

‘FutureSOILS’ Burrumbuttock lime trial site Project background and Season 1 results

Project Background

Soil acidity and declining soil organic carbon affects over half of agricultural soils in southern and central NSW and threatens the viability and resilience of farming systems. Current acid soil management practices are based on outdated models that are failing to prevent the widespread development of subsurface acidity in contemporary cropping and pasture systems.

During the next three years, FarmLink will coordinate the gathering of historical and new soil data across south-eastern Australia through a new research project called ‘FutureSOILS’.

Funded by the Australian Government’s National Landcare Program, the work is a collaboration between NSW DPI, the Australian National University, FarmLink, Holbrook Landcare Network, Central West Farming Systems, K-Line Ag and Westlime. Five farmers from Grenfell, Cowra and Burrumbuttock are also involved.

The research will look at changing pH and management to develop a predictive model using machine learning to improve decision-making around optimum lime rates and pre-sowing tillage methods.

Holbrook Landcare Network is hosting one of the five trial sites - a replicated farm-scale site at Burrumbuttock. The trial site was established in early 2020 and will run for 3 years.

Trial Site



The trial site is located in 30 ha paddock on a Red Chromosol soil. The paddock has a history of crop-pasture rotation and was cropped for the past 4 years. Lime has been applied at a rate of 1.25 t/ha (surface applied) every 7 years on average and was last applied in 2018.

Each of the 4 replicates were soil tested on 21 February 2020, to collect baseline data prior to liming. Average soil pH of the 4 replicates is presented in Table 1.

Table 1. Initial soil pH (CaCl₂) of the trial site (average of the 4 replicates).

Depth (cm)	Soil pH (CaCl ₂)
0 - 2.5	5.9
2.5 - 5.0	4.9
5.0 - 7.5	4.5
7.5 - 10.0	4.5
10.0 - 12.5	4.6
12.5 - 15.0	4.8
15.0 - 20.0	5.0

Treatments

The trial consists of 7 treatments investigating 4 different liming rates of 0.5 t/ha, 1 t/ha, 2.5 t/ha and the 'one-in-a-generation' 6 t/ha, as well as the effect of lime incorporation compared to surface applied. A total of 28 plots (7 treatments replicated 4 times), 70 m x 9 m in size, were marked out and lime was applied on 26 March 2020 with NSW DPI's direct drop spreader. Incorporation was completed with two passes of a scarifier and the incorporation depth was approximately 10 cm.

Table 2. Incorporated and surface applied lime treatments applied to the trial site, 26 March 2020.

Treatment	Surface lime application rate (t/ha)	Incorporated?	Target surface pH (CaCl ₂)	Comment
1	0	-	-	Control
2	2.5	No	>5.5 (0-10 cm)	trigger for re-liming at pH 5.5 in 0-10 cm layer
3	2.5	Yes	>5.5 (0-10 cm)	trigger for re-liming at pH 5.5 in 0-10 cm layer
4	1	No	>5.0 (0-10 cm)	trigger for re-liming at pH 5.0 in 0-10 cm layer
5	1	Yes	>5.0 (0-10 cm)	trigger for re-liming at pH 5.0 in 0-10 cm layer
6	0.5	No	>5.5 (0-5 cm)	trigger for re-liming at pH 5.5 in 0-5 cm layer
7*	6	Yes	-	'one-in-a-generation' higher lime rate treatment

* Treatment 7 (6 t/ha incorporated) was chosen to ameliorate acidity and prevent acidification in the long-term with a single incorporation. It will also test if high lime rate will induce nutrient deficiencies.

Season 1 Crop Details

Nuseed Trident TT canola was sown at the site on 22 April 2020 at a rate of 2.7 kg/ha. MAP was applied at sowing at a rate of 110 k/ha and gypsum was spread prior to sowing at of 500 kg/ha. Urea was top-dressed twice across the paddock (including the trial site) totalling 180 kg/ha. Emergence counts were conducted on 22 May 2020. Good plant establishment was observed across all plots and there was no significant difference between treatments (Table 3).



The trial site received 416 mm rainfall during the growing season (from the start of April to the end of October).



The canola was harvested on 17 November 2020 with NSW DPI's plot harvester. A 1.8 m wide X 25 m long area was harvested in each plot. The total seed harvested from each plot was weighed and yield was calculated in t/ha. A sub-sample of seed from each plot was sent to NSW DPI's oilseed testing laboratory for analysis.



Results

There was no expectation of a plant response to the different lime application rates this early in the trial. The observed differences in results from this season were mostly between the two different application methods of incorporation and nil-incorporation (Table 3). The differences were small and should be viewed carefully. The key findings were:

- Yield varied between treatments, but the differences were non-significant.
- Canola seed oil content was significantly higher, by more than 0.5%, in the 3 nil-incorporation treatments than the control and higher lime rate treatments with incorporation (Treatments 3 and 7).
- Canola meal protein was significantly higher, by more than 1%, in the 6 t/ha (incorporated) treatment than the 3 nil-incorporation treatments and the 1 t/ha incorporated treatment.

Table 3. Establishment counts, harvest yield and seed quality of Nuseed Trident TT canola, 2020.

Treatment	Plant count (plants/m ²)	Yield (kg/ha)	Moisture (as received) (%)	Canola Seed Oil (%)	Canola Meal Protein (%)	Glucosinates (seed) (µmoles/g)	Glucosinates (meal) (µmoles/g)
1	16.0	3613	5.88	46.40	37.23	9.50	18.50
2	18.0	3453	5.83	47.00	36.70	9.25	17.00
3	17.5	3439	5.93	46.40	37.58	9.50	18.00
4	14.8	3441	5.75	46.95	36.18	9.50	18.75
5	15.4	3318	5.83	46.75	36.75	9.75	18.50
6	17.3	3542	5.83	46.98	36.28	9.75	18.75
7	15.5	3434	6.00	46.20	37.80	10.00	18.50
Significance	n.s	n.s	n.s	**	*	n.s	n.s
LSD				0.48	0.94		

Least Significant Difference (LSD)

n.s. not significant, * P < 0.05, ** P < 0.01

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