

MANAGING SUBSOIL ACIDITY (GRDC DAN00206)

Addressing subsoil acidity in the field

Regional sites research update (2015-2019)

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

Deep ripping soil had an adverse effect on the crop establishment. Deep placement of lime increased grain yield compared with surface liming. Deep placement of lucerne hay pellets increased grain protein, but reduced grain yield due to vigorous vegetative growth followed by very dry spring conditions during the project period.

Introduction

Regional experiments were established across southern NSW and northwest Victoria. The objectives were a) to increase awareness of subsoil acidity; and b) to demonstrate the effectiveness of innovative technologies to ameliorate and/or prevent subsoil acidity on-farm.

Site selection and treatments

Nearly 1700 soil samples were taken in the 0-40 cm depth at 10 cm increments across the target region for the site selection during 2015-2018. Eight large-scale on-farm field experiments were established over four consecutive years by four leading grower groups (Table 1, Figure 1).

The key features of those experiments were a) a set of core treatments across all experiments (Table 2); b) all soil amendments were from the same source; and c) all treatments were implemented with the same 3D Ripper, making direct comparison across sites possible.

Table 1. Regional site location and crop sequence in 2016-2020

Grower group	Location	Establishment year	Crop sequence
FarmLink Research	Binalong, NSW	2016	Canola-Wheat-Canola
	Boorowa, NSW	2019	Oats-Wheat
Holbrook Landcare Network	Holbrook, NSW	2016	Canola-Oat-Faba bean
	Holbrook, NSW	2017	Wheat-Canola-Wheat
Riverine Plain	Rutherglen, Victoria	2018	Triticale-Triticale-Lupin
	Devenish, Victoria	2019	Canola-Wheat
Southern Farming Systems	Rokewood, Victoria	2018	Lupin-Wheat-Canola
	Stawell, Victoria	2019	Canola-Oat



Figure 1. Site location with pin markers

All field experiments were monitored for three growing seasons except for experiments established in 2019, for which only two years data were collected. A multi-site analysis will be possible when data collection is completed by 2021.

Table 2. Treatment description

Treatment	Description*
Surface liming	Surface soil limed to pH 5.5 in CaCl_2 at 0-10cm
Deep ripping only	Deep ripped to 30cm without soil amendment
Deep liming	Deep limed at 10-30cm to pH 5.0
Deep lucerne pellets	Deep lucerne pellets at 15 t/ha at 10-30cm

* Surface soil was limed to pH 5.0 for all deep ripping treatments with and without amendment.

Results

Soil survey results showed that soils in NSW were more acidic than those in Victoria, particularly at 20–40 cm (Figure 1).

The crop responses to soil amendments varied across sites (Table 3). Averaged across eight sites over 2–3 cropping seasons, the ripping operation had a negative effect on crop establishment. At anthesis, crop biomass increased by 10.4% with lucerne pellets placed at depth due to extra nitrogen input from lucerne pellets. The deep liming treatment increased grain yield by 9.6%, but the deep lucerne pellets reduced yield by 5.7%. This result was most likely due to vigorous vegetative growth and insufficient soil water after anthesis for grain-fill on account of the widespread drought. The deep lucerne pellet treatment increased grain protein by 10.1%, but reduced canola oil content by 5.4% due to increased nitrogen supply.

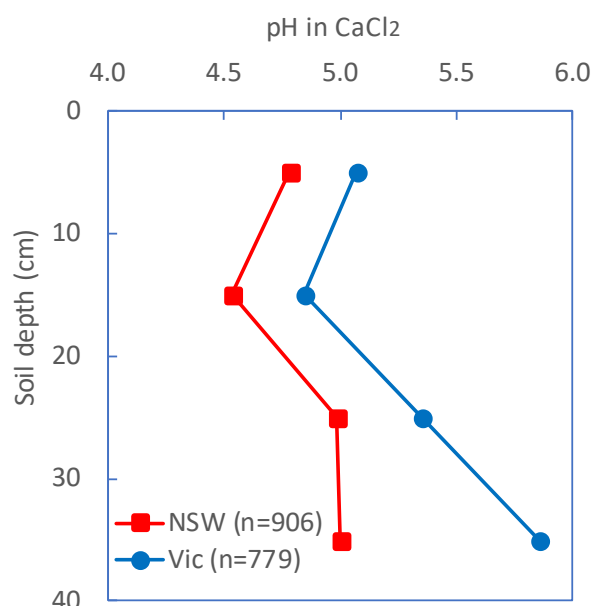


Figure 1. Soil survey results in 2015-2018

Table 3. Relative responses (%) to soil amendment treatments in reference to surface liming treatment across eight field sites over three cropping seasons for five sites and two crop seasons for 3 sites (n = 48).

Treatment	Establishment	Crop anthesis	Grain yield	Protein	Canola oil
Surface liming	0.0	0.0	0.0	0.0	0.0
Deep ripping only	-4.9	-1.6	6.0	3.3	-0.5
Deep liming	-7.3	2.8	9.6	1.8	-1.3
Deep lucerne pellets	-1.3	10.4	-5.7	10.1	-5.4
P-level	n.s.	P = 0.098	P < 0.05	P < 0.05	P < 0.01
LSD0.05			9.10	4.53	1.81

Conclusions

Deep ripping had an adverse effect on the crop establishment. Deep placement of lucerne pellets increase crop biomass at anthesis, but reduced grain yield due to a moisture deficit in dry years. Deep liming increased grain yield compared with the surface liming treatment. The deep lucerne pellet treatment increased grain protein, but reduced canola oil content. Monitoring of yields and soil chemistry over the longer term is required to assess the residual value of soil amendment on those field sites.

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