

## MANAGING SUBSOIL ACIDITY (GRDC DAN00206)

# Project overview

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<http://www.dpi.nsw.gov.au/agriculture/soils/acidity>

Welcome to the first issue of 'Managing subsoil acidity'. This issue provides an overview of this major GRDC funded project that commenced in 2015. This issue highlights the framework and key features of the experimental design for the long-term field experiment near Cootamundra in southern New South Wales.

## Project background

Subsoil acidity is a major constraint to crop productivity in the high rainfall zone (500–800 mm) of south-eastern Australia. The surface application of lime is commonly used to combat topsoil acidity. However, lime moves very slowly down the soil profile so subsoil acidity will only be ameliorated after years of surface application. In addition, at the current commercial rates of about 2.0-2.5 t/ha, most of the alkalinity added is consumed in the topsoil and has limited effect on neutralizing subsoil acidity or counteracting subsoil acidification.

## Experimentation

A series of laboratory soil incubation studies and glasshouse column experiments will be conducted under controlled environments to compare effects of various combinations of soil amendments on soil amelioration processes. These inform the most efficient soil amendments, optimum rates and best placements in the soil profile for current and future field experiments.

A long-term field experiment was established in 2016 at Dirnaseer, west of Cootamundra, NSW, to monitor long-term soil chemical, physical and biological processes as well as responses of crops to soil amendments in field.

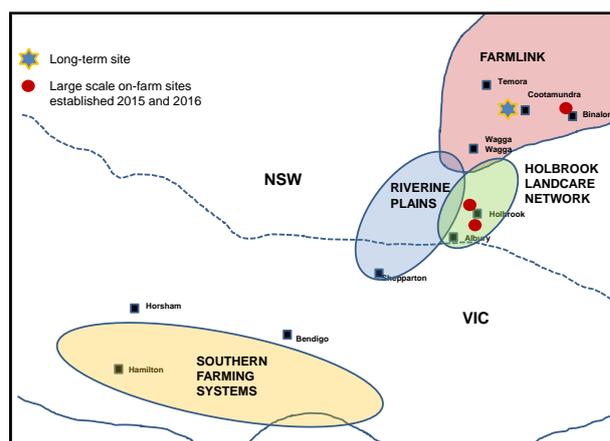
A number of large scale on-farm replicated experiments will also be conducted on farmers' paddocks to demonstrate the benefits of the most effective soil amendments and innovative technologies across a range of soil and climate conditions in southern NSW and south-west Victoria.

## Project aim

This project will investigate innovative technology to deliver novel soil amendments, such as calcium nitrate and magnesium silicate, lucerne pellets as well as lime, directly into the subsoil (10-30 cm) to ameliorate acidity.

## Target region

The project covers major high rainfall cropping areas from southern NSW to south-west Victoria.



## Project partners and contacts

Organisation	Key contact	Telephone
NSW Department of Primary Industries	Dr Guangdi Li Dr Ehsan Tavakkoli	02 6938 1930 02 6938 1992
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# Framework of long-term field experiment

'Ferndale', Dirnaseer, west of Cootamundra, NSW

## Objectives

- To manage subsoil acidity through innovative amelioration methods that will increase productivity, profitability and sustainability.
- To study soil processes and measure the long-term changes in soil chemical, physical and biological properties.

## Treatments and design

- Four crops in sequence (Table 1)
- Six soil amendments
  - Control, no amendment
  - Surface liming, target pH 5.5 at 0-10 cm
  - Deep ripping only (30 cm depth)
  - Deep liming, target pH 5.0 at 0-30cm
  - Deep lucerne pellets (15 t/ha)
  - Deep liming plus lucerne pellets
- A split-plot design with three replicates

Table 1. Crop rotation cycle and phases

		Phase 1	Phase 2	Phase 3	Phase 4
Year 1	2016	W1	C2	B3	F4
Year 2	2017	C2	B3	F4	W1
Year 3	2018	B3	F4	W1	C2
Year 4	2019	F4	W1	C2	B3
Year 5	2020	W1	C2	B3	F4
Year 6	2021	C2	B3	F4	W1
Year 7	2022	B3	F4	W1	C2
Year 8	2023	F4	W1	C2	B3
Year 9	2024	W1	C2	B3	F4
Year 10	2025	C2	B3	F4	W1
Year 11	2026	B3	F4	W1	C2
Year 12	2027	F4	W1	C2	B3
Year 13	2028	W1	C2	B3	F4
Year 14	2029	C2	B3	F4	W1
Year 15	2030	B3	F4	W1	C2
Year 16	2031	F4	W1	C2	B3

**Crop code:** W1, crop at phase 1 as wheat; C2, crop at phase 2 as canola; B3, crop at phase 3 as barley; F4, crop at phase 4 as faba bean for early sowing, or field pea for late sowing.

## Key features

- Phased design. There are 4 crops in rotations, arranged in a fully phased design. Each crop will appear once in any given year a) to assess responses of different crops to different soil amendments; b) to compare treatment effect, taking account of seasonal variation.
- Crop rotation cycle. One crop rotation cycle will take four years to complete in the sequence as wheat-canola-barley-grain legume.
- Soil amendment cycle. Soil amendments will be applied every 8 years in years 1 and 9, pending availability of funding.
- Soil samples. All soil samples will be archived for long-term storage.
- Data management. All data will be uploaded into the Katmandoo database.

## Measurements

- Soil chemical properties
  - Deep soil coring at 10 cm intervals to 40 cm and 20 cm intervals from 40 to 100 cm every 4 years
  - Shallow soil coring at 10 cm intervals to 60 cm every year except for the year with deep soil coring
  - pH in CaCl<sub>2</sub>; exchangeable Al, Ca, K, Na, Mg and Mn
  - Soil total C and N, organic C (Heanes)
  - Colwell P
- Soil physical properties
  - Particle size distribution
  - Soil aggregation stability
  - Penetrometer measurement
- Soil biological properties
  - Soil microbial diversity
  - Earthworm population and biomass
- Soil moisture and root depths
  - Neutron moisture meter measurements
  - Rooting depth and root density
- Agronomy measurements
  - Establishment count
  - Tiller count
  - Anthesis DM
  - Harvest DM
  - Grain yield and quality

