WODJIL AMELIORATION
Carly Longmuir

Aim

To determine the effectiveness of lime, dolomite and gypsum as ameliorants of aluminum toxicity on Wodjil soils over a period of time. With Wodjil soil all around the Wheatbelt, this trial is trying to determine the most effective way to increase yield production. In 2014 we have extended the research by trialing a granular Lime product. We have replicated the trial x3 to get an average and overcome variability in the plots

What are Wodjil Soils?

Wodjil' acacia grows on highly acidic yellow sandy earth and gravel soils in the eastern and north-eastern wheatbelt. These soils are naturally highly acidic, with acidity and exchangeable aluminum levels increasing with depth to levels that restrict root growth of all but the most tolerant crop and pasture species.

1. pH declines with depth, often down to pH 3.5 in calcium chloride at 20–30 cm.
2. Subsoil levels of available aluminum (calcium chloride extract) over 5 ppm.

Background

The trial has been running since 2008 and ameliorants were re-applied at the start of 2013. The trial rotation is as follows:
2013: Wheat; 2012: Chemical fallow; 2011: Wheat; 2010: Wheat; 2009: Lupins (failed); 2008: Wheat.

Trial Details and Design:

Property	McInnes – Bonnie Rock.
Plot size & replication	8 Treatments with 3 replications
Soil type	Sandy Loam
Soil pH ($CaCl_2$)	4.2 (20-30 in 2008) 4.8 (20-30 in 2013)
EC	As below.
Paddock rotation	Wheat / Wheat
Variety	Cobra
Seeding date	28th May
Seeding rate	64kg/Ha Mace
Fertiliser	50kg Agflow
Herbicide	2L Boxer Gold, 2L Treflan, 1.6L Ultra, 35g Logran, 400ml Lorsban
Growing Season Rainfall	

SOIL ANALYSIS: (2008)

	Description	pH	EC	OC	N(Nit)	N(Amm)	P	PBI	K	S
0-10	Sandy loam	4.4	0.07	0.80	28	12	32	31	70	11
10-20		4.2	003	0.63	7	1	14	40	61	10
20-30cm		4.2	0.03	0.31	7	1	6	40	56	14

	Ex Ca	Ex Mg	Ex K	Ex Na	Ex Al	ECEC	Cu	Zn	Al	B
0-10	0.72	0.19	0.15	0.06	0.16	1.4	0.4	0.2	3.6	0.8
10-20	0.46	0.03	0.11	0.02	0.33	1.0	0.3	0.2	10.3	0.6
20-30cm	0.54	0.05	0.12	0.03	0.39	1.1	0.2	0.1	11.9	1.0

Year's in short...

Year	EC	OC	Nit N	Amm N	P	PBI	K	S	Ex Ca	Ex Mg	ECEC	pH
2008	0.07	0.8	28	12	32	31	70	11	0.72	0.19	1.4	4.4
2011*	0.09	0.9	32	18	34		70	13	1.00	0.35	1.9	4.7
2013*	0.10	1.0	31	7	26	30	52	16	0.85	0.36	1.9	4.4

*Autumn results from the control (Treatment 1)

Aluminum ($CaCl_2$) was reduced with increasing pH.

2008 Treatment			2013 pH (CaCl2)			2013 Al (CaCl2)		
Trt	(t/ha)	(t/ha)	0-10	10-20	20-30	0-10	10-20	20-30
1	-	-	4.4	4.2	4.2	3	17	17
2	1 Lime	-	4.9	4.1	4.1	1	14	14
3	2 Lime	-	5.3	4.4	4.4	<1	8	8
4	4 Lime	-	5.4	4.9	4.9	<1	6	6
5	-	1 Gypsum	4.8	4.2	4.2	3	13	13
6	2 Lime	1 Gypsum	5.1	4.2	4.2	<1	10	10
7	2 Dolomite	-	5.4	4.3	4.3	<1	9	9
8	2 Dolomite	1 Gypsum	5.3	4.5	4.5	<1	4	4

Soil Test Results – pH and Al ($CaCl_2$) (March 2013 – prior to reapplication of ameliorants):
2008 applied lime and dolomite have increased top soil (0-10cm) pH from 4.4 to 5.4, but 4 t/ha lime was required to raise sub soil pH (10 -30cm) to above 4.8

Trial Design

Determining what Ameliorant is the most effective over a period of time.

	2013 (kg/ha)	2008 + 2013		P
1	50 Agflow	-	-	9
2	50 Agflow	1t/ha Lime	-	9
3	50 Agflow	2t/ha Lime	-	9
4	50 Agflow	4t/ha Lime	-	9
5	50 Agflow	-	1t/ha Gypsum	9
6	50 Agflow	2t/ha Lime	1t/ha Gypsum	9
7	50 Agflow	2t/ha Dolomite	-	9
8	50 Agflow	2t/ha	1t/ha Gypsum	9

Harvest Results:

Lime, dolomite and gypsum have all increased crop yields.

In 2014, as in previous years, there was a rate response to the top rate of lime in the trial and a significant response to gypsum.

Responses to lime and dolomite have been similar. Dolomite and gypsum have yielded the highest this year but as long term average Lime and Gypsum have seen the biggest increase. Will be interesting to if the pH is starting to be affected at depth in this year's soil results over all plots.

Trt	Treatment 2008 & 2013 (t/ha)		Wheat Yield (t/ha) 2008	2010	2011	2013	2014	Total
1	-	-	1.87	1.04	2.15	1.48	0.67	7.21
2	1 Lime	-	2.06	1.25	2.32	1.59	0.77	7.99
3	2 Lime	-	2.18	1.26	2.39	1.57	0.79	8.19
4	4 Lime	-	2.2	1.32	2.6	1.74	0.89	8.75
5	-	1 Gypsum	2.3	1.37	2.24	1.71	0.87	8.49
6	2 Lime	1 Gypsum	2.3	1.54	2.59	1.84	0.88	9.15
7	2 Dolomite	-	2.01	1.28	2.25	1.7	0.84	8.08
8	2 Dolomite	1 Gypsum	2.31	1.33	2.46	1.76	0.94	8.8
		Prob	0.007	0.03	0.004	0.03	0.18	
		Lsd	0.21	0.22	0.22	0.2	0.2	

Nil vs 2t Lime

Economic Analysis

Trt	Treatment 2008 & 2013 (t/ha)		Yield t/ha 5 years	Total $ (grain)	$ Made above Nil	Total cost (Treatment)	Overall Profit $/Ha
1	-	-	7.21	$ 1,874.60	$ -	$ -	$ -
2	1 Lime	-	7.99	$ 2,077.40	$ 202.80	$ 50.00	$ 152.80
3	2 Lime	-	8.19	$ 2,129.40	$ 254.80	$ 100.00	$ 154.80
4	4 Lime	-	8.75	$ 2,275.00	$ 400.40	$ 200.00	$ 200.40
5	-	1 Gypsum	8.49	$ 2,207.40	$ 332.80	$ 40.00	$ 292.80
6	2 Lime	1 Gypsum	9.15	$ 2,379.00	$ 504.40	$ 140.00	$ 364.40
7	2 Dolomite	-	8.08	$ 2,100.80	$ 226.20	$ 100.00	$ 126.20
8	2 Dolomite	1 Gypsum	8.8	$ 2,288.00	$ 413.40	$ 140.00	$ 273.40

Price of wheat @ $260,
Dolomite $50p/t
Lime $50p/t
Gypsum $40p/t

Field Walk September 2014

Had a great turn out for our field walk with 16 growers turning up interested in what we are doing with Ameliorants. James Easton our Field Research Manager and Luke Dawson District manager for Central Midlands were also at the day to help answer any questions. We had a little quiz and the growers had to asses and rate each trial plot – not knowing what treatment it was – and then average it out to see what they through was the best to worst plot. Happy to say that 99% had Nil as the worst! 2t Dolomite 1t Gypsum and 2t Lime 1t Gypsum came out on top. We had a prize of a carton of beer for the one that got the closest to the harvested data and the winner was :

Discussion

Looking at the above table Gypsum is a very economical way of increasing yield production but Gypsum has no effect on the pH. It reduces the toxicity of the Aluminum (ties it up) and also supplies soluble calcium to the soils. Gypsum and 2t of Lime has been the most economical and effective way to increase yield and profit in most years. High rates of Lime are increasing yield and profit also, as well as increasing subsoil pH and decreasing Al levels.

2t of Dolomite and 1t Gypsum yielded well this year, but still not as profitable as the Lime/Gypsum over the 5 year period. Dolomite is having the same effect on the top soil as Lime but we haven't seen it move down the profile over the 6year period. The application needs to be at 4tonne to compare with the lime, but this is not very economical where we farm.

The idea of the trial is to try and show the value in ameliorants and where to spend your money. The 1t of lime is seeing a $152.80/ha increase over 5 wheat crops with 2 applications at $50/ha ($100 for both.) This is a significant increase when you put it over the whole paddock.

The 1t Lime has only lifted pH on the top soil but is still a start to improving your soils for the future.

This year we have put in a granular Lime trial next to it to see how banding lime can potentially add gain to your soils and yield potential. There was no yield increase this year we will continue next year to see if there is fit for this product. The granules seem to need a fair bit of moisture to break down, when we had our trial walk in early September the granules were still quite hard.

	Treatment		Harvest
	IBS	Banded	Yield
Trt	(/ha)	(kg/ha)	(t/ha)
1	-	-	0.80
2	100 Gran Lime	-	0.87
3	200 Gran Lime	-	0.80
4	-	100 Gran Lime	0.88
		Prob	0.45
		Lsd	ns