Deep incorporation of lime into acidic subsoils

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Purpose: To assess amelioration of subsoil acidity using a range of tillage methods for incorporating surface applied lime into acidic subsoils and the impacts of tillage and lime on crop productivity.

Location: Peter Negus, "Cooligee", Dandaragan Rd, Dandaragan

Soil Type: Deep yellow sand

Rotation: Wheat-Pasture-Wheat-Pasture

Growing Season Rainfall (April- October 2015): 370 mm (decile 1)

TRIAL LAYOUT

	N			
Tillage	0 t/ha Lime	5 t/ha Lime	3 t/ha Lime	
Rip+Spade	1	2	3	4m wide
Control	4	5	6	
Spader	7	8	9	
Mouldboard	10	11	12	
Offsets	13	14	15	
Deep rip	16	17	18	
Scarifier	19	20	21	
One-way	22	23	24	
	20m	20m	20m	
				10 mts
	3 t/ha Lime	0 t/ha Lime	5 t/ha Lime	
Spader	25	26	27	
One-way	28	29	30	
Deep rip	31	32	33	
Control	34	35	36	
Rip+Spade	37	38	39	
Scarifier	40	41	42	
Offsets	43	44	45	
Mouldboard	46	47	48	
				10 mts
	5 t/ha Lime	3 t/ha Lime	0 t/ha Lime	
Control	49	50	51	
Scarifier	52	53	54	
Deep rip	55	56	57	
Mouldboard	58	59	60	
Spader	61	62	63	
One-way	64	65	66	
Rip+Spade	67	68	69	
Offsets	70	71	72	
				10 mts
	3 t/ha Lime	0 t/ha Lime	5 t/ha Lime	
Deep rip	73	74	75	
Offsets	76	77	78	
Control	79	80	81	
Rip+Spade	82	83	84	
One-way	85	86	87	
Spader	88	89	90	
Mouldboard	91	92	93	
Scarifier	94	95	96	
		15 metres from fence		

RESULTS/STATISTICS

Table 1: mean pH ($CaCl_2$) of 8 tillage treatments with 3 lime rates applied. Samples collected Jan 2015

	0 T/ha lime		
Tillage	**topsoil**	**midsoil**	**subsoil**
Control	6.1	4.9	4.3
Scarify	6.3	5.2	4.6
One way plough	6.0	4.6	4.2
Offset discs	6.2	4.9	4.3
Spade only	5.8	5.6	4.7
Deep rip only	6.0	4.9	4.3
Deep Rip & Spade	5.8	5.1	4.4
Mouldboard	5.2	4.8	4.4
l.s.d. (5%)	*0.19*	*0.36*	*0.33*

	3 T/ha lime		
Tillage	**topsoil**	**midsoil**	**subsoil**
Control	6.5	5.1	4.5
Scarify	6.6	5.0	4.4
One way plough	6.5	5.2	4.6
Offset discs	6.5	5.2	4.6
Spade only	6.3	5.2	4.3
Deep rip only	6.7	5.5	4.7
Deep Rip & Spade	6.3	5.8	5.0
Mouldboard	5.6	5.9	4.9
l.s.d. (5%)	*0.19*	*0.36*	*0.33*

	5 T/ha lime		
Tillage	**topsoil**	**midsoil**	**subsoil**
Control	6.2	5.0	4.6
Scarify	6.2	5.1	4.5
One way plough	6.4	5.1	4.5
Offset discs	6.4	5.2	4.4
Spade only	6.1	5.1	4.5
Deep rip only	6.4	5.2	4.6
Deep Rip & Spade	6.2	5.5	4.7
Mouldboard	5.3	5.6	5.0
l.s.d. (5%)	*0.19*	*0.36*	*0.33*

Table 2: Mean harvested grain yield (wheat, T/ha) of 8 tillage treatments with 3 lime rates applied

	Lime rate (2013)		
	Nil	**3 T/ha**	**5 T/ha**
Spade & Deep Rip	1.2	1.1	1.1
Spade only	0.9	0.9	1.3
Deep rip only	1.0	1.2	0.9
One way plough	1.2	1.2	1.2
Offset dics	1.1	1.0	1.0
Scarify	1.0	0.9	1.0
Control	1.1	1.1	1.1
Mouldboard	1.0	1.0	0.9
l.s.d. (5%)	*n.s.*	*n.s.*	*n.s*

OBSERVATION/ DISCUSSION/ MEASUREMENTS

The trial area was seeded in June 2015 to wheat by Peter Negus, while he was seeding the surrounding paddock. Unfortunately, the seeder ran out of seed as the trial was being sown. The result was that there were large unseeded strips running through the trial.

Rainfall at the site was very poor in September and October 2015; approximately 70% below average for that period. As a result, cereal crops on soils with low water holding capacity were badly affected, with yields well below average.

Analysis of the harvest results (excluding plots affected at seeding) showed no significant differences, leading us to conclude that either (a) the tillage and lime treatment effects have 'worn out' at the site, or that (b) poor rainfall in September and October severely reduced yields, obscuring any other effects. We believe that (b) is more likely.

This trial will be sown to lupins in 2016.

The pH results from this trial show some interesting trends.

The treatments with greater disturbance at depth (spade, deep rip + spade, mouldboard) tend to decrease surface pH. This is of concern if the 'new' topsoil pH is acidic enough to inhibit root development.

The treatments with greater disturbance at depth (spade, deep rip + spade, mouldboard) tend to increase midsoil pH most rapidly. This is the effect hoped for. The differences between treatments are generally not significant, but more intensive sampling may tease out differences.

The treatments with greater disturbance at depth (spade, deep rip + spade, mouldboard) tend to increase subsoil pH most rapidly. This is the effect hoped for. The differences between treatments are generally not significant, but more intensive sampling may tease out differences.

PEER REVIEW/REVIEW

Anne Wilkins

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