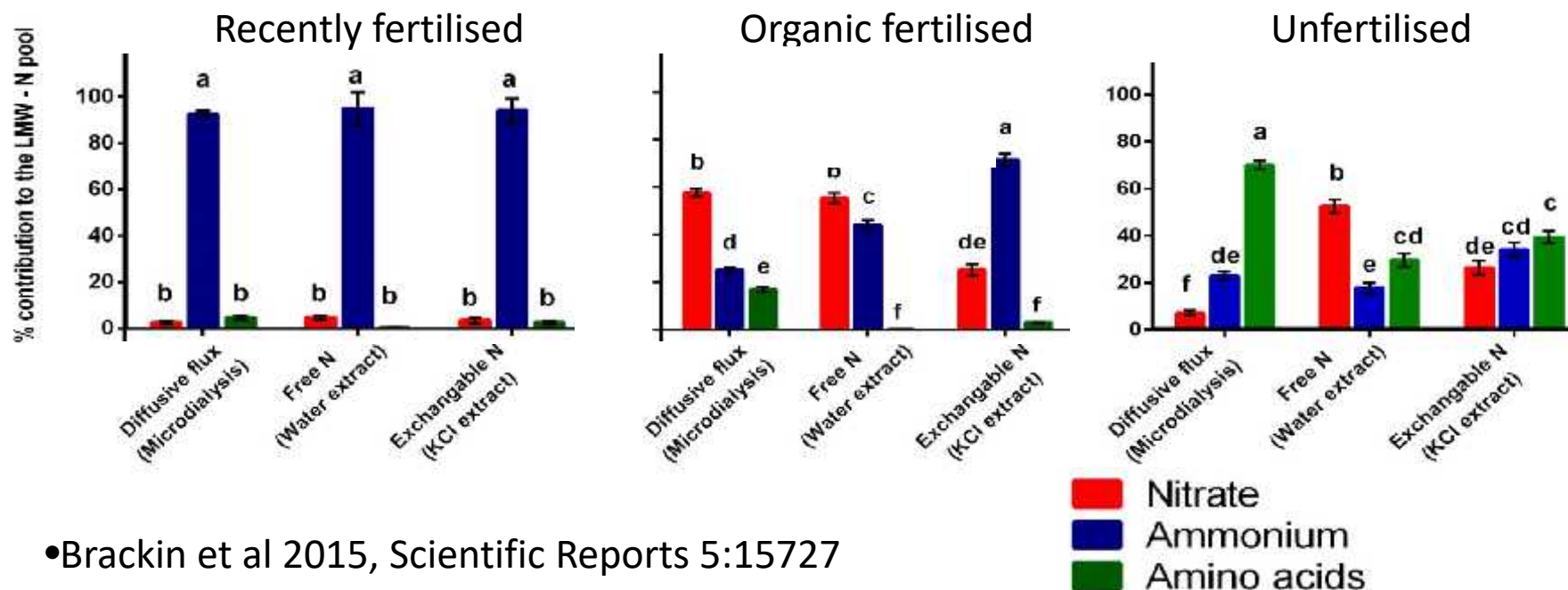
- Not optimised for field
- Requires dexterity and patience
- Small size limits depth
- Requires some soil moisture
- Doesn't measure concentrations
- Won't work well below 0°C, or above 40°C

Microdialysis shows greater proportions of high-turnover amino acids



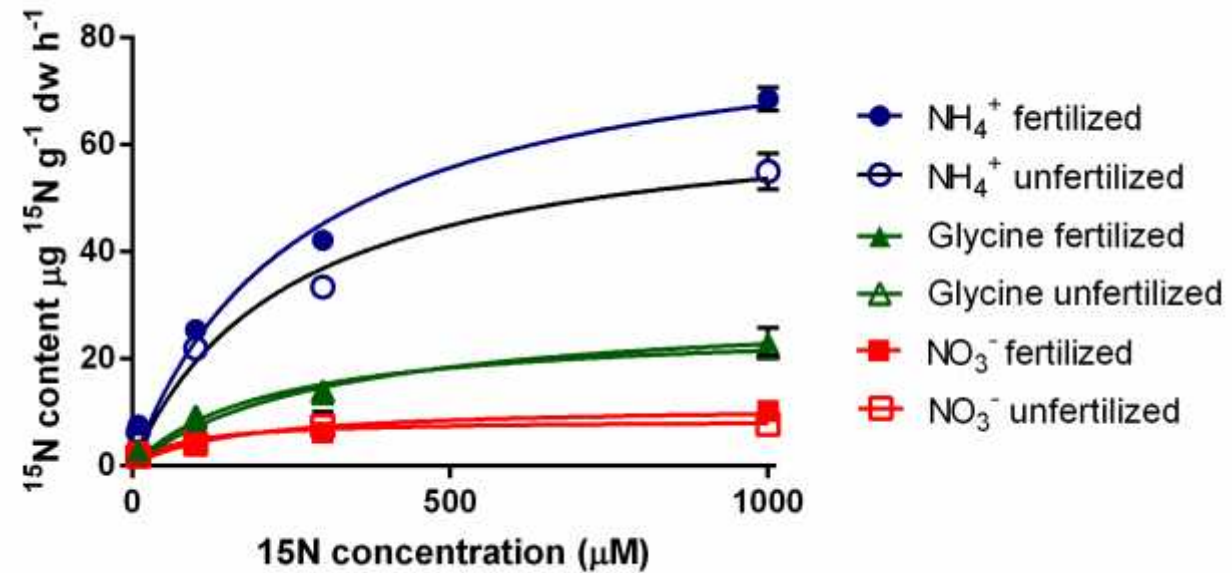
Microdialysis shows greater proportions of high-turnover amino acids

Microdialysis of sugarcane soils: November, Jacob's Well QLD



•Brackin et al 2015, Scientific Reports 5:15727

Sugarcane N uptake preferences



•Brackin et al 2015, Scientific Reports 5:15727

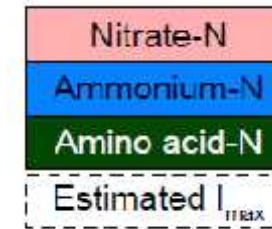
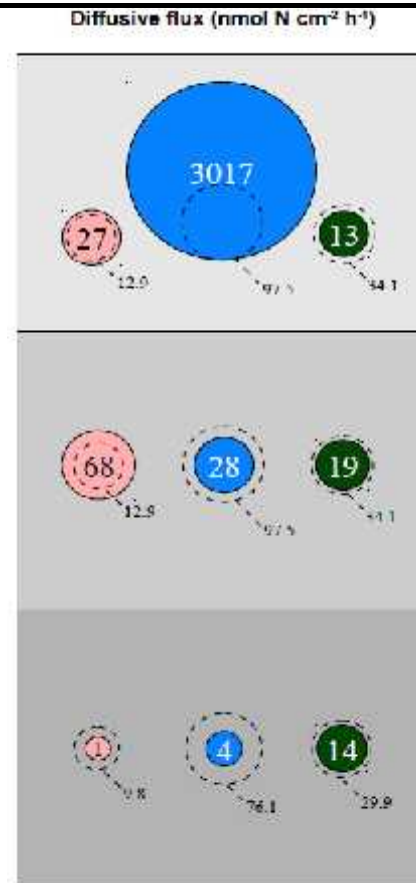
Microdialysis allows comparison to root uptake



Recently fertilised

Organic fertilised

Unfertilised

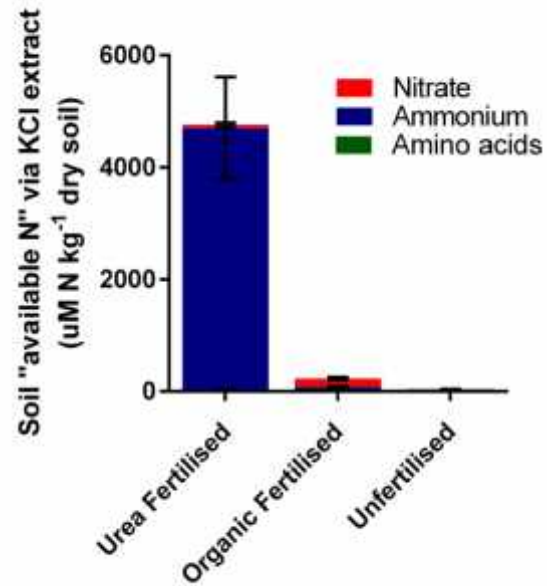


•Brackin *et al* 2015,
Scientific Reports 5:15727

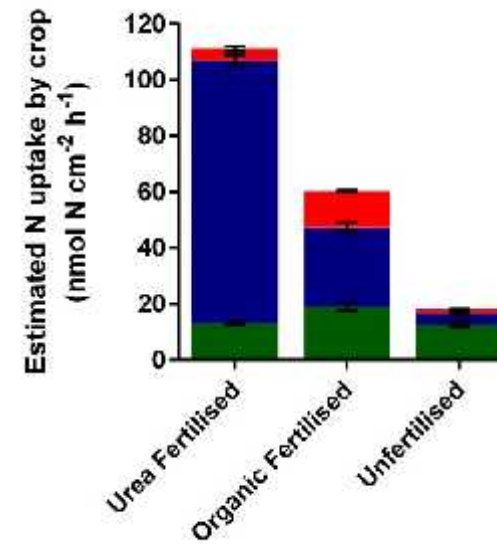
Modelling N form uptake



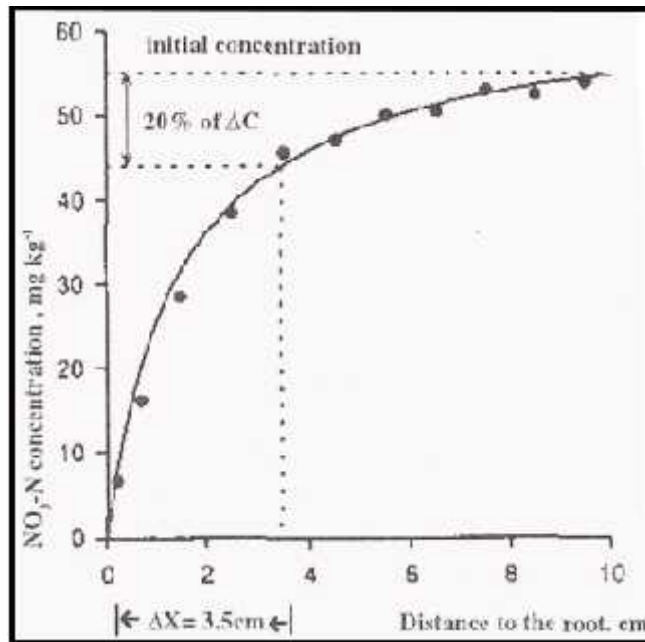
“Available N” as per soil extract



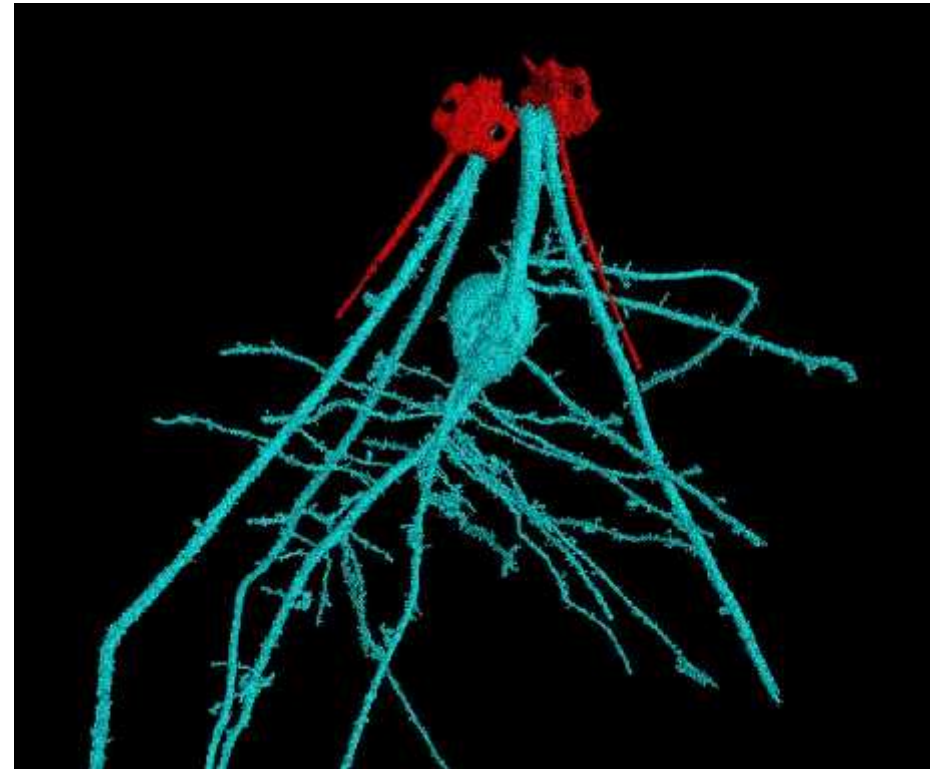
Estimated N uptake



Investigating depletion zones



Claassen and Steingrobe (1999)
(in Mineral Nutrition of Crops).



Conclusions

- Digging, sieving and extracting soils alters N composition
- Microdialysis results in minimal disturbance, and operates similarly to plant roots
- High temporal resolution for monitoring turnover
- Small scale, for measuring in precise locations
- Allows direct comparison of soil fluxes and plant physiology



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