Revisiting Gypsum for improved soil structure

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Aim

To determine the efficacy and rate of gypsum required to improve soil structure on heavy clay soils in a minimum tillage system.

Background

Gypsum (calcium sulphate) can improve soil structure on heavy clays by making the soil aggregates more stable (Jarvis R, 2000). Signs that the soil structure of a paddock might need improving include hardsetting or crusting of top soil, patchy germination and slow water infiltration (ponding on the soil surface). The calcium in gypsum helps the clay particles stay bound together when the soil gets wet reducing the tendency for the particles to disperse (Jarvis R, 2000). The use of gypsum as a soil ameliorant has become less popular with the advent of minimum tillage farming systems, which are less destructive to soil structure than conventional cultivation. This trial will investigate whether gypsum still plays a role in a minimum tillage system.

This trial has 3 main aims (a) to determine whether gypsum improves crop establishment and yield on the selected paddock (b) to determine if 4 t/ha is more effective than 2 t/ha and (c) to determine how long the benefits of gypsum application lasts. The gypsum was applied on 17th April 2010 and the trial will be monitored until 2012 thanks to funding from GRDC.

Trial Details

Property	Ian Hyde, Dalwallinu
Plot size & replication	24m x75m x 3 replicates
Soil type	Clay
Sowing date	10/5/2010
Seeding rate	Cobbler Canola 3.5 kg/ha
Paddock rotation	2007= pasture, 2008= wheat, 2009 = wheat
Fertilisers	26/4/10: 0.5 kg/ha ammonium sulphate 10/5/10: 90 kg/ha KTill extra, 0.5 kg/ha ammonium sulphate 23/7/10: 100 kg/ha Urea
Herbicides	26/4/10: 1 L/ha Gladiator, 1 kg/ha Atragen 10/5/10: 200 ml/ha Chlorphos, 1.5 L/ha Triflur x, 100 ml/ha LI 700 18/5/10: 125 ml/ha Venom 11/6/10: 1.1 kg/ha Geasaprim, 500 ml/ha Hasten 17/7/10: 500 ml/ha Status, 50 ml/ha Exert, 300 ml/ha Enhance 8/10/10: 300 ml/ha Chlorpyrphos, 300 ml/ha Alpha Suma Flex
Growing Season Rainfall	172 mm

Results

In 2010 applying gypsum did not increase canola yield (Table 2) and had no significant effect on plant emergence (Table 1). Yield for all plots was 0.5 t/ha and plant germination was good across the whole paddock. A jar dispersion test conducted at the site found that the soil did not disperse in water and therefore is unlikely to respond to gypsum. However the jar test only takes a small representative sample, results could change across the paddock.

Table 1: Canola emergence 67 days after sowing after 0,2,4 t/ha of gypsum was applied

Gypsum rate (t/ha)	Plants/m^2
0	55
2	42
4	43
l.s.d	*NS*

Table 2: Average canola yield (t/ha) for 2010 after gypsum was applied at 0, 2 and 4 t/ha in April 2010.

Gypsum rate (t/ha)	Yield t/ha
0	0.50
2	0.50
4	0.49
l.s.d	*NS*

Comments

One of the benefits of using gypsum can be more even crop germination however this year the paddock did not develop a hardpan therefore no differences in crop emergence were seen in the trial.

The lack of response from increasing rates of gypsum could stem from two reasons

1) Lack of rainfall in 2010 could have limited the gypsums ability to dissolve in the soil and the crop yield potential.
2) Not all clays are responsive to gypsum so it is important to conduct dispersion tests (e.g. jar tests) and soil tests (exchangeable sodium percentage, ESP) to gain an indication of the paddocks potential response to gypsum (Jarvis, 2000). The jar dispersion test conducted on the site indicated the site may not be responsive to gypsum because soil did not disperse in water. In general a soils with an exchangeable sodium percentage of 6-10 will tend to be mildly dispersive, 10-15 moderately dispersive and >15 strongly dispersive.

In order to account for seasonal variation and allow the gypsum to move down the profile the Liebe group will continue to monitor this trial into the future and conduct detailed soil tests to determine the severity of the problem.

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References

Jarvis R (2000) Deep tillage. In 'The Wheat Book: Principles and Practice' (Eds. WK Anderson and JR Garlinge) pp 185-187. Department of Agriculture, Western Australia Bulletin 4443.