MANAGING SUBSOIL ACIDITY (GRDC DAN00206)

La Trobe University Component

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La Trobe University is one of the key research partners in this major GRDC funded project which started in 2015. In this issue, we provide an overview of the laboratory and glasshouse experiments that the La Trobe University team will conduct over four years.

Project background

Subsoil acidity is a major limitation to crop productivity, primarily due to high concentrations of aluminium (Al) which limit root development and function. Innovative solutions to ameliorate subsoil acidity are needed since traditional application of lime on the soil surface is not effective at depth. Placement of ameliorants, including lime and/or organic materials, placed directly into acidic soil layers via deep ripping, is thought to be a promising approach.

The La Trobe University team, led by Professor Caixian Tang, will conduct experiments to compare effects of various organic and inorganic amendments, their rates and depth of placement on ameliorating soil acidity. The promising products, based on research results, will be recommended to field research team to implement in the field when available and if appropriate.

Photo by Clayton Butterly

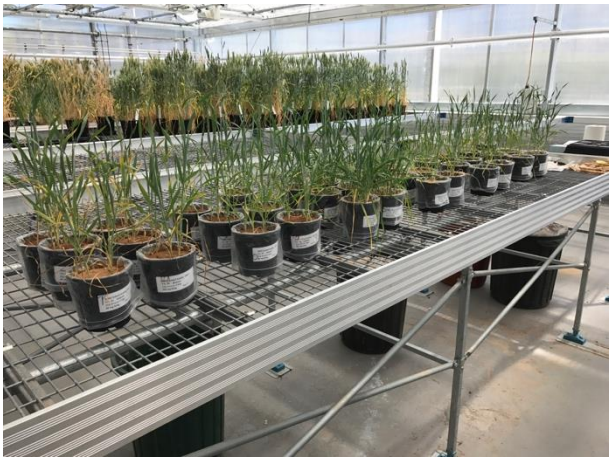

Figure 1. Glasshouse facility at La Trobe University

Photo by Clayton Butterly

Experimental plan

Over the next 4 years, the La Trobe University team will conduct a series glasshouse/laboratory experiments in the following areas:

- Evaluate the effectiveness of a range of inorganic (lime, gypsum and nutrients) and organic amendments (composts, animal wastes and crop residues) and their combinations to ameliorate subsoil acidity.
- Quantify the effectiveness of the amendments placed at various depths at different application rates with the best amendment treatments identified from previous screening experiments.
- Examine the effects of surface-applied lime alone or mixed with compost or gypsum on alkalinity movement in soil profiles and use a range of crop residues differing in ash alkalinity to examine their effects on the movement of surface applied lime to deep soil layers.
- Assess the effectiveness of calcium nitrate alone and in combination with phosphorus and other nutrients in ameliorating subsoil acidity and to study the nitrogen use efficiency by crops with fertilizers placed at various depths.

Soils

In addition to soils with specific characteristics from both Victoria and New South Wales (NSW), the experiments conducted by the La Trobe University team will utilize soils from the various field sites in the program, including the long-term field site at Dirnaseer, west of Cootamundra, NSW.

Experimental techniques

The La Trobe University team will utilize their state-of-the art laboratory facilities at the Centre for AgriBioscience at the La Trobe University, Melbourne Campus. In particular they will;

- Conduct experiments in controlled environment rooms and automated glasshouses.
- Use Al sensitive (ES8) and tolerant (ET8) wheat cultivars to quantify crop responses to various soil amendments.
- Quantify changes in soil pH using 0.01 M $CaCl_2$ extracts (1:5 soil:extract).
- Examine changes in dissolved organic carbon in soil extracts or leachates using an automated organic carbon analyser.

Photo by Clayton Butterly

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Figure 2. Laboratory facilities at La Trobe University

Photo by Clayton Butterly

Figure 3. Typical acidic soil profile in Victoria

- Determine Al concentrations in soil extracts (0.01 M $CaCl_2$) using inductively coupled plasma-optical emission spectroscopy (ICP-OES) and colourimetrically with pyrocatechol violet and the contribution of Al to the cation exchange capacity in amended soils.
- Assess changes in soil microbial biomass carbon using chloroform fumigation-extraction combined with organic carbon analysis.
- Estimate amendment decomposition rates by measuring temporal patterns of CO_2 release using an infra-red gas analyser.
- Measure crop biomass and root morphology (root length, diameter and volume) using a WinRHIZO Pro scanning system.
- Characterise the nutrient and Al content of root and shoot biomass using ICP-OES following digestion of plant material with nitric-perchloric acids.

Project partners and contacts

Organisation	Key contact	Telephone
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